R PUBLICA
LENDI

6

Resource Report

Gold deposits of New South Wales: BMR datafile (MINDEP)

C. M. Mock

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RESOURCE REPORT 6

Gold deposits of New South Wales: BMR Datafile (MINDEP)

C. M. MOCK

(Petrology & Geochemistry Division)

AUSTRALIAN GOVERNMENT PUBLISHING SERVICE

CANBERRA

ISBN 0644 095172
ISSN 0818-6278

DEPARTMENT OF PRIMARY INDUSTRIES & ENERGY
Minister for Resources: Senator The Hon. Peter Cook
Secretary: G. L. Miller

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS
Director: R. W. R. Rutland AO

Printed in Australia by Better Printing Service, 1 Foster Street, Queanbeyan N.S.W. 2620

CONTENTS

ABSTRACT

Data are presented for 60 New South Wales gold deposits. They include information on regional setting, geology, and characteristics of the deposits and their host rocks, including deposit type and proposed genetic models. Development history (including discovery and mining methods), resource and production data, and a bibliography are also presented. The data form part of BMR's mineral deposits (MINDEP) database.

INTRODUCTION

This report is the third in a series of datafiles on Australian gold deposits that are being derived from BMR's mineral deposits database (MINDEP). Data are presented for 60 New South Wales gold deposits, being those that had (or have) a recorded pre-mine resource in excess of 1000 kg Au. Earlier reports covered gold deposits of Western Australia (Mock & others, 1987) and Queensland (Mock & others, 1988). MINDEP data are available in four formats: (1) microfiche, (2) 5 1/4" diskette (IBM PC/ASCII/DOS3.1), (3) hard-copy computer printout, and (4) 1600 bpi magnetic tape.

The information in the database and this report were compiled using the MINDEP format for recording data (Appendix 1). The database was developed using ORACLE software on a Data General MV 20 000 mini-computer.

Australian gold mining began in New South Wales in 1851 when 4 oz (125 g) of alluvial gold was found at Lewis Ponds Creek (later renamed Ophir), 80 km northwest of Bathurst. Gold finds had been reported from various places in the State from as early as 1823, but it was not until a Government reward was offered in 1851 for the discovery of payable gold and the Lewis Ponds find was widely publicised that Australia's gold rushes started in earnest. By the end of 1851 other rich reef and alluvial fields had been found in the Bathurst region, at **Hill End–Tambaroora**[1], **Lucknow, Sofala–Wattle Flat, Stuart Town, Trunkey Creek, Tuena**, and **Hargraves–Windeyer**, and in the south coast region at **Araluen–Majors Creek**. Deposit localities are shown in Figure 1. By the end of 1861 the extent of known gold mineralisation had broadened to include **Young–Wombat, Forbes, Gulgong, Tumbarumba–Batlow, Adelong**, and **Kiandra**.

The periods of greatest gold production in NSW were 1851–75, when recorded output was between 5000 and 20 000 kg/year, and 1894–1912 (5000–12 000 kg/year). In the 1920s production levels declined to below 1000 kg annually. Activity increased in the 1930s in response to Government incentives, and annual yields rose to between 1000 and 3000 kg from 1934 to the early 1950s. Production then fell steadily and from the mid 1950s to 1982 was generally between 300 and 500 kg annually. From 1970–84, output was largely by-product gold derived from the treatment of base-metal sulphide concentrates from **Broken Hill**, CSA at Cobar, and Woodlawn (latter two not listed in datafile), and from antimony mining at **Hillgrove** (New South Wales Department of Mineral Resources[2], 1986). As a result of new mine developments and tailings re-treatment programs, production has since increased: in 1987 output exceeded 4000 kg, the highest level since 1913 and in 1988 reached 5471 kg (preliminary figure from New South Wales Department of Minerals & Energy). Total recorded gold production for NSW to the end of 1988 is approximately 532 700 kg, although many of the fields were exploited before recording procedures were established.

The resurgence of gold exploration in the 1980s has led to the delineation of disseminated extensions to deposits previously worked as reefs, and to the discovery of new deposits including the identification of new styles of gold mineralisation. One of the most important new developments has been the discovery of epithermal mineralisation at **Temora (Gidginbung)** (discovered in 1983), **Dobroyde**, and other sites in the mafic to intermediate volcanics that flank the Gilmore Fault Zone (Suppel & others, 1986) (Fig. 2). The Fault Zone is a major structural lineament that has been recognised historically as a locus of various styles of reef mineralisation (Gilmore Fault Zone group, Fig. 1, Table 1). Epithermal mineralisation also occurs at **Peak Hill**. Other 'grass roots' discoveries include porphyry copper–gold at **Parkes (Goonumbla)** (1977), and sediment-hosted disseminated gold at **Lucky Draw** (1988).

The Temora (Gidginbung) mine was opened in mid 1987. By late 1988, other new mines based on lower grade extensions to historical workings were in operation at **Browns Creek** and **Junction Reefs (Sheahan–Grants)** (skarn deposits), **Cowarra**, and **Drake**. Tailings re-treatment programs, in some cases preceding mine development, at **New Occidental, Canbelego, Bodangora (Mitchells Creek), West Wyalong**, and Lachlan (**Forbes**)[3] have also contributed to increased production in recent years. Projects under development in late 1988 included London–Victoria **(Parkes), Mineral Hill**, and Lucky Draw. Potential development or redevelopment projects included **The Peak**, Peak Hill, Parkes (Goonumbla), **Adelong**, Dobroyde, Comet (**Armidale–Rockvale**), and **Mount McDonald** (New South Wales Department of Mineral Resources, 1988).

Gold deposits in NSW are widely distributed mainly within the Palaeozoic Lachlan and New England Fold Belts (Figs. 1, 2), which are part of the Phanerozoic Tasman Fold Belt System. Figure 2 shows the structural units of NSW. One exception is the large Broken Hill massive sulphide orebody in high-grade metamorphics in the Proterozoic Broken Hill Block, where gold is associated with stratiform base-metal sulphides that have features of both volcanic exhalative and sedimentary exhalative orebodies (Stevens, 1974; Stevens & others, 1988). In the northerly outliers of the Proterozoic Wonominta Block small scattered gold deposits occurred in alluvial fields derived from veins in metasediments at **Tibooburra–Milparinka**.

The Lachlan Fold Belt is a composite orogenic belt that developed from the Late Proterozoic?–Cambrian to the Early Carboniferous (Degeling & others, 1986). Older anticlinorial zones (Girilambone and Wagga) are regional metamorphic terranes composed of deformed Cambro-Ordovician flysch complexes. The younger anticlinorial zones contain belts of Ordovician mafic to intermediate volcanics that formed over probable continental crust (Degeling & others, 1986; Wyborn, 1988) possibly in

1. Names of deposits in the datafile are highlighted at their first mention.
2. The NSW Department of Mineral Resources was amalgamated with the Department of Energy in December 1988 to form the Department of Minerals & Energy.
3. Lachlan is recorded in the datafile as an orebody of the Forbes deposit.

either a rift or volcanic arc setting (Molong Volcanic Arc). The anticlinorial zones were the sites of extensive orogenic and post-orogenic granite plutonism and comagmatic felsic volcanism in the Silurian and Early Devonian (Fig. 3). Intervening synclinorial zones contain thick sequences of deformed flysch sediments and minor felsic volcanics.

Gold deposits formed originally in a variety of settings in the structural zones:

(1) mafic to intermediate volcanic setting, in anticlinorial zones (gold deposits formed mainly by hydrothermal processes),

(2) altered ultramafic intrusive, mainly along zone margins,

(3) orogenic and post-orogenic intrusive, in the anticlinorial zones (magmatic–hydrothermal processes),

(4) felsic volcanic, in the synclinorial zones (volcanic exhalative processes), and

(5) slate belt setting, in synclinorial zones (syndeformational deposits formed by metamorphic hydrothermal processes associated with cleavage-forming folding and associated faulting).

The distribution of the main igneous rocks with which gold deposits are associated is shown in Figure 3.

(1) The Molong Volcanic Arc is a composite terrane of basaltic to andesitic volcanics, and sub-volcanic intrusions, of mostly shoshonitic character (Wyborn, 1988; Clarke, in press). Rocks of the arc are preserved in four main areas (Figs. 2, 3): (1) flanking the Parkes Thrust, (2) the Molong–South Coast Anticlinorial Zone (North), (3) the Capertee Block (Degeling & others, 1986), and (4) (probably) flanking the Gilmore Fault Zone (Suppel & others, 1986). In the case of (4), the age and chemical character of the volcanics are not yet well determined.

The Molong Volcanic Arc is a major gold province. Gold occurs in subvolcanic porphyry-copper mineralisation at Parkes (Goonumbla), and in vein and disseminated epithermal deposits at Parkes, Forbes, and Peak Hill–**Tomingley**. Probable Ordovician andesitic volcanics flanking the Gilmore Fault Zone host epithermal gold deposits at Temora (Gidginbung) and Dobroyde. The **Temora** reef deposit is associated with a high-level intermediate intrusive which is considered part of a volcanic complex (Suppel & others, 1986). Primary mineralisation at Kiandra is also hosted by Ordovician volcanics. In the Molong–South Coast Anticlinorial Zone (N) Ordovician volcanic/volcanogenic-sedimentary sequences are host to (1) vein and disseminated mineralisation at Bodangora (Mitchells Creek) and **Forest Reefs**, (2) stratiform Fe-Cu–Au bodies at **Cadia**, and (3) skarn deposits at Junction Reefs (Sheahan–Grants) and Browns Creek. Andesite-hosted mineralisation is also extensive in the Capertee Block at Sofala–Wattle Flat.

(2) Gold is associated with alpine-type serpentinite belts at **Lucknow** and at **Gundagai**. The ultramafic rocks may have been the source of the gold (Ashley, 1974).

(3) Granodiorite phases of the Siluro–Devonian batholiths are the host to, or were the source of, substantial primary and secondary gold mineralisation at (1) Adelong, West Wyalong, and **Sebastopol–Junee Reefs** (some orebodies) along the Gilmore Fault Zone, (2) Tumbarumba–Batlow (probably also related to the Gilmore Fault Zone), (3) Young–Wombat, **Harden–Murrumburrah**, and **McMahons Reef** in the Young Anticlinorial Zone, and (4) Araluen–Majors Creek in the Molong–South Coast Anticlinorial Zone (South).

(4) Gold is associated with Siluro–Devonian felsic volcanic centres in a number of settings. Middle–Late Silurian volcanics host disseminated gold at **Cullinga**. Late Silurian rift or basin felsic volcanics are host to stratiform volcanogenic auriferous base-metal deposits at Mineral Hill, **Wellington** (some orebodies), **Galwadgere**, and **Captains Flat** and to vein deposits at Wellington (some), Gundagai (some), and Tuena (some). Early Devonian felsic volcanics are host to stratabound gold at Canbelego (Suppel & Lewis, 1988), and to vein deposits at **Grenfell**. Epithermal gold deposits occur in Middle–Late Devonian felsic volcanics of the Eden–Comerong–Yalwal Rift Zone at **Pambula** and **Yalwal–Grassy Gully**.

(5) The Kanimblan Orogeny in the Early Carboniferous completed cratonisation of the Lachlan Fold Belt. Deformed interarch basin flysch sequences (slate belts) became host to vein and shear deposits, including saddle reefs. Slate belt deposits occur at Hill End–Tambaroora, Stuart Town, Hargraves–Windeyer, Tuena, and Trunkey Creek in the Hill End Synclinorial Zone. Mount McDonald, Lucky Draw, **Barmedman–Reefton**, Sebastopol–Junee Reefs (some orebodies), Cowarra, and **Nerrigundah** are also hosted by folded metasediments, although these deposits are close to granite intrusions. Gold mineralisation is associated with Carboniferous Kanimblan granites at Gulgong in the Capertee Block and at Wellington (some orebodies).

Gold-copper mineralisation occurs in stockwork and massive sulphide deposits in Early Devonian fine-grained sedimentary rocks at Cobar (New Occidental, **Great Cobar, New Cobar,** The Peak). The origin of the Cobar orebodies has been the subject of debate (see e.g. Glen, 1987): structural controls support a syndeformational hydrothermal origin; alternatively, stratigraphic features have been interpreted in favour of a remobilised exhalative origin.

The New England Fold Belt comprises mainly Early–Late Palaeozoic volcanic arc–fore-arc basin–accretionary prism complexes, intruded by syn- and post-orogenic granitoid plutons. Some gold deposits formed prior to accretion in oceanic crustal rocks that make up accretionary wedges, but the vast majority of deposits formed from magmatic–hydrothermal to metamorphic–hydrothermal processes related to late- and post-orogenic granite plutonism (Barnes & others, 1988).

Remobilised pre-accretionary fissure vein deposits occur in sedimentary rocks of the Coffs Harbour Block at **Coramba–Orara**. Volcanic-epithermal veins, stockworks, disseminations, and breccia infillings occur in Middle–Late Permian felsic volcanics and andesite at Drake. Au-Sb veins are hosted by Late Permian granitoids at **Uralla** and Armidale–Rockvale, and gold occurs in association with Mo(–Sn) in Permo–Triassic granites at **Timbarra–Poverty Point**. Veins in sedimentary rocks in the **Upper Hunter** and **Copeland (Barrington)** fields appear, at least in part, to be related to granite intrusion. Au±Sb±W veins at Hillgrove are within and adjacent to granite but a metamorphic–hydrothermal origin is indicated by structural relationships (Barnes & others, 1988). A similar origin is possible for Au–W–Sb mineralisation at **Nundle**, where veins are associated with dolerite and sedimentary rocks adjacent to the Peel Fault, along the eastern margin of the Tamworth Belt. Gold is associated with alpine-type serpentinite along the fault at **Bingara**.

Alluvial deposits were widespread and were the source of a high proportion of total gold production. The principal sources were Tertiary deep leads at Parkes, Forbes, Gulgong, Kiandra, Tumbarumba–Batlow, Temora, and Uralla, and Quaternary alluvials at Macquarie River (Wellington), Turon River (Sofala–Wattle Flat), Araluen–Majors Creek, Bingara, Nundle, and Uralla.

NOTES ON THE REPORT AND DATABASE HEADINGS

Table 1 lists the deposits in the order in which they appear in the datafile, by deposit group (see below), generally from west to east across the map (Fig. 1). Table 2 summarises location and production data, and Table 3 resources data. Appendix 2 (Temora (Gidginbung)) illustrates the format of the datafile. The index contains all deposit names, deposit synonyms, orebody names, and mine names.

The following notes should be read in conjunction with Appendix 2.

'DEPOSIT IDENTIFICATION' includes known synonyms for the deposit, the principal commodities mined or present, and listings of the various mines and orebodies within the deposit. Deposits may contain multiple orebodies, each of which may support a number of mines. The geological data have been recorded on a hierarchical basis to provide for flexibility of storage and ease of retrieval. As well as having been assigned to structural units (block, province, sub-province: see 'GEOLOGY'), deposits have been *grouped*, where appropriate, on the basis of a common geological affiliation. The geological setting that applies to all members of a group is given under only one deposit of the group and can be cross-referenced via the Deposit Identification 'Comments' field. The terms 'group', 'deposit', 'synonym', and 'orebody' are used informally and are to be regarded mainly as data storage and retrieval tools.

'LOCATION' data are linked to a separate database — the National Master Names File — supplied by AUSLIG and installed on the BMR's Data General MV 20 000. The Location section also includes reference to the Administrative Subdivision in which the deposit occurs. Administrative Subdivisions of New South Wales are shown in Figure 4.

'DEVELOPMENT HISTORY' lists historical and modern operations separately. Details of recent mine developments are contained in Hirst (1987; update in preparation).

The 'PRODUCTION' data presented are cumulative totals to 1964 (source: Markham & Gilligan, 1981), and annual production from 1965 to 1988 (source: company reports to the Stock Exchanges).

'RESOURCES' data were extracted from company reports to the Stock Exchanges and are classified according to the mineral resource classification system used by BMR (BMR, 1984).

'Pre-mine resource size' scales a deposit on a world scale as 'small' (<25 t Au), 'medium' (25–500 t Au), or 'large' (>500 t Au); this facilitates cross-referencing between MINDEP and the databases used in various map projects in progress or planned, such as the *BMR Earth Science Atlas*, Third *Atlas of Australian Resources* minerals maps, and *Circum-Pacific Map Project* mineral resources maps.

On a world scale, all NSW deposits except Araluen–Majors Creek are small (<25 t Au). With a total recorded output of around 30 t, Araluen–Majors Creek falls in the medium size range. In terms of recorded past production, three producing centres — Adelong, Hill End–Tambaroora, and New Occidental — exceeded 20 t, and a further ten — Broken Hill, Canbelego, Forbes, Grenfell, Gulgong, Hillgrove, Lucknow, Parkes, West Wyalong, and Young–Wombat — exceeded 10 t.

Mine capacity data are contained in the database, but are not reported in the datafile.

The 'GEOLOGY' and 'DEPOSIT CHARACTERISTICS' sections contain data at regional, deposit and orebody levels. At a regional level, deposits have been assigned to structural units (blocks, provinces, and sub-provinces) as defined by Scheibner (1987, in Suppel & Lewis, in press) (Fig. 2). Some subdivisions at the sub-province level are taken from metallogenic maps. Because of the importance of regional geological setting in gold exploration, summaries of the geological setting of the blocks and, where appropriate, the block subdivisions, have been included in the database. The summaries are based on Markham & Basden (1974), Degeling & others (1986), and relevant metallogenic studies. Pending revision of the database structure, the regional text data are stored at the orebody level in the text field 'GEOLOGICAL SETTING OF MINERALISATION', and may be cross-referenced via the Deposit Identification 'Comments' field.

The database is currently structured so that most of the geological information is stored at the orebody level. Hence for each deposit there is a principal orebody, equivalent to the deposit, whose description contains information relating to the deposit as a whole. The principal orebody is denoted by the suffix '(D)' on the orebody name. Orebody-specific data, such as dimensions, are presented separately under the appropriate orebody name.

'Deposit type' is a non-genetic description based on deposit morphology and host rock association. New South Wales gold deposits are classified in Markam & Gilligan (1981).

'REFERENCES AND FURTHER SOURCES' are current to December 1988 and contain data sources consulted plus sources of additional information. The references are stored in the BMR's bibliographic database, GEODX.

The prime data sources were publications and unpublished documents of the Geological Survey of New South Wales, Department of Minerals & Energy. Compilations of data on gold deposits are contained in:

— *The Mineral Deposits of New South Wales* (Markham & Basden, 1974)

— *Gold deposits of the New England Fold Belt* (Markham, 1975)

— *Gold deposits of the Lachlan Fold Belt* (Markham, 1982)

— Metallogenic map, mine data sheet, and metallogenic study series.

Reports in the unpublished GS series, and the unpublished manuscript of Markham (1982) are available from the Publications Office of the Department of Minerals & Energy.

The selected bibliography for the whole database (all States) has been published separately (Mock, 1988).

ACKNOWLEDGEMENTS

Project co-ordination by Brian Elliott. Database design and development by Rae Lorenz. Generation of tables, indexes and datafile by Keith Porritt. Text editing by Sandy Paine. Word-processing and keyboarding by Patricia Biezunski, Deonne Burge, Julia Ritchie, and Mary Roberson. Line drawings by Cartography Section, BMR. Preparation of introductory pages and appendices, using *Ventura* desktop publisher, by Peter Sharman.

REFERENCES

ASHLEY, P. M., 1974 — Southern serpentinite belts. *In* MARKHAM, N. L., & BASDEN, H. (Editors) — THE MINERAL DEPOSITS OF NEW SOUTH WALES. *Geological Survey of New South Wales*.

BARNES, R. G., BROWN, R. E., BROWNLOW, J. W., GILLIGAN, L. B., KRYNEN, J., & WILLIS, I. L., 1988 — A review of the mineral deposits of the New England Orogen in New South Wales. *In* KLEEMAN, J. D. (Editor) — New England Orogen — Tectonics and metallogenesis. Proceedings of symposium, University of New England, November 1988, 211–227. *Department of Geology and Geophysics, University of New England, Armidale.*

BMR, 1984 — BMR refines its mineral resource classification system. *Australian Mineral Industry Quarterly*, **36(3)**, 73–82.

CLARKE, I., in press — Igneous petrology. *In* CLARKE, I., & SHERWIN, L. (Editors) — Geological setting of gold and copper deposits in the Parkes area, New South Wales. *Geological Survey of New South Wales, Records* **23(1)**.

DEGELING, P. R., GILLIGAN, L. B., SCHEIBNER, E., & SUPPEL, D. W., 1986 — Metallogeny and tectonic development of the Tasman Fold Belt System in New South Wales. *In* SCHEIBNER, E. (Editor) — Metallogeny and tectonic development of eastern Australia. *Ore Geology Reviews*, **1(2–4)**, 259–313.

DOUTCH, H. F., NEEDHAM, R. H., McCOY, F. W., SWINT-IKI, T. R., ADDICOTT, W. O., & MOORE, G. W., 1988 — Explanatory notes for the geologic map of the Circum-Pacific Region Southwest Quadrant. *Circum-Pacific Map Project, Circum-Pacific Council for Energy & Mineral Resources*. Available from American Association of Petroleum Geologists.

GILLIGAN, L. B., & BARNES, R. G., 1988 — Gold in the New England Fold Belt in New South Wales. Bicentennial Gold 88, Extended Abstracts, Poster Programme 1, 215–218. *Geological Society of Australia Inc., Abstracts Series* **23**.

GLEN, R. A., 1987 — Copper- and gold-rich deposits in deformed turbidites at Cobar, Australia: their structural control and hydrothermal origin. *Economic Geology*, **82(1)**, 124–140.

HIRST, R.G., 1987 — New South Wales metallic minerals mine dossier. *Mineral Economics and Marketing Section, Department of Mineral Resources, New South Wales*.

MARKHAM, N. L., 1975 — Gold deposits of the New England Fold Belt. *Geological Survey of New South Wales, Report* **GS1975/378** (unpublished).

MARKHAM, N. L., 1982 — Gold deposits of the Lachlan Fold Belt. *Geological Survey of New South Wales.* Unpublished manuscript.

MARKHAM, N. L., & BASDEN, H. (Editors), 1974 — THE MINERAL DEPOSITS OF NEW SOUTH WALES. *Geological Survey of New South Wales*.

MARKHAM, N. L., & GILLIGAN, L. B., 1981 — Gold mineralisation in New South Wales. *Geological Survey of New South Wales, Report* **GS1981/433** (unpublished).

MOCK, C. M., 1988 — Australian gold deposits: selected references, late 1800s–1987. AESIS Special List No. 25. *Australian Mineral Foundation, Adelaide.*

MOCK, C., ELLIOTT, B. G., EWERS, G. R., & LORENZ, R. P., 1987 — Gold deposits of Western Australia: BMR datafile (MINDEP). *Bureau of Mineral Resources, Australia, Resource Report* **3**.

MOCK, C. M., LORENZ, R. P., & ELLIOTT, B. G., 1988 — Gold deposits of Queensland: BMR datafile (MINDEP). *Bureau of Mineral Resources, Australia, Resource Report* **4.**

NEW SOUTH WALES DEPARTMENT OF MINERAL RESOURCES, 1986 — Gold in New South Wales. Illustrated brochure, Department of Mineral Resources, New South Wales.

NEW SOUTH WALES DEPARTMENT OF MINERAL RESOURCES, 1988 — Metalliferous mining — 'The Bicentenary' and 'Towards 2000'. *Minfo (New South Wales Mining and Exploration Quarterly)*, **20**, 1–4.

SCHEIBNER, E., 1987 — Schematic structural map of New South Wales. *Geological Survey of New South Wales* (unpublished).

STEVENS, B. P. J., 1974 — Broken Hill type lead-zinc-silver deposits. *In* MARKHAM, N. L., & BASDEN, H. (Editors) — THE MINERAL DEPOSITS OF NEW SOUTH WALES. *Geological Survey of New South Wales*.

STEVENS, B. P. J., BARNES, R. G., BROWN, R. E., STROUD, W. J., & WILLIS, I. L., 1988 — The Willyama Supergroup in the Broken Hill and Euriowie Blocks, New South Wales. *Precambrian Research*, **40/41**, 297–327.

SUPPEL, D. W., & LEWIS, P. C., 1982 — Comments on magmatism and metallogenesis of the Lachlan Fold Belt. *Geological Survey of New South Wales, Report* **GS1982/602** (unpublished).

SUPPEL, D. W., & LEWIS, P. C., 1988 — Gold in the Lachlan Fold Belt in New South Wales. Bicentennial Gold 88, Extended Abstracts, Poster Programme 1, 233–235. *Geological Society of Australia Inc., Abstracts Series* **23**.

SUPPEL, D. W., & LEWIS, P. C. (in press) — Gold deposits of the Lachlan Fold Belt. *Geological Survey of New South Wales, Report* GS (unpublished).

SUPPEL, D. W., WARREN, A. Y. E., WATKINS, J. J., CHAPMAN, J., TENISON WOODS, K., & BARRON, L., 1986 — A reconnaissance study of the geology and gold deposits of the West Wyalong–Temora–Adelong district. *Geological Survey of New South Wales, Quarterly Notes*, **64**, 1–23, 30.

SUPPEL, D. W., LISHMUND, S. R., & ARMSTRONG, M., 1988 — Map, Mineral Deposits of New South Wales, 1:1 500 000. *Geological Survey of New South Wales.*

WYBORN, D., 1988 — Ordovician magmatism, gold mineralisation, and an integrated tectonic model for the Ordovician and Silurian history of the Lachlan Fold Belt in NSW. *BMR Research Newsletter*, **8**, 13–14.

Table 1. Deposits in the datafile, deposit groups, and structural units

No	Deposit name	Deposit group	Geological Sub-province	Geological Province
			BROKEN HILL BLOCK	
1	Broken Hill	--	--	--
			WONOMINTA BLOCK	
2	Tibooburra-Milparinka	--	--	--
			LACHLAN FOLD BELT	
3	Great Cobar	Cobar group	Cobar Block	--
4	New Cobar	Cobar group	Cobar Block	--
5	New Occidental	Cobar group	Cobar Block	--
6	The Peak	Cobar group	Cobar Block	--
7	Canbelego	--	--	Mineral Hill Synclinorial Zone
8	Mineral Hill	--	--	Mineral Hill Synclinorial Zone
9	Parkes (Goonumbla)	--	--	Girilambone Anticlinorial Zone
10	Peak Hill-Tomingley	Parkes Thrust group	Tumut Synclinorial Zone (N)	Tumut Synclinorial Zone
11	Parkes	Parkes Thrust group	Tumut Synclinorial Zone (N)	Tumut Synclinorial Zone
12	Forbes	Parkes Thrust group	Tumut Synclinorial Zone (N)	Tumut Synclinorial Zone
13	Grenfell	--	--	Young Anticlinorial Zone
14	West Wyalong	Gilmore Fault Zone group	--	Wagga Anticlinorial Zone
15	Barmedman-Reefton	Gilmore Fault Zone group	--	Girilambone Anticlinorial Zone
16	Temora (Gidginbung)	Gilmore Fault Zone group	--	Girilambone Anticlinorial Zone
17	Temora	Gilmore Fault Zone group	--	Girilambone Anticlinorial Zone
18	Sebastopol-Junee Reefs	Gilmore Fault Zone group	--	Wagga Anticlinorial Zone
19	Dobroyde	Gilmore Fault Zone group	--	Tumut Synclinorial Zone
20	Adelong	Gilmore Fault Zone group	--	Wagga Anticlinorial Zone
21	Tumbarumba-Batlow	--	--	Wagga Anticlinorial Zone
22	Kiandra	--	Tantangara Block	Molong-South Coast Anticlinorial Zone(S)
23	Gundagai	--	Gocup Block	Tumut Synclinorial Zone
24	Cullinga	--	Jindalee Block	Tumut Synclinorial Zone
25	Young-Wombat	Young group	Young Anticlinorial Zone (S)	Young Anticlinorial Zone
26	Harden-Murrumburrah	Young group	Young Anticlinorial Zone (S)	Young Anticlinorial Zone
27	McMahons Reef	Young group	Young Anticlinorial Zone (S)	Young Anticlinorial Zone
28	Lucknow	Orange group	Molong Anticlinorium	Molong-South Coast Anticlinorial Zone(N)

Table 1 (continued). Deposits in the datafile, deposit groups, and structural units

No	Deposit name	Deposit group	Geological Sub-province	Geological Province
29	Forest Reefs	Orange group	Molong Anticlinorium	Molong-South Coast Anticlinorial Zone(N)
30	Browns Creek	Orange group	Molong Anticlinorium	Molong-South Coast Anticlinorial Zone(N)
31	Cadia	Orange group	Molong Anticlinorium	Molong-South Coast Anticlinorial Zone(N)
32	Junction Reefs (Sheahan-Grants)	Orange group	Molong Anticlinorium	Molong-South Coast Anticlinorial Zone(N)
33	Mount McDonald	Orange group	Molong Anticlinorium	Molong-South Coast Anticlinorial Zone(N)
34	Trunkey Creek	Copperhania Thrust group	Trunkey Synclinorium	Hill End Synclinorial Zone
35	Tuena	Copperhania Thrust group	Trunkey Synclinorium	Hill End Synclinorial Zone
36	Lucky Draw	--	Rockley Anticlinorium	Molong-South Coast Anticlinorial Zone(N)
37	Bodangora (Mitchells Creek)	--	--	Molong-South Coast Anticlinorial Zone(N)
38	Wellington	Wellington group	Nindethana Thrust System	Molong-South Coast Anticlinorial Zone(N)
39	Galwadgere	Wellington group	Nindethana Thrust System	Molong-South Coast Anticlinorial Zone(N)
40	Stuart Town	Hill End group	Hill End Synclinorium	Hill End Synclinorial Zone
41	Hargraves-Windeyer	Hill End group	Hill End Synclinorium	Hill End Synclinorial Zone
42	Hill End-Tambaroora	Hill End group	Hill End Synclinorium	Hill End Synclinorial Zone
43	Gulgong	--	Sofala Anticlinorium	Molong-S C Anticlin Zone(Capertee Block)
44	Sofala-Wattle Flat	--	Sofala Anticlinorium	Molong-S C Anticlin Zone(Capertee Block)
45	Captains Flat	--	--	Captains Flat-Goulburn Synclinorial Zone
46	Cowarra	--	Cullarin Block	Molong-South Coast Anticlinorial Zone(S)
47	Yalwal-Grassy Gully	Eden-Comerong-Yalwal group	Eden-Comerong-Yalwal Rift Zone	Molong-South Coast Anticlinorial Zone(S)
48	Araluen-Majors Creek	--	South Coast Anticlinorium	Molong-South Coast Anticlinorial Zone(S)
49	Nerrigundah	--	South Coast Anticlinorium	Molong-South Coast Anticlinorial Zone(S)
50	Pambula	Eden-Comerong-Yalwal group	Eden-Comerong-Yalwal Rift Zone	Molong-South Coast Anticlinorial Zone(S)
		NEW ENGLAND FOLD BELT		
51	Bingara	--	--	Great Serpentinite Belt
52	Nundle	--	--	Tamworth Belt
53	Upper Hunter	--	--	Tamworth Belt
54	Copeland (Barrington)	--	--	Tamworth Belt
55	Uralla	--	--	Central Block
56	Armidale-Rockvale	--	--	Central Block
57	Hillgrove	--	--	Central Block
58	Timbarra-Poverty Point	--	--	Coffs Harbour Block
59	Drake	--	--	Coffs Harbour Block
60	Coramba-Orara	--	--	Coffs Harbour Block

Table 2. Location and production of NSW gold deposits

No	Deposit name	Location Lat	Location Long	1:250 000 Map sheet	Latest production period	Production (kg) Cumulative to 1964	Cumulative 1965-86	Annual 1987	Annual 1988	Resources
1	Broken Hill	31 58	141 27	SH5415	1883-	12 076	19 911	804	1 035	(see Table 3)
2	Tibooburra-Milparinka	29 35	141 53	SH5407	1880-1929	1 905				--
3	Great Cobar	31 30	145 50	SH5514	1894-1919	9 128				--
4	New Cobar	31 31	145 51	SH5514	1936-1948	7 400				--
5	New Occidental	31 32	145 52	SH5514	1987-	19 985		2 244	2 349	(see Table 3)
6	The Peak	31 34	145 53	SH5514	1924-1946	639				--
7	Canbelego	31 34	146 19	SH5514	1988-	13 510			4 280	(see Table 3)
8	Mineral Hill	32 35	146 59	SI5502	1989-	73				(see Table 3)
9	Parkes (Goonumbla)	32 57	148 06	SI5503	--	--				(see Table 3)
10	Peak Hill-Tomingley	32 44	148 11	SI5503	1988-	4 095			1 196	(see Table 3)
11	Parkes	33 08	148 11	SI5507	1989-	11 309				(see Table 3)
12	Forbes	33 23	148 01	SI5507	1898-1910	14 876				--
13	Grenfell	33 54	148 10	SI5507	1866-1935	10 028				--
14	West Wyalong	33 55	147 12	SI5507	1987-1988	14 104		330	87	--
15	Barmedman-Reefton	34 09	147 24	SI5511	1870-1903	1 052				--
16	Temora (Gidginbung)	34 20	147 28	SI5511	1987-	--		2 692	3 232	(see Table 3)
17	Temora	34 27	147 32	SI5511	1880-1890	4 619				--
18	Sebastopol-Junee Reefs	34 35	147 32	SI5511	1869-1898	476				--
19	Dobroyde	34 45	147 39	SI5511	--	--				(see Table 3)
20	Adelong	35 19	148 04	SI5515	1857-1927	21 234				(see Table 3)
21	Tumbarumba-Batlow	35 47	148 03	SI5515	1859-1910	4 549				--
22	Kiandra	35 52	148 30	SI5515	1860-1909	4 600				--
23	Gundagai	35 04	148 07	SI5515	1896-1935	1 269				--
24	Cullinga	34 36	148 10	SI5511	1892-1941	1 242				(see Table 3)
25	Young-Wombat	34 19	148 18	SI5511	1860-1875	10 000				--
26	Harden-Murrumburrah	34 34	148 22	SI5511	1883-1913	1 796				--
27	McMahons Reef	34 40	148 26	SI5511	1885-1899	630				--
28	Lucknow	33 21	149 10	SI5508	1933-1987	16 189				--
29	Forest Reefs	33 27	149 05	SI5508	1880-1916	74				--
30	Browns Creek	33 32	149 10	SI5508	1987-	1 517		1 410	1 980	(see Table 3)

Table 2 (continued). Location and production of NSW gold deposits

No	Deposit name	Location: Lat	Location: Long	1:250 000 Map sheet	Latest production period	Production (kg) Cumulative to 1964	Production (kg) Cumulative 1965-86	Production (kg) Annual 1987	Production (kg) Annual 1988	Resources
31	Cadia	33 27	149 01	SI5508	1941-1943	--				(see Table 3)
32	Junction Reefs (Sheahan-Grants)	33 38	148 59	SI5508	1988-	1 680			16 185	(see Table 3)
33	Mount McDonald	33 55	148 57	SI5508	1881-1916	1 698				--
34	Trunkey Creek	33 49	149 19	SI5508	1887-1908	1 630				--
35	Tuena	34 01	149 20	SI5512	1875-1909	1 383				--
36	Lucky Draw	33 55	149 34	SI5508	1989-	--				(see Table 3)
37	Bodangora (Mitchells Creek)	32 27	148 58	SI5504	1986-	5 972		308	136	(see Table 3)
38	Wellington	32 35	149 04	SI5504	1990-	7 134				(see Table 3)
39	Galwadgere	32 40	149 04	SI5504	1936-1948	31				(see Table 3)
40	Stuart Town	32 48	149 05	SI5504	1931-1945	5 365				--
41	Hargraves-Windeyer	32 48	149 28	SI5504	1850-1874	878				--
42	Hill End-Tambaroora	33 02	149 25	SI5508	1870-1886	22 000				--
43	Gulgong	32 22	149 32	SI5504	1895-1900	17 606				(see Table 3)
44	Sofala-Wattle Flat	33 09	149 41	SI5508	1876-1914	4 452				(see Table 3)
45	Captains Flat	35 35	149 27	SI5516	1937-1962	7 341				--
46	Cowarra	36 01	149 18	SJ5504	1986-1988	700		471	726	--
47	Yalwal-Grassy Gully	34 56	150 23	SI5609	1885-1900	2 579				--
48	Araluen-Majors Creek	35 35	149 46	SI5516	1875-1900	35 378				(see Table 3)
49	Nerrigundah	36 07	149 54	SJ5504	1865-1900	1 418				--
50	Pambula	36 56	149 52	SJ5504	1892-1915	1 406				--
51	Bingara	29 52	150 34	SH5605	1876-1906	1 316		228		--
52	Nundle	31 27	151 08	SH5613	1852-1914	9 405				--
53	Upper Hunter	31 57	151 03	SH5613	1888-1902	1 228				--
54	Copeland (Barrington)	32 00	151 49	SH5614	1876-1886	2 867				--
55	Uralla	30 38	151 30	SH5610	1858-1885	5 192				--
56	Armidale-Rockvale	30 31	151 40	SH5610	1856-1898	636				(see Table 3)
57	Hillgrove	30 34	151 54	SH5610	1891-1899	17 109	10 326	1 500	1 050	(see Table 3)
58	Timbarra-Poverty Point	29 08	152 19	SH5606	1859-1866	2 029				(see Table 3)
59	Drake	28 55	152 22	SH5602	1988-	2 531			5 010	(see Table 3)
60	Coramba-Orara	30 10	153 00	SH5610	1882-1914	1 183				--

Table 3. Resources of NSW gold deposits

No	Deposit name	Date	Ore ('000 t)	Grade (g/t)	Gold (kg)	Type	Classification	Comments
1	Broken Hill	Dec 1987	41 100	0.20	8 220	In-situ u/g	Economic demonstrated	ZC mine (includes ZC and NBHC mines)
		June 1988	5 400	0.20	1 080	In-situ u/g	Economic demonstrated	North mine
		Dec 1988	2 700	0.20	540	In-situ o/c	Economic demonstrated	South mine (Kintore open cut)
5	New Occidental	June 1987	2 800	0.95	2 660	Recoverable t	Economic demonstrated	Tailings
7	Canbelego	Dec 1988	180	4.30	774	Recoverable t	Economic demonstrated	Tailings
		Dec 1987	80	4.00	320	In-situ o/c	Economic inferred	Mount Boppy
8	Mineral Hill	June 1988	342	6.70	2 291	In-situ o/c	Economic demonstrated (indicated)	Eastern and 5001, `gold ore'
		June 1988	353	3.60	1 271	In-situ o/c	Economic demonstrated (indicated)	Eastern and 5001, `copper ore'
9	Parkes (Goonumbla)	June 1987	1 171	2.70	3 162	Recoverable o/c	Paramarginal demonstrated	Shallow oxidised ore, E 22, E 27; cut-off grade 1.0 g/t Au
		June 1988	13 100	0.55	7 205	In-situ o/c	Paramarginal demonstrated	Endeavour 22
		June 1988	9 000	0.16	1 440	In-situ o/c	Paramarginal demonstrated	Endeavour 26N
		June 1988	7 700	0.72	5 544	In-situ o/c	Paramarginal demonstrated	Endeavour 27
		June 1987	1 610	2.20	3 542	Recoverable o/c	Paramarginal demonstrated	Shallow oxidised ore, E 22, E 27; cut-off grade 0.75 g/t Au
		June 1988	29 800	0.48	14 304	In-situ o/c	Paramarginal demonstrated	Total Endeavours 22, 26N, 27 open-cut
		June 1988	25 200	0.63	15 876	In-situ u/g	Paramarginal demonstrated	Endeavour 26N
10	Peak Hill-Tomingley	Dec 1988	1 100	3.00	3 300	In-situ o/c	Economic demonstrated (measured)	Oxide ore, cut-off grade 1.00 g/t Au
11	Parkes	May 1988	65	3.20	208	In-situ o/c	Economic demonstrated	London-Victoria
		Dec 1987	313	2.65	829	In-situ o/c	Paramarginal demonstrated	Shaws
		May 1988	1 375	2.27	3 121	Recoverable o/c	Economic demonstrated	London-Victoria
16	Temora (Gidginbung)	Dec 1988	230	2.05	472	Recoverable s	Economic demonstrated (measured)	Stockpile
		Dec 1988	3 110	2.63	8 179	Recoverable o/c	Economic demonstrated (measured)	Oxide ore, cut-off grade 1.5 g/t Au
19	Dobroyde	June 1988	34	4.80	163	Recoverable u/g	Paramarginal demonstrated	
		June 1988	926	2.10	1 945	Recoverable	Paramarginal demonstrated	Total of open-cut and underground resources
		June 1988	892	2.00	1 784	Recoverable o/c	Paramarginal demonstrated	Cut-off grade 0.5 g/t Au
20	Adelong	June 1987	35	2.00	70	In-situ t	Submarginal demonstrated	Challenger; established by previous operator
		June 1987	287	5.40	1 550	In-situ o/c	Submarginal demonstrated	" " "
24	Cullinga	Sept 1988	150	4.50	675	In-situ o/c	Subeconomic inferred	Christmas Gift
30	Browns Creek	May 1988	410	4.80	1 968	Recoverable o/c	Economic demonstrated	
31	Cadia	Dec 1975	29 400	0.57	16 758	In-situ o/c	Subeconomic demonstrated	Copper grade 0.72% Cu

Table 3 (continued). Resources of NSW gold deposits

No	Deposit name	Date	Ore ('000 t)	Grade (g/t)	Gold (kg)	Type	Classification	Comments
32	Junction Reefs (Sheahan-Grants)	Sept 1988	328	2.40	787	Recoverable o/c	Economic demonstrated (measured)	Sheahan-Grants, oxide ore
		Mar 1989	460	3.70	1 702	In-situ o/c	Subeconomic demonstrated	Frenchmans, Cornishmens
		Sept 1988	300	2.00	600	In-situ o/c	Subeconomic inferred	Glendale East, Prince of Wales
		Sept 1988	1 300	2.00	2 600	In-situ o/c	Subeconomic demonstrated	Glendale, Glendale North
		Sept 1988	876	3.20	2 803	Recoverable u/g	Economic demonstrated (measured)	Sheahan-Grants, sulphide ore
36	Lucky Draw	June 1988	140	3.50	490	Recoverable o/c	Economic inferred	
37	Bodangora (Mitchells Creek)	Dec 1988	270	1.50	405	In-situ o/c	Subeconomic demonstrated	Mitchells Creek (Kaiser)
		Dec 1988			143	Recoverable t	Economic demonstrated	Mitchells Creek (Cluff Resources)
38	Wellington	Dec 1988	82	5.90	484	In-situ u/g	Subeconomic demonstrated	Commonwealth
		Dec 1988	10			In-situ u/g	Subeconomic inferred	Commonwealth
		Dec 1988	10 600	0.20	2 120	In-situ alluv	Subeconomic inferred	Wellington alluvial; units: '000 cubic metres, g/cubic m
39	Galwadgere	Dec 1972	2 960			In-situ	Subeconomic demonstrated	Dawn of Galwadgere, 1.4% Cu, cut-off grade 1.0% Cu
43	Gulgong	Dec 1988	2 200	0.25	550	In-situ alluv	Subeconomic demonstrated	Cudgegong alluvial; units: '000 cubic metres, g/cubic m
44	Sofala-Wattle Flat	July 1988	898	0.60	539	In-situ alluv	Subeconomic demonstrated	Turon River alluvial; units: '000 cubic metres, g/cubic m
48	Araluen-Majors Creek	Dec 1988	57	7.45	425	In-situ u/g	Subeconomic demonstrated	Dargues
		Dec 1988	57	6.10	346	In-situ u/g	Subeconomic inferred	Dargues
56	Armidale-Rockvale	June 1988	122	8.70	1 061	Recoverable u/g	Subeconomic demonstrated	Comet, (Brackins Spur)
57	Hillgrove	June 1988	119	9.10	1 080	In-situ u/g	Economic demonstrated (measured)	
		June 1988	9	6.20	56	In-situ u/g	Economic demonstrated (indicated)	
58	Timbarra-Poverty Point	Mar 1989	750	1.44	1 080	In-situ o/c	Subeconomic inferred	Poverty Point, soil & oxidised granite to 30 m
59	Drake	June 1987	180	0.90	162	In-situ o/c	Economic inferred	Red Rock, high Ag grade
		Mar 1988	335	1.70	570	In-situ o/c	Economic inferred	North Kylo
		Mar 1988	701	3.30	2 313	In-situ o/c	Economic inferred	Strauss
		Mar 1988	65	3.60	234	In-situ o/c	Economic inferred	Hot Scone
		Mar 1988	124	3.10	384	In-situ o/c	Economic inferred	Carrington
		Mar 1988	127	4.90	622	In-situ o/c	Economic inferred	Guy Bell
		Mar 1988	228	2.70	616	In-situ o/c	Economic inferred	North Kylo
		June 1987	931	10.40	9 682	In-situ o/c	Economic inferred	Lady Hampden
		June 1987	1 400	0.10	140	In-situ o/c	Economic inferred	White Rock, high Ag grade
		June 1987	300	0.20	60	In-situ o/c	Economic inferred	Silver King, high Ag grade

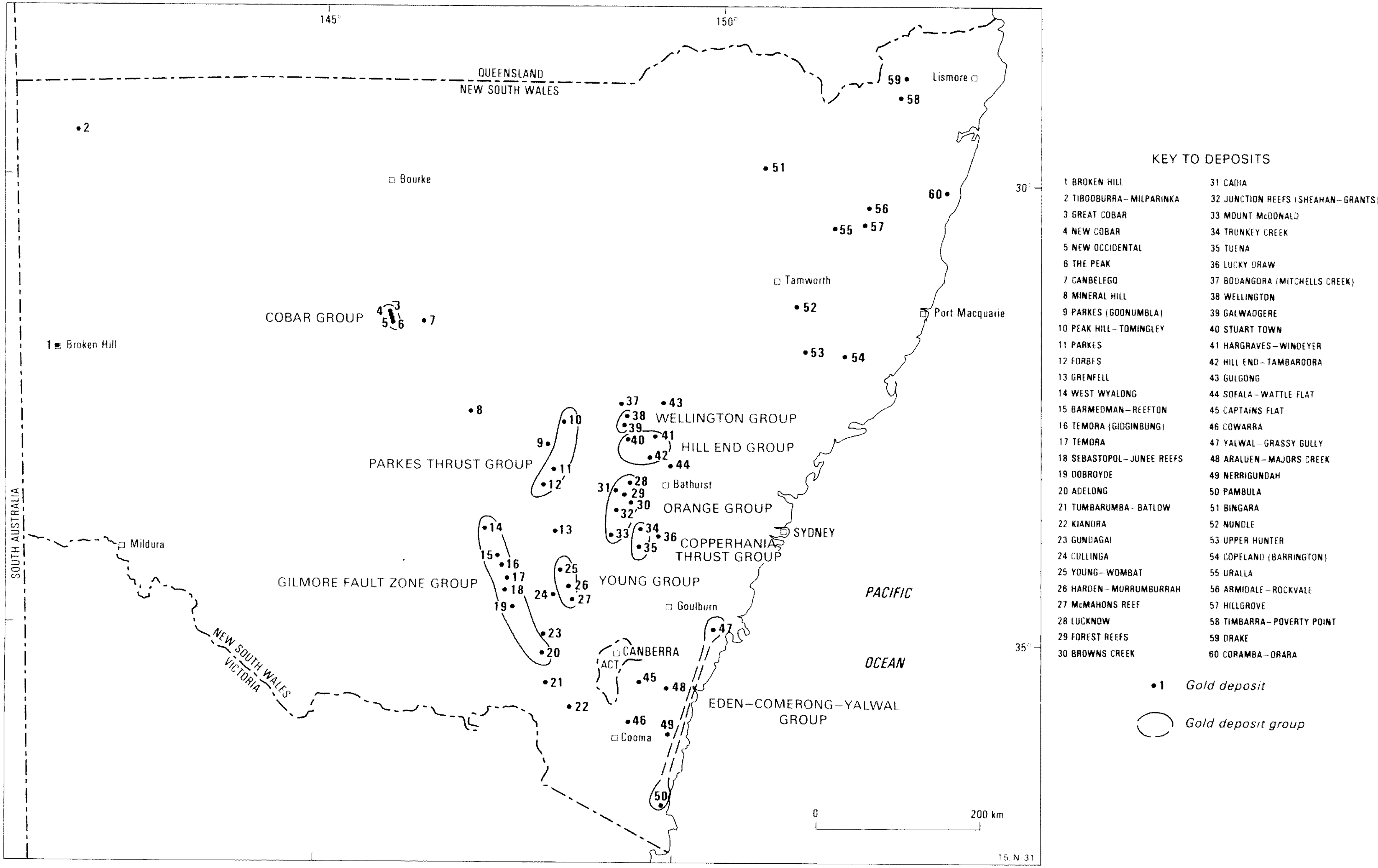

Fig. 1. Gold deposits and deposit groups (from Suppel & Lewis, 1988; Gilligan & Barnes, 1988; Suppel & others, 1988).

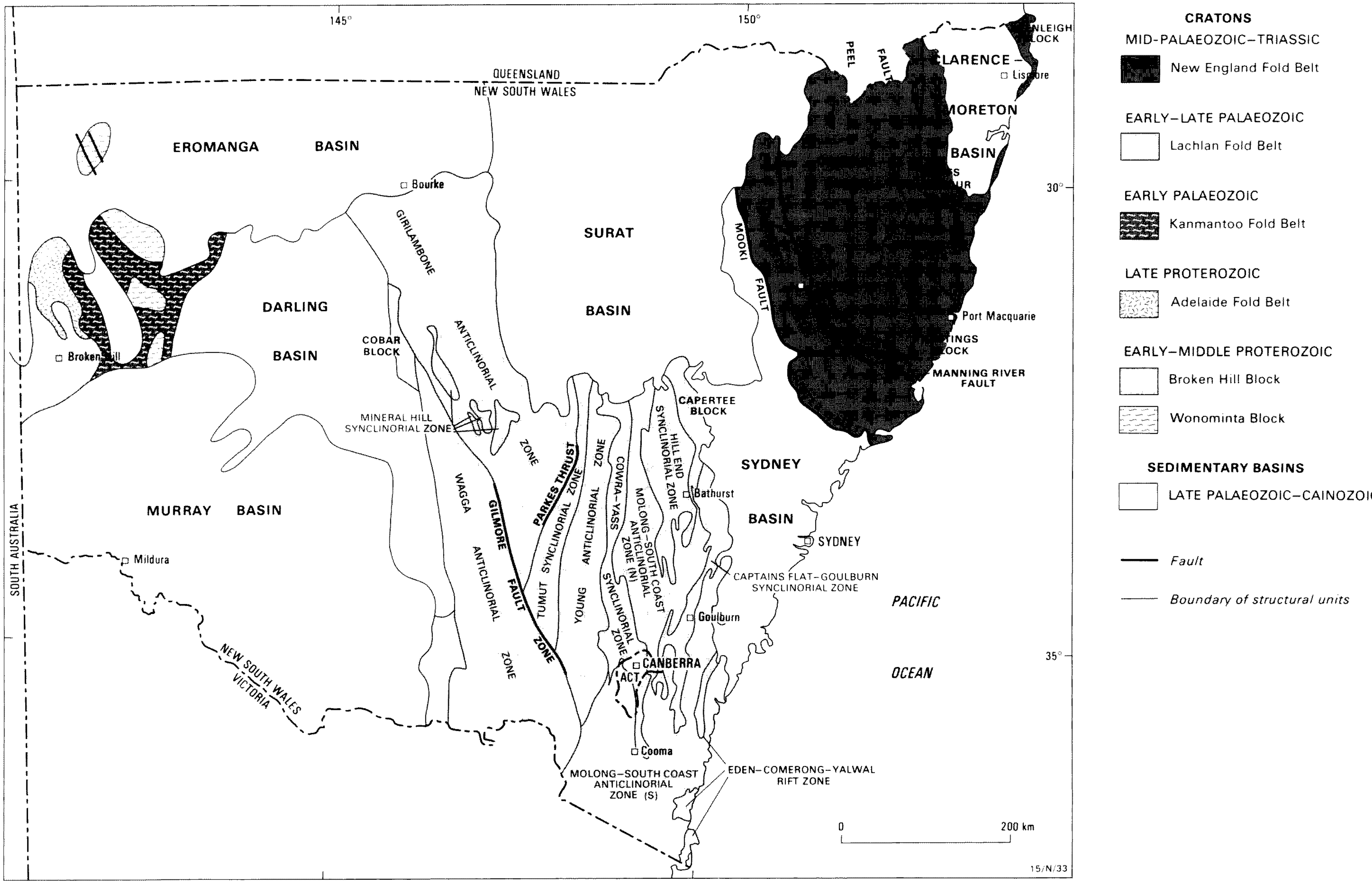

Fig. 2. Structural units of New South Wales (modified from Scheibner, 1987, *in* Suppel & Lewis, in press; Doutch & others, 1988).

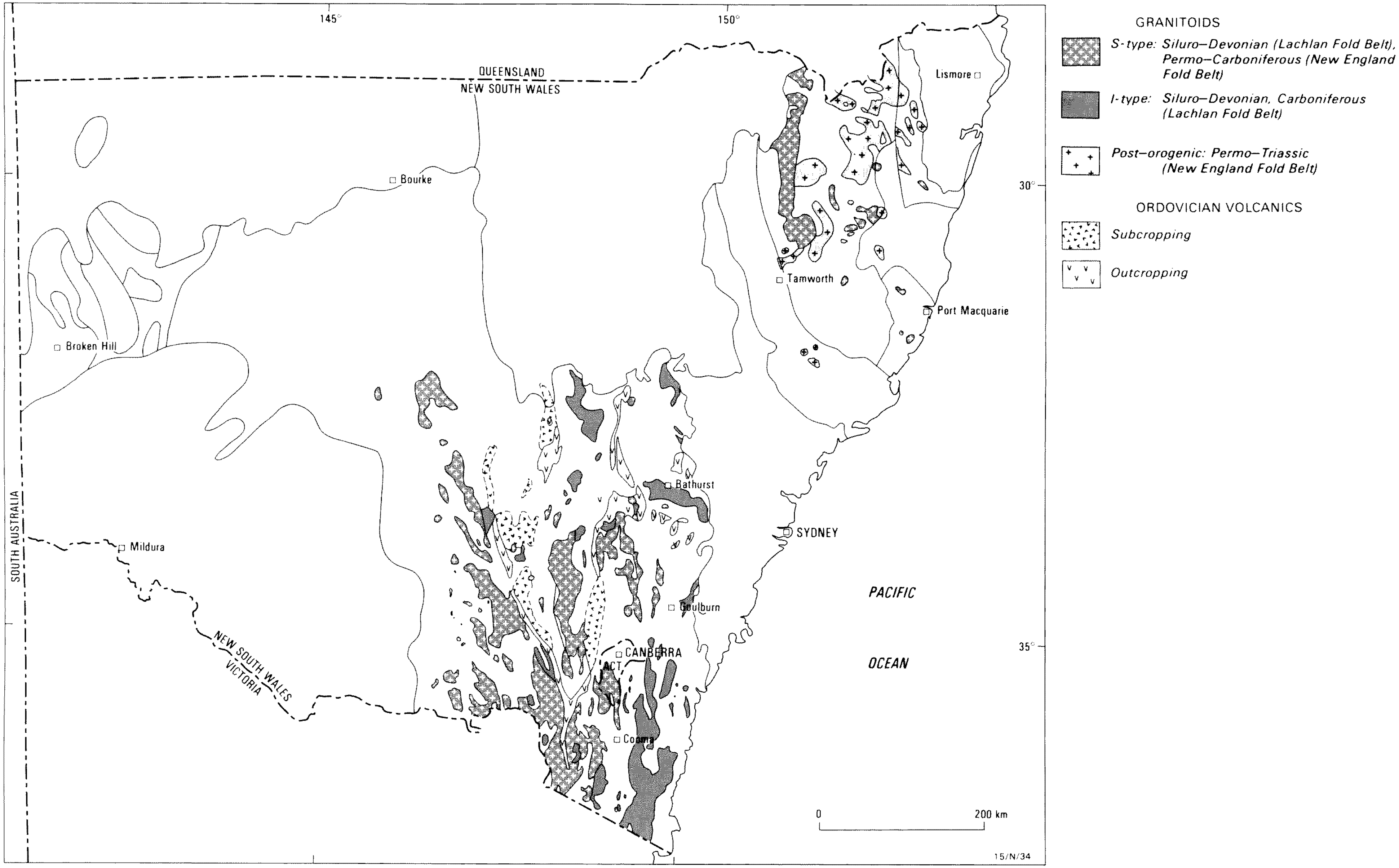

Fig. 3. Granitoids and Ordovician volcanics of the Lachlan Fold Belt and New England Fold Belt of New South Wales (from Suppel & Lewis, 1982; Wyborn, 1988; Barnes & others, 1988).

CITIES AND MUNICIPALITIES

1. CITY OF LISMORE
2. CASINO
3. CITY OF GOSFORD
4. GLEN INNES
5. CITY OF GRAFTON
6. CITY OF ARMIDALE
7. CITY OF TAMWORTH
8. HASTINGS
9. CITY OF GREATER TAREE
10. CITY OF DUBBO
11. LAKE MACQUARIE
12. CITY OF SHOALHAVEN
13. CITY OF MAITLAND
14. CITY OF NEWCASTLE
15. CITY OF GREATER CESSNOCK
16. CITY OF BLUE MOUNTAINS
17. CITY OF GREATER LITHGOW
18. CITY OF BATHURST
19. CITY OF ORANGE
20. CITY OF WOLLONGONG
21. SHELLHARBOUR
22. KIAMA
23. CITY OF GOULBURN
24. CITY OF WAGGA WAGGA
25. DENILIQUIN
26. CITY OF ALBURY
27. CITY OF QUEANBEYAN
28. CITY OF BROKEN HILL

INVERELL — *Local government areas (LGA)*

COBAR — *Mining division*

Fig. 4. Administrative subdivisions of New South Wales (from Statistical Section, New South Wales Department of Minerals & Energy).

Appendix 1. Mineral deposits (MINDEP) database recording format

1. RECORD/DEPOSIT IDENTIFICATION

DEPOSIT NO. [ ] FILE NO. [ ]

RECORD TYPE [ ] s (single)/c (compound)/p (partial)

PRINCIPAL COMMODITY(IES)

MINOR COMMODITY(IES)

DEPOSIT SIZE [ ] l (large)/m (medium)/s (small)

DEPOSIT DISTRIBUTION

RECORD/DEPOSIT COMMENTS

2. LOCATION

LATITUDE

LONGITUDE

METHOD OF LOCATION

[ ] verified
[ ] map ref.
[ ] published
[ ] determined

REFERENCE POINT

[ ] shaft
[ ] open cut
[ ] plant
[ ] town
[ ] centroid

DEPOSIT NAME

SYNONYMS

OREBODY(IES)

MINE(S)

DEPOSIT TYPE(S)

1:250 000 MAP SHEET NO.

1:100 000 MAP SHEET NO.

1:250 000 MAP SHEET NAME

STATE [ ] (Qld/NSW/Vic/Tas/SA/WA/NT)

LOCATION COMMENTS

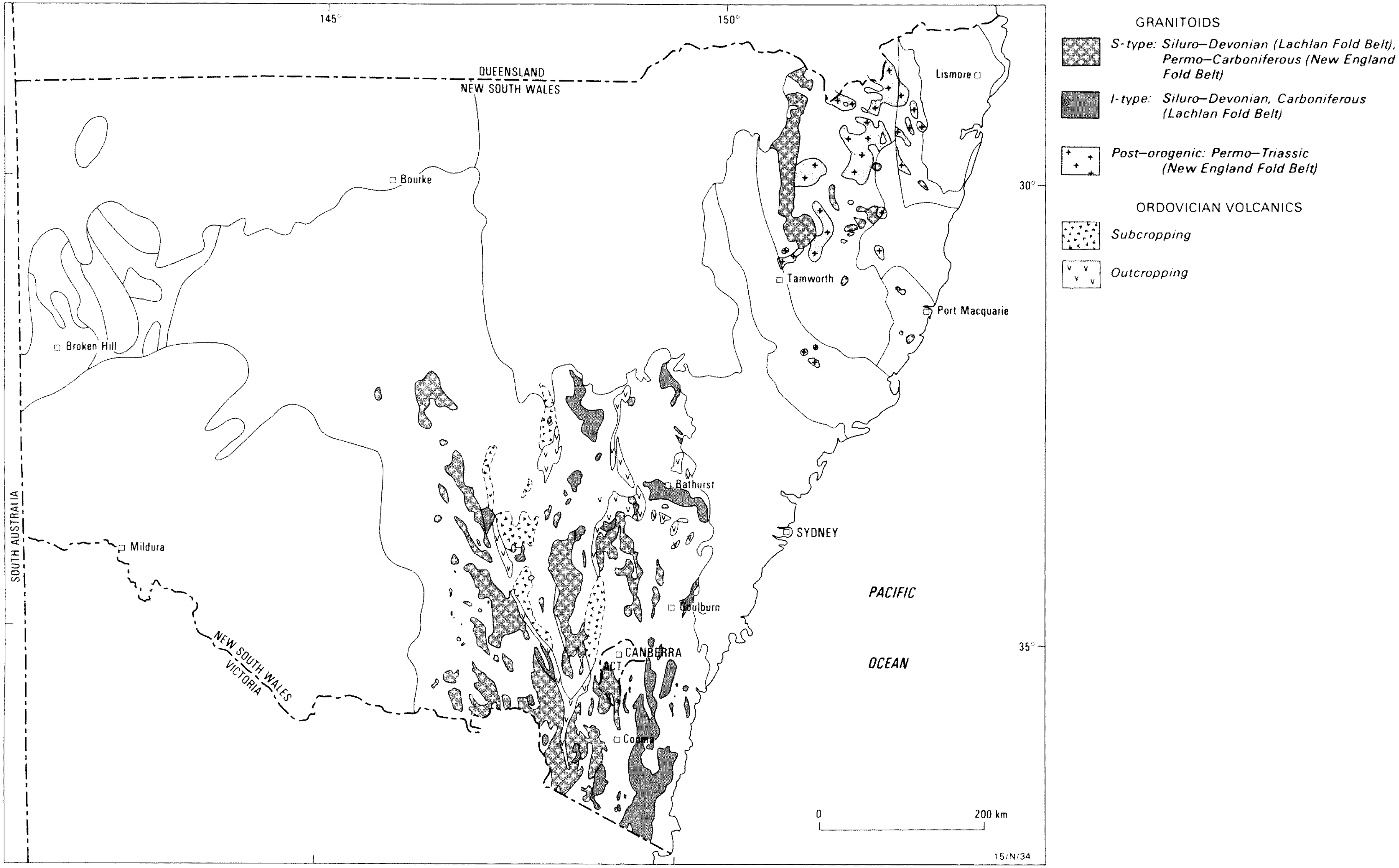

Fig. 3. Granitoids and Ordovician volcanics of the Lachlan Fold Belt and New England Fold Belt of New South Wales (from Suppel & Lewis, 1982; Wyborn, 1988; Barnes & others, 1988).

CITIES AND MUNICIPALITIES

1. CITY OF LISMORE
2. CASINO
3. CITY OF GOSFORD
4. GLEN INNES
5. CITY OF GRAFTON
6. CITY OF ARMIDALE
7. CITY OF TAMWORTH
8. HASTINGS
9. CITY OF GREATER TAREE
10. CITY OF DUBBO
11. LAKE MACQUARIE
12. CITY OF SHOALHAVEN
13. CITY OF MAITLAND
14. CITY OF NEWCASTLE
15. CITY OF GREATER CESSNOCK
16. CITY OF BLUE MOUNTAINS
17. CITY OF GREATER LITHGOW
18. CITY OF BATHURST
19. CITY OF ORANGE
20. CITY OF WOLLONGONG
21. SHELLHARBOUR
22. KIAMA
23. CITY OF GOULBURN
24. CITY OF WAGGA WAGGA
25. DENILIQUIN
26. CITY OF ALBURY
27. CITY OF QUEANBEYAN
28. CITY OF BROKEN HILL

INVERELL *Local government areas (LGA)*

COBAR *Mining division*

Fig. 4. Administrative subdivisions of New South Wales (from Statistical Section, New South Wales Department of Minerals & Energy).

Appendix 1. Mineral deposits (MINDEP) database recording format

1. RECORD/DEPOSIT IDENTIFICATION

DEPOSIT NO.

FILE NO.

RECORD TYPE s (single)/c (compound)/p (partial)

PRINCIPAL COMMODITY(IES)

MINOR COMMODITY(IES)

DEPOSIT SIZE l (large)/m (medium)/s (small)

DEPOSIT DISTRIBUTION

RECORD/DEPOSIT COMMENTS

2. LOCATION

LATITUDE

LONGITUDE

METHOD OF LOCATION

verified

map ref.

published

determined

REFERENCE POINT

shaft

open cut

plant

town

centroid

DEPOSIT NAME

SYNONYMS

OREBODY(IES)

MINE(S)

DEPOSIT TYPE(S)

1:250 000 MAP SHEET NO.

1:100 000 MAP SHEET NO.

1:250 000 MAP SHEET NAME

STATE (Qld/NSW/Vic/Tas/SA/WA/NT)

LOCATION COMMENTS

3. GEOLOGY

DEPOSIT NAME

ADMINISTRATIVE SUBDIVISIONS

GEOLOGICAL PROVINCE/SUB-PROVINCE/GROUP

STRATIGRAPHIC AGE:

HOST SEQUENCE:

MINERALISATION:

IGNEOUS INTRUSION:

GEOCHRONOLOGY

HOST ROCKS

(1) LITHOLOGY: FORMATION NAME: AGE:

RELATIONSHIP TO MINERALISATION

(2) LITHOLOGY: FORMATION NAME: AGE:

RELATIONSHIP TO MINERALISATION

(3) LITHOLOGY: FORMATION NAME: AGE:

RELATIONSHIP TO MINERALISATION

GENETIC CONTROLS

GENETIC MODELS

DEPOSIT NAME [ ]
OREBODY NAME [ ]

NAME:

DIMENSIONS

	MIN		AVE		MAX		O/C
Strike length	[ ]	m	[ ]	m	[ ]	m	[ ]
True width	[ ]	cm/m	[ ]	cm/m	[ ]	cm/m	[ ]
Vertical depth	[ ]	m	[ ]	m	[ ]	m	[ ]
Down-dip depth	[ ]	m	[ ]	m	[ ]	m	[ ]
Depth of oxidation	[ ]	m	[ ]	m	[ ]	m	[ ]
Depth of cover	[ ]	m	[ ]	m	[ ]	m	[ ]
Area	[ ]	km^2	[ ]	km^2	[ ]	km^2	[ ]

OREBODY STYLE(S)

- [ ] conformable
- [ ] discordant
- [ ] stratabound
- [ ] stratiform

OREBODY MORPHOLOGY

orebody/ore shoot

- [ ] tabular
- [ ] lenticular
- [ ] pipe like
- [ ] irregular

orebody/ore shoot

- [ ] folded
- [ ] flat-lying
- [ ] sheeted
- [ ] network

orebody/ore shoot

- [ ] strike
- [ ] dip
- [ ] pitch
- [ ] plunge

directions

[ ]
[ ]

NATURE OF MINERALISATION

Primary ore

- [ ]
- [ ] vein (reef)
- [ ] lode (alt'n zone)
- [ ] multiple veins
- [ ] stockwork
- [ ] breccia
- [ ] saddle reef
- [ ] bed

[ ]

Secondary ore

- [ ] detrital (alluvial)
- [ ] supergene enrichment
- [ ] laterite/bauxite
- [ ] deep lead

LOCAL GEOLOGICAL ENVIRONMENT

Structural features

- [ ]
- [ ] fracturing
- [ ] faulting
- [ ] shearing
- [ ] folding
- [ ] fold axis
- [ ] schistosity

Igneous activity

- [ ] volcanism
- [ ] sub-volcanism
- [ ] plutonism

Structural/strat. intersections

- [ ] fault/fault
- [ ] fault/fold
- [ ] stratig. bdry
- [ ] intr. contact
- [ ] fold/fold
- [ ] flt/strat. bdry
- [ ] flt/strat. unit

Favourable lithology(ies)

- [ ] BIF
- [ ] mafic int.
- [ ] ultramafic
- [ ] felsic porph.
- [ ] granitic
- [ ] mafic extr.
- [ ] chert

- [ ] carbonate
- [ ] clastic sed.
- [ ] volcanogenic sed.
- [ ] metasedimentary
- [ ] mafic igneous
- [ ] felsic intrusive
- [ ] intermed. intrusive
- [ ] laterite

ORE TEXTURE

- [ ] massive
- [ ] disseminated
- [ ] banded/laminated
- [ ] zoned
- [ ] oxidised
- [ ] primary

- [ ] free milling
- [ ] refractory

3. GEOLOGY cont'd

DEPOSIT NAME |
OREBODY NAME |

GEOLOGICAL SETTING OF MINERALISATION

METAMORPHISM

MINERALOGY

ALTERATION

PRESENT OPERATOR(S)/EQUITY

DEPOSIT NAME
OREBODY NAME

PRESENT OWNER(S)/EQUITY

DEVELOPMENT HISTORY

Name	Type of body	Discovery Year	Discovery Method

Type of Body: Select from: Deposit / Orebody

Method: Select from: Prospecting / Geochemistry / Drilling / Geology / Geophysics / Extension to known mineralisation / Other (state)

OPERATING STATUS

Mine	Start year	End year	Production type	Method	Current status

Production type: Select from: Original / Modern / Main production periods / Other (state)

Method: Select from: Underground / Heap leach / Open cut / Alluvial / Other (state)

Current status: Select from: Operating / Non-operating / Historical / Other (state)

COMMENTS

RESOURCES

DEPOSIT NAME [ ]

Facility		Item	Metal: 1. Material: 1.			2.				Contained metal			Cut-off grade				Classification	
Name	Type	Years from	to / Units	Quantity	Data status	Grade	Units	Metal	Data status	Quantity	Metal	Data status	Grade	Units	Metal	Data status	BMR	Company

Type: Select from: Mining centre / Deposit / Orebody / Mine / Mill / Dump / Other (state)

1. Specify metal(s) or commodity(ies) and type of material, e.g. [Au ore], [Pb-Zn u/g ore], [Cu-Au o/c ore]

2. Select from: Ore grade / Reserve grade / Recoverable grade / Other (state)

Data status: Select from: leave blank (data item is actual, reported, installed or calculated) / e (estimated by company) / f (forecast by company)

COMMENTS:

 CAPACITY

DEPOSIT NAME [ ]

Facility		Item	Metal: / Material:	1. / 1.		2						1. / 1.							
Name	Type	Years from	Units to	Quantity	Data status	Grade	Units	Metal	Data status	Recovery rate (%)	Data status	Quantity	Data status	Grade	Units	Metal	Data status	Recovery rate (%)	Data status

Type: Select from: Mining centre / Deposit / Orebody / Mine / Mill / Dump / Other (state)

1. Specify metal(s) or commodity(ies) and type of material, e.g. [Au ore], [Pb-Zn u/g ore], [Cu-Au o/c ore]

2. Select from: Ore grade / Reserve grade / Recoverable grade / Other (state)

Data status: Select from: leave blank (data item is actual, reported, installed or calculated) / e (estimated by company) / f (forecast by company)

COMMENTS:

PRODUCTION

DEPOSIT NAME

Facility		Item	Metal:	1.								1.							
			Material:	1.		2.						1.		2.					
Name	Type	Years from	to / Units	Quantity	Data status	Grade	Units	Metal	Data status	Recovery rate (%)	Data status	Quantity	Data status	Grade	Units	Metal	Data status	Recovery rate (%)	Data status

Type: Select from: Mining centre / Deposit / Orebody / Mine / Mill / Dump / Other (state)

1. Specify metal(s) or commodity(ies) and type of material, e.g. [Au ore], [Pb-Zn u/g ore], [Cu-Au o/c ore]

2. Select from: Ore grade / Reserve grade / Recoverable grade / Other (state)

Data status: Select from: leave blank (data item is actual, reported, installed or calculated) / e (estimated by company) / f (forecast by company)

COMMENTS:

REFERENCE LIST

DEPOSIT NAME [ ]

GEODX REFN1	REFERENCE

GEODX REFN1	REFERENCE

CROSS REFERENCES

[ ] detailed cost data available (y/n)

[ ] confidential information available

DATE OF ORIGINAL REPORT [ ]

REPORTER(S) [ ]

Appendix 2

DATAFILE SAMPLE: TEMORA (GIDGINBUNG)

DEPOSIT: 16 TEMORA (GIDGINBUNG)

DEPOSIT IDENTIFICATION:

SYNONYMS: Gidginbung

PRINCIPAL COMMODITIES: Au, Ag, Cu, As

DISTRIBUTION:
Deposit is situated on a low ridge which is split into two hills, a northern hill and a southern hill. Ore zone is on the southern hill associated with a 2 km x 1 km alteration zone which forms the spine of the ridge.

OREBODIES:
Temora (Gidginbung) (D)

MINES:
Temora (Gidginbung)

GROUP: Gilmore Fault Zone Group

COMMENTS:
Record includes regional setting of Gilmore Fault Zone group; see Deposit No.9 PARKES (GOONUMBLA) for regional setting of Girilambone Anticlinorial Zone.

LOCATION:

LATITUDE: 34 20	LONGITUDE: 147 28
250K SHEET: SI55 11	100K SHEET: 8329

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Wagga Wagga
LOCAL GOVERNMENT AREA (LGA): Temora

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1983	Geology
1983	Geochemistry
1983	Drilling

OPERATING STATUS AT 1989

OREBODY	MINE	STATUS	MINING METHOD
Temora (Gidginbung) (D)	Temora (Gidginbung)	Operating	Open-Cut

COMPANIES:

OREBODY: Temora (Gidginbung) (D)

PRESENT OPERATORS:
Paragon Gold Pty Ltd

PRESENT OWNERS:	EQUITY%
Paragon Resources N L	100.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 0

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

YEAR	PRODUCTION
1987	1,346
1988	1,616

MAIN PRODUCTION PERIODS: 1987-,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION		
Dec 1988	230	2.1	472	Economic Demonstrated (Measured)	Recoverable s	Stockpile
Dec 1988	3,110	2.6	8,179	Economic Demonstrated (Measured)	Recoverable o/c	Oxide ore, cut-off grade 1.5 g/t Au

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Girilambone Anticlinorial Zone
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Unnamed Volcanic Complexes - Late Ordovician-Early Silurian
LITHOLOGY: Intermediate volcanics: andesitic and latitic pyroclastics and lavas, minor basaltic andesite, latite, associated micromonzonite, microsyenite.
RELATIONSHIP TO MINERALISATION: Gold is disseminated within a series of irregular zones of intense silicification at the core of an advanced argillic alteration system within andesitic volcanics.

FORMATION NAME & AGE: Unnamed Sedimentary Rocks - Late Ordovician
LITHOLOGY: Banded cherts, siltstone.
RELATIONSHIP TO MINERALISATION: Sequence is spatially associated with mineralised volcanic complex.

GEOCHRONOLOGY:
K-Ar dating on alunite yielded age of alteration ?=age of mineralisation of 422+-2 my, i.e. Middle Silurian (Thompson & others, 1986). If this interpretation is correct, then the epithermal deposits associated with the Gilmore Fault Zone, together with those at PEAK HILL (Deposit No.10), are amongst the oldest typically epithermal disseminated gold deposits documented.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Intermediate Extrusive

STRUCTURAL FEATURES:

MAJOR: Faulting

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

MAJOR: Volcanism (Intermediate)

METAMORPHISM:
Regional metamorphic grade is greenschist facies.

ALTERATION:

OREBODY: Temora (Gidginbung) (D)
PRINCIPAL SOURCES: Thompson & others (1986), Binns & Eames (1988).

Mineralisation occurs at the silicic core of strong hydrothermal alteration.
Alteration zonation, in order of decreasing intensity, is:
1./ Silicified (mineralised) core: characterised by pervasive silicification consisting of microcrystalline silica. Pseudomorphous ghosts of feldspar phenocrysts indicate that original material was andesitic lava or tuff. Silica is cut by several generations of quartz veins varying from chalcedonic to coarse white vuggy quartz. Veins are restricted to silicified zone. Minor minerals accompanying quartz are pyrophyllite, diaspore, alunite, barite, pyrite in sulphide zone; and rutile with hematite and jarosite in oxidised quartz. Alunite and barite are associated with the coarser quartz veins and as disseminations within silica, where alunite is pseudomorphous after feldspar phenocrysts.
2./ Advanced argillic zone: pyrophyllite, quartz, alunite, (diaspore, pyrite, kaolinite). Crystalline alunite is disseminated through the foliated quartz-pyrophyllite rock and forms

distinctive veins. The zone is extensive, locally covers 2 sq km.
3./ Intermediate argillic zone: kaolinite, mica-illite, quartz, montmorillonite. Zone contains mineralised quartz veins.
4./ Propylitic zone: chlorite, calcite, pyrite, epidote. Zone is regional, more intense near deposit.

Alteration trends from andesite: decreasing CaO, MgO, FeO, Na2O contents, increasing Al2O3, K2O, Na2O contents, increasing feldspar destruction. Plagioclase is progressively replaced by albite+calcite +epidote in propylitic zone, by kaolinite + illite in intermediate argillic zone, and by alunite + quartz in advanced argillic/quartz zones. Accompanied by increasing density of weakly mineralised, fractured and silicified quartz veins surrounded by narrow argillic alteration selvages.

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Disseminated/quartz stockwork gold in altered intermediate volcanics (epithermal).

STYLE:
MAJOR: Discordant, Stratabound

MORPHOLOGY: Lenticular

AGE OF MINERALISATION: Palaeozoic Middle Silurian

DIMENSIONS/ORIENTATION:

OREBODY: Temora (Gidginbung) (D)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			500.0
TRUE WIDTH	(m)			300.0
VERTICAL DEPTH	(m)			100.0
		ANGLE (deg.)		DIRECTION
PLUNGE				S
STRIKE		340		

ORE TEXTURE:
Oxidised, Primary

NATURE OF MINERALISATION:
PRIMARY ORE: Disseminated

MINERALOGY:

OREBODY: Temora (Gidginbung) (D)
PRINCIPAL SOURCES: Thompson & others (1986).

Sulphide ore: quartz, pyrite, enargite, loellingite, (covellite, tennantite, argentite, native silver, chlorargyrite (formerly cerargyrite), iodargyrite (formerly iodirite). Pyrite content can be up to 40%; copper grades (enargite) average 0.1-0.2%. Gold occurs both free and as inclusions in quartz, pyrite, enargite, and loellingite.
Ag:Au = 2.3:1, but varies from <1:1 in the northern part of the deposit to 10:1 at the deeper southern end.
Oxide ore: free gold (<15 microns across), goethite, hematite, alunite, pyrophyllite and diaspore in limonitic veins and fractures. Gold is evenly distributed, possibly as a result of supergene effects.
Metal association: arsenic, usually <1000 ppm, up to 1%; barium, usually 500-3000 ppm, higher corresponding to local occurrence of barite; antimony, usually <15 ppm, >100 ppm in hydrothermal breccia; lead and zinc, usually low, but 500-1000 ppm on the periphery corresponding to occurrence of minor sphalerite and galena. Tellurium, thallium, mercury not detected at significant levels.

CONTROLS OF MINERALISATION:
PRINCIPAL SOURCES: Thompson & others (1986).

1./ Cross-cutting relationship of mineralised pyrite-enargite veinlets and quartz veinlets indicates that primary mineralisation post-dated the main phase of silicification.
2./ Enargite-pyrite association + high-sulphur ore and alteration mineral assemblage (barite, alunite, jarosite) indicate a high oxidised sulphur content for the mineralisation relative to its metal content.
3./ The presence of mineralised hydrothermal breccias, hydrofracturing in veins and zones of silicification, and numerous vugs in coarse quartz veins suggests that the system may have boiled periodically at or below the level of mineralisation.
4./ The presence of pyrophyllite and diaspore suggests a temperature of formation in the range 260-280 deg C. Similar temperatures (270-300 deg C) have been indicated by decrepitation studies.
5./ The temperature range 260-300 deg C implies a minimum depth of

formation of between 600-900 m (assuming no CO_2 and 0-10% salinity).

GENETIC MODELS:

PRINCIPAL SOURCES: Thompson & others (1986).

High sulphur-type gold-copper epithermal deposit related to the upper levels of a porphyry copper system. The temperature range is in the upper temperature range for epithermal deposits corresponding to the deeper parts of an epithermal system. (Thompson & others, 1986).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Temora (Gidginbung) (D)
PRINCIPAL SOURCES: Suppel & others (1986), Thompson & others (1986). Fitzpatrick (1979).
SUMMARY

Temora (Gidginbung) is situated E of the Gilmore Fault Zone on the southwestern margin of the Girilambone Anticlinorial Zone. The deposit consists of a series of irregular mineralised zones of silicification enveloped by advanced argillic alteration within intermediate volcanics.

REGIONAL SETTING: GILMORE FAULT ZONE GROUP
PRINCIPAL SOURCES: Suppel & others (1986); Fitzpatrick (1976, 1979), Degeling (1982).

The Gilmore Fault Zone is a major tectonic feature delineated by regional geological, aeromagnetic and gravity data. The known extent of the fault zone is from near West Wyalong in the N to near Adelong in the S. The fault zone forms the boundary between geological provinces with very different geological histories - the Wagga Anticlinorial Zone in the W and the Girilambone Anticlinorial Zone and Tumut Synclinorial Zone in the E (Suppel & others, 1986).

To the W of the fault zone the Wagga Metamorphic Belt is an extensive NW-trending belt of metamorphosed tightly-folded and steeply-dipping deep-water flysch sediments (Q3L on Cootamundra metallogenic map, Fitzpatrick, 1976). The sequence was deposited by turbidity currents in the Wagga Marginal Basin during the Ordovician, and deformed during the Benambran Orogeny (Late Ordovician-Early Silurian) (Fitzpatrick, 1979).
During the Silurian, the metamorphic belt was extensively intruded by syn- and late-kinematic mainly S-type granite batholiths (gamma2-3L1 on Cootamundra metallogenic map, Fitzpatrick, 1976).
Silurian granitoids are prominent in the eastern part of the anticlinorial zone flanking the fault zone, where they are disposed in broadly en echelon NW-trending zones.

E of the fault zone Ordovician metavolcanic and metasedimentary strata of the Molong Volcanic Arc and Molong Microcontinent form basement to an extensive sequence of Silurian volcanics and associated sediments which were deposited on the Bogan Gate Terrace (southern part of Girilambone Anticlinorial Zone) and in the Tumut Trough (Fitzpatrick, 1979).
The Molong Microcontinent and Molong Volcanic Arc may have underthrust the Wagga Marginal Basin during the Benambran Orogency, forming the Gilmore Fault Zone (Suppel & others, 1986).
The Tumut Trough evolved during the Silurian by rifting of the western edge of the Molong Volcanic Arc, influenced by the pre-existing Gilmore Fault Zone (Suppel & others, 1986).

REGIONAL SUCCESSION: TUMUT TROUGH
PRINCIPAL SOURCES: Suppel & others (1986).

1./ Intermediate volcanic complexes (Late Ordovician-Early Silurian). Not distinguished on Cootamundra metallogenic map (Fitzpatrick, 1976), but unit includes andesite/diorite exposed SE of West Wyalong.
The complexes comprise andesitic and latitic pyroclastics and lavas, and minor basaltic andesites and latites, intruded by micromonzonite and microsyenite dykes. The volcanic complexes occur close to the Late Ordovician sediments. The volcanics may be related to the Molong Volcanic Arc (cf PARKES (GOONUMBLA), Deposit No.9); alternatively at least some of the Silurian rocks may be related to early rifting of the Tumut Trough (Suppel & others, 1986).
The volcanic complexes are conformably overlain by:-

2./ Sedimentary-volcanic sequences (Late Silurian-?Early Devonian) - comprising a series of volcaniclastics, shale, quartzo-feldspathic sandstone, conglomerate and minor pyroclastics north of Temora, and an ?equivalent sequence of siltstone, phyllite, sandstone, carbonaceous siltstone and chert overlain by micaceous sediments S of the Springdale Rift. The sequences are shown as T2L4 undifferentiated Bogan Gate Terrace sequence on the Cootamundra metallogenic map (Fitzpatrick, 1976) and mapped as Jackalass Slate and Bumbolee Creek Formation on the Tumut 1:100 000 sheet to the S (Basden, 1982).
The Tumut Trough was closed and the fill deformed and metamorphosed Bowning Orogeny during Late Silurian-Early Devonian (Fitzpatrick, 1979).

3./ The Silurian rocks were intruded by I-type granites (Early Devonian) (gamma3-4L on Cootamundra metallogenic map, Fitzpatrick, 1976), and diorite and gabbro intrusions, and overlain by associated felsic volcanics and shallow marine sediments.

ASSOCIATED GOLD MINERALISATION: GILMORE FAULT ZONE
PRINCIPAL SOURCES: Fitzpatrick (1979), Degeling (1982).

Gold mineralisation occurs close to the Gilmore Fault Zone in a variety of geological settings. W of the fault zone:
i) large vein deposits in Late Silurian granites which have intruded mafic igneous rocks (WEST WYALONG, ADELONG, Deposit Nos 14, 20);
ii) vein deposits hosted by metasediments of the Wagga Metamorphic Belt (SEBASTOPOL-JUNEE REEFS, Deposit No.18).
iii) disseminated gold in granite intruding mafic rocks (possibly extensions or equivalents of the mafic complex at Adelong (Mount Adrah).
E of the fault zone:
iv) vein gold in Silurian sediments (BARMEDMAN-REEFTON, Deposit No.15)
v) vein mineralisation associated with monzodiorite which could be part of a Silurian volcanic complex (TEMORA, Deposit No. 17) (Suppel & others, 1986).
vi) disseminated epithermal mineralisation in altered and andesitic volcanics of the Ordovician-Silurian volcanic complexes (Temora (Gidginbung), DOBROYDE, Deposit No. 19 - although the age of the volcanics here is uncertain (Suppel & others, 1986), and the Showground prospect.
vii) minor gold mineralisation is spatially related to Early Devonian intrusives.

GEOLOGICAL SETTING: TEMORA (GIDGINBUNG)
PRINCIPAL SOURCES: Suppel & others (1986), Thompson & others (1986).

Temora (Gidginbung) occurs within a sequence of steeply-folded, foliated (subvertical, NNW trend), moderately E-dipping intermediate volcanics and volcaniclastics. Lithologies are predominantly massive feldspar porphyritic andesite with lesser amounts of coarse to fine intermediate fragmental and dacitic volcanic rocks.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Suppel & others (1986), Thompson & others (1986).

Mineralisation is associated with two parallel irregular elongate NNW-trending zones of intense chalcedonic silica alteration which form the core of an advanced argillic alteration system. The two surface zones are continuous at depth. The siliceous cores are enveloped by zones of decreasing alteration intensity, through advanced intermediate argillic to propylitic.
The deposit has been downthrown to the SW by a NW-trending fault which bounds the ore zone on its NE margin.
Several types of brecciation occur: primary pyroclastic tuff breccias; tectonic breccias; hydrothermal breccias (limited in extent but generally well mineralised); and crackle breccias, in which the host rocks have been repeatedly fractured and silicified. A zone of brecciation occurs at or near the base of the major siliceous alteration zone. There are several generations of quartz veining, but no major veins.

The main ore zone comprises a fractured and quartz-veined chalcedonic lens 90 m thick containing most of the economic gold in oxidised mineralisation, underlain by a lens containing primary ore. The lenses are joined in the east by a chalcedonic ?feeder zone.
The totally oxidised zone is relatively shallow (5-15 m), but partial oxidation extends to 90 m and is broadly coincident with the base of siliceous alteration and economic mineralisation. Fractures and veins are totally oxidised within this zone, but kernels of pyritic quartz remain surrounded by bleached or hematitic quartz.
The gold is concentrated in limonitic stringers and joints.
Primary mineralisation occurs within fractured and brecciated siliceous rock containing sinuous stringer pyrite and disseminated pyrite.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Basden H. , 1982
Preliminary report on the geology of the Tumut 1:100 000 sheet area, southern New South Wales.
Geological Survey of New South Wales. Quarterly Notes
46 P1-18

Binns R.A. , Eames J.C. , 1988
Geochemistry of wallrock alteration at the Temora gold deposit, New South Wales. IN Bicentennial Gold 88, Extended Abstracts.
Geological Society of Australia. Abstracts
23 P422-424

Chapman J. , 1986
Disseminated gold deposits along the Gilmore Suture. IN Geological setting of precious metals in New South Wales. One-day symposium, Sydney, October 1986. Abstracts.
Geological Society of Australia
18

Chapman J. , Ferguson A. , Suppel D.W. , 1986
Gold deposits of the West Wyalong-Temora-Adelong district.
Geological Survey of New South Wales. Report
GS1986/162

Degeling P.R. , 1982
Mine data sheets and metallogenic study of the Wagga Wagga 1:250 000 metallogenic map.
Geological Survey of New South Wales
1v

Fitzpatrick K.R. , 1976
Cootamundra, New South Wales, 1:250 000 metallogenic map. Sheet SI/55-11, 1st edition.
Geological Survey of New South Wales
1v

Fitzpatrick K.R. , 1979
Cootamundra, New South Wales, 1:250 000 metallogenic map SI 55-11: mine data sheets and metallogenic study.
Geological Survey of New South Wales. Metallogenic Map Series
1v

Lessman J.L. , 1985
The Temora project. Lecture, AusIMM, Sydney Branch, Sydney, November 1985.
AusIMM. Sydney Branch
1v

Suppel D.W. , Warren A.Y.E. , Watkins J.J., Chapman J., Tenison Woods K.L. , Barron L. , 1986
A reconnaissance study of the geology and gold deposits of the West Wyalong - Temora - Adelong district.
Geological Survey of New South Wales. Quarterly Notes
64 P1-23

Suppel D.W. , Watkins J.J. , Warren A.Y.E., Chapman J., Tenison Woods K.L. , 1985
The geology and gold deposits of the West Wyalong-Temora-Adelong district. IN Seminar: New South Wales, the potential for development. Abstracts.
AMF and Department of Mineral Resources. Report
GS1985/292 P20-23

Tenison Woods K.L. , 1985
Qualitative interpretation of the regional geophysics of the Cootamundra 1:250 000 sheet, with reference to gold mineralization in the Wyalong-Adelong district.
Geological Survey of New South Wales. Report
GS1985/238

Thompson J.F.H. , Lessman J. , Thompson A.J.B. , 1986
The Temora gold-silver deposit: a newly recognized style of high sulfur mineralization in the Lower Paleozoic of Australia.
Economic Geology
81(3) P732-738

oooooooooooooooooooooooooooooooooooooooo

Mine, orebody, deposit or synonym	No	Type
5001	8	Orebody
5001	8	Mine
Abercrombie River	34	Orebody
Abercrombie River	34	Mine
Ada	15	Mine
Adams	43	Mine
Adams & Nugents	17	Mine
Adeline	59	Orebody
Adeline	59	Mine
Adelong	20	Deposit
Adelong (D)	20	Orebody
Adelong Creek	20	Orebody
Adelong Creek	20	Mine
Adelong Creek	21	Mine
Adelong United	20	Mine
Advance	35	Orebody
Advance	35	Mine
Advance Australia	60	Mine
Advance Orara	60	Mine
After Dark	49	Mine
Agnes	17	Mine
Aladdins Lamp	28	Mine
Albion	5	Orebody
Albion	5	Mine
Albion	54	Mine
Alectown	10	Orebody
Alexander	34	Mine
Alexandria (Bald Ridge)	35	Orebody
Alicks Paddock	10	Mine
All Nations	11	Mine
All Nations	22	Mine
All Nations	51	Mine
All Nations	56	Mine
All Nations	59	Mine
All Nations (A)	56	Orebody
All Nations (Flag Of All Nations)	17	Mine
All Nations (MC)	59	Orebody
All Nations (New Bingara)	51	Orebody
Alliance	52	Mine
Alliance/Heymanns (BAP)	52	Orebody
Alma	41	Mine
Amana	28	Mine
Amelia	17	Mine
American Star	34	Orebody
American Star	34	Mine
Anderson (C)	54	Orebody
Anderson (Lady Belmore)	54	Mine
Annetts	20	Mine
Ante-Up	14	Mine
Apex	12	Mine
Araluen	48	Synonym
Araluen Creek	48	Orebody
Araluen Creek	48	Mine
Araluen-Majors Creek	48	Deposit
Araluen-Majors Creek (D)	48	Orebody
Archdeacon	25	Orebody
Archdeacon	25	Mine
Argentine (Aplite Dykes Or Blacks)	58	Mine
Armidale-Rockvale	56	Deposit
Armidale-Rockvale (D)	56	Orebody
Aurania	60	Orebody
Austral	29	Mine
Australia	10	Mine
Baalgammons (BC)	57	Orebody
Bachelors	10	Mine
Back Creek	21	Mine
Baden-Powell	11	Orebody
Baden-Powell	11	Mine
Bagleys & Penningtons	17	Mine
Bakers	7	Orebody
Bakers	7	Mine
Bakers Creek	57	Orebody
Bakers Creek	57	Mine
Balaclava	14	Mine
Bald Hill	12	Orebody
Bald Hill	12	Mine
Bald Hill	21	Mine
Bald Hill	40	Mine
Bald Hill	44	Orebody
Bald Hill	44	Mine
Bald Hill (Deep Lead)	12	Orebody
Ballarat	51	Mine
Balmoral	33	Orebody
Balmoral	33	Mine
Balmoral West	33	Mine
Band Of Hope	11	Mine
Band Of Hope	13	Mine
Band Of Hope	41	Mine
Banner (Shekamuno)	48	Mine
Bantam & Lady	14	Mine
Barmedman-Reefton	15	Deposit
Barmedman-Reefton (D)	15	Orebody
Barnes	25	Orebody
Barnes	25	Mine
Barnetts	15	Orebody
Barnetts	15	Mine
Barrack Creek	51	Orebody
Barrack Creek	51	Mine
Barratts	34	Orebody
Barren Syndicate	18	Orebody
Barren Syndicate	18	Mine
Barrier	14	Mine
Barrington	54	Synonym
Barrington River	54	Mine
Barrys	54	Mine
Bartleys Happy Moments	50	Mine
Basalt Hill	22	Mine
Batlow (Alluvial)	21	Orebody
Batlow (Reef)	21	Orebody
Baulderstones	24	Mine
Beacon & Reward	60	Mine
Beargamil	11	Orebody
Beehive	40	Mine
Bellbird	59	Mine
Bellbird (MC)	59	Orebody
Bellbottom	59	Orebody
Bellbottom	59	Mine
Bells	34	Mine
Bells	40	Mine
Bells Creek	48	Orebody
Ben Nevis	11	Orebody
Ben Nevis	11	Mine
Benduck	54	Mine
Benjamins	34	Mine
Bennetts	34	Mine
Bennetts	38	Orebody
Bennetts (Welcome Irish)	38	Mine
Bergalia	30	Orebody
Beryl (Diamond Fields)	43	Mine
Betsys Flat	34	Orebody
Big Ben	23	Mine
Big Ben Creek	23	Mine
Big Ben-Stoney Creek	23	Orebody
Big Bonser	49	Mine
Big Lode	6	Orebody
Big Lode	6	Mine
Big Nugget	41	Mine
Big Oakey	44	Orebody
Big Oakey	44	Mine
Big Reef	23	Mine
Big Reef (BC)	57	Orebody
Billabong	11	Synonym
Bingara	51	Deposit
Bingara (D)	51	Orebody
Bingara Creek	51	Orebody
Bingara Creek	51	Mine
Birthday	7	Orebody
Birthday	7	Mine
Birthday	11	Orebody
Birthday	11	Mine
Bismarck Range	28	Mine
Black	34	Mine
Black	43	Mine
Black & Berrys	50	Mine
Black Angel	15	Orebody
Black Angel	15	Mine
Black Hill	43	Mine
Black Lode	57	Orebody
Black Mystery	60	Mine
Black Snake	10	Mine
Black Snake	52	Mine
Black Snake (HR)	52	Orebody
Black Swan	43	Mine
Blackfellows	41	Mine
Blackfellows (Knob)	52	Mine
Blairmore	52	Mine
Blands Freehold	50	Mine
Blind Creek	26	Mine
Blue	53	Mine
Blue Lode	6	Orebody
Blue Mystery	60	Mine
Blue Reef	11	Mine
Blue Spec	41	Orebody
Blue Spec	41	Mine
Bluey	53	Orebody
Bluey	53	Mine
Bobby Burns	10	Mine
Bobby Burns	33	Mine
Bobby Burns-Great Eastern (PH)	10	Orebody
Bobby Whitlow Creek	51	Orebody
Bobby Whitlow Creek	51	Mine
Bodangora (Mitchells Creek)	37	Deposit
Bodangora (Mitchells Creek) (D)	37	Orebody
Boltons	34	Mine
Bonanza	54	Mine
Bonds	52	Mine
Bonnie Doon	58	Mine
Bonnie Dundee	11	Orebody
Bonnie Dundee	11	Mine
Bonny Dundee	52	Mine

Mine, orebody, deposit or synonym	No	Type
Boomerang	49	Mine
Boppy Blocks	7	Orebody
Boppy Blocks	7	Mine
Boppy Boulder	7	Orebody
Boppy Boulder	7	Mine
Boranel	54	Mine
Boranel Creek	54	Mine
Bourkes	17	Mine
Bourkes	52	Mine
Bourkes (South Australian)	17	Mine
Bourkes/Kanaka/D'Uasons (BAP)	52	Orebody
Bowes	17	Mine
Bowling Alley Point	52	Orebody
Bowmans	5	Orebody
Box Ridge	42	Orebody
Boyles	12	Orebody
Boyles	12	Mine
Boyles (Trafalgar)	12	Mine
Brackins Spur	56	Mine
Brackins Spur (A)	56	Orebody
Brand & Fletchers (Amalgamated) (HH)	42	Orebody
Brands (BAP)	52	Orebody
Brassknocker	49	Orebody
Brassknocker	49	Mine
Brassknocker	50	Orebody
Brassknocker	50	Mine
Bread & Dripping	11	Orebody
Brickkiln	14	Mine
Brilliant	43	Mine
Britannia	12	Orebody
Britannia	12	Mine
Britannia	42	Mine
Britannia	43	Mine
British Lion	34	Mine
Britisher	50	Mine
Brittania	13	Mine
Broken Hill	1	Deposit
Broken Hill (D)	1	Orebody
Brooklyn	56	Mine
Brooklyn (R)	56	Orebody
Brown	6	Mine
Brown Eagle	41	Mine
Brown Snake	43	Mine
Browns	48	Mine
Browns	55	Orebody
Browns	55	Mine
Browns Creek	30	Deposit
Browns Creek	30	Mine
Browns Creek (D)	30	Orebody
Browns Creek (Historical)	30	Orebody
Buchanan	11	Mine
Buchanan/Phoenix	11	Orebody
Buckleys	17	Mine
Buckleys	52	Mine
Buckleys	54	Mine
Bulldog	50	Mine
Bullock Flat	44	Orebody
Bullock Flat	44	Mine
Bumbo	49	Orebody
Bumbo	49	Mine
Bumbo No. 2	49	Mine
Burkes	48	Mine
Burra Creek	21	Orebody
Burra Creek	21	Mine
Burraga	36	Synonym
Burrangong Creek	25	Mine
Burrangong-Possum Flat	25	Orebody
Burthundra	40	Mine
Burying Ground Creek	56	Mine
Burying Ground Creek (R)	56	Orebody
Bushman	11	Synonym
Bushman	11	Mine
Bushman	11	Orebody
Bushmans	11	Mine
Bushmans (New Bushmans Hill)	11	Orebody
Bushmans Daughter	23	Orebody
Bushmans Daughter	23	Mine
Butchers Boy	44	Orebody
Butchers Boy	44	Mine
Cadia	31	Deposit
Cadia (D)	31	Orebody
Caledonia Reform	33	Mine
Caledonian	12	Orebody
Caledonian	12	Mine
Caledonian	17	Mine
Caledonian	20	Orebody
Caledonian	20	Mine
Caledonian	33	Orebody
Caledonian	33	Mine
Caledonian	34	Mine
Caledonian	35	Mine
Caledonian	40	Mine
Caledonian	43	Mine
Caledonian	44	Mine
Caledonian	47	Mine
Caledonian Hill	11	Mine
Caledonian-Star	47	Orebody
Called Back	14	Orebody
Called Back	14	Mine
Camages	48	Mine
Camerons Creek	56	Mine
Camerons Creek (Guyra or Gara R.) (R)	56	Orebody
Camp	20	Orebody
Camp	20	Mine
Campbells Creek	41	Orebody
Campbells Creek	41	Mine
Canadian	40	Mine
Canadian	43	Mine
Canbelego	7	Deposit
Canbelego	7	Mine
Canbelego (D)	7	Orebody
Canbelego King	7	Orebody
Canbelego King	7	Mine
Cantwells	54	Mine
Captains Flat	45	Deposit
Captains Flat (D)	45	Orebody
Capulet	54	Mine
Carlton	35	Mine
Carrington	52	Mine
Carrington	57	Mine
Carrington	59	Mine
Carters	53	Mine
Cartwrights	34	Mine
Cash & Party	33	Mine
Cashs	34	Mine
Catherine	41	Mine
Cement Hill	52	Orebody
Cement Hill	52	Mine
Cemetery	51	Orebody
Cemetery	51	Mine
Cemetery Hill/Harden Hill	52	Orebody
Cemetery Reef (PH)	10	Orebody
Centenary	10	Mine
Centennial & Golden Crown	54	Mine
Centennial&Golden Crown/Town&Country(C	54	Orebody
Central	3	Orebody
Central	45	Orebody
Challenger	20	Mine
Challenger Extended	20	Mine
Chamberlains	52	Mine
Chambers Creek	42	Orebody
Chance Gully	13	Orebody
Chance Gully	13	Mine
Charcoal	22	Orebody
Charcoal	22	Mine
Chard & Arthurs	34	Orebody
Chard & Arthurs	34	Mine
Cherry Hill	21	Mine
Cherry Tree	49	Mine
Chilcott	31	Orebody
Chilcott	31	Mine
Christies	39	Orebody
Christies	39	Mine
Christmas	43	Mine
Christmas	52	Mine
Christmas Box	49	Mine
Christmas Box	54	Mine
Christmas Gift	14	Mine
Christmas Gift	24	Synonym
Christmas Gift	24	Orebody
Christmas Gift	24	Mine
Christmas Gift Block	14	Mine
Christmas Gift Extended (Boxsells)	24	Mine
Chump	40	Mine
City Of Sydney	34	Mine
City Of Sydney	35	Orebody
City Of Sydney	35	Mine
Clara Bell	49	Mine
Clarke & Wesley	23	Mine
Clarke & Wesley-Big Reef-Morning Star	23	Orebody
Clarkes Creek	41	Orebody
Clarkes Creek	41	Mine
Cobar	3	Synonym
Cobar	4	Synonym
Cobar	5	Synonym
Cobar	6	Synonym
Cobar (Silver) Peak	6	Orebody
Cobar (Silver) Peak	6	Mine
Cobark	54	Orebody
Coleman & Glasheen	10	Mine
Coleman & Party	10	Mine
Colossal	34	Orebody
Comet	10	Mine
Comet	56	Mine
Comet (R)	56	Orebody
Coming Event	43	Mine
Commonwealth	38	Orebody
Commonwealth	38	Mine
Commonwealth (CC)	54	Orebody
Commonwealth (Cravens Creek)	54	Mine

Mine, orebody, deposit or synonym	No	Type
Commonwealth Creek	54	Orebody
Company (Mookerawa)	40	Mine
Connollys	52	Mine
Conqueror	6	Mine
Conqueror South	6	Mine
Conqueror-Brown	6	Orebody
Consols	13	Orebody
Consols	57	Mine
Consols (O'Briens)	13	Mine
Cooks	12	Orebody
Cooks	12	Mine
Cooper & McKenzie	35	Orebody
Cooper & McKenzie	35	Mine
Cootamundra	24	Synonym
Copeland	54	Orebody
Copeland (Barrington)	54	Deposit
Copeland (Barrington)(D)	54	Orebody
Coramba	60	Orebody
Coramba King	60	Mine
Coramba Queen	60	Mine
Coramba-Orara	60	Deposit
Coramba-Orara (D)	60	Orebody
Cornish Point	40	Mine
Cornishmens	22	Mine
Coronation	41	Mine
Cosmopolitan	43	Mine
Cosmopolitan	57	Mine
Cosmopolitan-South Cosmopolitan	57	Orebody
Cowan & McClifty	58	Mine
Cowarra	46	Deposit
Cowarra	46	Mine
Cowarra (D)	46	Orebody
Cowarra (Victoria)	46	Mine
Cowarra (Victoria)-King	46	Orebody
Cowra Creek	46	Synonym
Cowra Creek	46	Mine
Cox & McPeaks	44	Orebody
Cox & McPeaks	44	Mine
Craig & Pollocks	17	Mine
Craiglea	34	Orebody
Crams	49	Mine
Craven Plateau (IXL)	54	Orebody
Cripples Reef	12	Mine
Cross	17	Mine
Cross Gully	41	Mine
Crouchers	34	Mine
Crowhurst & Sons	10	Mine
Crown Of Peak Hill (Golden Crown)	10	Mine
Crown Of Peak Hill (PH)	10	Orebody
Crystal Palace	41	Orebody
Crystal Palace	41	Mine
Cudgegong	43	Orebody
Cudgegong	43	Mine
Cudgegong	59	Mine
Cullinga	24	Deposit
Cullinga (D)	24	Orebody
Cullinga Extended	24	Mine
Cumbandry	43	Mine
Cunninghams	17	Mine
Currajong	11	Orebody
Currajong	11	Mine
Currajong	14	Mine
Currajong	20	Orebody
Currajong	20	Mine
Currys	17	Mine
Currys Hill	17	Mine
D'Uasons	52	Mine
Daddys/Rowleys (HH)	42	Orebody
Daisy	14	Mine
Daisy	40	Mine
Daleys	13	Mine
Dalys Creek	41	Orebody
Dalys Creek	41	Mine
Dargues	48	Orebody
Dargues	48	Mine
Davidsons	25	Orebody
Davidsons	25	Mine
Davies	34	Orebody
Davorsons	17	Mine
Dawn Of Galwadgere	39	Synonym
Dawn Of Hope	24	Mine
Day Dawn	13	Mine
Day Dawn	14	Mine
Day Dawn	60	Mine
Daylight	52	Mine
Dayspring	11	Orebody
Dayspring	11	Mine
Dead Bird	10	Mine
Dead Dog	12	Orebody
Dead Dog	12	Mine
Dead Mans	13	Mine
Democrat	24	Orebody
Democrat	24	Mine
Demondrille Creek	25	Mine
Depot Glen	2	Orebody

Mine, orebody, deposit or synonym	No	Type
Depot Glen	2	Mine
Deutschers	17	Mine
Dewar & Mcfarlane	10	Mine
Digger Prince	43	Mine
Diggers Ridge	55	Orebody
Diggers Ridge	55	Mine
Ding Dong	41	Orebody
Ding Dong	41	Mine
Diorite-Killaloe	50	Mine
Dirt Hole	42	Orebody
Dirt Hole	42	Mine
Dirty Hole Creek	52	Orebody
Dirty Hole Creek	52	Mine
Dixon	53	Mine
Dobroyde	19	Deposit
Dobroyde	19	Mine
Dobroyde (D)	19	Orebody
Doctor	51	Orebody
Doctor	51	Mine
Doctor Watson	59	Mine
Doctor Watson (MC)	59	Orebody
Dog & Cat	43	Mine
Dog Trap	41	Orebody
Dog Trap	41	Mine
Dohertys Hill	55	Orebody
Dohertys Hill	55	Mine
Domimish & Frazer	33	Mine
Donkey Hill	20	Orebody
Donkey Hill	20	Mine
Drake	59	Deposit
Drake	59	Mine
Drake (D)	59	Orebody
Dreamers	13	Mine
Ducksburys (Jewellers Shop)	34	Mine
Duke Of York	52	Mine
Dun Dun	41	Orebody
Dun Dun	41	Mine
Dunns	17	Mine
Dunsheas	48	Mine
Durkins	17	Mine
Duval Creek	56	Mine
Duval Creek (A)	56	Orebody
Eaglehawk	41	Mine
Eaglehawk Broken Hill	41	Mine
Eaglehawk Gully	41	Orebody
Eaglehawk Gully	41	Mine
Easdowns	34	Mine
East (HH)	42	Orebody
East -- Eureka/Scandinavian	43	Orebody
East -- Helvetia/Brown Snake	43	Orebody
East Cadia	31	Mine
East Mount Boppy	7	Orebody
East Mount Boppy	7	Mine
East Pioneer	34	Mine
Easter Gift (Dead Rabbit)	14	Mine
Easter Monday	2	Orebody
Easter Monday	2	Mine
Eastern	5	Orebody
Eastern	8	Orebody
Eastern	8	Mine
Eclipse	47	Mine
Eldorado Hill	41	Orebody
Eldorado Hill	41	Mine
Eldorado/Williams	44	Orebody
Eldorado/Williams	44	Mine
Eleanora	57	Mine
Eleanora-Carrington	57	Orebody
Electric Spark	34	Mine
Elizabeth	2	Orebody
Elizabeth	2	Mine
Elliots	45	Orebody
Elslie	40	Mine
Empress	22	Mine
Emu Creek	13	Synonym
Emu Creek	59	Orebody
Emu Creek	59	Mine
Emu Reef	10	Mine
Endeavour 20	9	Orebody
Endeavour 22	9	Orebody
Endeavour 22	9	Mine
Endeavour 26	9	Orebody
Endeavour 26	9	Mine
Endeavour 27	9	Orebody
Endeavour 28	9	Orebody
Endeavour 28	9	Mine
Endeavour 28NE	9	Orebody
Endeavour 31	9	Orebody
Endeavour 31NE	9	Orebody
Endeavour 37	9	Orebody
Enterprise	13	Orebody
Enterprise	13	Mine
Erins Isle	14	Mine
Ethel May	53	Mine
Eureka	17	Mine
Eureka	33	Orebody

Mine, orebody, deposit or synonym	No	Type
Eureka	33	Mine
Eureka	41	Mine
Eureka	43	Mine
Eureka	49	Mine
Eureka	60	Mine
Eureka (Evening Star)	13	Orebody
Eureka (Evening Star)	13	Mine
Eureka Flat	13	Orebody
Eureka Flat	13	Mine
Evans	34	Mine
Evening Staf	60	Mine
Evening Star	18	Orebody
Evening Star	18	Mine
Evening Star	60	Mine
Excelsior	52	Mine
Exhibition	54	Mine
Fairy	11	Mine
Falkner	50	Mine
Fanny Park	15	Mine
Farnham	40	Orebody
Federal	11	Mine
Federal	38	Orebody
Federal	38	Mine
Federal (Iakwa)	12	Mine
Federal/ Possum	11	Orebody
Federation	53	Mine
Federation	54	Mine
Federation (UB)	54	Orebody
Fergussons	33	Mine
Fiery Cross	15	Orebody
Fiery Cross	15	Mine
Fifield & Mullen	33	Mine
Finlays	17	Mine
Finnerans Hill	29	Orebody
Fitzgeralds	54	Mine
Fitzsimmons	40	Mine
Flagstaff	20	Mine
Fletchers	20	Mine
Fletchers	43	Mine
Florence	41	Mine
Floyds	13	Mine
Fly-Away	17	Mine
Foleys	17	Mine
Foleys	41	Mine
Foleys	52	Mine
Foleys Folly	52	Mine
Foleys/Golden Hole (BAP)	52	Orebody
Folly Creek	52	Orebody
Forbes	12	Deposit
Forbes (D)	12	Orebody
Fords Creek	43	Mine
Forest Reefs	29	Deposit
Forest Reefs (D)	29	Orebody
Fort Bourke	4	Synonym
Fortune Teller	60	Mine
Fosters	17	Mine
Fountainhead	47	Mine
Four Mile	13	Orebody
Four Mile	13	Mine
Four Mile	22	Orebody
Four Mile Creek	22	Mine
Franklin & Party	33	Mine
Frasers	43	Mine
Frasers Find	55	Orebody
Frasers Find	55	Mine
Frazer	33	Mine
Frazer & Coleman	10	Mine
Frazer & Farquharson	10	Mine
Frazer & Ward	10	Mine
Freehold	57	Mine
Freehold Eastern	57	Mine
Freehold-Freehold Eastern	57	Orebody
Frenchmans	11	Mine
Frenchmans	13	Mine
Frenchmans	17	Mine
Frenchmans	32	Mine
Frenchmans	41	Mine
Frenchmans	49	Mine
Frenchmans (HH)	42	Orebody
Frenchmans-Cornishmens	32	Orebody
Frenchmans-Cornishmens	32	Mine
Frewins	23	Mine
Fullers	53	Orebody
Fullers	53	Mine
Fullers North	53	Mine
Fulton	11	Mine
Galena-Sphalerite	5	Orebody
Galwadgere	39	Deposit
Galwadgere (D)	39	Orebody
Galwadgere (Dawn Of Galwadgere)	39	Mine
Garibaldi	25	Orebody
Garibaldi	25	Mine
Garibaldi	57	Orebody
Garibaldi	57	Mine
Garnet	35	Mine

Mine, orebody, deposit or synonym	No	Type
Garnet-Advance	35	Orebody
Garry Owen (Wyndham)	53	Mine
Garryowen	60	Mine
Gatlaus	14	Mine
Geenobby	38	Orebody
German Hill	40	Mine
German Jack	40	Mine
Germania	54	Mine
Gersbachs	11	Mine
Giandarra	22	Mine
Gibraltar	20	Orebody
Gibraltar	20	Mine
Gidginbung	16	Synonym
Gilmore Creek	21	Mine
Giros	53	Mine
Gladstone	11	Mine
Gladstone	59	Orebody
Gladstone	59	Mine
Gleam Of Hope	53	Mine
Glendale	32	Orebody
Glendale-Glendale North	32	Mine
Gloucester River	54	Orebody
Gloucester River	54	Mine
Gohanna-Wrights Spur (HR)	52	Orebody
Gold Diggers Creek	53	Orebody
Gold Diggers Creek	53	Mine
Golden	41	Orebody
Golden	60	Mine
Golden Arrow	60	Mine
Golden Bar & Brumby Charlie	52	Orebody
Golden Belt	17	Mine
Golden Consuls	54	Mine
Golden Crown	47	Mine
Golden Crown	54	Mine
Golden Crown & Cross	42	Mine
Golden Crown-Fountainhead	47	Orebody
Golden Crystal	54	Mine
Golden Crystal (CC)	54	Orebody
Golden Drake	59	Orebody
Golden Drake	59	Mine
Golden Dream	53	Mine
Golden Dream/Carters/Lady Maude	53	Orebody
Golden Dyke	49	Mine
Golden Dyke/Dyke	35	Orebody
Golden Fleece (Reef Gully)	44	Orebody
Golden Fleece (Reef Gully)	44	Mine
Golden Garter	17	Mine
Golden Gate	17	Mine
Golden Gate	41	Mine
Golden Gate	49	Mine
Golden Gate	52	Mine
Golden Gate	57	Orebody
Golden Gully	42	Orebody
Golden Gully	48	Mine
Golden Hole	52	Mine
Golden Lily	41	Mine
Golden Note	38	Orebody
Golden Paint	13	Mine
Golden Point	34	Orebody
Golden Quarry	47	Mine
Golden Spur (C)	54	Orebody
Golden Spur Northern	54	Mine
Golden Spur Southern	54	Mine
Golden Wattle	34	Orebody
Golden Wattle	60	Mine
Golden Wattle (Balmers)	34	Mine
Goldsworth	55	Orebody
Goldsworth	55	Mine
Good Friday	2	Orebody
Good Friday	2	Mine
Goonumbla	9	Synonym
Gossan	5	Orebody
Gouron Gouron Creek	51	Orebody
Gowan Gowan Creek	51	Mine
Grants	32	Mine
Grants Amalgamated	33	Orebody
Grants Amalgamated	33	Mine
Grassatts	12	Mine
Grasstree	49	Mine
Grassy Gully	47	Orebody
Grassy Gully	47	Mine
Great Britain	10	Mine
Great Britain	40	Mine
Great Britain	53	Mine
Great Britain	56	Mine
Great Britain (A)	56	Orebody
Great Cobar	3	Deposit
Great Cobar	3	Mine
Great Cobar (D)	3	Orebody
Great Cobar North	3	Mine
Great Cobark	54	Mine
Great Eastern	10	Mine
Great Eastern	33	Mine
Great Extended	29	Orebody
Great Extended	29	Mine

Mine, orebody, deposit or synonym	No	Type
Great Northern	11	Mine
Great Northern	40	Mine
Great Peak	6	Mine
Great South Peak	6	Orebody
Great South Peak	6	Mine
Great Southern	14	Mine
Great Southern	50	Mine
Great Star	48	Mine
Great Victoria	20	Mine
Great Western	5	Mine
Great Western Pioneer	41	Mine
Grecian Bend	43	Mine
Grenfell	13	Deposit
Grenfell	13	Mine
Grenfell (Alluvial)	13	Orebody
Grenfell (Reef) (D)	13	Orebody
Growlers	11	Orebody
Gulgong	43	Deposit
Gulgong	43	Mine
Gulgong (D)	43	Orebody
Gully	41	Mine
Gulph Creek	49	Orebody
Gulph Creek	49	Mine
Gum Flat	40	Mine
Gundagai	23	Deposit
Gundagai (D)	23	Orebody
Gunnas Blow	34	Mine
Gurneys (Lonsdale Creek)	49	Mine
Gusts	17	Mine
Guy Bell	59	Mine
Guy Bell (MC)	59	Orebody
Gwydir River	51	Orebody
Gwydir River	51	Mine
Gwydir River	55	Orebody
Halpins Secret	42	Mine
Hampden Hill	41	Orebody
Hampden Hill	41	Mine
Hanging Rock	52	Orebody
Hanlon	40	Mine
Hanlons	48	Mine
Hans	42	Mine
Happy Dicks	41	Mine
Happy Valley	10	Mine
Happy Valley	43	Mine
Happy Valley	52	Mine
Hard To Find	15	Orebody
Hard To Find	15	Mine
Harden Central	26	Mine
Harden Future	26	Mine
Harden West	26	Mine
Harden-Murrumburrah	26	Deposit
Harden-Murrumburrah (D)	26	Orebody
Hardwicks	7	Orebody
Hardwicks	7	Mine
Hargraves	41	Orebody
Hargraves-Windeyer	41	Deposit
Hargraves-Windeyer (D)	41	Orebody
Harris	54	Mine
Harrisons	50	Mine
Harrys Find	14	Mine
Hassetts	15	Orebody
Hassetts	15	Mine
Hawkins Hill	42	Orebody
Hazelbank	11	Orebody
Hazelbank	11	Mine
Headricks	34	Mine
Healeys	49	Mine
Heazlitt & Crandell	48	Mine
Heffernan	18	Orebody
Heffernan	25	Mine
Helvetia	43	Mine
Henrietta	41	Mine
Hermans (HH)	42	Orebody
Heymanns	52	Mine
Hibernia	17	Mine
Hidden Secret (Johnsons)	35	Mine
Hidden Star	17	Mine
Hidden Star	25	Mine
Hidden Treasure	7	Orebody
Hidden Treasure	7	Mine
Hidden Treasure	17	Mine
Hidden Treasure	50	Mine
Hidden Treasure	54	Mine
Hidden Treasure	60	Mine
Hidden Treasure (C)	54	Orebody
Hidden Treasure (Danjera Treasure)	47	Mine
Hidden Treasure (Stewarts Brook)	53	Mine
Hidden Treasure-Buck Reef	47	Orebody
Hidden Treasure/Garry Owen	53	Orebody
Highland Marg	60	Mine
Highland Mary	60	Mine
Hill End (D)	42	Orebody
Hill End-Tambaroora	42	Deposit
Hill Top	14	Mine
Hill Top	44	Orebody
Hill Top	44	Mine
Hillgrove	57	Deposit
Hillgrove	57	Mine
Hillgrove (D)	57	Orebody
Hills (BC)	57	Orebody
Hit Or Miss	35	Orebody
Hit Or Miss	41	Mine
Hogans	7	Mine
Hogans	41	Mine
Holmes Brothers	54	Mine
Home Rule	43	Mine
Homeward Bound	11	Orebody
Homeward Bound	11	Mine
Homeward Bound	13	Orebody
Homeward Bound	13	Mine
Homeward Bound	18	Orebody
Homeward Bound	18	Mine
Homeward Bound	22	Mine
Homeward Bound	41	Mine
Homeward Bound	42	Mine
Homeward Bound	47	Mine
Homeward Bound	54	Mine
Homeward Bound	60	Mine
Hopetoun	57	Orebody
Hopkins	49	Mine
Horseshoe	40	Mine
Hot Scone	59	Mine
Hot Scone (MC)	59	Orebody
Hughes	40	Mine
Hunted To Death	15	Mine
Ida	41	Mine
Illabo	60	Mine
Iodide	8	Orebody
Iron Duke	31	Orebody
Iron Duke	31	Mine
Iron Duke	40	Mine
Ironclad	29	Mine
Ironclad	46	Mine
Ironclad-Vanderbilt-Ambassador-etc	46	Orebody
Isabella Creek	21	Mine
Isons	47	Mine
Italians	15	Mine
Ixl	17	Mine
Ixl	54	Mine
Jack Locks	7	Orebody
Jack Locks	7	Mine
Jackalass Lead	23	Orebody
Jackalass Lead	23	Mine
Jackass	51	Orebody
Jackass	51	Mine
Jacksons	15	Mine
Jembaicumbene	48	Synonym
Jembaicumbene	48	Orebody
Jembaicumbene Creek	48	Orebody
Jembaicumbene Creek	48	Mine
Jewellers Shop (Denison)	53	Orebody
John Bull (Hard-Up)	52	Mine
John Bull/Connollys etc (BAP)	52	Orebody
Johnsons	53	Orebody
Johnsons	53	Mine
Joker	60	Mine
Jubilee	4	Orebody
Jubilee	41	Mine
Judds	12	Orebody
Judds	12	Mine
Jumping Frog	41	Mine
Junction	14	Mine
Junction Point	40	Mine
Junction Reefs (Sheahan-Grants)	32	Deposit
Junction Reefs (Sheahan-Grants) (D)	32	Orebody
Junee Reefs	18	Synonym
Just In Time	14	Mine
Just-In-Time	18	Mine
Kables	11	Orebody
Kables	11	Mine
Kaiser	37	Mine
Kaiser Wilhelme	40	Mine
Kanakas	52	Mine
Kangaloolah Creek	35	Mine
Kangaroo	23	Orebody
Kangaroo	23	Mine
Keating & Hayes	17	Mine
Keatings	45	Orebody
Kellys Perseverance	38	Orebody
Kellys Perseverance (Welcome Mick)	38	Mine
Kennedy & Cash	33	Mine
Kennedys	52	Mine
Kenny	23	Mine
Kentucky Creek	55	Orebody
Kerripit	54	Mine
Kerripit (Rawdon Vale)	54	Orebody
Kerripit River	54	Mine
Kiandra	22	Deposit
Kiandra (D)	22	Orebody
Kiandra (Deep Lead)	22	Orebody

Mine, orebody, deposit or synonym	No	Type
Kin San (Bartletts)	54	Mine
Kin San (CC)	54	Orebody
Kinbalu	52	Orebody
Kinbalu	52	Mine
King	12	Orebody
King	12	Mine
King Dick	38	Orebody
King Dick	38	Mine
King Solomon	53	Mine
Kings (HH)	42	Orebody
Klondyke	14	Orebody
Klondyke	14	Mine
Klondyke	52	Mine
Knockout	40	Mine
Koh-I-Noor	11	Orebody
Koh-I-Noor	11	Mine
Korora	60	Mine
Kylo	59	Orebody
Kylo	59	Mine
Lachlan	12	Synonym
Lachlan	12	Mine
Lachlan	12	Orebody
Lady Belle	60	Mine
Lady Belmore	48	Mine
Lady Belmore (HH)	42	Orebody
Lady Carrington	40	Mine
Lady Carrington	60	Mine
Lady Claire	20	Mine
Lady Elsie	60	Mine
Lady Greaves	6	Orebody
Lady Greaves & Peak Prospecting	6	Mine
Lady Hampden	59	Orebody
Lady Hampden	59	Mine
Lady Jersey	11	Mine
Lady Jersey	59	Orebody
Lady Jersey	59	Mine
Lady Lizzie	54	Mine
Lady Loftus	54	Mine
Lady Macquarie	38	Orebody
Lady Macquarie	38	Mine
Lady Mary	14	Mine
Lady Mary	17	Mine
Lady Mary	20	Orebody
Lady Mary	20	Mine
Lady Mary	51	Orebody
Lady Mary	51	Mine
Lady Mary	52	Mine
Lady Mary	54	Mine
Lady Mary	59	Mine
Lady Mary Extended	59	Mine
Lady Mary/Lady Mary Extended (MC)	59	Orebody
Lady Matilda	54	Mine
Lady Maude	53	Mine
Lady Milburn	23	Orebody
Lady Milburn	23	Mine
Lady Of The Mountain	52	Mine
Lagoon Gully	21	Mine
Lake George	45	Synonym
Lake George	45	Mine
Lambing Flat	25	Synonym
Lambing Flat	25	Mine
Laurel Hill	21	Mine
Laurie Bros (Sea Breeze)	60	Mine
Lawsons	44	Mine
Lawsons Gully	13	Orebody
Lawsons Gully	13	Mine
Lawsons Hill	13	Orebody
Lawsons Hill	13	Mine
Lead No. 2	1	Orebody
Lead No. 3	1	Orebody
Letts	15	Orebody
Letts	15	Mine
Leykaufes	21	Mine
Lilla	60	Mine
Lily May	43	Mine
Little Belimbla Creek	49	Orebody
Little Belimbla Creek	49	Mine
Little Bushman	11	Mine
Little Cadia	31	Orebody
Little Cadia (Cadia Extended)	31	Mine
Little Caledonian	43	Mine
Little Cumbandry	43	Mine
Little Emma	29	Orebody
Little Emma (Beneree)	29	Mine
Little Gracie	55	Orebody
Little Gracie	55	Mine
Little Nell	53	Mine
Little Nell	56	Mine
Little Nell (A)	56	Orebody
Little Oakey	44	Orebody
Little Oakey	44	Mine
Little Reef	13	Mine
Little Reef (BC)	57	Orebody
Little Victoria	20	Mine
Little Wonder	11	Mine
Little Wonder	41	Mine
Live Bird	10	Mine
Lizzie Watson	41	Mine
London	11	Orebody
London	11	Mine
London-Victoria	11	Synonym
London-Victoria	11	Mine
London-Victoria	11	Orebody
Lone Hand	59	Mine
Lone Hand (MC)	59	Orebody
Long & Party	33	Mine
Long Creek	41	Orebody
Long Creek	41	Mine
Long Gully	41	Mine
Long Tunnel	20	Mine
Long Tunnel	23	Orebody
Long Tunnel	23	Mine
Longmores Reward	41	Orebody
Longmores Reward	41	Mine
Lord Carrington	52	Mine
Louisa	17	Mine
Louisa	43	Mine
Louisa Creek	41	Orebody
Louisa Creek	41	Mine
Louisianna	43	Orebody
Louisianna	43	Mine
Lower Mookerawa	40	Mine
Lucknow	13	Mine
Lucknow	14	Mine
Lucknow	28	Deposit
Lucknow	28	Orebody
Lucknow (D)	28	Orebody
Lucknow 66	28	Mine
Lucknow Pups	28	Mine
Lucks All	41	Mine
Lucky Draw	36	Deposit
Lucky Draw	36	Mine
Lucky Draw (D)	36	Orebody
Lucky Hit (Amos)	35	Orebody
Lumpy	29	Orebody
Lumpy	29	Mine
Luttrels	22	Mine
Macatanamys	40	Mine
Macquarie Hills	40	Mine
Macquarie River	38	Synonym
Madmans	12	Mine
Madmans	40	Mine
Magenta	44	Mine
Magpie	12	Orebody
Magpie (Eldorado)	12	Mine
Magpie (Eldorado)	43	Mine
Maid O'Galla	53	Mine
Maid Of Ashford	51	Orebody
Maid Of Ashford	51	Mine
Maid Of Judah	18	Orebody
Maid Of Judah	18	Mine
Maiee	14	Mine
Main	4	Orebody
Main	5	Orebody
Main Axis	41	Mine
Main Grenfell	13	Orebody
Main Grenfell Lead	13	Mine
Maitland	52	Mine
Maitland Bar	41	Orebody
Maitland Bar	41	Mine
Majors	11	Mine
Majors Creek	48	Synonym
Majors Creek	48	Orebody
Majors Creek (East)	48	Orebody
Majors Creek (West)	48	Orebody
Mallee Bull	14	Orebody
Maloneys	17	Mine
Manna Hill	40	Mine
Mannus Creek	21	Mine
Mariners	43	Mine
Markhams Hill	35	Mine
Markhams Hill-Peeks Reef	35	Orebody
Marquis Of Lorne	52	Mine
Marshalls (HH)	42	Orebody
Martins Creek	53	Mine
Martins Creek-Tiverton	53	Orebody
Mary Anderson	56	Mine
Mary Anderson (A)	56	Orebody
Marys Dream	12	Orebody
Marys Dream	12	Mine
Marys Dream	25	Orebody
Marys Dream	25	Mine
Marys Dream (Stricklands)	12	Mine
Mascotte	40	Mine
Mascotte	59	Orebody
Mascotte	59	Mine
Masonic (Golden Eagle)	54	Mine
Mastodon	34	Orebody
Mathesons	48	Mine
Mathieson	12	Mine

Mine, orebody, deposit or synonym	No	Type
McAnallys	60	Mine
McCormacks	17	Mine
McCuddens	44	Orebody
McCuddens	44	Mine
McDowells	17	Mine
McDowells	39	Orebody
McDowells (Old Paint)	39	Mine
McGregors	11	Orebody
McGregors	11	Mine
McGuiggans	11	Orebody
McGuiggans	11	Mine
McGuiggans North	11	Mine
McGuiggnas South	11	Mine
McKenzies	34	Mine
McLeods Shaft	24	Orebody
McLeods Shaft	24	Mine
McMahons Reef	27	Deposit
McMahons Reef (D)	27	Orebody
McMillans	11	Mine
McPhersons	17	Mine
Mechanics	54	Mine
Mechanics (C)	54	Orebody
Melbourne	11	Mine
Melbourne	54	Mine
Melbourne (C)	54	Orebody
Meroo Creek	41	Orebody
Meroo Creek	41	Mine
Merricumbene	48	Orebody
Merricumbene Creek	48	Mine
Metcalfs	26	Mine
Metz	57	Synonym
Middle Reef	20	Orebody
Middle Reef (BC)	57	Orebody
Middle Workings (HH)	42	Orebody
Middletons	24	Mine
Milkmans	13	Orebody
Milkmans	13	Mine
Millers	54	Mine
Milparinka	2	Synonym
Mineral Hill	8	Deposit
Mineral Hill	8	Mine
Mineral Hill (D)	8	Orebody
Miners Right	14	Mine
Miscellaneous Group	14	Mine
Mitchells Creek	37	Synonym
Mitchells Creek	37	Mine
Mitchells Creek (Cluff Resources)	37	Orebody
Mitchells Creek (Kaiser)	37	Orebody
Mobbs	48	Mine
Moleton	60	Orebody
Monks	40	Mine
Monte Carlo	10	Mine
Moonan Flat	53	Synonym
Moonlight	15	Orebody
Moonlight	15	Mine
Moonlight	43	Mine
Moonlight (BAP)	52	Orebody
Morellis	15	Orebody
Morellis	15	Mine
Morning Star	17	Mine
Morning Star	18	Orebody
Morning Star	18	Mine
Morning Star	23	Mine
Morning Star	50	Mine
Mosquito	34	Mine
Mother Shipton	17	Mine
Mother Shipton Hill	17	Synonym
Mount Boppy	7	Synonym
Mount Boppy	7	Orebody
Mount Boppy	7	Mine
Mount Boppy South	7	Orebody
Mount Boppy South	7	Mine
Mount Bromley	54	Mine
Mount Browne	2	Orebody
Mount Browne	2	Mine
Mount Carrington	59	Orebody
Mount Carrington	59	Mine
Mount Coman (Radiant)	49	Mine
Mount Copeland	54	Mine
Mount Copeland (C)	54	Orebody
Mount Dudley	34	Orebody
Mount Dudley	34	Mine
Mount Ephraim	52	Orebody
Mount Ephraim	52	Mine
Mount Gahan	50	Mine
Mount Jones	55	Orebody
Mount Jones	55	Mine
Mount Lewisson	50	Mine
Mount Lewisson-Great Southern	50	Orebody
Mount Marshall	8	Orebody
Mount McDonald	33	Deposit
Mount McDonald (D)	33	Orebody
Mount Morgan	11	Orebody
Mount Mutton	55	Orebody
Mount Mutton	55	Mine

Mine, orebody, deposit or synonym	No	Type
Mount Nicholls	34	Orebody
Mount Parnassus	23	Orebody
Mount Parnassus	23	Mine
Mount Parnassus Tunnel	23	Mine
Mount Peerless	54	Mine
Mount Peerless (UB)	54	Orebody
Mount Pleasant	11	Mine
Mount Pleasant	49	Mine
Mount Poole	2	Orebody
Mount Potter	23	Orebody
Mount Potter	23	Mine
Mount Waddell	48	Orebody
Mount Waddell	48	Mine
Mount Walsh	55	Orebody
Mount Walsh	55	Mine
Mount Wiagdon	44	Orebody
Mount Wiagdon	44	Mine
Mountain Hero	54	Mine
Mountain Maid	51	Orebody
Mountain Maid	51	Mine
Mountain Maid	53	Mine
Mountain Maid	54	Mine
Mountain Maid	60	Mine
Mountain Maid (C)	54	Orebody
Mountain Maid (HH)	42	Orebody
Mountain Rose	54	Mine
Mountain Run	34	Orebody
Mountain Run	34	Mine
Mouse Trap	14	Mine
Moustakas (HH)	42	Orebody
Muckerawa Creek	40	Orebody
Mudgee	41	Mine
Murphys	34	Mine
Murphys	54	Mine
Murrays	17	Mine
Murrays	34	Mine
Murrumburrah	26	Synonym
Myall	10	Orebody
Myall United	10	Mine
Myall United (McPhails)	10	Mine
Nana Creek		Synonym
Nana Creek	60	Synonym
Nana Glen	60	Orebody
Nanas Daughter	60	Mine
Native Bear	13	Orebody
Native Bear Lead	13	Mine
Neelds No. 1	14	Mine
Nerrigundah	49	Deposit
Nerrigundah (D)	49	Orebody
Nerrigundah (East)	49	Orebody
Nerrigundah (West)	49	Orebody
Never Never	46	Orebody
Never Never	46	Mine
Never-Say-Die	43	Mine
Neversweat	15	Orebody
Neversweat	15	Mine
New Bendigo	2	Orebody
New Bendigo	2	Mine
New Burrangong	25	Mine
New Bushmans Hill	11	Mine
New Cadia	31	Mine
New Caledonian	20	Mine
New Chum	25	Orebody
New Chum	25	Mine
New Chum Hill	22	Orebody
New Chum Hill	22	Mine
New Cobar	4	Deposit
New Cobar (Cobar Or Fort Bourke)	4	Mine
New Cobar (D)	4	Orebody
New Haven	11	Mine
New McMahons Reef	27	Mine
New Occidental	5	Deposit
New Occidental	5	Mine
New Occidental (D)	5	Orebody
New Royal Standard	53	Mine
New South Wales (Klinks, Lighthouse)	14	Mine
New Standard/Dixon/New Years Gift	53	Orebody
New Welcome	13	Mine
New Year	54	Mine
New Years Gift	53	Mine
New Years Gift	60	Mine
Newhaven	7	Orebody
Newhaven	7	Mine
Nibblers	11	Orebody
Nibblers	11	Mine
Nibblers Hill	11	Orebody
Nibblers Hill	11	Mine
Nil Desperandum	12	Mine
Nil Desperandum	43	Mine
Nil Desperandum	59	Mine
Nil Desperandum (MC)	59	Orebody
Nimrod	48	Mine
Nine Mile	22	Orebody
Nine Mile Creek	22	Mine
Nixons	49	Mine

Mine, orebody, deposit or synonym	No	Type
No Mistake	11	Mine
No Mistake/Reids Gully	11	Orebody
No. 1 West Lady Belle	60	Mine
No. 6 Orebody	30	Orebody
No. 8 Orebody	30	Orebody
No. 9	59	Mine
No. 9 (MC)	59	Orebody
Nobles	34	Mine
North	12	Mine
North Bloomfield	22	Mine
North Broken Hill	1	Mine
North Burrangong	25	Mine
North Hard To Find No.1	15	Mine
North Hard To Find No.2	15	Mine
North Kylo	59	Mine
North Lachlan	12	Mine
North Lucknow	28	Orebody
North Mount Boppy	7	Orebody
North Mount Boppy	7	Mine
North Williams	20	Mine
Northeast -- Black/Happy Valley	43	Orebody
Northern	3	Orebody
Northern	4	Orebody
Northern	36	Orebody
Norton-John Norton	52	Orebody
Nuggetty Gully	2	Orebody
Nuggetty Gully	2	Mine
Nuggetty Gully	20	Orebody
Nuggetty Gully	20	Mine
Nuggetty Gully	35	Orebody
Nuggetty Hill	44	Orebody
Nuggetty Hill	44	Mine
Number Five	34	Mine
Number Seven (Alma)	34	Orebody
Number Seven (Alma)	34	Mine
Number Six	34	Mine
Numerous Mines	42	Mine
Nundle	52	Deposit
Nundle (D)	52	Orebody
O'Briens	53	Mine
Oakenville	52	Mine
Oakey Creek	34	Orebody
Oakey Creek	34	Mine
Oakey Creek	41	Orebody
Oakey Creek	41	Mine
Oakey Creek	42	Orebody
Oakey Creek	42	Mine
Occidental	5	Synonym
Ocean View	49	Mine
Old 44	43	Mine
Old Cadia (White Engine)	31	Mine
Old Christmas Gift	24	Mine
Old Federal	24	Mine
Old Gulgong	43	Orebody
Old McMahons Reef	27	Mine
Old Ramsays	11	Orebody
Old Reef	20	Orebody
Olivers Freehold	33	Orebody
Olivers Freehold	33	Mine
Omadale	53	Mine
Opossum	52	Mine
Opossum Gully	52	Mine
Opossum/Lord Carrington etc (BAP)	52	Orebody
Orara	60	Synonym
Oriental	13	Mine
Our Own	20	Mine
Outward Bound	13	Mine
Paddys Flat	10	Mine
Paddys Flat (PH)	10	Orebody
Paddys Flat/Yarran	11	Mine
Pambula	50	Deposit
Pambula (D)	50	Orebody
Panbula	50	Synonym
Panuara	29	Orebody
Parkers	17	Mine
Parkers Hill	8	Orebody
Parkers Hill	8	Mine
Parkes	11	Deposit
Parkes (D)	11	Orebody
Parkes (Goonumbla)	9	Deposit
Parkes (Goonumbla) (D)	9	Orebody
Parramatta	43	Mine
Parramatta/Happy Valley	43	Orebody
Patience (Womans)	34	Orebody
Patons	10	Mine
Pattinson & Wincklers	22	Mine
Paxtons (HH)	42	Orebody
Peak	6	Synonym
Peak Hill	10	Orebody
Peak Hill	10	Mine
Peak Hill Proprietary	10	Mine
Peak Hill-Tomingley	10	Deposit
Peak Hill-Tomingley (D)	10	Orebody
Peeks Reef	35	Mine
Peel River	52	Orebody
Peel River	52	Mine
Peep Of Day	13	Orebody
Peep Of Day	13	Mine
Penmans	17	Mine
Penningtons	12	Mine
Peppertree	53	Mine
Periwinkle	43	Mine
Perrys	14	Mine
Perseverance	6	Orebody
Perseverance	6	Mine
Perseverance	14	Mine
Perseverance	40	Mine
Perseverance	43	Mine
Perseverance	53	Mine
Perseverance	59	Mine
Perseverance (MC)	59	Orebody
Perseverance & Hindhaughs	48	Mine
Perseverance/Omadale/Blue	53	Orebody
Phantom	35	Mine
Phantom-Carlton-White	35	Orebody
Pheonix	15	Orebody
Phillipsons (HH)	42	Orebody
Phoenix	2	Orebody
Phoenix	2	Mine
Phoenix	15	Mine
Phoenix	56	Mine
Phoenix (Haselhurst)	11	Mine
Phoenix (R)	56	Orebody
Pig & Whistle	59	Mine
Pig & Whistle (MC)	59	Orebody
Pilot-Hidden Treasure-Diorite	50	Orebody
Pine Hill	14	Orebody
Pine Hill	14	Mine
Pine Ridge	14	Orebody
Pine Ridge	14	Mine
Pine Ridge	34	Orebody
Pine Ridge (Hells Hole or Omrah)	34	Mine
Pinnacle	47	Mine
Pinnacle-Eclipse	47	Orebody
Pioneer	2	Orebody
Pioneer	2	Mine
Pioneer	11	Mine
Pioneer	14	Orebody
Pioneer	34	Mine
Pioneer	47	Mine
Pioneer	59	Mine
Pioneer (Enterprise)	15	Mine
Pioneer (MC)	59	Orebody
Pioneer Whip	34	Mine
Pioneer-Homeward Bound	47	Orebody
Pipes	13	Mine
Polar Star	46	Mine
Poor Man	47	Orebody
Poor Man	47	Mine
Poormans	40	Mine
Possum	11	Mine
Possum	52	Mine
Possum Flat	25	Mine
Possum Gully	11	Mine
Post Office	40	Mine
Pound Creek	21	Mine
Poverty Point	58	Synonym
Poverty Point	58	Mine
Poverty Point	58	Orebody
Prices	52	Mine
Prices Hill	52	Mine
Pride Of Reefton	15	Mine
Pride Of The Brook	53	Orebody
Pride Of The Brook	53	Mine
Prima Donna	34	Mine
Prince Alfred (HH)	42	Orebody
Prince Edward	54	Mine
Prince Of Wales	17	Mine
Prince Of Wales	23	Orebody
Prince Of Wales	23	Mine
Prince Of Wales	32	Orebody
Princess	14	Mine
Princess	46	Orebody
Princess Alexandra	40	Mine
Princess Alexandra Extended	40	Mine
Princess Marina	23	Orebody
Princess Marina	23	Mine
Prospecting	15	Orebody
Prospecting	15	Mine
Prowse & Woodwards	20	Mine
Prowses	20	Mine
Prussian	13	Mine
Puddledock Creek	56	Mine
Puddledock Creek (A)	56	Orebody
Pukka	11	Orebody
Pukka	11	Mine
Quails	15	Orebody
Quails	15	Mine
Quart Pot	49	Mine
Quartpot-Tinpot-Grasstree	49	Orebody

Mine, orebody, deposit or synonym	No	Type
Quartz Hill	13	Orebody
Quartz Hill	13	Mine
Quartz Hill	40	Mine
Quartz Reef Hill	25	Orebody
Quartz Reef Hill	25	Mine
Quartz Ridge	42	Orebody
Quartz Ridge	42	Mine
Quartzville	21	Mine
Queen	12	Mine
Queen Of Beauty	54	Mine
Queen Of Shebah	41	Mine
Queen Of The Mount	33	Mine
Queen-Democrat	46	Orebody
Queens	12	Orebody
Queens Record Reign	60	Mine
Queensland Utopia	49	Mine
Queenslander (King)	44	Orebody
Queenslander (King)	44	Mine
Quondong	13	Orebody
Quondong	13	Mine
Rainbow	54	Mine
Rainbow	59	Mine
Rainbow (C)	54	Orebody
Rainbow (MC)	59	Orebody
Ramsays	11	Mine
Randwick	42	Mine
Ranekies	34	Mine
Rapps Gully	43	Mine
Red	43	Mine
Red Creek	49	Mine
Red Flag	35	Orebody
Red Hill	42	Orebody
Red Hill	43	Orebody
Red Hill	43	Mine
Red Hill	44	Orebody
Red Hill	44	Mine
Red Hill	54	Mine
Red Rock	59	Orebody
Red Rock	59	Mine
Red Streak	43	Mine
Red White & Blue	60	Mine
Redfern	40	Mine
Redgate	43	Mine
Reedy Flat	21	Synonym
Reedy Flat Creek	21	Mine
Reef Hill	41	Mine
Reefton	15	Orebody
Reid & Rankens	7	Orebody
Reid & Rankens	7	Mine
Reids Gully	11	Mine
Research	20	Mine
Result	13	Mine
Richardsons	11	Mine
Richs	17	Mine
Riddicks	54	Mine
Rileys Creek	44	Orebody
Rileys Creek	44	Mine
Rise & Shine	12	Orebody
Rise & Shine (Penningtons)	12	Mine
Rise & Shine No. 1	48	Mine
Rise & Shine No. 2	48	Mine
River View	49	Mine
Rob Roys	34	Orebody
Robert Bruce	47	Orebody
Robert Bruce	47	Mine
Robinson & Rices	23	Orebody
Robinson & Rices	23	Mine
Robyns Tunnel	22	Mine
Rockdale	18	Orebody
Rockdale	18	Mine
Rockdale	40	Mine
Rockvale	56	Synonym
Rockvale (Wollomombi) Creek (R)	56	Orebody
Rockvale Creek	56	Mine
Rocky Bridge	34	Orebody
Rocky Bridge	34	Mine
Rocky Creek	55	Orebody
Rocky Hill	25	Mine
Rocky River	55	Synonym
Rocky River	55	Orebody
Rocky River	58	Synonym
Rose & Thistle (C)	54	Orebody
Rose & Thistle (Sydney Flag)	54	Mine
Rose Of Australia	34	Orebody
Rose Of England	43	Mine
Rosemount	2	Orebody
Rosemount	2	Mine
Roxburgh	44	Mine
Royal Bengal Tiger	54	Mine
Royal George	35	Mine
Royal George	43	Orebody
Royal George	43	Mine
Royal George-Victoria	35	Orebody
Royal Standard	35	Orebody
Russels (Lonsdale Creek)	49	Mine
Ruzickas	52	Mine
Ruzickas/Lady Of The Mountain etc (HR)	52	Orebody
S.C. Martins	55	Orebody
S.C. Martins	55	Mine
Sailors Gully	40	Mine
Sailors Gully	41	Mine
Salvation Hill	43	Orebody
Salvation Hill	43	Mine
Sandemans	47	Mine
Santa Claus	14	Mine
Santa Claus & Klinks	14	Orebody
Sardine	11	Mine
Sargents Hill	42	Orebody
Sawpit	49	Mine
Sawpit Gully	25	Orebody
Sawpit Gully	25	Mine
Sawpit Gully	55	Orebody
Sawpit Gully	55	Mine
Sawtells	49	Mine
Sawyers	41	Mine
Sawyers	54	Mine
Saxbys (Bowman River)	54	Mine
Saxbys (UB)	54	Orebody
Scabben Flat	34	Orebody
Scabby Gully	43	Orebody
Scandinavian	43	Mine
Scandinavian	52	Mine
Scandinavian/Bonny Dundee etc (BAP)	52	Orebody
Schultzs	34	Mine
Scotch Hill	41	Mine
Scotchmans	38	Orebody
Scotchmans	38	Mine
Scotchmans	49	Mine
Scotchmans	53	Mine
Scotsmans Gully (N)	48	Mine
Scotsmans Gully (S)	48	Mine
Scotsmans Gully-Whiteman & Merton	48	Orebody
Scott & Clarkes	44	Mine
Scotts & Baileys	13	Mine
Scotts Gully	22	Mine
Scrub	11	Mine
Scrubby Gully (HR)	52	Orebody
Scrubby Plains	11	Orebody
Scrubby Plains	11	Mine
Sebastopol-Junee Reefs	18	Deposit
Sebastopol-Junee Reefs (D)	18	Orebody
Secret	11	Orebody
Secret	11	Mine
Secret	13	Orebody
Secret	13	Mine
Sesame	21	Orebody
Sesame (L'Aiglon)	21	Mine
Seven Mile	13	Orebody
Seven Mile	13	Mine
Shakespeare	42	Mine
Shallow Rush	11	Mine
Shallow Rush	43	Mine
Shamrock	14	Mine
Shamrock	17	Mine
Shamrock	33	Mine
Shamrock & Thistle	14	Mine
Shanahans	55	Orebody
Sharpes	10	Mine
Shaws	11	Mine
Sheahan	32	Mine
Sheahan-Grants	32	Synonym
Sheahan-Grants	32	Mine
Sheahan-Grants	32	Orebody
Sheba/ Red Hill/Mount Misery etc	52	Orebody
Sherlaw & Jones	10	Mine
Showground	15	Orebody
Sid Lakes	49	Mine
Silver King	59	Orebody
Silver King	59	Mine
Sir John Moore	42	Mine
Six Mile	22	Orebody
Smails	53	Mine
Smiths	57	Orebody
Snobs	48	Orebody
Snobs (Mount Hope)	48	Mine
Snows	10	Mine
Sofala	44	Orebody
Sofala	44	Mine
Sofala-Wattle Flat	44	Deposit
Sofala-Wattle Flat (D)	44	Orebody
Solitary	44	Orebody
South	12	Orebody
South	12	Mine
South (Kintore)	1	Mine
South -- Magpie/Rapps Gully	43	Orebody
South Bloomfield	22	Mine
South Burrangong	25	Mine
South Cosmopolitan	57	Mine
South Hill	41	Mine
South Lucknow	28	Orebody

Mine, orebody, deposit or synonym	No	Type
South Lucknow	28	Mine
South Vanderbilt	34	Orebody
Southeast -- Canadian/Home Rule	43	Orebody
Southeast -- Cumbandry/Britannia	43	Orebody
Southeast -- Little Cumbandry	43	Orebody
Southern	3	Orebody
Southern	4	Orebody
Southern	36	Orebody
Southwest -- Caledonian	43	Orebody
Southwest -- Moonlight	43	Orebody
Sovereign	43	Mine
Specimen Hill	40	Mine
Spencers	48	Mine
Sperantum	48	Mine
Sphinx No. 1	48	Mine
Sphinx No. 2	48	Mine
Spirit Of Iron	59	Orebody
Spirit Of Iron	59	Mine
Splitters Gully	40	Mine
Spring Creek	25	Orebody
Spring Creek	25	Mine
Spring Creek	51	Orebody
Spring Creek	51	Mine
Spring Creek	52	Mine
Spring Gully	52	Mine
Spring Gully/Lady Mary (HR)	52	Orebody
Springfield	43	Mine
St Aigans	28	Mine
St George	41	Mine
St Patricks	23	Orebody
St Patricks	23	Mine
Stalkers	48	Mine
Standard	43	Mine
Standard	53	Mine
Stanleys Blow	14	Mine
Staples	11	Mine
Staples	12	Orebody
Staples	12	Mine
Star	23	Mine
Star	43	Mine
Star	47	Mine
Star	51	Orebody
Star	51	Mine
Star Gully	13	Orebody
Star Gully	13	Mine
Star Gully (Alluvial)	13	Orebody
Star Gully Lead	13	Mine
Star Of Peace (HH)	42	Orebody
Star Of The South	43	Mine
Stewart & Mertons	48	Mine
Stewarts	29	Mine
Stockmans	10	Mine
Stockyard	35	Mine
Stockyard Creek	41	Orebody
Stockyard Creek	41	Mine
Stockyard-Hidden Secret	35	Orebody
Stoney Creek	23	Mine
Stoney Creek	25	Orebody
Stoney Creek	25	Mine
Stony Creek	23	Orebody
Stony Creek	23	Mine
Strauss	59	Mine
Strauss (MC)	59	Orebody
Stringers	38	Orebody
Stringers (Independent)	38	Mine
Stringy Bark	40	Mine
Stuart Town	40	Deposit
Stuart Town	40	Orebody
Stuart Town (Alluvial)	40	Orebody
Stuart Town (D)	40	Orebody
Stuarts Gully	13	Orebody
Stuarts Gully	13	Mine
Sueys	55	Orebody
Sugarloaf	53	Mine
Sulphide (Cornishmens)	32	Mine
Summergills	14	Orebody
Summergills	14	Mine
Sunlight	57	Mine
Sunlight-West Sunlight	57	Orebody
Surface Hill	21	Mine
Surface Hill	22	Orebody
Surface Hill	22	Mine
Surface Hill	44	Orebody
Surface Hill	58	Orebody
Surface Hill	58	Mine
Surprise	13	Orebody
Surprise	13	Mine
Surprise	28	Orebody
Surprise	28	Mine
Sutherland	22	Orebody
Sutherland	22	Mine
Swallows Nest	40	Mine
Swamp Creek	52	Mine
Sybil	23	Mine
Sydney Clinker	11	Mine
Sydney Flat	55	Orebody
Syndicate	57	Orebody
Taits Gully	56	Mine
Taits Gully (A)	56	Orebody
Tallawang	43	Orebody
Tallawudja Creek	60	Orebody
Tambaroora	42	Synonym
Tamworth	52	Mine
Tamworth etc/Opossum Gully (HR)	52	Orebody
Tanners	34	Mine
Tarcutta Creek	21	Mine
Tarvainens/Brown Snake/Shamrock	52	Orebody
Taylors	17	Mine
Tea Tree Creek	51	Orebody
Tea Tree Gully	51	Mine
Tearaway	11	Mine
Temora	17	Deposit
Temora (D)	17	Orebody
Temora (Deep Lead)	17	Orebody
Temora (Gidginbung)	16	Deposit
Temora (Gidginbung)	16	Mine
Temora (Gidginbung) (D)	16	Orebody
Temora (Reef)	17	Orebody
The Ambassador	46	Mine
The Bank	54	Mine
The Blacksmiths	29	Orebody
The Blacksmiths	29	Mine
The Bluff	10	Mine
The Caledonian	44	Orebody
The Democrat	46	Mine
The Doctors	18	Orebody
The Doctors	18	Mine
The Dust Holes	18	Orebody
The Dust Holes	18	Mine
The Folly/Bonds (HR)	52	Orebody
The Gap	52	Mine
The Gap/Marquis Of Lorne etc (BAP)	52	Orebody
The German Band	34	Mine
The King	46	Mine
The Mint	54	Mine
The Mint (C)	54	Orebody
The New Eldorado	58	Mine
The Peak	6	Deposit
The Peak	6	Mine
The Peak (AM&S)	6	Orebody
The Peak (D)	6	Orebody
The Pioneer	14	Mine
The Prime Minister	46	Mine
The Princess	46	Mine
The Queen	46	Mine
The Snakes	7	Mine
Thomas	17	Mine
Thomas	47	Mine
Thompsons	12	Orebody
Thompsons	12	Mine
Thompsons	34	Mine
Thompsons (BAP)	52	Orebody
Three Mile	22	Orebody
Three Mile	22	Mine
Three Mile	25	Mine
Three Mile	43	Mine
Tibooburra	2	Orebody
Tibooburra	2	Mine
Tibooburra-Milparinka	2	Deposit
Tibooburra-Milparinka (D)	2	Orebody
Tichborne	11	Orebody
Tichborne	11	Mine
Tichborne/Wapping Butcher	11	Orebody
Tigeroo	29	Orebody
Tigeroo	29	Mine
Tilbuster	56	Synonym
Tilbuster Creek	56	Mine
Tilbuster Creek (A)	56	Orebody
Timbarra	58	Orebody
Timbarra (Rmt, Hortons)	58	Orebody
Timbarra (Rocky) River	58	Orebody
Timbarra River	58	Synonym
Timbarra-Poverty Point	58	Deposit
Timbarra-Poverty Point (D)	58	Orebody
Timmins	29	Mine
Tipperary Gully	2	Orebody
Tipperary Gully	2	Mine
Tipperary Gully	25	Orebody
Tipperary Gully	25	Mine
Tiverton	53	Mine
Tom Tiger (BAP)	52	Orebody
Tomingley	10	Orebody
Toss Of A Penny	12	Mine
Town & Country	54	Mine
Township Hill	22	Orebody
Township Hill	22	Mine
Trafalgar	12	Mine
Trevena (HR)	52	Orebody
Trevena (Trevenna)	52	Mine
Trewilga	10	Orebody

Mine, orebody, deposit or synonym	No	Type
Trewilga	10	Mine
Trianbil Basalt Hill	40	Mine
Tricketts	40	Mine
Trojan	12	Mine
True Blue	14	Mine
Trunkey	34	Synonym
Trunkey	34	Mine
Trunkey (Deep Lead)	34	Orebody
Trunkey Creek	34	Deposit
Trunkey Creek (D)	34	Orebody
Tuckers Creek	54	Orebody
Tuckers Hill	41	Orebody
Tuckers Hill	41	Mine
Tuena	35	Deposit
Tuena (D)	35	Orebody
Tuena Creek	35	Mine
Tuena Creek-Kangaloolah Creek	35	Orebody
Tumbarumba	21	Orebody
Tumbarumba	21	Mine
Tumbarumba-Batlow	21	Deposit
Tumbarumba-Batlow (D)	21	Orebody
Tunnel Hill	2	Orebody
Tunnel Hill	2	Mine
Turn On The Tide	41	Mine
Turners	10	Mine
Turners	34	Mine
Turon River	42	Orebody
Turon River	42	Mine
Turon River	44	Synonym
Turon River	44	Orebody
Two Mile	13	Orebody
Two Mile	13	Mine
Two Mile Flat	43	Orebody
Tyagong	13	Synonym
Tynans	17	Mine
Underwoods	47	Mine
Union	12	Mine
Union	20	Mine
Union Jack	21	Mine
United Miners	48	Mine
Upper & Lower Bucca	60	Orebody
Upper Bingara	51	Orebody
Upper Bingara	51	Mine
Upper Bowman	54	Orebody
Upper Hunter	53	Deposit
Upper Hunter (D)	53	Orebody
Uralla	55	Deposit
Uralla (D)	55	Orebody
Usher	47	Mine
Usher-Golden Quarry	47	Orebody
Utopia	49	Orebody
Valentine	42	Orebody
Valentine	42	Mine
Vanderbilt	45	Orebody
Vanderbilt	46	Mine
Venables	24	Mine
Verden Road (HR)	52	Orebody
Victoria	11	Mine
Victoria	12	Mine
Victoria	20	Orebody
Victoria	35	Mine
Victoria	38	Mine
Victoria	46	Synonym
Victoria Hill (Victoria Gully)	25	Orebody
Victoria Hill (Victoria Gully)	25	Mine
Victorian	43	Mine
Victory	13	Mine
Victory	47	Orebody
Victory	47	Mine
Victory	50	Mine
Vyners Creek	21	Mine
Walletts	18	Orebody
Walletts	18	Mine
Walshs	21	Orebody
Walshs Dyke (Mutooroo)	21	Mine
Wandella Mountain	49	Mine
Wapping Butcher	11	Mine
Waratah	14	Mine
Warnocks	17	Mine
Warratta	2	Orebody
Warratta	2	Mine
Washington	35	Orebody
Washington	35	Mine
Water Lilly	40	Mine
Wattle Flat	44	Synonym
Wattle Flat Hill	44	Orebody
Wattle Flat Hill	44	Mine
Wealth Of Nations	7	Orebody
Wealth Of Nations	7	Mine
Wealth Of Nations	54	Mine
Webb & Party	33	Mine
Weddin Mountain	13	Synonym
Welcome	11	Orebody
Welcome	11	Mine
Welcome	13	Mine
Welcome	43	Orebody
Welcome	43	Mine
Welcome (Wild Cat)	11	Orebody
Welcome Jack	38	Orebody
Welcome Jack	38	Mine
Welcome Stranger	53	Mine
Welcome Stranger/King Solomon etc	53	Orebody
Well Tried	11	Mine
Wellington	38	Deposit
Wellington	38	Mine
Wellington (D)	38	Orebody
Wellington Alluvials	38	Orebody
Wellwood	28	Orebody
Wellwood	28	Mine
Welshmans	53	Mine
Welshmans/Scotchmans	53	Orebody
Wentworth	28	Synonym
Wentworth	28	Mine
Weselmans Tunnel	22	Mine
West -- Adams	43	Orebody
West -- Perseverance/Frasers	43	Orebody
West Bingara	51	Orebody
West Bingara	51	Mine
West Bopppy	7	Orebody
West Boppy	7	Mine
West Cadia	31	Orebody
West Cadia	31	Mine
West Sunlight	57	Mine
West Workings (HH)	42	Orebody
West Wyalong	14	Deposit
West Wyalong (D)	14	Orebody
Western	3	Orebody
Western	4	Orebody
Western	5	Orebody
Western	8	Orebody
Western	8	Mine
Western	36	Orebody
Western Reef	13	Mine
Western West Wyalong	14	Orebody
Wet	53	Mine
Whalans Hill	44	Orebody
Whalans Hill	44	Mine
Whipstick Gully	22	Mine
White	35	Mine
White	51	Orebody
White	51	Mine
White Cross	15	Orebody
White Cross	15	Mine
White Engine	31	Orebody
White Rock	59	Orebody
White Rock	59	Mine
White Rose	13	Mine
White Rose	52	Mine
Whiteman & Merton	48	Mine
Who'd A Thought It	10	Mine
Who'd Have Thought It	13	Mine
Whybatong	56	Mine
Whybrows	25	Mine
Whybrows-Rocky Hill	25	Orebody
Widows Mite	40	Mine
Williams	13	Mine
Williams	20	Mine
Williams	29	Mine
Wilsons	13	Mine
Wilsons	34	Orebody
Wilsons	34	Mine
Windeyer	41	Synonym
Wombat Creek	25	Mine
Wombat Creek-Demondrille Creek	25	Orebody
Wombat Gully	52	Orebody
Wombat Gully (Dog Trap Hill)	52	Mine
Woolgoolga-Coffs Harbour	60	Orebody
Woolston & Co	33	Mine
Wrenchs	34	Mine
Wrights	15	Orebody
Wrights	15	Mine
Wrights	34	Orebody
Wrights	34	Mine
Wyalong	14	Synonym
Wythes & Mooneys	10	Mine
Wythes & Mooneys (PH)	10	Orebody
Ya Hoo Hills	40	Mine
Yalwal-Grassy Gully	47	Deposit
Yalwal-Grassy Gully (D)	47	Orebody
Yankee Jack	52	Mine
Yellokok	54	Mine
Yellow Streak	34	Mine
Yellow Streak-Podgers	34	Orebody
Young Australia	34	Orebody
Young Australia	48	Mine
Young Australian (Queen Of Australia)	34	Mine
Young Farmer	13	Orebody
Young Farmer	13	Mine
Young O'Brien	13	Orebody
Young O'Brien	13	Mine

Previous titles in the Resource Report Series

(year of publication in brackets)

1. *Australian uranium resources* (1987)

2. *Coal potential of Antarctica* (1987)

3. *Gold deposits of Western Australia: BMR datafile (MINDEP)* (1987)

4. *Gold deposits of Queensland: BMR datafile (MINDEP)* (1988)

5. *Geology and economics of platinum-group metals in Australia* (1989)

Availability of BMR publications

BMR publications and maps are listed in *Publications of the Bureau of Mineral Resources, Geology and Geophysics (Part 1: Publications other than maps; Part II: Maps)*, which is available free of charge from: BMR Publications Sales, GPO Box 378, Canberra, ACT 2601 (phone 062-499519). A *Quarterly List of Publications* showing current releases of all publications and other data is also available free of charge from BMR Publication Sales, together with detailed information on prices and postage costs. A brochure illustrating the extent of coverage of Australia by geoscientific surveys carried out by BMR and the State mines departments is also available.

All publications can be bought at the Publication Sales counter, BMR building, cnr Constitution Avenue and Anzac Parade, Parkes, ACT. Further information on the availability of preliminary data may be obtained from the Information Section, phone 062-499620. Please note that orders for publications must be acompanied by payment in advance. Cheques, postal orders, etc., should be made payable to: Collector of Public Monies (BMR). Payment from overseas should be made by bank draft or international money order in Australian currency.

BMR RESOURCE REPORT No.6: GOLD DEPOSITS OF NEW SOUTH WALES: BMR DATAFILE (MINDEP) - EXPLANATORY NOTES ON A REPORT GENERATED FROM THE MINDEP DATABASE

1. Deposit Identification:

Orebodies: The deposits listed below include one or more centres of production. The listing of individual orebody names includes both the names of the main production centres and the individual orebodies at each centre. Suffixes (eg (PH) for Peak Hill, (MC) for Mount Carrington) indicate the centre to which individual orebodies belong.

Deposit No.10.	**Peak Hill-Tomingley:** 'Orebody name' (PH) indicates that the orebody belongs to the Peak Hill centre (orebody Peak Hill).
Deposit No.42.	**Hill End-Tambaroora:** (HH) = Hawkins Hill Centre
Deposit No.52.	**Nundle:** (BAP) = Bowling Alley Point Centre; (HR) = Hanging Rock Centre.
Deposit No.54.	**Copeland (Barrington):** (C) = Copeland Centre; (CC) = Commonwealth Creek Centre; (UB) Upper Bowman Centre.
Deposit No.56.	**Armidale-Rockvale:** (A) = Armidale Centre; (R) = Rockvale Centre.
Deposit No.57.	**Hillgrove:** (BC) = Bakers Creek Centre.
Deposit No.59.	**Drake:** (MC) = Mount Carrington Centre.

2. Development History:

Discovery date: For some deposits exact dates of discovery are unknown. In these cases discovery dates are qualified 'Date approximate' under 'comments'. Alluvial gold was discovered and worked at some deposits for several years prior to discovery of reef ore. In these cases dates of discovery are qualified as 'Alluvial' or 'Reef' mineralisation under 'comments'; 'extension to known mineralisation' indicates more recent discovery of ore mineralisation.

Operating status: Operating status at June 1989:

Key:-

Historical:	major production period(s) between 1850-1950; not currently prospective.
Completed:	redeveloped since 1980, production since ceased.
Operating:	in production at June 1989.
Maintenance:	on care-and-maintenance.
Possible:	advanced exploration stage, mine development committed or likely.

3. Production:

Main production periods: Production periods are listed in the following order: minor production period(s)(in brackets); major production period(s).

4. Resources: (see also Table 3)

Abbreviations: Abbreviations used in column 7 of the resource listing for each deposit are:-

O/C	- Open-Cut	**T**	- Tailings
U/G	- Underground	**Alluv**	- Alluvial
S	- Stockpile	**Total**	- Total of two or more of above

5. Geology: Host rocks:

Formation name and ages: Formation age is based on:-
Haq B.U. & Van Eysinga F.W.B. (1987) -
Geological Time Table 4th Edition
Elsevier, Amsterdam

In particular, subdivision of the Permian follows that of Haq & Van Eysinga viz. Early Permian: 290-270 my; Late Permian: 270-251 my. This approach differs from the subdivision into Early, Middle, and Late Permian used by many workers in the New England region; hence ages given as Middle Permian by these authors are reported either as Early Permian or Late Permian.

6. Deposit Characteristics:

Dimensions: For previously worked orebodies, minimum and average dimensions generally refer to orebody (vein) dimensions; maximum dimensions refer to extent of mine workings.

Mineralogy (Order of listing): major minerals, are listed first, followed by minor minerals shown in brackets e.g. Pyrite, (sphalerite, gold).

Geological Setting of Mineralisation: Data are reported under the following headings:-

SUMMARY: A summary of the geological setting of mineralisation.
REGIONAL SETTING: A descriptive summary of the regional setting of the Province, or Sub-province in which the deposit occurs.
REGIONAL SUCCESSION AND ASSOCIATED MINERALISATION: A summary of the regional succession and notes on mineralisation by Province, Sub-province, group, or deposit.
GEOLOGICAL SETTING: A summary of the geological setting of the deposit group or deposit.
LOCAL SETTING; MINERALISATION: A summary of the local setting of the mineralisation.

Geological Setting of Mineralisation: Where deposits included elsewhere in the datafile are referred to in the text their names are shown in upper case and their deposit number is given; the names of deposits not included elsewhere in the datafile and place names are shown in upper and lower case.

Geological Setting of Mineralisation and Bibliographic References and Other Sources: Some sources quoted are not listed under 'Bibliographic References and other Sources' because they are of marginal relevance to the deposit. For bibliographic details of unlisted sources, please refer to a source listed in 'Bibliographic References and other Sources'.

2 January 1990

DEPOSIT: 1 BROKEN HILL

DEPOSIT IDENTIFICATION:

COMMODITIES: Pb, Zn, Ag, Mn, Fe, Cu, F, P, Bi, Au, U, Th

DISTRIBUTION:
Deposit occupies elongate NE- .ending zone 7.3 km long worked over width of 250 m. From NE to SW, major mines are: North Broken Hill Limited, South Mine, Zinc Corporation Limited, New Broken Hill Consolidated.

OREBODIES:
Broken Hill (D), Lead No. 2, Lead No. 3, Zinc B, Zinc C, Zinc Lower A, Zinc Lower No. 1, Zinc Upper A, Zinc Upper No. 1

MINES:
North Broken Hill, South (Kintore), ZC (Includes ZC & NBHC Mines)

GROUP: -

COMMENTS:
Although not primarily a gold deposit, Broken Hill is included in the datafile as it has produced over 12 t Au as a by-product of base metal mining.

LOCATION:

LATITUDE: 31 58 LONGITUDE: 141 27
250K SHEET: SH54 15 100K SHEET: 7134

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Broken Hill
LOCAL GOVERNMENT AREA (LGA): Unincorporated

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1883	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Broken Hill (D)	North Broken Hill	Operating	Underground
Broken Hill (D)	South (Kintore)	Operating	Open-Cut
Broken Hill (D)	ZC (Includes ZC & NBHC Mines)	Operating	Underground

COMPANIES:

OREBODY: Broken Hill (D)

PRESENT OPERATORS:
Pasminco Ltd

PRESENT OWNERS:	EQUITY%	
Minerals Mining And Metallurgy Ltd	100.00	South (Kintore) mine
Pasminco Ltd	100.00	ZC and North Broken Hill mines

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 12,076
Gold grade 0.1-0.2 g/t Au. Grades of principal metals lead 11-15% Pb (in lead lodes), zinc 10-20% Zn, silver 100-300 g/t Ag (in lead lodes).

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

YEAR	PRODUCTION
1965	295

1966	277
1967	303
1968	266
1969	317
1970	320
1971	304
1972	274
1973	285
1974	265
1975	303
1976	311
1977	319
1978	300
1979	217
1980	391
1981	398
1982	342
1983	366
1984	299
1985	284
1986	201
1987	268
1988	345

MAIN PRODUCTION PERIODS: 1883-,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION			
Dec 1987	41,100	0.2	8,220	Economic Demonstrated	In-Situ	u/g	ZC mine (includes ZC and NBHC mines)
Dec 1988	2,700	0.2	540	Economic Demonstrated	In-Situ	o/c	South mine (Kintore open cut)
June 1988	5,400	0.2	1,080	Economic Demonstrated	In-Situ	u/g	North mine

PRE-MINE RESOURCE SIZE:

GEOLOGY:

PROVINCE:

BLOCK: Broken Hill Block
PROVINCE: -
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Willyama Supergroup - Early-Middle Proterozoic
LITHOLOGY: Pelitic & psammitic metasediments, migmatite, feldspathic & quartzofeldspathic metasedimentary gneisses, sodic quartz-plagioclase rocks, amphibolite, garnetiferous quartzofeldspathic gneiss, 'lode horizon' rocks, carbonaceous metasediments.
RELATIONSHIP TO MINERALISATION: Stratiform base metal mineralisation occurs in Broken Hill Group in upper part of supergroup, at boundary between inferred volcanogenic lower section of supergroup and non-volcanogenic upper section.

FORMATION NAME & AGE: Broken Hill Group - Early-Middle Proterozoic
LITHOLOGY: Metasediments, increasingly pelitic up-sequence, interbedded garnetiferous quartzofeldspathic gneiss ('Potosi' gneiss), amphibolite, 'lode horizon' rocks: banded iron formation (BIF), quartz-gahnite rock, garnet-quartz rock.
RELATIONSHIP TO MINERALISATION: Stratiform base metal sulphide mineralisation is associated with a distinctive formation of layered rocks ('lode horizon') in the upper unit of metasediments with interbedded felsic and basic gneisses (Hores Gneiss).

FORMATION NAME & AGE: Hores Gneiss - Early-Middle Proterozoic
LITHOLOGY: Lenticular elongate bodies of quartz-feldspar-biotite-garnet gneiss ('Potosi' gneiss), interbedded metasediments, amphibolite, quartz-gahnite rock, BIF, tourmaline-quartz rock, massive sulphides.
RELATIONSHIP TO MINERALISATION: Mineralisation occurs at top of Hores Gneiss, enclosed by metasediments, spatially associated with garnetiferous quartzofeldspathic gneiss, amphibolite, BIF, quartz-gahnite rock, garnet-quartz rock, and pegmatite.

GEOCHRONOLOGY:

Age of deposition of sedimentary/volcanic sequence: 1820+-60 my (Shaw, 1968); 1820+-100 my (Pidgeon, 1967) (initial Sr ratios).
Age of peak metamorphism: 1660+-10 my (Rb-Sr); 1660+-16 my (207Pb-206Pb) (Harrison & McDougall, 1981, recalculated from Shaw, 1968; and Reynolds, 1971 respectively); 1663+-9 my (U-Th-Pb in zircon) (Gulson, 1984).
Age of third deformation: 1605 my (sources cited by Barnes, 1988).

STRATIGRAPHIC ENVIRONMENT:

SIGNIFICANT: Clastic Sedimentary, Metasedimentary , Volcanogenic Sedimentary

STRUCTURAL FEATURES:

SIGNIFICANT: Folding, Shearing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

SIGNIFICANT: Volcanism (Felsic), Volcanism (Mafic)

METAMORPHISM:

Prograde metamorphic zones grade from upper greenschist/lower amphibolite facies - andalusite/muscovite, sillimanite/muscovite, and sillimanite/K-feldspar zones - in the NW part of the Broken Hill Block, to granulite facies - two-pyroxene zone - in the central and SE parts of the block (sources quoted by Willis & others, 1983; Barnes, 1988).
Granulite facies rocks are overprinted by retrograde kyanite and staurolite zones (sources quoted by Barnes, 1988).
Broken Hill deposit lies within retrogressed granulite facies rocks.

ALTERATION:

OREBODY: Broken Hill (D)

Plimer (1979, 1984) identified pre-metamorphic hydrothermal alteration spatially associated with the sulphide rocks.
Within 500 m-wide zone in stratigraphic footwall, rocks are depleted in Na_2O, CaO, Sr, MgO, and enriched in SiO_2, K_2O, Rb, MnO, Pb, Zn, U, S, possibly also total iron, TiO_2.
Rb/Sr increases from less than unity 500 m from the orebodies to 30-100 at the orebodies (Plimer, 1984).
The most intense alteration (silicification) occurs stratigraphically beneath and between the maximum development of sulphide mineralisation.

DEPOSIT CHARACTERISTICS:

TYPES:

MAJOR: Sediment-hosted stratiform ?volcanogenic massive sulphide.

STYLE:

MAJOR: Conformable, Stratabound, Stratiform

AGE OF MINERALISATION: Proterozoic Middle, Proterozoic Early

DIMENSIONS/ORIENTATION:

OREBODY: Broken Hill (D)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			7300.0
TRUE WIDTH	(m)			250.0
VERTICAL DEPTH	(m)			850.0

ORE TEXTURE:

Disseminated, Massive

NATURE OF MINERALISATION:

MINERALOGY:

OREBODY: Broken Hill (D)

PRINCIPAL SOURCES: Johnson & Klingner (1975), Markham (1982), Stevens & others (1988).

Sulphide zone: galena, sphalerite, (chalcopyrite, pyrrhotite, loellingite, arsenopyrite, tetrahedrite, native silver).

Gangue: quartz, calcite, rhodonite, garnet, fluorite, manganoan hedenbergite, (feldspars, bustamite, gahnite, apatite, wollastonite, trace sillimanite, staurolite, chloritoid, amphiboles, sulphosalts, vesuvianite, micas).
(Johnson & Klingner, 1975; Stevens & others, 1988).

Much of the gold occurs as minute inclusions (1-15 microns) within tetrahedrite (Stillwell, 1940, reported by Markham, 1982).
Some gold is associated with the comparatively rare occurrences of cobaltite (Stillwell, 1953, reported by Markham, 1982).
During milling operations, tetrahedrite and contained gold report in the lead concentrates (Markham, 1982).

CONTROLS OF MINERALISATION:

1./ General localisation of the orebodies is closely controlled by primary stratigraphic features (Laing & others, 1978; Barnes, 1988). Stratigrahic control is reflected in i) the association of stratiform base metal (Broken Hill type) mineralisation throughout the Broken Hill district with a particular, lithologically distinctive rock sequence, ii) the overall conformability of Broken Hill type orebodies, and iii) the dominant concordancy of layering in the orebodies with lithological layering in the host rocks (Johnson & Klingner, 1975; Barnes, 1988).

2./ Details of orebody thickness and shape are controlled by the subsequent deformation history (Laing & others, 1978).

3./ Isotope data.
i) Sulphur isotope data from Broken Hill type deposits throughout the Broken Hill district (Both & Smith, 1975) indicate more than one source of sulphur, primary hydrothermal sulphide and biogenic sulphide contributing different proportions of sulphur in different deposits.

Spry (1987): Sulphur in Broken Hill deposit was derived from either
a) inorganic reduction of seawater sulphate, mixed with magmatic S, or
b) low-temperature biological reduction of sulphate from contemporaneous seawater.

ii) Lead isotope data indicate derivation of lead from a deep-seated homogeneous source, possibly deep crust or mantle (sources quoted by Barnes, 1988).

GENETIC MODELS:

Earlier theories:-
i) Late-stage replacement.
ii) Early stage epigenetic.
iii) Lateral secretion and metamorphic transformation.

Current consensus is that the deposit is syngenetic, either sediment-hosted exhalative or volcanogenic exhalative (see discussions in Barnes, 1988; and Stevens & others, 1988), or, more recently, diagenetic inhalative (Haydon & McConachy, 1987).

Metals may have been derived directly from the mantle (Plimer, 1985) or crust via deep fractures, or from dispersions in the volcanic-sedimentary sequence (part of which may have had a mantle source) (sources quoted by Stevens & others, 1988).

Broken Hill is part of an elongate line of stratiform base metal mineralisation which may represent a fundamental line of weakness within which separate deposits formed in restricted basins.
The Broken Hill basin was possibly 30 km long (Johnson & Klingner, 1975).

Mineralisation was remobilised into fold hinge zones during subsequent deformations (Laing & others, 1978).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Broken Hill (D)

PRINCIPAL SOURCES: Johnson & Klingner (1975), Laing & others (1978), Plimer (1979), Stevens & Willis (1983), Stevens & others (1983), Willis & others (1983), Plimer (1984, 1985), Haydon & McConachy (1987), Barnes (1988), Stevens & others (1988).

SUMMARY

Broken Hill lies in the central part of the Broken Hill Block.
Low-grade gold mineralisation occurs in stratiform massive lead-zinc-silver sulphides in tightly folded granulite facies metasediments or gneisses of the Early-Middle Proterozoic Willyama Supergroup.

REGIONAL SETTING: BROKEN HILL BLOCK

PRINCIPAL SOURCES: Stevens & others (1983), Willis & others (1983), Barnes (1988), Stevens & others (1988).

The Broken Hill Block is composed predominantly o... ...sediments and metasedimentary gneisses, and metavolcanics of the Proterozoic Willyama Supergroup (Stevens & others, 1983; Willis & othe... 1983; Barnes, 1988). The succession includes stratiform bodies of ...tzofeldspathic gneiss and basic gneiss that are significant in the mineralised formations. The succession is intruded by pre- and post-folding intrusives including mafic and ultramafic rocks and granite. (Willis & others, 1983; Barnes, 1988).

The Willyama Supergroup has been interpreted as a deepening marine sequence of immature terrigenous sediments, volcaniclastics, felsic and mafic volcanics and sub-volcanic intrusives, and rare chemical sediments (Willis & others, 1983).
The inferred environment of deposition was a volcanically active, continually subsiding rift zone in an ensialic extensional tectonic setting (Willis & others, 1983).

Metavolcanics representing a bimodal series of tholeiites and rhyolites-rhyodacites were deposited in the lower and middle parts of the sequence (within and below the Broken Hill Group, immediate host to stratiform mineralisation) (Willis & others, 1983; Stevens & others, 1988).

Age of deposition of the supergroup is around 1820 my (Pidgeon, 1967; Shaw, 1968).

An alternative interpretation of the quartzofeldspathic and basic gneisses presented by Haydon & McConachy (1987) is that these bodies represent clastic sediments deposited in a prograding deltaic environment with no close association with felsic volcanics.

The Willyama Supergroup was subjected to a complex history of post-depositional deformation and metamorphism from about 1660-500 my. High-grade metamorphism at 1660 my was associated with two phases of deformation during the Olarian Orogeny. A third deformation occurred during cooling, when retrograde schist zones were initiated.
Granitoids and pegmatites were subsequently emplaced, followed by erosion, mafic/ultramafic intrusion, low-grade metamorphism, faulting. (Barnes, 1988; Stevens & others, 1988).

REGIONAL SUCCESSION: BROKEN HILL BLOCK
PRINCIPAL SOURCES: Stevens & Willis (1983), Stevens & others (1983), Willis & others (1983), Barnes (1988), Stevens & others (1988).

Willyama Supergroup (Early-Middle Proterozoic) (7-9 km thick):-
1./ Redan Gneiss - basal unit in SE of block (Stevens & others, 1988).
2./ Clevedale Migmatite - metasedimentary and quartzofeldspathic migmatites, composite gneiss, subordinate basic gneiss. Equivalent unit in SE of block is Ednas Gneiss (Stevens & others, op.cit).
3./ Thorndale Composite Gneiss - metasedimentary composite gneiss, basic gneiss, subordinate metasedimentary migmatite. Equivalent unit in SE is Mulculca Formation (Stevens & others, op.cit).
4./ Thackaringa Group - quartzofeldspathic gneiss and large bodies of leucocratic plagioclase-quartz rock; associations of metasedimentary and quartzofeldspathic composite gneiss, basic gneiss, and leucocratic quartzofeldspathic gneiss; quartz-magnetite rock.
5./ Broken Hill Group - metasediments with essential basic gneiss, quartz+feldspar+biotite+garnet gneiss ('Potosi' gneiss), quartz-gahnite rock, garnet-quartz rock, quartz-tourmaline rock, and banded iron formation (BIF).
6./ Sundown Group - metasediments, commonly dominantly pelitic, locally abundant calc-silicate ellipsoids.
7./ Paragon Group - graphitic metasediments.

GEOLOGICAL SETTING AND STRUCTURE: BROKEN HILL
PRINCIPAL SOURCES: Johnson & Klingner (1975), Laing & others (1978), Stevens & others (1983), Willis & others (1983), Plimer (1984, 1985), Stevens & others (1988).

The Broken Hill Group (Suite 4 or Mine Sequence of earlier terminology) (thickness 1000-1500 m) is subdivided into (Willis & others, 1983):-
1) Allendale Metasediments (average thickness 500 m), including Ettlewood Calc-silicate Member - dominantly pelitic sedimentation in contrast to dominantly feldspathic facies of Thackaringa Group.
2) Purnamoota Subgroup, comprising:-
. Parnell Formation (150-500 m) - metasediments with interbedded amphibolite, garnetiferous quartzofeldspathic gneiss ('Potosi' gneiss), and bodies of quartz-gahnite rock/garnet-quartz rock. Interpreted as the product of bimodal rhyodacite-tholeiitic basalt volcanism, with associated Pb, Zn, Ag, and W-rich exhalites (Willis & others, 1983;

Stevens & others, 1988).
. Freyers Metasediments (200-300 m) - pelitic-psammitic metasediments (including sillimanite schist and gneiss, andalusite schist, quartzite). Interpreted as medial to distal thin-bedded turbidites (Willis & others, 1983). Directly underlies orebodies.
. Hores Gneiss (50-200 m) - similar to felsic gneiss of Parnell Formation, contains intercalated metasediments, amphibolite and 'lode horizon' rocks: quartz-gahnite rock, garnet-quartz rock, quartz-garnet rock, magnetite-garnet (+-quartz, apatite) rock (BIF), quartz-tourmaline rock, and Pb-Zn-Ag sulphide orebodies.
Equivalent unit in NW part of block is Silver King Formation (Stevens & others, 1988).
The Broken Hill orebodies occur at the top of the Hores Gneiss, associated with 'lode horizon' rocks and 'Potosi' gneiss.

The fold structure of the deposit area has components of three phases of deformation. The stratigraphic succession was inverted during D1. The principal macroscopic folds are of F2 age, including the Broken Hill antiform and complementary Hanging Wall Synform. The orebodies lie on an F3 antiform superimposed on the northwestern limb of the Broken Hill antiform (which is also southeastern limb of Hanging Wall Synform).
F1, F2 and F3 folds are broadly coaxial. (Laing & others, 1978).
Retrograde schist zones are steeply dipping, planar or curviplanar zones with a well-developed generally intense schistosity and steeply-pitching lineation, which are defined by the development of retrograde metamorphic minerals, principally micas and chlorite. The schist zones were formed during D3 and occur in an anastomosing network throughout the Broken Hill Block. (Stevens & others, 1988).
The deposit is spatially related to retrograde schist zones.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Johnson & Klingner (1975), Plimer (1979, 1985), Laing & others (1978), Barnes (1988), Stevens & others (1988).

The Broken Hill deposit consists of seven stacked sulphide-bearing lenses, each characterised by distinctive chemical and mineralogical features. The stratigraphic base is the structural top; lead-rich lodes lie stratigraphically above zinc-rich lodes (Laing & others, 1978; Stevens & others, 1988).

The lodes and lithological compositions (Plimer, 1984; Stevens & others, 1988) are:-
Lead lodes:-
. No.3 lens - sulphide-quartz-Mn-silicate-fluorite rock, rhodonite-sulphide rock, fine grained garnet rock (adjacent).
. No.2 lens - sulphide-calcite-CaMn-silicate rock, fine-grained garnet rock (adjacent).
Zinc lodes:-
. No.1 lens (upper and lower) - sulphide-quartz-calcite rock.
. A lode - sulphide-mica-silicate-quartz rock, quartz-garnet rock.
. B lode - quartz-sulphide rock.
. C lode - quartz-garnet-gahnite-sulphide rock.

The orebodies are enclosed by pelitic to psammitic metasediments. Amphibolites grade into metasediments adjacent to mineralisation. Quartz-feldspar-biotite-garnet gneiss ('Potosi' gneiss) is found below, equivalent to, and above the sulphides, with the greatest mass of gneiss below the orebodies (Plimer, 1979).
Banded iron formation occurs as lateral equivalent of sulphide facies rocks. Quartz-gahnite rock occurs up-plunge from the sulphide rocks.

In longitudinal section the deposit is arcuate, plunging shallowly SW at its southwestern end, and steeply NE at its northeastern end (Johnson & Klingner, 1975).
Host rocks are lithologically layered; ore lenses are concordant with layering (Barnes, 1988).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Andrews E.C., 1922
The geology of the Broken Hill district.
Geological Survey of New South Wales. Memoirs (Geology)
8

Barnes R.G., 1988
Metallogenic studies of the Broken Hill and Euriowie Blocks, New South Wales. 1. Styles of mineralization in the Broken Hill Block.
Geological Survey of New South Wales. Bulletin
32(1) P1-116

Both R.A., Smith J.W., 1975
A sulfur isotope study of base-metal mineralization in the Willyama Complex, western New South Wales, Australia.
Economic Geology
70(2) P308-318

Brown R.E., 1984
Broken Hill, New South Wales, 1:25 000 geological series map. Sheet 7134-II-S, 1st edition.
Geological Survey of New South Wales
1v

Gulson B.L., 1984
Uranium-lead and lead-lead investigations of minerals from the Broken Hill lodes and mine sequence rocks.
Economic Geology
79(3) P476-490

Gustafson J.K., Burrell H.C., Garretty M.D., 1950
Geology of the Broken Hill ore deposit, Broken Hill, NSW, Australia.
Geological Society of America. Bulletin
61 P1369-1438

Gustafson J.K., Burrell H.C., Garretty M.D., 1952
Geology of the Broken Hill ore deposit, Broken Hill, NSW.
Bureau Mineral Resources, Australia. Bulletin
20

Harrison T.M., McDougall I., 1981
Excess 40Ar in metamorphic rocks from Broken Hill, New South Wales: implications for 40Ar/39Ar age spectra and the thermal history of the region.
Earth and Planetary Science Letters
55 P123-149

Haydon R.C., McConachy G.W., 1987
The stratigraphic setting of Pb-Zn-Ag mineralization at Broken Hill.
Economic Geology
82(4) P826-856

Johnson I.R., Klingner G.D., 1975
Broken Hill ore deposit and its environment. IN Knight C.L.(ed) - Economic geology of Australia and Papua New Guinea - 1.Metals.
AusIMM. Monograph Series
5 P476-491

King H.F., Thomson B.P., 1953
The geology of the Broken Hill district. IN Edwards A.B. (ed) - Geology of Australian ore deposits. 5th Empire Mining & Metallurgical Congress, Melbourne, 1953.
AusIMM
1 P533-577

King H.F., O'Driscoll E.S., 1953
The Broken Hill lode. IN Edwards A.B. (ed) - Geology of Australian ore deposits. 5th Empire Mining & Metallurgical Congress, Melbourne, 1953.
AusIMM
1 P578-600

Laing W.P., Marjoribanks R.W., Rutland R.W.R., 1978
Structure of the Broken Hill Mine area and its signifiance for the genesis of the orebodies.
Economic Geology
73(6) P1112-1136

Lawrence L.J., 1968
The minerals of the Broken Hill district. IN Radmanovich M. & Woodcock J.T. (eds) - Broken Hill Mines - 1968.
AusIMM. Monograph Series
3 P103-136

Lewis B.R., Forward P.S., Roberts J.B., 1965
Geology of the Broken Hill lode, reinterpreted. IN McAndrew J. (ed) - Geology of Australian ore deposits. 8th Commonwealth Mining & Metallurgical Congress, Melbourne, 1965.
AusIMM
1 P319-322

Main J.V., Mason D.O., Tuckwell K.D., 1983
The characteristics and interpretation of whole rock geochemical data, the Willyama Supergroup, New South Wales - trends towards ore. IN Broken Hill Conference, 1983.

AusIMM. Conference Series
12 P115-131

Marjoribanks R.W., Rutland R.W.R., Glen R.A., Laing W.P., 1980
The structure and tectonic evolution of the Broken Hill region, Australia.
Precambrian Research
13(2/3) P209-240

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Pidgeon R.T., 1967
A rubidium-strontium geochronological study of the Willyama Complex, Broken Hill, Australia.
Journal of Petrology
8 P283-324

Plimer I.R., 1979
Sulphide rock zonation and hydrothermal alteration at Broken Hill, Australia.
Institution of Mining and Metallurgy. Transactions
88B(Nov.79) PB161-B176

Plimer I.R., 1984
The mineralogical history of the Broken Hill Lode, NSW.
Australian Journal of Earth Sciences
31(4) P379-402

Plimer I.R., 1985
Broken Hill Pb-Zn-Ag deposit - a product of mantle metasomatism.
Mineralium Deposita
20 P147-153

Reynolds P.H., 1971
A U-Th-Pb lead isotope study of rocks and ores from Broken Hill, Australia.
Earth and Planetary Science Letters
12 P215-223

Shaw S.E., 1968
Rb-Sr isotopic studies of the mine sequence rocks at Broken Hill. IN Radmanovich M. & Woodcock J.T. (eds) - Broken Hill Mines - 1968.
AusIMM. Monograph Series
3 P185-198

Spry P.G., 1987
A sulphur isotope study of the Broken Hill deposit, New South Wales, Australia.
Mineralium Deposita
22 P109-115

Stanton R.L., 1976
Petrochemical studies of the ore environment at Broken Hill, New South Wales: 4. environmental synthesis.
Institution of Mining and Metallurgy. Transactions
85B(Aug.1976) PB221-B233

Stanton R.L., Roberts W.F.H., Chant R.A., 1978
Petrochemical studies of the ore environment at Broken Hill, New South Wales: 5 - Major element constitution of the lode and its interpretation.
AusIMM. Proceedings
266 P51-78

Stevens B.P.J., Willis I.L., 1983
Systematic classification of rock units: a key to mapping and interpretation of the Willyama Complex. IN Stevens B.P.J. & Stroud W.J. (eds) - Rocks of the Broken Hill Block: their classification, nature, stratigraphic distribution & origin.
Geological Survey of New South Wales. Records
21(1) P1-56

Stevens B.P.J., Willis I.L., Brown R.E., Stroud W.J., 1983
The Early Proterozoic Willyama Supergroup: definitions of stratigraphic units from the Broken Hill Block, New South Wales.
Geological Survey of New South Wales. Records
21(2) P407-442

Stevens B.P.J., Barnes R.G., Brown R.E., Stroud W.J., Willis I.L., 1988
The Willyama Supergroup in the Broken Hill and Euriowie Blocks, New South

Wales.
Precambrian Research
40/41 P297-327

Stillwell F.L., 1953
Mineralogy of the Broken Hill lode. IN Edwards A.B. (ed) - Geology of Australian ore deposits. 5th Empire Mining & Metallurgical Congress, Melbourne, 1953.
AusIMM
1 P601-626

Willis I.L., Brown R.E., Stroud W.J., Stevens B.P.J., 1983
The Early Proterozoic Willyama Supergroup: stratigraphic subdivision and interpretation of high to low-grade metamorphic rocks in the Broken Hill Block, New South Wales.
Geological Society of Australia. Journal
30(2) P195-224

Worner H.K., Mitchell R.W., 1982
Minerals of Broken Hill.
Australian Mining & Smelting Limited
1v 259 pp

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 2 TIBOOBURRA-MILPARINKA

DEPOSIT IDENTIFICATION:

SYNONYMS: Milparinka

COMMODITIES: Au

DISTRIBUTION:
Field extends over an area of 500 km2 and includes deposits in three small isolated inliers at northern end of Wonominta Block.

OREBODIES:
Tibooburra-Milparinka (D), Depot Glen, Easter Monday, Elizabeth, Good Friday, Mount Browne, Mount Poole, New Bendigo, Nuggetty Gully, Phoenix, Pioneer, Rosemount, Tibooburra, Tipperary Gully, Tunnel Hill, Warratta

MINES:
Depot Glen, Easter Monday, Elizabeth, Good Friday, Mount Browne, New Bendigo, Nuggetty Gully, Phoenix, Pioneer, Rosemount, Tibooburra, Tipperary Gully, Tunnel Hill, Warratta

GROUP: -

COMMENTS:
Record includes regional setting of Wonominta Block.

LOCATION:

LATITUDE: 29 35	LONGITUDE: 141 53
250K SHEET: SH54 7	100K SHEET: 7238

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Broken Hill
LOCAL GOVERNMENT AREA (LGA): Unincorporated

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1880	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Depot Glen	Depot Glen	Historical	Surface
Easter Monday	Easter Monday	Historical	Surface
Elizabeth	Elizabeth	Historical	Underground
Good Friday	Good Friday	Historical	Surface
Mount Browne	Mount Browne	Historical	Underground
Mount Browne	Mount Browne	Historical	Surface
New Bendigo	New Bendigo	Historical	Underground
Nuggetty Gully	Nuggetty Gully	Historical	Surface
Phoenix	Phoenix	Historical	Underground
Pioneer	Pioneer	Historical	Underground
Rosemount	Rosemount	Historical	Underground
Tibooburra	Tibooburra	Historical	Underground
Tipperary Gully	Tipperary Gully	Historical	Surface
Tunnel Hill	Tunnel Hill	Historical	Surface
Tunnel Hill	Tunnel Hill	Historical	Underground
Warratta	Warratta	Historical	Underground
Warratta	Warratta	Historical	Surface

COMPANIES:

OREBODY: Tibooburra-Milparinka (D)

PRESENT OPERATORS:
Planet Resources Group N L.

PRESENT OWNERS: EQUITY%
Planet Resources Group N L. 100.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 1,905
Average recovered grade 23 g/t Au (reef deposits)

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: 1880-1929,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Wonominta Block
PROVINCE: -
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Gum Vale Beds - Cretaceous
LITHOLOGY: Conglomerate sandstone, siltstone, shale.
RELATIONSHIP TO MINERALISATION: Host to principal mineralisation in alluvial deposits at Mount Browne, Warratta, Tibooburra, and elsewhere.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to some mineralisation in alluvial deposits at Mount Browne, Warratta, Tibooburra, and elsewhere.

FORMATION NAME & AGE: Wonominta Beds - Middle Proterozoic
LITHOLOGY: Phyllite, slate, chert, quartz-muscovite schist.
RELA NSHIP TO MINERALISATION: Host to relatively minor vein miner. .ion at Warratt, Tibooburra.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Alluvium, Clastic Sedimentary

STRUCTURAL FEATURES:

MAJOR: Faulting,
SIGNIFICANT: Folding

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

SIGNIFICANT: Intrusive Contact

IGNEOUS ACTIVITY:

SIGNIFICANT: Plutonism (Granite)

METAMORPHISM:
Low grade.

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Deep lead.
SIGNIFICANT: Alluvial.
MINOR: Auriferous quartz veins in low to intermediate grade metasediments.

MORPHOLOGY: Lenticular

AGE OF MINERALISATION: Cainozoic, Proterozoic, Mesozoic Early Cretaceous

DIMENSIONS/ORIENTATION:

OREBODY: Tibooburra-Milparinka (D)

		MIN	AVE	MAX
STRIKE LENGTH	(m)	300.0		3000.0
TRUE WIDTH	(cm)			100.0
VERTICAL DEPTH	(m)			65.0
		ANGLE (deg.)		DIRECTION
STRIKE		340		

OREBODY: Easter Monday

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			2.0

OREBODY: Mount Browne

		MIN	AVE	MAX
VERTICAL DEPTH	(m)	60.0		
		ANGLE (deg.)		DIRECTION
DIP		15-30		E

OREBODY: New Bendigo

		MIN	AVE	MAX
TRUE WIDTH	(m)			1.0
VERTICAL DEPTH	(m)			30.0

OREBODY: Tunnel Hill

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			0.6

OREBODY: Warratta

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			65.0
TRUE WIDTH	(m)			1.0
STRIKE LENGTH	(m)		300.0	3000.0
		ANGLE (deg.)		DIRECTION
STRIKE		340		

ORE TEXTURE:

NATURE OF MINERALISATION:

PRIMARY ORE: Vein (Reef),
SECONDARY ORE: Detrital (Alluvial)

MINERALOGY:

OREBODY: Tibooburra-Milparinka (D)

Gold, quartz, (siderite, feldspar, pyrite).
Characteristically the quartz of the gold-bearing reefs contained accessory minerals as well as inclusions of slate host rock, which imparted a greyish colour and platy appearance.
Numerous barren quartz reefs (many of which contain gold) also occur in the Precambrian rocks; these are distinguished from the auriferous reefs as massive clean white quartz free of inclusions.

CONTROLS OF MINERALISATION:

Primary deposits show regional structural control.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Tibooburra-Milparinka (D)

PRINCIPAL SOURCES: Markham & Basden (1974), Rose (1975), Markham (1982).
SUMMARY

The Tibooburra and Milparinka gold fields are centred on three small inliers at the northern end of the Tibooburra-Wonominta Block. Minor primary gold mineralisation occurred in quartz veins in low-grade Precambrian quartz-rich sediments. The principal production was from alluvial deposits in Cainozoic and Cretaceous sediments immediately surrounding the Precambrian inliers.

REGIONAL SETTING: WONOMINTA BLOCK
PRINCIPAL SOURCES: Markham & Basden (1974), Rose (1975).

The Wonominta Block consists of a series of disconnected outcrops of Precambrian metasediments and granite, and Cambrian metasediments and metamorphosed mafic volcanics, overlain by Mesozoic and Cainozoic craton cover sediments.

The block forms part of the Kanmantoo Fold Belt which developed from a Late Proterozoic-Early Palaeozoic pre-cratonic province containing deep-water turbiditic strata, some volcanics, and shallow water sediments.
The older sediments, the Wonominta Beds, are a multiply deformed complex of greywacke, phyllite, slate, magnetite chert, quartz-muscovite schist and minor mafic volcanics of ?Carpentarian age which may be a lower grade equivalent of the Willyama Complex (host to BROKEN HILL, Deposit No. 1).

In the vicinity of Tibooburra the metasediments are intruded by ?Adelaidean hornblende-biotite granite, the Tibooburra Granite.

The main inlier to the S of the Tibooburra-Milparinka inliers contains Cambrian volcanics and sediments deposited on a volcanic arc and shelf, the Mount Wright Volcanic Arc, which formed during the Cambrian at the boundary between the Precambrian high and the Bancannia Trough to the W (Scheibner, 1976).

The pre-cratonic development of the Kanmantoo Fold Belt was terminated by the Middle Cambrian-Early Ordovician Delamerian Orogeny. Minor younger Palaeozoic sediments occur locally. Cover sedimentation occurred in the Mesozoic with the deposition of minor Jurrasic sandstone and siltstone and the more extensive Cretaceous Gum Vale Beds and Rolling Downs Group. Shallow terrestrial sediments were laid down in the Cainozoic.

The Tibooburra-Milparinka inliers occur in blocks bounded by faults - Mount Poole, New Bendigo, and Warratta Faults - which are part of a major NW fault system. A major dislocation, the Koonenberry Fault Zone, formed the boundary between the Precambrian basement and the Cambrian arc-shelf system and now transects the Precambrian rocks of the Warratta inlier, the central of the three Tibooburra-Milparinka inliers.

LOCAL SETTING: MINERALISATION (TIBOOBURRA-MILPARINKA)
PRINCIPAL SOURCES: Markham & Basden (1974), Rose (1975), Markham (1982).

Known gold mineralisation occurred within and around the inliers of Precambrian basement. The gold deposits may be classified into three types:-
i) quartz reef deposits which occurred within Precambrian slates;
ii) detrital or alluvial deposits which occurred within the basal conglomerates of the Cretaceous Gum Vale Beds; and
iii) Recent alluvial deposits derived from the conglomerates or from primary reefs.

Primary gold mineralisation in the Wonominta Block occurred in fissure vein quartz reefs in slates of the Wonominta Beds at Tibooburra, Mount Browne, Warratta, and New Bendigo in the Tibooburra-Milparinka inliers, and at several localities in the main inlier.
Reef deposits were a minor direct source of gold but were the source of extensive alluvials in adjacent sediments of Cretaceous to Holocene age.
The reefs consisted of stringer quartz veins and had a strike grossly parallel to the NW fault system and to the cleavage of the Precambrian host rocks. The most productive centre was Warratta.

The main source of alluvial gold was the basal conglomerate and sandstone of the Cretaceous Gum Vale Beds, which are widespread over the Precambrian slates and Tibooburra Granite. A smaller proportion of production was won from Cainozoic gravels and detritus derived from the conglomerate..
The conglomerate consists predominantly of rounded white quartz pebbles with lesser amounts of rounded or angular slate and quartzite. The distribution of gold was apparently erratic and may have been related to the former Cretaceous shoreline and/or the palaeo-drainage.

The main alluvial field worked was Mount Browne, where gold occurred in both Cretaceous and Cainozoic sediments.
Other production, apparently mostly from Cainozoic sediments, came from Tipperary Gully, Nuggetty Gully, Tunnel Hill, and Easter Monday (all within a few kilometres of Tibooburra); the Warratta field (about half way between Milparinka and Tibooburra); and Depot Glen. At Warratta Creek the alluvial deposits extended to within less than 100 m of primary reef deposits.

OREBODY: Good Friday
Quartz-rich conglomeratic material of probable Quaternary age was worked in shallow pits in an area extending over a few square kilometres.

OREBODY: Mount Browne
The main field in which conglomerate was worked, occupying an area of

50-70 km2. Principal workings were Billygoat Hill, The One Mile, The Four Mile, and Stringers Gully.
Gold occurred in:-
i) coarse conglomerate (Gum Vale Beds) overlying Precambrian basement,
ii) Shallow gravels of Recent age formed by erosion of conglomerate
Distribution of the gold is sporadic, possibly due to concentration at the shoreline by wave action and stream discharge.
The most extensive workings were at shallow levels where the conglomerate crops out near its boundary with the underlying Precambrian basement.

OREBODY: New Bendigo
Veins were hosted by extremely deformed chloritic schist and phyllite, possibly in a fault zone or several fault zones.

OREBODY: Nuggetty Gully
Gold was won from gravel formed from weathered conglomerate.

OREBODY: Pioneer
Veins were grossly parallel to cleavage, but highly divergent to bedding, possibly indicative of localisation in the hinge zone of a fold.

OREBODY: Tibooburra
The Tibooburra field extends over an area that includes the Tibooburra Granite, small inliers of Precambrian metasediments, and surrounding Cretaceous conglomerate and Cainozoic sediments.
The principal localities of the field are Easter Monday, Nuggetty Gully, Tunnel Hill, and Tipperary Gully.
Fine but flaky gold occurred in shallow (<3 m deep) areas of gravel and clayey loam formed from breakdown of the conglomerate (e.g. Nuggetty Gully).
Payable gold was also found in a quartz-veined belt about 1 km wide trending E-W across the granite.
The alluvial gold may have been derived from conglomerate which originally overlay the granite.

OREBODY: Tunnel Hill
Relatively low-grade gold occurred in a coarse basal conglomerate which rests unconformably on Precambrian metasediments.

OREBODY: Warratta
The Warratta field occurs in the central of the three northerly inliers of the Wonominta Block (Warratta Inlier).
Five lines of reef were worked:- Pioneer, Warratta, Phoenix, Rosemount, and Elizabeth. The reefs occurred as lenticular bodies oriented parallel to major faults and cleavage directions, within slate and phyllite.
The field also includes alluvial workings, principally Good Friday, Evans Gully, Warratta Creek, and Moffitts Gully.
At Warratta Creek the alluvial deposits extended to within less than 100 m of primary deposits.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Rose G., 1975
Wonominta Block - regional geology and mineralization. IN Knight C.L.(ed) - Economic geology of Australia and Papua New Guinea - 1. Metals.
AusIMM. Monograph Series
5 P508-510

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

oooooooooooooooooooooooooooooooooooooooo

COBAR GROUP

DEPOSIT IDENTIFICATION:

OREBODIES:
Cobar (D)

COMMENTS:
Record covers regional data on the Cobar Block - regional setting and associated mineralisation; plus general data on Cobar group of deposits - geological setting, geochronology, controls of mineralisation & genetic models.

LOCATION:

LATITUDE: 31 32 LONGITUDE: 145 51
:50K SHEET: SH55 14 100K SHEET: 8034

DEVELOPMENT HISTORY:

OPERATING STATUS AT JUNE 1989

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg):

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS:

RESOURCES:

PRE-MINE RESOURCE SIZE:

GEOLOGY:

GEOCHRONOLOGY:
Age of host rocks:-
Chesney Formation, Great Cobar Slate (Nurri Group): Early Devonian age based on palaeontological data obtained from the Cobar 1:100 000 sheet area to the N (Baker, 1978).
Age of deformation:-
Russell & Lewis (1965): first folding pre-Late Silurian; second folding during Early Devonian (Bowning Orogeny), which was possibly also the time of mineralisation.
Rayner (1961, 1969): most of the deformation was Middle Devonian (Tabberabberan Orogeny); some later folding was Early Carboniferous (Kanimblan Orogeny).
Gilligan (1980): major deformation was Carboniferous (Kanimblan Orogeny)
Glen (1986): deformation of the upper part of the Cobar Supergroup and the Mulga Downs Group occurred in the Carboniferous, and was probably part of the Early Carboniferous Kanimblan Orogeny.

Glen & others (1986): isotopic data indicates an Early Devonian age for at least some S1 cleavage near Cobar. Implications are:-
i) regional deformation may have an Early Devonian component (D1) near Cobar, and a Carboniferous component (D2) further W;
ii) if, as suggested by Glen (1987), Cu-Au mineralisation is broadly syn-deformational, age of mineralisation may be Early Devonian although some mineralisation may have formed in each deformation event (Glen & others, 1986).
Age of mineralisation:-
Glen (1986): there is no direct evidence for the age of the Cobar orebodies, although field relations indicate that mineralisation is broadly synchronous with deformation (Glen, 1987).
Pb isotope data indicate an age of 321-324 my (Late Carboniferous) (Ostic & others, 1967; reported by Glen, 1986), but recalculation by J.R. Richards (reported by Glen, op. cit) yielded an age of 416-422 my (Late Silurian), which probably reflects incorporation of lead into the upper crust (Glen, 1986).

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Clastic Sedimentary

STRUCTURAL FEATURES:

MAJOR: Faulting, Shearing,
SIGNIFICANT: Fold Axis

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

SIGNIFICANT: Fault/Fault, Stratigraphic Boundary

IGNEOUS ACTIVITY:

METAMORPHISM:

Regional metamorphic grade of the Cobar Slate is ?lower greenschist facies. Beyond zones of mineralisation, slates are grey-blue. Within deformation zones, where lodes are localised, rocks are chloritic slates of higher grade grade greenschist facies. Chlorite abundance increases with intensity of mineralisation, so that slates are dark green to black in the ore zone, this being the zone of maximum shearing and brecciation.

ALTERATION:

OREBODY: Cobar (D)

PRINCIPAL SOURCES: Robertson (1974, reported by Kirk, 1983), Kirk (1983).

Unaltered host rock assemblage = quartz-muscovite-chlorite-albite+- carbonate. Ore zones are rimmed by well-developed alteration haloes of silicification, chloritisation and carbonate alteration (Kirk, 1983) (for alteration minerals see 'MINERALOGY').
Robertson (1974, reported by Kirk, 1983) noted a common zoning in the Cobar deposits from mineralised quartz-chlorite veining within the ore zone to quartz-carbonate veining without chlorite and sulphides on the periphery of the iron-rich chlorite halo.

DEPOSIT CHARACTERISTICS:

TYPES:

MAJOR: Auriferous base metal sulphides in structurally controlled sites in fine-grained sediments.

STYLE:

MAJOR: Discordant, Stratabound

MORPHOLOGY: Lenticular, Pipe-Like, Tabular

DIMENSIONS/ORIENTATION:

OREBODY: Cobar (D)

	ANGLE (deg.)	DIRECTION
DIP	70-85	E
PITCH	75	N
STRIKE	340-350;(330);	

ORE TEXTURE:

Banded/Laminated, Disseminated

NATURE OF MINERALISATION:
PRIMARY ORE: Dissemination, Fault/Shear-Filling, Multiple Veins, Vein (Reef),
SECONDARY ORE: Supergene Enrichment

MINERALOGY:

OREBODY: Cobar (D)
PRINCIPAL SOURCES: Thomson (1953), Rayner (1961), Gilligan (1980), Markham (1982), Kirk (1983).

A wide variety of ore types, based on textural and compositional differences, is represented in the Cobar field.
Two broad categories can be distinguished:- i) copper(-gold) ore, and ii) lead-zinc ore. Type i) can be subdivided on the basis of gold content:-
i) Copper(-gold) ore:-
a) siliceous ore - disseminated gold and chalcopyrite+-pyrrhotite, pyrite, magnetite, (galena, sphalerite, arsenopyrite, bornite, bismuth minerals).
This ore type is characteristic of the NEW OCCIDENTAL (Deposit No.5)-Chesney-NEW COBAR (Deposit No.4) and THE PEAK (Deposit No.6) lines of mineralisation. At NEW COBAR and Chesney, chalcopyrite exceeds pyrrhotite in abundance, at NEW OCCIDENTAL and THE PEAK the reverse applies.
b) siliceous-pyritic ore - chalcopyrite plus pyrite (?bornite) in siliceous gangue, (arsenopyrite, marcasite, trace gold, magnetite, pyrrhotite). Queen Bee, Gladstone and C.S.A. (copper lodes) are of this ore type.
Total sulphide+oxide content of copper(-gold) ores ranges from <10%->50% and averages 10%-30%. Textures range from aggregations of veins to submassive and massive types.

ii) Massive lead-zinc sulphide ore - varying proportions of chalcopyrite pyrrhotite, magnetite, pyrite, galena, sphalerite, marcasite, (very minor stilpnomelane, arsenopyrite, cubanite, tetrahedrite, covellite, galenobismutite, native bismuth, rutile, anatase.
The main assemblage is sphalerite-galena-pyrrhotite or pyrite.
Total sulphide content of lead-zinc ores ranges from 50%-90%, although lower grade disseminated ore types occur.
Deposits containing massive sulphides include GREAT COBAR (Deposit No.4) Dapville, and C.S.A. (copper-zinc lodes).

Gangue (alteration minerals):- quartz, as veins or fine-grained replacement silica, +-chlorite, muscovite, talc, stilpnomelane, calcite, dolomite, siderite.

Banded textures are common in both vein and massive sulphide ore. Mineral and grain-size banding are oriented parallel to vein walls, i.e. parallel to cleavage planes. Development of banding is greatest where sulphide content is high.

Gold shows an apparent strong association with bismuth minerals, i.e. native bismuth, bismuthinite, tetradymite, galenobismutite. Gold-bismuth association is strong at NEW OCCIDENTAL, where gold and bismuth minerals occur with pyrite and pyrrhotite, and at NEW COBAR where possible occurrence of maldonite (Au_2Bi) has been reported. Gold also occurs as inclusions in galena, sphalerite, and chalcopyrite. Grain size is normally < 0.05 mm. (Markham, 1982).

CONTROLS OF MINERALISATION:
PRINCIPAL SOURCES: Glen (1987, 1988).

Mineralisation is strongly structurally controlled. The three main lines of deposits are localised on or adjacent to major faults in a D1 high-strain zone. In the interpretation of Glen (1988), major ore deposits lie not on reactivated extensional faults but on short cut back thrusts (Great Chesney and Queen Bee Faults) and fore thrusts (The Peak Fault). Faults through the Great Cobar, Dapville, and Gladstone deposits are inferred by Glen (1988) to be fore thrusts.
Ore accumulations are localised at or near intersections of the thrusts with cross structures, either tear faults which developed during thrusting (e.g. NEW COBAR, NEW OCCIDENTAL (Deposit Nos. 4,5)), or dilatational jogs associated with strike slip movements.
Ore lenses occur mainly in steeply-dipping vein sets which are transgressive to bedding but sub-parallel to S1 cleavage.
The steep N-plunging form of the orebodies reflects maximum dilation at the intersections of vein sets.
Glen (1987) identified six geometric sets of surface veins which formed during D1 deformation, and inferred that the vein-style mineralisation was epigenetic in origin.

GENETIC MODELS:

PRINCIPAL SOURCES: Russell & Lewis (1965), Gilligan & Suppel (1978), Sangster (1979), Kirk (1983), Glen (1987).

Theories of ore genesis proposed for Cobar have ranged with time from epigenetic replacement to remobilised syngenetic to, more recently, syn-deformational hydrothermal.

1./ Epigenetic replacement - favoured by earlier workers, e.g. Andrews, (1913), More (1914), Gray (1918), Sullivan (1950, 1951); latter four reported by Glen (1987); Thomson (1953), Mulholland & Rayner (1961, reported by Glen, 1987), Russell & Lewis (1965), Rayner (1969, reported by Glen (1987).
Model involved ore deposition from hydrothermal fluids possibly derived from a granitic source at depth. The epigenetic model is supported by the discordance between ore lenses and bedding, the localisation of orebodies in structural sites, and the disparity between indicated temperatures of ore formation - 400-600 deg C - and the maximum temperature of metamorphism of the country rocks - 300 deg C (see 'GENETIC MODELS').
However a granitic source is refuted by the absence of evidence for granite at depth.

2./ Remobilised sedimentary exhalative (stratabound syngenetic) - favoured by Robertson (1974), Brooke (1975), Gilligan & Suppel (1978), Sangster (1979), Suppel (1984). Marshall & others (1981), Marshall & Sangameshwar (1982); latter three reported by Glen (1987).
Model involved ore formation by mechanical &/or chemical remobilisation in response to shortening or shearing of a pre-existing syngenetic (organically or chemically precipitated) orebody, with deposition of sulphides, mainly in veins, being controlled by hydraulic fracturing.
The model is supported by the presence of sedimentary features such as euhedral pyrite favouring coarse-grained beds, framboidal pyrite, carbon in sediments, similarity of gangue minerals with rock components, and local bedded sphalerite transposed along cleavage directions.
Gilligan & Suppel (1978) cited felsic volcanics that occur within the sequence at several localities in the SE part of the Cobar Block as a possible source of metal-rich solutions.
Sangster (1979) related the two main ore types at Cobar to the two stratigraphic zones of the exhalative model - the siliceous copper ore corresponding to the lower discordant disseminated copper feeder zone, and the massive lead-zinc ore corresponding to the overlying stratiform zone. However the relative stratigraphic positions of the ore zones, critical to the interpretation, have not been clearly established.

3./ Syn-deformational hydrothermal - advocated by Glen (1987). Kirk (1983) and Binns & Appleyard (1986, cited by Glen, 1987) also favoured an epigenetic model.
Glen (1987) proposed a hydrothermal genesis in which fluids were focussed along major faults and connected fractures and silica and metals were deposited in response to changes in physical and chemical conditions. Localisation of ore on thrust faults may have been favoured because these formed later in the deformation history and developed synchronously with cleavage formation and fluid circulation (Glen,1988).
The absence of proximal igneous activity is taken by Glen (1987) to suggest that the energy was derived from the metamorphic and deformation processes. Silica may have been derived from the dissolution of detrital quartz during cleavage formation, and its transportation and subsequent precipitation as syntectonic quartz veins. Metals may have been leached from the sedimentary pile or the underlying basement. Metals underwent solid state deformation after precipitation.
An epigenetic origin is supported by the strong structural control on mineralisation.
Russell & Lewis (1965): mineral exsolution textures indicate temperatures of ore deposition above 450 deg C, probably between 400 and 600 deg C. The country rock enclosing the orebody is metamorphosed only to the chlorite stage of the greenschist facies, and therefore rock temperatures probably did not exceed 300 deg C. The disparity beween temperatures of ore formation and metamorphism provides evidence for an epigenetic origin.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Cobar (D)

PRINCIPAL SOURCES: Sullivan (1951), Mulholland & Rayner (1953), Thomson (1953), Russell & Lewis (1965), Brooke (1975), Gilligan (1978), Gilligan (1980), Kirk (1983), Glen (1986, 1987).

SUMMARY

The Cobar group of deposits - GREAT COBAR, NEW COBAR, NEW OCCIDENTAL and THE PEAK (Deposit Nos.3-6) is part of the Cobar mineral field.

The field contains base and precious metal deposits hosted by folded and cleaved thin-bedded turbidites of the Early Devonian Nurri and Amphitheatre Groups of the Cobar Supergroup.
Mineralisation comprises vein and disseminated orebodies in zones of silicification in structurally controlled sites oblique to bedding.

Relative proportions of metals vary widely: copper-gold rich ores occur S of Cobar at GREAT COBAR, NEW COBAR, NEW OCCIDENTAL, and THE PEAK; copper-lead-zinc rich deposits occur N of Cobar at the C.S.A. deposit; and silver-lead-zinc rich ores occur further N at Elura.
The Elura deposit occurs in a lower strain structural setting and is geologically distinct from the remainder of the field, and is not included in the following general description of the Cobar field.
Deposits of the Cobar field (excluding Elura) are characterised by similar style of mineralisation and geological setting, and are considered to be cogenetic. Hence they are grouped in this report.
The regional geology of the Cobar Block, and the general features of the four deposits in the Cobar group are described hereunder; additional features specific to individual deposits are reported separately under Deposit Nos 3-6.

The principal deposits of the field and their metal associations are:-
C.S.A. - Cu-Pb-Zn
GREAT COBAR (Deposit No.3) - Cu-Au(-Pb-Zn-Ag)
NEW COBAR (Deposit No.4), Chesney - Cu-Au(-Pb-Zn)
NEW OCCIDENTAL (Deposit No.5) - Au(-Cu-Pb-Zn-Bi)
THE PEAK (Deposit No.6) - Ag-Au(Pb-Zn-Cu)
Queen Bee - Cu(-Ag-Pb-Zn)
Gladstone - Cu(-Ag)
(Although gold grades at Chesney were comparable with those at New Occidental and New Cobar, past production was lower, hence Chesney is not included in the datafile. However the general characteristics described herein also appply to Chesney.)
Smaller deposits of the field are Mount Pleasant, Young Australia, Wood Duck, Coronation, Beechworth, Spotted Leopard, Tharsis, East Cobar, Dapville, Old Fort Bourke, Burrabungie.

REGIONAL SETTING: COBAR BLOCK
PRINCIPAL SOURCES: Gilligan (1978), Glen (1986).

The Cobar Block contains deep-water marine sediments of Early Devonian age which were deposited in a rapidly-filling graben-like basin, the Cobar Basin (part of the rifted Cobar Trough). The Cobar Basin is considered to have developed as a relatively deep intracratonic graben formed as a result of crustal extension and rifting in the Late Silurian-Early Devonian (Scheibner, 1976, reported by Gilligan, 1978). Graben development was controlled by reactivation of large N- and WNW-trending basement faults.
Shallow-water sediments and high-K calc-alkaline volcanics were deposited in shelf environments on the basin margins - the Kopyje Group on the Kopyje Shelf to the E, and the Winduck Group on the Winduck Shelf to the W. Areas of greater subsidence, bounded by synsedimentary, normal faults (the Rookery Fault represents the eastern margin of the Cobar Basin) received thick turbiditic sequences now represented by the Nurri Group in the eastern part of the basin, and the Amphiteatre Group in the W.

The Nurri Group is an upward-fining lithic-rich turbiditic sequence deposited from graded submarine fans derived from an easterly land source of Girilambone Group and basement granite.
The Amphitheatre Group consists of upper and lower thin-bedded quartz-rich turbiditic sequences separated by thicker-bedded units, reflecting progradation of a turbiditic fan system, followed by retrogradation to fan fringe or basin plain deposition (Glen, 1986). The Amphitheatre Group was deposited from different submarine distributary systems entering the basin from the NW, W, and S (Glen, op. cit).

The Kopyje, Winduck, Nurri, and Amphitheatre Groups make up the Cobar Supergroup.

Marine deposition gave way to fluviatile sedimentation (Mulga Downs Group) following mild tectonism at the end of the Early Devonian. Terminal deformation of the whole succession probably took place in the Early Carboniferous and resulted in closure of the basin by approximately E-W shortening.

REGIONAL SUCCESSION: COBAR BLOCK
PRINCIPAL SOURCES: Glen (1986, 1987).

1./ Girilambone Group - Ballast beds (Og on Wrightville 1:100 000 geological map and Cobar 1:250 000 metallogenic map) (Cambro-Ordovician) - metamorphosed turbidite sequence of quartz-mica schist, quartzite sandstone, siltstone. Forms basement to the Cobar Supergroup. Unconformably overlain by or in faulted contact with:-

2./ Nurri Group (Early Devonian) - comprises:-
i) Chesney Formation, and ii) Great Cobar Slate.
i) Chesney Formation (Dnc on Wrightville and Cobar sheets) (1400 m max thickness) - proximal turbidite sequence of thick-bedded (at base of sequence) to thin-bedded (at top) (sub)lithic arenites, interbedded with siltstone, mudstone, and minor pebbly to conglomeratic units. Laminated and graded intervals common. Includes: -
a) crystal to lithic tuff (Dncv on Wrightville sheet), including former Queen Bee Porphyry, and
b) Drysdale Conglomerate and Bee Conglomerate (Dncb on Wrightville sheet) Members - basal fluvial to shallow marine extraformational boulder to granule conglomerate and pebbly lithic arenite. Conformably overlain by or in faulted contact, along the Great Chesney, Blue Lode, and Queen Bee Faults, with:-
ii) Great Cobar Slate (Dng on Wrightville and Cobar sheets) (1700 m)- distal turbidite sequnce of mudstone, now slate, with thin interbeds of siltstone and fine sandstone.

The faulted contact between the Chesney Formation and Great Cobar Slate is a major host setting for mineralisation in the Cobar field (see 'ASSOCIATED MINERALISATION: COBAR BLOCK' below).
A) The deposits Mount Pleasant, Young Australia, Wood Duck, the ?Jubilee lode of NEW COBAR (Deposit No.4), and the Eastern lode of NEW OCCIDENTAL (Deposit No.5) lie on the Great Chesney Fault, which forms the boundary between the formations in the central part of the field; the deposits Tharsis, Chesney, Old Fort Bourke, and the remaining lodes of NEW OCCIDENTAL and NEW COBAR lie in Great Cobar Slate immediately W of the Great Chesney Fault.
B) Deposits at THE PEAK (Deposit No.6) to the S lie on the Blue Lode fault or on parallel faults in the Cobar Slate just W of the Blue Lode Fault.
C) A line of mineralisation including Coronation, Beechworth, The Central and Queen Bee deposits is asociated with the Queen Bee Fault which marks the formation boundary in the SE part of the field.

The Great Cobar Slate is host to the second group of deposits (of three groups into which deposits of the Cobar field can be categorised (see 'ASSOCIATED MINERALISATION: COBAR BLOCK' below).
This group lies on probable fault zones at a higher stratigraphic level within the slate (500-100 m W of the Great Chesney Fault).
The principal deposits are GREAT COBAR (Deposit No.3), Dapville, and Gladstone.

3./ Amphitheatre Group (Early Devonian) (3 km thick at Cobar, max. thickness 15 km) - comprises:- i) C.S.A. Siltstone (in Cobar area, elsewhere known as lower Amphitheatre Group), ii) Biddabirra Formation, and iii) upper Amphitheatre Group.
i) C.S.A. Siltstone (Dac on Wrightville 1:100 000 geological map and Cobar metallogenic map) (max. thickness 1300 m) - distal turbidite sequence of interbedded thin-bedded mudstone and carbonaceous siltstone with some sandstone. Coarser lithologies are dominated by quartz. Felsic volcanics occur near the top of the formation near the C.S.A. deposit.
The C.S.A. Siltstone is host to the third group of Cobar deposits (C.S.A. Siltstone-hosted deposits, see 'ASSOCIATED MINERALISATION: COBAR BLOCK' below), which include the currently producing base metal deposits C.S.A. and Elura, also the smaller, previously worked Spotted Leopard. Gold is not significant at these deposits.
ii) Biddabirra Formation (Dab) (estimated average thickness 1-1.5 km, estimated max. thickness 3-4 km) - proximal sandy turbiditic sequence of thick- to medium-bedded and lesser thin-bedded, quartz lithic sandstone/ siltstone with interbedded mudstone. Sandstones vary from massive graded to cross and planar laminated.
The C.S.A. Siltstone and Biddabirra Formation represent an upward coarsening, prograding cycle.
iii) Upper Amphitheatre Group (Dan) (estimated maximum thickness 6-8 km) - thin-to medium-bedded sequence of interbedded quartz-lithic sandstone/ siltstone and mudstone. Sandstones are commonly graded and vary from massive to cross and planar laminated.

REGIONAL STRUCTURE: COBAR BLOCK
PRINCIPAL SOURCES: Gilligan (1978), Gilligan & Suppel (1978), Kirk (1983), Glen (1986, 1988).

Deformation of the Cobar Supergroup (and Mulga Downs group) was controlled by reactivation of pre-existing basement faults. Two structural zones can be distinguished on the basis of differing style and intensity of deformation (Glen, 1986).
Structural zone 1 is a meridional belt approximately 10 km wide along

the eastern side of the basin, bounded by the Rookery and Myrt Faults (latter beneath Myrt Syncline). The Rookery Fault is considered to be a reactivated thrust fault that was originally a syn-depositional extensional fault marking the eastern depositional margin of the basin (Glen, 1988).
Rocks in structural zone 1 were strongly deformed by a possibly Early Devonian deformation event D1, which resulted in a high degree of shortening achieved by folding and upfaulting of the deeper water sequences against the shelf sequences, and development of regional cleavage S1. Zone 1 is also characterised by a steeply N-plunging down-dip mineral and extension lineation L1.

The high strain zone 1 contrasts with a lower strain zone to the W - structural zone 2 - which is characterised by two stages of o[illegible] folding F1, F2 and poor cleavage development. Zone 2 correspond broadly with the area of upper Amphitheatre Group. D2 probabl occurred in the Early Carboniferous (see 'GEOCHRONOLOGY').

D2 effects are minor in zone 1.
The Cobar mineral field lies within the high strain structural zone 1, and deposit characteristics are related to regional structures.
Regional F1 folds of zone 1 are a series of NW- to N-trending, steeply S-plunging (in Cobar area; N-plunging further N), upright close to tight (to isoclinal) folds, from E to W: the Beechworth Syncline, the Chesney-Narri Anticline, and the Myrt Syncline. The area of principal mineralisation (Central-THE PEAK) lies on the western limb of the Chesney-Narri Anticline; the Queen Bee-Coronation deposits lie on the eastern limb of the Beechworth Syncline. On the western anticlinal limb, regional strike of bedding is 345 deg, dip 50-80 deg W. Regional strike of S1 cleavage is 355 deg (in finer lithologies, 015 deg in sandstones), dip 75-85 deg. Bedding and cleavage diverge by 10-20 deg. S1 is oblique to the F1 folds.

On the basis of bedding truncation along 'stratigraphic' contacts, Glen (1988) suggested that most formation boundaries in structural zone 1 are not stratigraphic but are in fact thrust faults which flatten and join at depth. In particular, the Great Chesney Fault may extend much further N along the Chesney Formation/Great Cobar Slate contact, and the Great Cobar Slate/C.S.A. Siltstone contact may be a W-dipping thrust fault (named Cobar Fault by Glen, 1988) which is largely (sub)parallel to bedding in the C.S.A. Siltstone.
The Great Chesney Fault is offset by E-W tear faults.

ASSOCIATED MINERALISATION: COBAR BLOCK
PRINCIPAL SOURCES: Thomson (1953), Russell & Lewis (1965), Gilligan (1978), Kirk (1983), Glen (1987).

Base and precious metal deposits of the Cobar field occur in three groups, reflecting three different lithological-structural settings:-
1./ Deposits on, or in Great Cobar Slate immediately W of, faulted contacts between Chesney Formation and Great Cobar Slate. Deposits occur on three lines:-
i) Great Chesney Fault - Tharsis, East Cobar, Old Fort Bourke, NEW COBAR (Deposit No.4), Chesney, Burrabungie, Mount Pleasant, Young Australia, Wood Duck, NEW OCCIDENTAL (Deposit No.5).
ii) The Peak and Blue Lode Faults - THE PEAK (Deposit No. 6) (includes Cobar Peak (Silver Peak), Blue Lode, Great Peak (Conqueror and Brown), Big Lode, Perseverance, Great South Peak, and Lady Greaves).
ii) Queen Bee Fault - Coronation, Beechworth, The Central, Queen Bee.
2./ Deposits within faulted anticlinal hinge areas within Great Cobar Slate - GREAT COBAR (Deposit No. 3), Dapville, Gladstone.
3./ Deposits within C.S.A. Siltstone - (Elura), C.S.A., Spotted Leopard.

All deposits of the Cobar field (excluding Elura) are characterised by the following general features:-
. Host rocks are fine-grained turbiditic lithologies of the Nurri and Amphitheatre Groups, mainly Great Cobar Slate, also C.S.A. Siltstone, indicating broad stratigraphic control. However, significant mineralisation occurs in coarser-grained sediments at NEW OCCIDENTAL (Deposit No.5) and THE PEAK (Deposit No.6).
. Deposits are concentrated close to the syn-depositional, fault-bounded eastern margin of the Cobar Basin.
. Deposits are aligned on regional zones of above normal deformation - major faulting/shearing, intensified cleavage development, vertical fold plunges. The Great Chesney line of mineralisation may represent a structural, rather than a stratigraphic control, mineralisation being related to the fault which forms the formation contact.
. Ore accumulations occur where major faults are intersected by cross structures (E-W tear faults).
. Ore occurs as high-grade elongate lenses of limited horizontal but great vertical extent.
. Lenses comprise sulphide-metal veins, mineralised quartz veins, and

mineralised silicified rock with some massive or banded sulphides, within lower grade shear zones of silicification and quartz veining, some chloritisation and carbonate veining.
. Ore zone orientation - NNW-trending, planar subvertical (E-dipping) - is discordant to bedding (moderately to steeply W-dipping) and is subparallel to S1 cleavage.
. The principal set of mineralised quartz veins lies close to or parallel to S1, locally follows other lines of weakness such as fractures.
. Ranges of ore zone dimensions are width 30-200+ m, strike length 100-500 m, depth 900+ m, i.e. zones are vertically persistent.
. Within ore zones, ore lenses are tabular to pipe-like bodies distributed in a linear, en echelon or irregular pattern.
. Ore lenses strike slightly W of N, dip steeply E, and plunge steeply N. I.e. lenses are coaxial with mineral lineation L1.
. Ranges of dimensions of individual ore lenses are width <10-40 m, strike length 30-200 m.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Andrews E.C., 1913
Report on the Cobar copper and gold-field. Part 1.
Geological Survey of New South Wales. Mineral Resources
17

Baker C.J., 1978
Geology of the Cobar 1:100 000 sheet 8035.
Geological Survey of New South Wales
1v

Brooke W.J.L., 1975
Cobar mining field. IN Knight C.L.(ed) - Economic geology of Australia and Papua New Guinea - 1. Metals.
AusIMM. Monograph Series
5 P683-694

Gilligan L.B., Suppel D.W., 1978
Mineral deposits in the Cobar Super-Group and their structural setting.
Geological Survey of New South Wales. Quarterly Notes
33 P15-22

Gilligan L.B., 1978
A preliminary metallogenic study of the Cobar 1:250 000 sheet.
Geological Survey of New South Wales. Report
GS1978/332

Gilligan L.B., 1980
Mine data sheets to accompany the Cobar 1:250 000 metallogenic map.
Geological Survey of New South Wales. Report
GS1980/097

Glen R.A., 1982
The Amphitheatre Group, Cobar, New South Wales: preliminary results of new mapping and implications for ore search.
Geological Survey of New South Wales. Quarterly Notes
49 P2-14

Glen R.A., MacRae G.P., Pogson D.J., Scheibner E., Agostini A., Sherwin L., 1985
Summary of geology and controls of mineralization in the Cobar region.
Geological Survey of New South Wales. Report
GS1985/203

Glen R.A., Dallmeyer R.D., Black L.P., 1986
Preliminary report on new isotopic evidence for, and implications of, an Early Devonian deformation at Cobar.
Geological Survey of New South Wales. Quarterly Notes
64 P26-30

Glen R.A., 1986
Geology of the Wrightville 1:100 000 geological sheet 8034.
Geological Survey of New South Wales
1v

Glen R.A., 1987
Copper- and gold- rich deposits in deformed turbidites at Cobar, Australia: their structural control and hydrothermal origin.
Economic Geology
82(1) P124-140

Glen R.A., 1988
Basin inversion, thrusts, and ore deposits at Cobar, New South Wales: A preliminary report.
Geological Survey of New South Wales. Quarterly Notes
73 P21-26

Kirk B.I., 1983
A review of the geology and ore genesis of the Cobar mining field. IN AusIMM Annual Conference, Broken Hill, July 1983.
AusIMM. Conference Series
12 P183-195

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Mulholland C. St J., Rayner E.O., 1953
New Occidental, New Cobar, and Chesney mines. IN Edwards A.B.(ed) - Geology of Australian ore deposits. 5th Empire Mining & Metallurgical Congress, Australia & New Zealand, 1953, Melbourne.
AusIMM
1 P897-906

Mulholland C. St J., Rayner E.O., 1961
The gold-copper deposits of Cobar, New South Wales: central section (Great Cobar to New Occidental).
New South Wales. Department of Mines. Technical Report
1958(6) P23-47

Plibersek P., 1982
Structure, stratigraphy, wallrock alteration and mineralization of 'The Peak' near Cobar, New South Wales. B.Appl.Sci. thesis.
New South Wales. Institute of Technology
1v

Rayner E.O., 1961
The mineralogy and genesis of the iron-rich copper ores of the Cobar province, New South Wales. Ph.D. thesis.
University of New South Wales. Unpublished
1v

Rayner E.O., 1969
The copper ores of the Cobar region, New South Wales.
Geological Survey of New South Wales. Memoirs (Geology)
10

Robertson I.G., 1974
The environmental features and petrogenesis of the mineral zones of Cobar, New South Wales. Ph.D. thesis.
University of New England. Unpublished
1v

Russell R.T., Lewis B.R., 1965
Gold and copper deposits of the Cobar district. IN McAndrew J.(ed) - Geology of Australian ore deposits. 8th Commonwealth Mining & Metallurgical Congress, Australia & New Zealand, 1965, Melbourne.
AusIMM
1 P411-419

Sangster D.F., 1979
Evidence of an exhalative origin for deposits of the Cobar district, New South Wales.
BMR Journal of Australian Geology & Geophysics
4(1) P 15-24

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

Sullivan C.J., 1951
Geology of New Occidental, New Cobar and Chesney mines, Cobar, New South Wales.
Bureau Mineral Resources, Australia. Report
6

Suppel D.W., 1984
A study of mineral deposits in the Cobar Supergroup, Cobar region, New South Wales. M.Sc. thesis.
University of New South Wales. Unpublished
1v

Thomson B.P., 1953
Geology and ore occurrence in the Cobar district. IN Edwards A.B.(ed) - Geology of Australian ore deposits. 5th Empire Mining & Metallurgical Congress, Australia & New Zealand, 1953, Melbourne.
AusIMM
1 P863-896

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 3 GREAT COBAR

DEPOSIT IDENTIFICATION:

SYNONYMS: Cobar

COMMODITIES: Cu, Pb, Zn, Au, Ag

DISTRIBUTION:
Deposit occurs in southern part of Cobar township. Nos. 54, 55 on Cobar metallogenic map; No. 1 on Wrightville 1:100 000 geological map.

OREBODIES:
Great Cobar (D), Central, Northern, Southern, Western

MINES:
Great Cobar, Great Cobar North

GROUP: Cobar Group

COMMENTS:
See Deposit 'Cobar Group' for regional setting and associated mineralisation of Cobar Block.

LOCATION:

LATITUDE: 31 30 LONGITUDE: 145 50
250K SHEET: SH55 14 100K SHEET: 8034

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Cobar
LOCAL GOVERNMENT AREA (LGA): Cobar

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1869	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Great Cobar (D)	Great Cobar	Historical	Underground
Great Cobar (D)	Great Cobar	Historical	Open-Cut
Great Cobar (D)	Great Cobar North	Historical	Underground

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 9,128
Average recovered grade 2.18 g/t Au, range 3.4-4.6 g/t Au

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: 1871-1889, 1894-1919,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: -
SUB-PROVINCE: Cobar Block

HOST ROCKS:

FORMATION NAME & AGE: Great Cobar Slate - Early Devonian
LITHOLOGY: Slate, siltstone, mudstone.
RELATIONSHIP TO MINERALISATION: Mineralisation comprises five en echelon steeply-dipping ore lenses associated with quartz-veined shear zones which are transgressive to folded bedding.

FORMATION NAME & AGE: Nurri Group - Early Devonian
LITHOLOGY: Arenite, siltstone, mudstone, slate, conglomerate.
RELATIONSHIP TO MINERALISATION: Includes Great Cobar Slate. (Group comprises Chesney Formation and Great Cobar Slate.)

GEOCHRONOLOGY:
See Deposit 'Cobar Group'.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Clastic Sedimentary

STRUCTURAL FEATURES:

SIGNIFICANT: Faulting, Fold Axis

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

ALTERATION:

OREBODY: Great Cobar (D)
Ore lenses occur within zones of silicification, quartz veining and quartz-carbonate veining.
Beyond the lode, the orebody is rimmed by an alteration halo up to 60 m wide in which cleavage development is intensified, bedding commonly destroyed, and muscovite replaced by Fe-rich chlorite. The chlorite commonly forms bands parallel to cleavage. Unaltered mineral assemblage = quartz-muscovite-chlorite-albite+-carbonate. Alteration minerals include steatite, albite, tourmaline, talc, dolomite, orthoclase, stilpnomelane, biotite, epidote.

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Auriferous base metal sulphides in structurally controlled sites in fine-grained sediments.

STYLE:

MAJOR: Discordant, Stratabound

MORPHOLOGY: Lenticular, Pipe-Like, Tabular

AGE OF MINERALISATION: Palaeozoic Carboniferous

DIMENSIONS/ORIENTATION:

OREBODY: Great Cobar (D)

		MIN	AVE	MAX
TRUE WIDTH	(m)	10.0		30.0
STRIKE LENGTH	(m)			365.0
VERTICAL DEPTH	(m)			470.0
DEPTH OXIDATION	(m)		60.0	
		ANGLE (deg.)		DIRECTION
DIP		85-90		E,W
PLUNGE		75-80		N
STRIKE		340		

OREBODY: Central

		MIN	AVE	MAX
STRIKE LENGTH	(m)			130.0
TRUE WIDTH	(m)			24.0

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			470.0

OREBODY: Northern

		MIN	AVE	MAX
STRIKE LENGTH	(m)			114.0
TRUE WIDTH	(m)			27.0

OREBODY: Southern

		MIN	AVE	MAX
STRIKE LENGTH	(m)			46.0
TRUE WIDTH	(m)			15.0

ORE TEXTURE:
Banded/Laminated, Disseminated, Zoned

NATURE OF MINERALISATION:
PRIMARY ORE: Dissemination, Fault/Shear-Filling, Multiple Veins,
SECONDARY ORE: Supergene Enrichment

MINERALOGY:

OREBODY: Great Cobar (D)
PRINCIPAL SOURCES: Thomson (1953), Gilligan (1980).

Sulphide zone: pyrite, chalcopyrite, pyrrhotite, magnetite, ekmannite, marcasite, sphalerite, galena, (cubanite, arsenopyrite, mackinawite, ?bismutite, bismuth, tetrahedrite, guanajuatite, bornite, stannite, gold, anatase, cobaltite).
Oxide zone: limonite, hematite, malachite, azurite, chalcocite, (native copper, gold, silver).
The Western lode consists of three ore types, from W to E:-
i) narrow (up to 3.5 m wide) zone of vertically banded ore consisting of massive galena-sphalerite-chalcopyrite, which lies E of chalcopyrite and quartz veins adjacent to a well-defined western footwall;
ii) 6 m-wide low-silica zone of massive banded ore consisting of chalcopyrite in pyrrhotite-magnetite plus slate fragments;
iii) 10 m-wide zone of 'siliceous' vein and disseminated ore consisting of quartz-chalcopyrite-pyrrhotite-magnetite veins in slate.
Veined ore grades eastwards into silicified slate on eastern (hanging) wall of ore lode.

Gangue: quartz, calcite, dolomite, siderite, feldspar, chlorite, stilpnomelane

CONTROLS OF MINERALISATION:
See Deposit 'COBAR GROUP'.

GENETIC MODELS:
See Deposit 'COBAR GROUP'.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Great Cobar (D)
GEOLOGICAL SETTING: GREAT COBAR
PRINCIPAL SOURCES: Thomson (1953), Russell & Lewis (1965), Gilligan (1980), Glen (1987).

Great Cobar is associated with NNW-trending quartz-veined shear zones in a possible anticlinal hinge area within Great Cobar Slate. The shear zones cut folded bedding, lie at low angles to S1 in strike and probably mark the trace of faults (Glen, 1987). The lode shears may be spur-like features on the edge of a broad shear zone which continues S adjacent to the Dapville, and possibly also Gladstone, deposits. Ore lenses are coaxial with steeply N-plunging small-scale folds.

Great Cobar consists of five ore lenses, separated by barren slate, arranged en echelon to the NE. The main, or Western, lens consists of three along-strike ore shoots: Northern, Central, and Southern shoots.
Lode material in the Western lode consists of mineralised quartz veins in silicified slate.
The four eastern lenses consist of quartz veins and breccias with fragments of chloritised slate and patches of sulphides.
Widths of the four smaller lenses are 49 m, 10 m, 11 m, and 18 m.
Most of the high-grade ore was won from a zone of secondary enrichment extending from 60-150 m.
Lode channel extends to 1000 m depth.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Andrews E.C., 1913
Report on the Cobar copper and gold-field. Part 1.
Geological Survey of New South Wales. Mineral Resources
17

Brooke W.J.L., 1975
Cobar mining field. IN Knight C.L.(ed) - Economic geology of Australia and Papua New Guinea - 1. Metals.
AusIMM. Monograph Series
5 P683-694

Gilligan L.B., Suppel D.W., 1978
Mineral deposits in the Cobar Super-Group and their structural setting.
Geological Survey of New South Wales. Quarterly Notes
33 P15-22

Gilligan L.B., 1978
A preliminary metallogenic study of the Cobar 1:250 000 sheet.
Geological Survey of New South Wales. Report
GS1978/332

Gilligan L.B., 1980
Mine data sheets to accompany the Cobar 1:250 000 metallogenic map.
Geological Survey of New South Wales. Report
GS1980/097

Glen R.A., MacRae G.P., Pogson D.J., Scheibner E., Agostini A. , Sherwin L., 1985
Summary of geology and controls of mineralization in the Cobar region.
Geological Survey of New South Wales. Report
GS1985/203

Glen R.A., 1986
Geology of the Wrightville 1:100 000 geological sheet 8034.
Geological Survey of New South Wales
1v

Glen R.A., 1987
Copper- and gold- rich deposits in deformed turbidites at Cobar, Australia: their structural control and hydrothermal origin.
Economic Geology
82(1) P124-140

Kirk B.I., 1983
A review of the geology and ore genesis of the Cobar mining field. IN AusIMM Annual Conference, Broken Hill, July 1983.
AusIMM. Conference Series
12 P183-195

Mulholland C. St J., Rayner E.O., 1961
The gold-copper deposits of Cobar, New South Wales: central section (Great Cobar to New Occidental).
New South Wales. Department of Mines. Technical Report
1958(6) P23-47

Rayner E.O., 1961
The mineralogy and genesis of the iron-rich copper ores of the Cobar province, New South Wales. Ph.D. thesis.
University of New South Wales. Unpublished
1v

Rayner E.O., 1969
The copper ores of the Cobar region, New South Wales.
Geological Survey of New South Wales. Memoirs (Geology)
10

Robertson I.G., 1974
The environmental features and petrogenesis of the mineral zones of Cobar, New South Wales. Ph.D. thesis.
University of New England. Unpublished
1v

Russell R.T., Lewis B.R., 1965
Gold and copper deposits of the Cobar district. IN McAndrew J.(ed) - Geology of Australian ore deposits. 8th Commonwealth Mining & Metallurgical Congress, Australia & New Zealand, 1965, Melbourne.
AusIMM
1 P411-419

Suppel D.W., 1984

A study of mineral deposits in the Cobar Supergroup, Cobar region, New South Wales. M.Sc. thesis.
University of New South Wales. Unpublished
1v

Thomson B.P., 1953
Geology and ore occurrence in the Cobar district. IN Edwards A.B.(ed) - Geology of Australian ore deposits. 5th Empire Mining & Metallurgical Congress, Australia & New Zealand, 1953, Melbourne.
AusIMM
1 P863-896

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 4 NEW COBAR

DEPOSIT IDENTIFICATION:

SYNONYMS: Cobar, Fort Bourke

COMMODITIES: Au, Cu, Pb, Zn

DISTRIBUTION:
Deposit occurs 3 km S of Cobar township. No. 71 on Cobar metallogenic map; No.17 on Wrightville 1:100 000 geological map.

OREBODIES:
New Cobar (D), Jubilee, Main, Northern, Southern, Western

MINES:
New Cobar (Cobar Or Fort Bourke)

GROUP: Cobar Group

COMMENTS:
See Deposit 'Cobar Group' for regional setting and associated mineralisation of Cobar Block.

LOCATION:

LATITUDE: 31 31 LONGITUDE: 145 51
250K SHEET: SH55 14 100K SHEET: 8034

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Cobar
LOCAL GOVERNMENT AREA (LGA): Cobar

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1887	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
New Cobar (D)	New Cobar (Cobar Or Fort Bourke)	Historical	Underground
New Cobar (D)	New Cobar (Cobar Or Fort Bourke)	Historical	Open-Cut

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 7,400
Average recovered grade 5.7 g/t, range 7.92-11.36 g/t

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1910-1919), 1890-1910, 1936-1948,

RESOURCES:

PRE-MINE RESOURCE SIZE: 3

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt

PROVINCE: -
SUB-PROVINCE: Cobar Block

HOST ROCKS:

FORMATION NAME & AGE: Nurri Group - Early Devonian
LITHOLOGY: Arenite, siltstone, mudstone, slate, conglomerate.
RELATIONSHIP TO MINERALISATION: Includes Great Cobar Slate. (Group comprises Chesney Formation and Great Cobar Slate.)

FORMATION NAME & AGE: Great Cobar Slate - Early Devonian
LITHOLOGY: Slate, siltstone, sandstone.
RELATIONSHIP TO MINERALISATION: Mineralisation comprises five steeply-dipping arcuate lodes in silicified shear zones associated with cross-faults W of the Great Chesney Fault.

FORMATION NAME & AGE: Chesney Formation - Early Devonian
LITHOLOGY: Arenite, siltstone, mudstone, conglomerate.
RELATIONSHIP TO MINERALISATION: Occurs adjacent to mineralised Great Cobar Slate, separated from latter by Great Chesney Fault.

GEOCHRONOLOGY:
See Deposit 'Cobar Group'.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Clastic Sedimentary

STRUCTURAL FEATURES:

MAJOR: Shearing,
SIGNIFICANT: Faulting, Fold Axis

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

MAJOR: Fault/Fault,
SIGNIFICANT: Stratigraphic Boundary

IGNEOUS ACTIVITY:

ALTERATION:

OREBODY: New Cobar (D)
Ore lenses occur within zones of strong silicification containing segregations of coarse-grained quartz; other alteration minerals are Fe- and Mg-rich chlorite, biotite, steatite, stilpnomelane.

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Auriferous base metal sulphides in structurally controlled sites in fine-grained sediments.

STYLE:

MAJOR: Discordant, Stratabound

MORPHOLOGY: Lenticular, Pipe-Like, Tabular

AGE OF MINERALISATION: Palaeozoic Carboniferous

DIMENSIONS/ORIENTATION:

OREBODY: New Cobar (D)

		MIN	AVE	MAX
TRUE WIDTH	(m)			10.0
STRIKE LENGTH	(m)			220.0
VERTICAL DEPTH	(m)			342.0
DEPTH OXIDATION	(m)		100.0	
		ANGLE (deg.)		DIRECTION
DIP		80-90		E
PLUNGE		75		N
STRIKE		350,(320)		

OREBODY: Jubilee

		MIN	AVE	MAX
TRUE WIDTH	(m)	3.0		6.0

STRIKE LENGTH	(m)			50.0

OREBODY: Main

		MIN	AVE	MAX
STRIKE LENGTH	(m)			190.0
TRUE WIDTH	(m)	6.0		12.0

OREBODY: Western

		MIN	AVE	MAX
STRIKE LENGTH	(m)			46.0

ORE TEXTURE:
Disseminated

NATURE OF MINERALISATION:
PRIMARY ORE: Dissemination, Multiple Veins,
SECONDARY ORE: Supergene Enrichment

MINERALOGY:

OREBODY: New Cobar (D)
Sulphide zone: chalcopyrite, pyrrhotite, pyrite, magnetite, (sphalerite, galena, bismuth, ?bismuthinite, clausthalite, guanajuatite, cubanite, bornite, arsenopyrite, gold).
Oxide zone: hematite, chalcocite, (covellite, marcasite, todorakite, carphosiderite, plumbogummite).
Gangue: quartz, calcite, chlorite.

CONTROLS OF MINERALISATION:
See Deposit 'COBAR GROUP'.

GENETIC MODELS:
See Deposit 'COBAR GROUP'.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: New Cobar (D)
GEOLOGICAL SETTING: NEW COBAR
PRINCIPAL SOURCES: Mulholland & Rayner (1953), Thomson (1953), Russell & Lewis (1965), Gilligan (1980), Glen (1987).

New Cobar lies within Great Cobar Slate immediately to the W of the Great Chesney Fault. The northernmost lode of the deposit (Jubilee) lies within 20 m of the fault itself, which separates Chesney Formation from Great Cobar Slate. The remaining lodes lie SW of a NW-trending, steeply NE-dipping cross fault along which the Great Chesney Fault is offset 100 m to the E.
The deposit consists of four lodes (Jubilee, Main, Northern, Southern) disposed in a dextral en echelon pattern along strike, which occupy a slightly arcuate, eastwards concave silicified shear zone, and a fifth lode (Western), which occupies a slightly more W-trending shear W of the Main lode.
The Main lode splits at 90 m depth along strike into the Northern and Southern lodes, which are separated by thin bands of subeconomic mineralisation. The Jubilee lode lies 80 m N of the Main Lode. The Western lode occurs at depth 60 m W and 46 m S of the Main lode, separated by low grade mineralisation in quartz-veined slate.
The deposit is apparently bounded to the N and S by NW-trending, steeply E-dipping cross faults.
All lodes are apparently associated with 'warps' and associated prominent cross fractures in the shears.
Primary ore consists of disseminated sulphides and quartz-sulphide veinlets in brecciated silicified slate. The deposit is extensively veined by several sets of cross veins which are parallel to the cross fault in the Great Chesney Fault. Steeply N-plunging shoots of quartz +sulphide are developed along vein intersections.

OREBODY: Jubilee
Orebody lies at northern end of deposit close to Great Chesney Fault.

OREBODY: Main
Orebody lies within Great Cobar Slate on southerly projection of northern segment of Great Chesney Fault; southern segment of the fault is offset to the E by a cross-fault which intersects deposit N of main lode.
Lode divides at 90 m depth to form Northern and Southern Lodes.

OREBODY: Northern
Orebody is northern part of divided Main Lode, occurs at 90 m depth.

OREBODY: Southern
Orebody is southern part of divided Main Lode, occurs at 90 m depth.

OREBODY: Western
Orebody occurs at depth 60 m W and 46 m S of Main Lode.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Andrews E.C., 1913
Report on the Cobar copper and gold-field. Part 1.
Geological Survey of New South Wales. Mineral Resources
17

Brooke W.J.L., 1975
Cobar mining field. IN Knight C.L.(ed) - Economic geology of Australia and Papua New Guinea - 1. Metals.
AusIMM. Monograph Series
5 P683-694

Gilligan L.B., Suppel D.W., 1978
Mineral deposits in the Cobar Super-Group and their structural setting.
Geological Survey of New South Wales. Quarterly Notes
33 P15-22

Gilligan L.B., 1978
A preliminary metallogenic study of the Cobar 1:250 000 sheet.
Geological Survey of New South Wales. Report
GS1978/332

Gilligan L.B., 1980
Mine data sheets to accompany the Cobar 1:250 000 metallogenic map.
Geological Survey of New South Wales. Report
GS1980/097

Glen R.A., MacRae G.P., Pogson D.J., Scheibner E., Agostini A. , Sherwin L., 1985
Summary of geology and controls of mineralization in the Cobar region.
Geological Survey of New South Wales. Report
GS1985/203

Glen R.A., 1986
Geology of the Wrightville 1:100 000 geological sheet 8034.
Geological Survey of New South Wales
1v

Glen R.A., 1987
Copper- and gold- rich deposits in deformed turbidites at Cobar, Australia: their structural control and hydrothermal origin.
Economic Geology
82(1) P124-140

Kirk B.I., 1983
A review of the geology and ore genesis of the Cobar mining field. IN AusIMM Annual Conference, Broken Hill, July 1983.
AusIMM. Conference Series
12 P183-195

Mulholland C. St J., Rayner E.O., 1953
New Occidental, New Cobar, and Chesney mines. IN Edwards A.B.(ed) - Geology of Australian ore deposits. 5th Empire Mining & Metallurgical Congress, Australia & New Zealand, 1953, Melbourne.
AusIMM
1 P897-906

Mulholland C. St J., Rayner E.O., 1961
The gold-copper deposits of Cobar, New South Wales: central section (Great Cobar to New Occidental).
New South Wales. Department of Mines. Technical Report
1958(6) P23-47

Rayner E.O., 1961
The mineralogy and genesis of the iron-rich copper ores of the Cobar province, New South Wales. Ph.D. thesis.
University of New South Wales. Unpublished
1v

Rayner E.O., 1969
The copper ores of the Cobar region, New South Wales.
Geological Survey of New South Wales. Memoirs (Geology)
10

Robertson I.G., 1974
The environmental features and petrogenesis of the mineral zones of Cobar, New South Wales. Ph.D. thesis.
University of New England. Unpublished
1v

Russell R.T., Lewis B.R., 1965
Gold and copper deposits of the Cobar district. IN McAndrew J.(ed) - Geology of Australian ore deposits. 8th Commonwealth Mining & Metallurgical Congress, Australia & New Zealand, 1965, Melbourne.
AusIMM
1 P411-419

Sullivan C.J., 1951
Geology of New Occidental, New Cobar and Chesney mines, Cobar, New South Wales.
Bureau Mineral Resources, Australia. Report
6

Suppel D.W., 1984
A study of mineral deposits in the Cobar Supergroup, Cobar region, New South Wales. M.Sc. thesis.
University of New South Wales. Unpublished
1v

Thomson B.P., 1953
Geology and ore occurrence in the Cobar district. IN Edwards A.B.(ed) - Geology of Australian ore deposits. 5th Empire Mining & Metallurgical Congress, Australia & New Zealand, 1953, Melbourne.
AusIMM
1 P863-896

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 5 NEW OCCIDENTAL

DEPOSIT IDENTIFICATION:

SYNONYMS: Cobar, Occidental

COMMODITIES: Au, Cu, Pb, Zn, Bi

DISTRIBUTION:
Deposit occurs 6 km S of Cobar township. No. 58 on Cobar metallogenic map; No. 4 on Wrightville 1:100 000 geological map.

OREBODIES:
New Occidental (D), Albion, Bowmans, Eastern, Galena-Sphalerite, Gossan, Main, Western

MINES:
Albion, Great Western, New Occidental

GROUP: Cobar Group

COMMENTS:
See Deposit 'Cobar Group' for regioal setting and associated mineralisation of Cobar Block.

LOCATION:

LATITUDE: 31 32 LONGITUDE: 145 52
250K SHEET: SH55 14 100K SHEET: 8034

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Cobar
LOCAL GOVERNMENT AREA (LGA): Cobar

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1871	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
New Occidental (D)	New Occidental	Historical	Underground
New Occidental (D)	New Occidental	Operating	Tailings Re-Treatment
New Occidental (D)	New Occidental	Historical	Open-Cut
Albion	Albion	Historical	Underground
Albion	Albion	Historical	Open-Cut
Western	Great Western	Historical	Underground
Western	Great Western	Historical	Open-Cut

COMPANIES:

OREBODY: New Occidental (D)

PRESENT OPERATORS:
Ranger Exploration N L.

PRESENT OWNERS:	EQUITY%
Gold Fields Metallurgical Services	15.00
Mawson Pacific Ltd	25.00
Ranger Exploration N L.	60.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 19,985
Average recovered grade 9.56 g/t Au, 10.1 during 1935-1952

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

YEAR	PRODUCTION	
1987	748	Tailings re-treatment
1988	783	

MAIN PRODUCTION PERIODS: 1889-1921, 1935-1953, 1987-,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION		
June 1987	2,800	1.0	2,660	Economic Demonstrated	Recoverable t	Tailings

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: -
SUB-PROVINCE: Cobar Block

HOST ROCKS:

FORMATION NAME & AGE: Great Cobar Slate - Early Devonian
LITHOLOGY: Slate, siltstone, sandstone.
RELATIONSHIP TO MINERALISATION: Host to the two principal lodes which lie S of a cross-fault in the Great Chesney Fault.

FORMATION NAME & AGE: Chesney Formation - Early Devonian
LITHOLOGY: Arenite, siltstone, mudstone, conglomerate.
RELATIONSHIP TO MINERALISATION: Host to two minor lodes which lie N of a cross-fault in the Great Chesney Fault.

FORMATION NAME & AGE: Nurri Group - Early Devonian
LITHOLOGY: Arenite, siltstone, mudstone, slate, conglomerate.
RELATIONSHIP TO MINERALISATION: Comprises immediate host formations Great Cobar Slate and Chesney Formation.

GEOCHRONOLOGY:

See Deposit 'Cobar Group'.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Clastic Sedimentary

STRUCTURAL FEATURES:

MAJOR: Faulting, Shearing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

MAJOR: Fault/Fault,
SIGNIFICANT: Stratigraphic Boundary

IGNEOUS ACTIVITY:

ALTERATION:

OREBODY: New Occidental (D)
Mineralisation is associated with silicification, chloritisation, steatite alteration, and dolomitisation.

DEPOSIT CHARACTERISTICS:

TYPES:

MAJOR: Auriferous base metal sulphides in structurally controlled sites in fine-grained sediments.

STYLE:

MAJOR: Discordant, Stratabound

MORPHOLOGY: Lenticular, Pipe-Like, Tabular

AGE OF MINERALISATION: Palaeozoic Carboniferous

DIMENSIONS/ORIENTATION:

OREBODY: New Occidental (D)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			150.0
TRUE WIDTH	(m)			24.0
VERTICAL DEPTH	(m)			650.0

	ANGLE (deg.)	DIRECTION
DIP	80-90	E
PLUNGE	80-40	N-S
STRIKE	(330),340-350	

OREBODY: Albion

		MIN	AVE	MAX
STRIKE LENGTH	(m)			34.0
TRUE WIDTH	(m)			3.0

OREBODY: Bowmans

		MIN	AVE	MAX
STRIKE LENGTH	(m)			30.0
TRUE WIDTH	(m)			3.0

OREBODY: Eastern

		MIN	AVE	MAX
STRIKE LENGTH	(m)	50.0		60.0
TRUE WIDTH	(cm)	300.0		760.0

OREBODY: Main

		MIN	AVE	MAX
STRIKE LENGTH	(m)	50.0		60.0
TRUE WIDTH	(m)	6.0		24.0

OREBODY: Western

		MIN	AVE	MAX
STRIKE LENGTH	(m)	50.0		90.0
TRUE WIDTH	(m)	3.0		12.0

ORE TEXTURE:
Disseminated, Massive

NATURE OF MINERALISATION:
PRIMARY ORE: Dissemination, Fault/Shear-Filling, Multiple Veins

MINERALOGY:

OREBODY: New Occidental (D)
Sulphide zone: chalcopyrite, pyrrhotite, pyrite, magnetite, (sphalerite, galena, tetrahedrite, bismuth, bismuthinite, guanajuatite, kobellite, clausthalite, bornite, arsenopyrite, tetradymite, gold).
Oxide zone: haematite, marcasite.
Gangue: quartz, calcite, dolomite, chlorite, stilpnomelane, talc.
Ore texture similar to that of GREAT COBAR (Deposit No.3).

OREBODY: Bowmans
Sulphide zone: magnetite, bismuth, galena, pyrite, gold.

CONTROLS OF MINERALISATION:
See Deposit 'COBAR GROUP'.

GENETIC MODELS:
See Deposit 'COBAR GROUP'.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: New Occidental (D)
GEOLOGICAL SETTING: NEW OCCIDENTAL
PRINCIPAL SOURCES: Mulholland & Rayner (1953), Thomson (1953), Russell & Lewis (1965), Gilligan (1980).

New Occidental comprises six lodes associated with a cross-fault in the Great Chesney Fault (probably a linking fault between two segments of the fault). The minor Albion and Bowman lodes lie N of the cross-fault on the Great Chesney Fault, which locally lies within the Chesney Formation. The principal lodes - Eastern and Western - lie S of the

cross-fault within Great Cobar Slate.
The Eastern lode lies on and W of the Great Chesney Fault, where it separates Chesney Formation from Great Cobar Slate. The Western lode lies 5 m to the W, separated by slate and chloritic schist; further W lie the Gossan and Galena-Sphalerite lodes.
The Eastern and Western lodes merge to the S at 290 m depth.
The lodes are slightly arcuate, concave to the E.
Primary ore is brecciated chert and chloritic slate containing gold-sulphide mineralisation in quartz veins and as disseminations.
Cross veins are strongly mineralised, and high gold values correlate with cherts.
New Occidental was worked solely for gold.

OREBODY: Albion
Orebody lies on Great Chesney Fault N of a cross-fault. Great Chesney Fault lies locally within Chesney Formation, not along contact with Great Cobar Slate.

OREBODY: Bowmans
As for Albion. Ore occurred in magnetite vein in slate.

OREBODY: Eastern
Eastern lode lies on and W of the Great Chesney Fault, S of a cross-fault, where the Great Chesney Fault separates Chesney Formation from Great Cobar Slate. Host rocks to orebody are brecciated siliceous slate of Great Cobar Slate. Northern part of lode trends more westerly than other ore lenses of the deposit - 330 deg compared with 340-350 deg, and lies along the cross-fault.

OREBODY: Galena-Sphalerite
Host rocks are calcite and dolomite breccia.

OREBODY: Gossan
Orebody lies W of and parallel to Western lode.

OREBODY: Main
Orebody consists of southward, merged extensions of Eastern and Western lodes.

OREBODY: Western
Orebody lies several metres W of and subparallel to the Eastern lode, within Great Cobar Slate. Eastern and Western lodes merge S at depth to form the Main lode.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Andrews E.C., 1913
Report on the Cobar copper and gold-field. Part 1.
Geological Survey of New South Wales. Mineral Resources
17

Brooke W.J.L., 1975
Cobar mining field. IN Knight C.L.(ed) - Economic geology of Australia and Papua New Guinea - 1. Metals.
AusIMM. Monograph Series
5 P683-694

Gilligan L.B., Suppel D.W., 1978
Mineral deposits in the Cobar Super-Group and their structural setting.
Geological Survey of New South Wales. Quarterly Notes
33 P15-22

Gilligan L.B., 1978
A preliminary metallogenic study of the Cobar 1:250 000 sheet.
Geological Survey of New South Wales. Report
GS1978/332

Gilligan L.B., 1980
Mine data sheets to accompany the Cobar 1:250 000 metallogenic map.
Geological Survey of New South Wales. Report
GS1980/097

Glen R.A., MacRae G.P., Pogson D.J., Scheibner E., Agostini A. , Sherwin L., 1985
Summary of geology and controls of mineralization in the Cobar region.
Geological Survey of New South Wales. Report
GS1985/203

Glen R.A., 1986
Geology of the Wrightville 1:100 000 geological sheet 8034.

Geological Survey of New South Wales
1v

Glen R.A., 1987
Copper- and gold- rich deposits in deformed turbidites at Cobar, Australia: their structural control and hydrothermal origin.
Economic Geology
82(1) P124-140

Kirk B.I., 1983
A review of the geology and ore genesis of the Cobar mining field. IN AusIMM Annual Conference, Broken Hill, July 1983.
AusIMM. Conference Series
12 P183-195

Mulholland C. St J., Rayner E.O., 1953
New Occidental, New Cobar, and Chesney mines. IN Edwards A.B.(ed) - Geology of Australian ore deposits. 5th Empire Mining & Metallurgical Congress, Australia & New Zealand, 1953, Melbourne.
AusIMM
1 P897-906

Mulholland C. St J., Rayner E.O., 1961
The gold-copper deposits of Cobar, New South Wales: central section (Great Cobar to New Occidental).
New South Wales. Department of Mines. Technical Report
1958(6) P23-47

Rayner E.O., 1961
The mineralogy and genesis of the iron-rich copper ores of the Cobar province, New South Wales. Ph.D. thesis.
University of New South Wales. Unpublished
1v

Rayner E.O., 1969
The copper ores of the Cobar region, New South Wales.
Geological Survey of New South Wales. Memoirs (Geology)
10

Robertson I.G., 1974
The environmental features and petrogenesis of the mineral zones of Cobar, New South Wales. Ph.D. thesis.
University of New England. Unpublished
1v

Russell R.T., Lewis B.R., 1965
Gold and copper deposits of the Cobar district. IN McAndrew J.(ed) - Geology of Australian ore deposits. 8th Commonwealth Mining & Metallurgical Congress, Australia & New Zealand, 1965, Melbourne.
AusIMM
1 P411-419

Sullivan C.J., 1951
Geology of New Occidental, New Cobar and Chesney mines, Cobar, New South Wales.
Bureau Mineral Resources, Australia. Report
6

Suppel D.W., 1984
A study of mineral deposits in the Cobar Supergroup, Cobar region, New South Wales. M.Sc. thesis.
University of New South Wales. Unpublished
1v

Thomson B.P., 1953
Geology and ore occurrence in the Cobar district. IN Edwards A.B.(ed) - Geology of Australian ore deposits. 5th Empire Mining & Metallurgical Congress, Australia & New Zealand, 1953, Melbourne.
AusIMM
1 P863-8

oooooooooooooooooooooooooooooooooooooo

DEPOSIT: 6 THE PEAK

DEPOSIT IDENTIFICATION:

SYNONYMS: Cobar, Peak

COMMODITIES: Au, Pb, Zn, Cu, Ag

DISTRIBUTION:
Record covers orebodies lying along two parallel adjacent NNW-trending lines 2.5 km long 8 km S of Cobar township. Nos. 59-65 on Cobar metallogenic map; Nos. 5-11 on Wrightville 1:100 000 geological map.

OREBODIES:
The Peak (D), Big Lode, Blue Lode, Cobar (Silver) Peak, Conqueror-Brown, Great South Peak, Lady Greaves, Perseverance, The Peak (AM&S)

MINES:
Big Lode, Brown, Cobar (Silver) Peak, Conqueror, Conqueror South, Great Peak, Great South Peak, Lady Greaves & Peak Prospecting, Perseverance, The Peak

GROUP: Cobar Group

COMMENTS:
See Deposit 'Cobar Group' for regional setting and associated mineralisation of Cobar Block.

LOCATION:

LATITUDE: 31 34	LONGITUDE: 145 53
250K SHEET: SH55 14	100K SHEET: 8034

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Cobar
LOCAL GOVERNMENT AREA (LGA): Cobar

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1887	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Big Lode	Big Lode	Historical	Underground
Big Lode	Big Lode	Historical	Surface
Blue Lode	Great Peak	Historical	Underground
Blue Lode	Great Peak	Historical	Open-Cut
Blue Lode	Great Peak	Historical	Surface
Cobar (Silver) Peak	Cobar (Silver) Peak	Historical	Underground
Cobar (Silver) Peak	Cobar (Silver) Peak	Historical	Open-Cut
Conqueror-Brown	Brown	Historical	Underground
Conqueror-Brown	Conqueror	Historical	Underground
Conqueror-Brown	Conqueror South	Historical	Underground
Conqueror-Brown	Great Peak	Historical	Underground
Conqueror-Brown	Great Peak	Historical	Open-Cut
Conqueror-Brown	Great Peak	Historical	Surface
Great South Peak	Great South Peak	Historical	Underground
Lady Greaves	Lady Greaves & Peak Prospecting	Historical	Underground
Lady Greaves	Lady Greaves & Peak Prospecting	Historical	Open-Cut
Lady Greaves	Lady Greaves & Peak Prospecting	Historical	Surface
Perseverance	Perseverance	Historical	Underground
The Peak (AM&S)	The Peak	Possible	Underground

COMPANIES:

OREBODY: The Peak (AM&S)

PRESENT OPERATORS:
Cobar Mines Pty Ltd

PRESENT OWNERS:	EQUITY%
Cobar Mines Pty Ltd	100.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 639
Average recovered grade 20.51 g/t Au

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: 1890-1919, 1924-1946,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: -
SUB-PROVINCE: Cobar Block

HOST ROCKS:

FORMATION NAME & AGE: Great Cobar Slate - Early Devonian
LITHOLOGY: Slate, siltstone, sandstone
RELATIONSHIP TO MINERALISATION: Mineralisation comprises a series of lodes in shear zones in slate adjacent to faults which in part form the contact between Great Cobar Slate and Chesney Formation.

FORMATION NAME & AGE: Nurri Group - Early Devonian
LITHOLOGY: Arenite, siltstone, mudstone, slate, conglomerate.
RELATIONSHIP TO MINERALISATION: Includes Great Cobar Slate. (Group comprises Great Cobar Slate and Chesney Formation.)

FORMATION NAME & AGE: Chesney Formation - Early Devonian
LITHOLOGY: Arenite, siltstone, mudstone, conglomerate.
RELATIONSHIP TO MINERALISATION: Occurs adjacent to mineralised slate; contact is in part faulted.

GEOCHRONOLOGY:
See Deposit 'Cobar Group'.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Clastic Sedimentary

STRUCTURAL FEATURES:

MAJOR: Faulting, Shearing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

SIGNIFICANT: Fault/Stratigraphic Boundary, Stratigraphic Boundary

IGNEOUS ACTIVITY:

METAMORPHISM:
Regional metamorphic grade is greenschist facies.

ALTERATION:

OREBODY: The Peak (D)
Silicification: mineralised lenses are surrounded by zones of quartz-veined, silicified slate.

OREBODY: Conqueror-Brown
Silicification, chloritisation.

OREBODY: The Peak (AM&S)
Mineralisation is associated with an alteration zone characterised by silicification, quartz veining, chloritisation, montmorillonite formation, and alkali depletion.

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Auriferous base metal sulphides in structurally controlled sites in fine-grained sediments.

STYLE:

MAJOR: Discordant, Stratabound

MORPHOLOGY: Pipe-Like

AGE OF MINERALISATION: Palaeozoic Carboniferous

DIMENSIONS/ORIENTATION:

OREBODY: The Peak (D)

		MIN	AVE	MAX
VERTICAL DEPTH	(m)	45.0		90.0
		ANGLE (deg.)		DIRECTION
PLUNGE				S

OREBODY: Big Lode

		MIN	AVE	MAX
STRIKE LENGTH	(m)			215.0
TRUE WIDTH	(m)			12.0
		ANGLE (deg.)		DIRECTION
DIP		70		SW
STRIKE		330		

OREBODY: Blue Lode

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			72.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		E
PLUNGE				S
STRIKE		330		

OREBODY: Cobar (Silver) Peak

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			107.0
		ANGLE (deg.)		DIRECTION
DIP		85		E
STRIKE		345		

OREBODY: Conqueror-Brown

		MIN	AVE	MAX
STRIKE LENGTH	(m)			225.0
TRUE WIDTH	(cm)			130.0
VERTICAL DEPTH	(m)	45.0		90.0
		ANGLE (deg.)		DIRECTION
DIP		60-70,70-80		SW,NE
PLUNGE		70-90		S
STRIKE		325,335		

OREBODY: Great South Peak

		MIN	AVE	MAX
TRUE WIDTH	(cm)			50.0
VERTICAL DEPTH	(m)			73.0
		ANGLE (deg.)		DIRECTION
DIP		85		E
STRIKE		343		

OREBODY: Lady Greaves

	ANGLE (deg.)	DIRECTION
STRIKE	180	

OREBODY: Perseverance

	ANGLE (deg.)	DIRECTION
DIP	85-90	W
STRIKE	343	

OREBODY: The Peak (AM&S)

		MIN	AVE	MAX
STRIKE LENGTH	(m)	110.0		230.0
TRUE WIDTH	(m)	8.0		25.0
DOWN-DIP DEPTH	(m)			650.0
DEPTH OF COVER	(m)		250.0	

ORE TEXTURE:
Banded/Laminated, Disseminated, Massive, Oxidised, Primary

NATURE OF MINERALISATION:
PRIMARY ORE: Dissemination, Fault/Shear-Filling, Multiple Veins, Vein (Reef),
SECONDARY ORE: Supergene Enrichment

MINERALOGY:

OREBODY: The Peak (D)
Sulphide zone: pyrite, native gold, native silver, galena, chalcopyrite).
Oxide zone: limonite, native gold, copper carbonates, cuprite, chalcopyrite, cerussite, chalcocite.

OREBODY: Big Lode
Sulphide zone: pyrite, sphalerite, galena, chalcopyrite, (tetrahedrite).
Oxide zone: limonite, malachite, chalcocite, cuprite, (native copper, gold, cerussite).

OREBODY: Blue Lode
Sulphide zone: pyrite, pyrrhotite, chalcopyrite, (sphalerite, galena, arsenopyrite, gold).
Oxide zone: malachite, azurite, hematite, (hemimorphite, cerussite, pyromorphite, cerargyrite, embolite).

OREBODY: Cobar (Silver) Peak
Sulphide zone: pyrite, pyrrhotite, chalcopyrite, sphalerite, (galena, tetrahedrite, gold). Galena-sphalerite-pyrrhotite-quartz form polygranular aggregates containing traces of chalcopyrite with exsolved cubanite. The grains show evidence of deformation and recrystallisation. Tetrahedrite forms exsolution blebs and thread-like grains transgressive to sphalerite twins and grains randomly distributed along sphalerite grain boundaries.
Oxide zone: cerussite, hematite, (embolite, cerargyrite, covellite, cuprite, silver, chalcopyrite, malachite).

OREBODY: Conqueror-Brown
Sulphide zone: pyrrhotite, pyrite, chalcopyrite, (sphalerite, galena). Pyrrhotite occurs as narrow discontinuous elongate grains, up to 1 cm long, 0.1 mm wide, along cleavage planes. Chalcopyrite is most commonly either included within pyrrhotite, or is intergranular or peripheral to pyrrhotite.
Oxide zone: limonite, (gold).

OREBODY: Great South Peak
Sulphide zone: (sphalerite, pyrite).
Oxide zone: limonite, hematite, (gold).

OREBODY: Lady Greaves
Sulphide zone: pyrite, arsenopyrite.
Oxide zone: limonite, (gold).

OREBODY: Perseverance
Sulphide zone: (pyrite, chalcopyrite, sphalerite).
Oxide zone: (limonite, pyrolusite).

OREBODY: The Peak (AM&S)
Sulphide zone: lenses 1, 2: galena, sphalerite.
Copper lens (lens 3): chalcopyrite, pyrrhotite, sphalerite, galena.
Lens 4: mainly sphalerite, galena, pyrrhotite, pyrite, chalcopyrite.
Lens 5: pyrrhotite, galena, sphalerite in quartz-chlorite veins.
Gold occurs in all lenses except lens 4.

CONTROLS OF MINERALISATION:
See Deposit 'COBAR GROUP'.

GENETIC MODELS:
See Deposit 'COBAR GROUP'.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: The Peak (D)

GEOLOGICAL SETTING: THE PEAK

PRINCIPAL SOURCES: Thomson (1953), Rayner (1961a), Russell & Lewis (1965), Gilligan (1980), Glen (1987).

Gold-silver-lead-copper-zinc orebodies in The Peak area occur in prominent shear zones associated with The Peak and Blue Lode faults. Orebodies on The Peak fault include Conqueror-Brown, The Peak (AM&S), Big Lode, Perseverance and Great South Peak. Cobar (Silver) Peak, Lady Greaves, and Blue Lode lie on the Blue Lode fault which lies 200 m to the E of The Peak fault.

The faults trend NNW and dip steeply E, and are sub-parallel to, and in part coincide with, the contact between Chesney Formation and Great Cobar Slate. The structure of the faults varies from brittle, indicated by quartz veining, to brittle-ductile schist zones, containing chlorite, talc schist, quartz veins,and breccias.

Mineralisation is confined to sandy slate of the Great Cobar Slate adjacent to the faults, and most of the economic ore occurs in the enriched oxidised zone. Ore zones comprise sub-vertical pipe-like lodes surrounded by alteration zones of quartz-veined silicified slate carrying lower grade mineralisation. Ore lenses plunge S, apparently coaxial with bedding/cleavage intersection.

OREBODY: Big Lode

Big Lode lies just W of The Peak fault parallel to the Conqueror-Brown lode (which lies adjacent to Big Lode on the E side of the fault). The orebody comprises a zone of siliceous weakly limonitic oxidised Cu-Au ore above a broad zone of weak primary Cu-Pb-Zn ore.

OREBODY: Blue Lode

Blue Lode lies on the Blue Lode fault and consists of two small shoots - an eastern shoot and a western shoot - of quartz-sulphide veins and crushed slate.

OREBODY: Cobar (Silver) Peak

Orebody comprises small discontinuous shoots of enriched gold-silver and lead mineralisation. Both vein and massive to disseminated mineralisation occur, the latter varying from banded to foliated to homogeneous (Plibersek, 1982, reported by Glen, 1987).

OREBODY: Conqueror-Brown

Conqueror-Brown lode lies immediately E of The Peak fault, in a narrow zone of crushed slate or silicified sandy slate containing zones of quartz-limonite veining. Orebody comprises a well defined western lode of high-grade gold and silver shoots in a linear shear zone, and a less well defined eastern lode. Eastern and western lodes merge to the south.

OREBODY: Great South Peak

Lies on southern extension of The Peak Fault. Orebody parallels S1 and consists of gold in quartz veins in silicified slate.

Historically, veins were worked solely for gold content.

OREBODY: Lady Greaves

Orebody consisted of a narrow shear zone - the Lady Greaves shear - of crushed sandy slate and quartz-sulphides, with relatively low gold content.

OREBODY: Perseverance

Perseverance and Great South Peak apparently represent a southerly continuation of The Peak shear line of mineralisation.

OREBODY: The Peak (AM&S)

Orebody comprises five sub-vertical lenses within and adjacent to weakly mineralised altered silicified slate in a shear zone on The Peak fault. The orebody occurs at depth below the Conqueror lode. The alteration zone lies above a steeply N-plunging breccia pipe, which is intersected at a depth of about 450 m.

Copper-lead-zinc-gold mineralisation occurs in quartz-carbonate veins generally close to S1 cleavage; ore lenses are defined as economic concentrations of veins.

Breccia consists of angular to subangular fragments of silicified country rock 0.5-2.0 cm in diameter, in a matrix of vein quartz and fine-grained silica.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Andrews E.C., 1913
Report on the Cobar copper and gold-field. Part I.
Geological Survey of New South Wales. Mineral Resources
17

Brooke W.J.L., 1975
Cobar mining field. IN Knight C.L.(ed) - Economic geology of Australia and Papua New Guinea - 1. Metals.
AusIMM. Monograph Series
5 P683-694

Gilligan L.B., Suppel D.W., 1978
Mineral deposits in the Cobar Super-Group and their structural setting.
Geological Survey of New South Wales. Quarterly Notes
33 P15-22

Gilligan L.B., 1978
A preliminary metallogenic study of the Cobar 1:250 000 sheet.
Geological Survey of New South Wales. Report
GS1978/332

Gilligan L.B., 1980
Mine data sheets to accompany the Cobar 1:250 000 metallogenic map.
Geological Survey of New South Wales. Report
GS1980/097

Glen R.A., MacRae G.P., Pogson D.J., Scheibner E., Agostini A., Sherwin L., 1985
Summary of geology and controls of mineralization in the Cobar region.
Geological Survey of New South Wales. Report
GS1985/203

Glen R.A., 1986
Geology of the Wrightville 1:100 000 geological sheet 8034.
Geological Survey of New South Wales
1v

Glen R.A., 1987
Copper- and gold- rich deposits in deformed turbidites at Cobar, Australia: their structural control and hydrothermal origin.
Economic Geology
82(1) P124-140

Kirk B.I., 1983
A review of the geology and ore genesis of the Cobar mining field. IN AusIMM Annual Conference, Broken Hill, July 1983.
AusIMM. Conference Series
12 P183-195

Plibersek P., 1982
Structure, stratigraphy, wallrock alteration and mineralization of 'The Peak' near Cobar, New South Wales. B.Appl.Sci. thesis.
New South Wales. Institute of Technology
1v

Rayner E.O., 1961
The Peak area, Cobar mineral field, New South Wales.
New South Wales. Department of Mines. Technical Report
6 P49-62

Rayner E.O., 1961
The mineralogy and genesis of the iron-rich copper ores of the Cobar province, New South Wales. Ph.D. thesis.
University of New South Wales. Unpublished
1v

Rayner E.O., 1969
The copper ores of the Cobar region, New South Wales.
Geological Survey of New South Wales. Memoirs (Geology)
10

Robertson I.G., 1974
The environmental features and petrogenesis of the mineral zones of Cobar, New South Wales. Ph.D. thesis.
University of New England. Unpublished
1v

Russell R.T., Lewis B.R., 1965
Gold and copper deposits of the Cobar district. IN McAndrew J.(ed) - Geology of Australian ore deposits. 8th Commonwealth Mining & Metallurgical Congress, Australia & New Zealand, 1965, Melbourne.
AusIMM

1 P411-419

Suppel D.W., 1984
A study of mineral deposits in the Cobar Supergroup, Cobar region, New South Wales. M.Sc. thesis.
University of New South Wales. Unpublished
1v

Thomson B.P., 1953
Geology and ore occurrence in the Cobar district. IN Edwards A.B.(ed) - Geology of Australian ore deposits. 5th Empire Mining & Metallurgical Congress, Australia & New Zealand, 1953, Melbourne.
AusIMM
1 P863-896

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 7 CANBELEGO

DEPOSIT IDENTIFICATION:

SYNONYMS: Mount Boppy

COMMODITIES: Au, Zn, Pb, Ag, Cu, Mn, Fe

DISTRIBUTION:
Record covers deposits concentrated in 2 areas, one 2 x 3 km centred on Canbelego, and a smaller area 5 km to the NW. Nos. 89, 91, 93-109 on Cobar metallogenic map.

OREBODIES:
Canbelego (D), Bakers, Birthday, Boppy Blocks, Boppy Boulder, Canbelego King, East Mount Boppy, Hardwicks, Hidden Treasure, Jack Locks, Mount Boppy, Mount Boppy South, Newhaven, North Mount Boppy, Reid & Rankers, Wealth Of Nations, West Bopppy

MINES:
Bakers, Birthday, Boppy Blocks, Boppy Boulder, Canbelego, Canbelego King, East Mount Boppy, Hardwicks, Hidden Treasure, Hogans, Jack Locks, Mount Boppy, Mount Boppy South, Newhaven, North Mount Boppy, Reid & Rankens, The Snakes, Wealth Of Nations, West Boppy

GROUP: -

COMMENTS:
See Deposit No.8 MINERAL HILL for regional setting of Mineral Hill Synclinorial Zone. Copper deposits which occur from 2 to 8 km S of Canbelego are not included in this report.

LOCATION:

LATITUDE: 31 34   LONGITUDE: 146 19
250K SHEET: SH55 14   100K SHEET: 8134

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Cobar
LOCAL GOVERNMENT AREA (LGA): Cobar

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1896	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Canbelego (D)	Canbelego	Operating	Tailings Re-Treatment
Bakers	The Snakes	Historical	Underground
Bakers	Bakers	Historical	Underground
Birthday	Birthday	Historical	Underground
Boppy Blocks	Boppy Blocks	Historical	Underground
Boppy Blocks	Boppy Blocks	Historical	Open-Cut
Boppy Blocks	Boppy Blocks	Historical	Surface
Boppy Boulder	Boppy Boulder	Historical	Underground
Canbelego King	Canbelego King	Historical	Underground
East Mount Boppy	Hogans	Historical	Underground
East Mount Boppy	East Mount Boppy	Historical	Underground
Hardwicks	Hardwicks	Historical	Underground
Hidden Treasure	Hidden Treasure	Historical	Unknown
Jack Locks	Jack Locks	Historical	Underground
Jack Locks	Jack Locks	Historical	Surface
Mount Boppy	Mount Boppy	Historical	Underground
Mount Boppy	Mount Boppy	Operating	Open-Cut
Mount Boppy South	Mount Boppy South	Historical	Underground
Newhaven	Newhaven	Historical	Underground
Newhaven	Newhaven	Historical	Surface
North Mount Boppy	North Mount Boppy	Historical	Underground
Reid & Rankens	Reid & Rankens	Historical	Underground
Wealth Of Nations	Wealth Of Nations	Historical	Underground

Wealth Of Nations	Wealth Of Nations	Historical	Surface
West Bopppy	West Boppy	Historical	Underground
West Bopppy	West Boppy	Historical	Surface

COMPANIES:

OREBODY: Canbelego (D)

PRESENT OPERATORS:
Epoch Mining NL

PRESENT OWNERS:	EQUITY%
Epoch Mining NL	100.00

OREBODY: Mount Boppy

PRESENT OPERATORS:
Epoch Mining NL

PRESENT OWNERS:	EQUITY%
Epoch Mining NL	51.00
Mount Boppy Mines Pty Ltd	49.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 13,510
Average recovered grade 12.25 g/t Au Mount Boppy; 8.7-60 g/t Au other orebodies.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

YEAR	PRODUCTION
1988	214

MAIN PRODUCTION PERIODS: (1939-1940), (1975-1976), 1901-1923, 1985-, 1988-
,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION			
Dec 1988	180	4.3	774	Economic Demonstrated	Recoverable	t	Tailings
Dec 1987	80	4.0	320	Economic Inferred	In-Situ	o/c	Mount Boppy

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Mineral Hill Synclinorial Zone
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Girilambone Beds - Cambrian-Ordovician
LITHOLOGY: Metamorphosed turbidite.
RELATIONSHIP TO MINERALISATION: Host to many smaller deposits of field in fault breccia zones and veins.

FORMATION NAME & AGE: Baledmund Formation - Early Devonian
LITHOLOGY: Conglomerate, sandstone, siltstone, limestone.
RELATIONSHIP TO MINERALISATION: Host to principal mineralisation in stratabound fault breccia above basal conglomerate.

FORMATION NAME & AGE: Florida Volcanics - Early Devonian
LITHOLOGY: Felsic pyroclastic.
RELATIONSHIP TO MINERALISATION: Possibly genetically related to mineralisation - possible volcanic exhalative source.

FORMATION NAME & AGE: Kopyje Group - Early Devonian
LITHOLOGY: Sediments, felsic volcanics.
RELATIONSHIP TO MINERALISATION: Comprises Baledmund Formation and Florida Volcanics.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Clastic Sedimentary, Metasedimentary

STRUCTURAL FEATURES:

MAJOR: Faulting, Fold Axis, Folding,
SIGNIFICANT: Folding

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

MAJOR: Stratigraphic Boundary
SIGNIFICANT: Fault/Stratigraphic Boundary

IGNEOUS ACTIVITY:

SIGNIFICANT: Volcanism (Felsic)

METAMORPHISM:

Metamorphic grade of the Girilambone Beds ranges from lower to upper greenschist facies, with local development of amphibolite facies adjacent to granitoid intrusives that are probable anatectic derivatives of the Girilambone Beds (Pogson & Felton, 1978). Regional metamorphic grade of the Cobar Supergroup is very low, restricted to the limited development of secondary white mica (Felton, 1981).

ALTERATION:

OREBODY: Mount Boppy
Strong silicification.

DEPOSIT CHARACTERISTICS:

TYPES:

MAJOR: Stratabound auriferous base metal sulphides in fault breccia zones in coarse sediments stratigraphically close to felsic volcanics.

STYLE:

MAJOR: Stratabound

AGE OF MINERALISATION: Palaeozoic Early Devonian

DIMENSIONS/ORIENTATION:

OREBODY: Bakers

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			18.0
		ANGLE (deg.)		DIRECTION
STRIKE		328		

OREBODY: Birthday

		MIN	AVE	MAX
STRIKE LENGTH	(m)			50.0
VERTICAL DEPTH	(m)	50.0		
		ANGLE (deg.)		DIRECTION
DIP		90		
STRIKE		350		

OREBODY: Boppy Blocks

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			60.0

OREBODY: Boppy Boulder

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			60.0

OREBODY: Canbelego King

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			30.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		W
STRIKE		355		

OREBODY: East Mount Boppy

		MIN	AVE	MAX
STRIKE LENGTH	(m)			33.0
VERTICAL DEPTH	(m)			60.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		W
STRIKE		325		

OREBODY: Jack Locks

		MIN	AVE	MAX
TRUE WIDTH	(m)			3.0
VERTICAL DEPTH	(m)			66.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		W
STRIKE		320		

OREBODY: Mount Boppy

		MIN	AVE	MAX
STRIKE LENGTH	(m)	100.0	400.0	1000.0
TRUE WIDTH	(cm)	30.0	180.0	1500.0
VERTICAL DEPTH	(m)			244.0
		ANGLE (deg.)		DIRECTION
DIP		90		
STRIKE		180		

OREBODY: Mount Boppy South

		MIN	AVE	MAX
TRUE WIDTH	(m)			160.0
STRIKE LENGTH	(m)			130.0
VERTICAL DEPTH	(m)			100.0
		ANGLE (deg.)		DIRECTION
DIP		90		
STRIKE		135		

OREBODY: Newhaven

		MIN	AVE	MAX
TRUE WIDTH	(cm)	30.0		130.0
VERTICAL DEPTH	(m)			19.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		E
STRIKE		350		

OREBODY: North Mount Boppy

		MIN	AVE	MAX
TRUE WIDTH	(cm)			450.0
VERTICAL DEPTH	(m)			113.0
		ANGLE (deg.)		DIRECTION
DIP		80		W
STRIKE		342		

OREBODY: Reid & Rankens

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			52.0
		ANGLE (deg.)		DIRECTION
DIP				W

OREBODY: Wealth Of Nations

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			40.0
		ANGLE (deg.)		DIRECTION
DIP		85-90		W
STRIKE		355		

OREBODY: West Bopppy

		MIN	AVE	MAX
TRUE WIDTH	(m)			50.0
VERTICAL DEPTH	(m)			60.0
		ANGLE (deg.)		DIRECTION
DIP		70		W
STRIKE		150		

ORE TEXTURE:

Banded/Laminated, Oxidised

NATURE OF MINERALISATION:
PRIMARY ORE: Breccia, Dissemination, Fault/Shear Filling, Multiple Veins, Vein (Reef),
SECONDARY ORE: Residual, Supergene Enrichment

MINERALOGY:

OREBODY: Bakers
Oxide zone: limonite, (gold).

OREBODY: Birthday
Sulphide zone: (pyrite, gold).
Oxide zone: limonite, pyrolusite.

OREBODY: Boppy Blocks
Oxide zone: limonite, pyrolusite.

OREBODY: Boppy Boulder
Sulphide zone: pyrite.
Oxide zone: limonite, pyrolusite, (gold).

OREBODY: Canbelego King
Oxide zone: limonite, gold.

OREBODY: East Mount Boppy
Oxide zone: limonite, gold.

OREBODY: Hardwicks
Oxide zone: pyrolusite, limonite, psilomelane, (gold, unidentified lead-bearing manganese mineral).

OREBODY: Jack Locks
Oxide zone: limonite, (pyrolusite), ?gold.

OREBODY: Mount Boppy
PRINCIPAL SOURCES: Gilligan (1977, 1978a, 1980).

Sulphide zone: iron-rich sphalerite, galena, pyrite, (chalcopyrite, cubanite, gold, arsenopyrite).
The sulphides generally occur disseminated in interstitial fill.
Free gold occurs in quartz and associated with sulphides, most commonly sphalerite, also chalcopyrite.
Oxide zone: limonite, hematite, pyrolusite, (chalcocite, anglesite, cerussite, gold).
Gangue: quartz, calcite, ferroan-dolomite, dolomite.

Gold in the siliceous breccia zones is believed to have been derived from the primary zone by remobilisation during deformation and further enhanced by supergene enrichment (Gilligan, 1977, 1978a).

OREBODY: Mount Boppy South
Sulphide zone: pyrite.
Oxide zone: gold.

OREBODY: Newhaven
Oxide zone: limonite, gold.

OREBODY: North Mount Boppy
Sulphide zone: chalcopyrite, pyrite, galena, sphalerite.
Oxide zone: gold, limonite, pyrolusite.
Gangue (quartz-filled breccia): ferroan-dolomite, calcite, (pyrite, sphalerite, galena, chalcopyrite.

OREBODY: Reid & Rankens
Sulphide zone: pyrite, chalcopyrite.
Oxide zone: gold.

OREBODY: Wealth Of Nations
Sulphide zone: ?pyrite.
Oxide zone: limonite, (gold).

OREBODY: West Bopppy
Oxide zone: pyrolusite (at depth), limonite, (gold).

GENETIC MODELS:
PRINCIPAL SOURCES: Gilligan (1977, 1978a).

Andrews (1913): hydrothermal replacement, with ore solutions penetrating along the folded sandstone/slate interface, and causing also silicification of the fine-grained sediments.

Gilligan (1977, 1978a): originally stratabound volcanic exhalative, subsequently modified by remobilisation resulting from brittle deformation and supergene enrichment.
Gilligan (1977) suggested the following formation history:-
i) deposition during latest Silurian-earliest Devonian of marine sediments (Baledmund Formation) on a shallow shelf at the eastern edge of a subsiding deep-water trough (Cobar Trough);
ii) commencement of felsic volcanism during very early stages of sedimentation (Florida Volcanics); initially submarine, then emergent;
iii) emission of metal and sulphur complex ions leading to the formation of stratabound Pb-Zn-Cu-Au sulphide mineralisation localised above the basal conglomerate of the sedimentary sequence; mineralisation was hosted by siltstone, siliceous siltstone, or chert, the silica possibly being of the same origin as the metals; co-precipitation of carbonate.

The stratabound volcanogenic model is supported by a) the persistence of gold and base metal mineralisation at the same stratigraphic level throughout the Canbelego area, b) the stratabound nature of the deposit, c) the proximity of volcanic rocks, and d) the occurrence of sedimentary pyrite in siltstone overlying the Mount Boppy orebody.

Ore formation was followed by:-
iv) continued marine sedimentation and volcanism;
v) folding and deformation of Baledmund Formation and Girilambone Beds (D4) resulting in development of slaty cleavage in cover and crenulation cleavage and chevron folds in basement; brittle failure and flexural slip along contact between conglomerate and overlying mineralised chert; synfolding brecciation of siliceous sulphide-bearing unit; remobilisation of sulphides, carbonate, and silica to heal breccia;
vi) brittle-transitional deformation controlled by axial planes of D4 folds resulting in faulting parallel to S4 in both basement and cover rocks; downwards remobilisation of gold and base metals into fault breccia zones which extended into basement (smaller deposits);
vii) supergene enrichment, involving oxidation of sulphides, release and reprecipitation of gold at higher grades both in the oxidised zone and at deeper levels along permeable breccia zones; extensive silicification of upper levels of breccia.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Canbelego (D)

PRINCIPAL SOURCES: Markham & Basden (1974), Gilligan (1977, 1978a,b, 1980), Felton (1981), Markham (1982).
SUMMARY

Canbelego lies at the northern extremity of the Mineral Hill Synclinorial Zone. Mineralisation comprised supergene-enriched stratabound gold-silver-lead-zinc-copper sulphides in siliceous fault breccia zones. The fault zones occur stratigraphically close to the locally faulted unconformable contact between Cambrian-Ordovician Girilambone Beds and Early Devonian Baledmund Formation.
The deposit may represent deformed volcanic exhalative mineralisation. (Gilligan, 1977). All past production has come from the oxidised zone.

REGIONAL SETTING: CANBELEGO SYNCLINORIUM
PRINCIPAL SOURCES: Gilligan (1978a,b), Felton (1981).

The Mineral Hill Synclinorial Zone consists of a number of synclines and synclinoria containing Siluro-Devonian felsic volcanics and sediments, which have been infolded and faulted into blocks of Cambrian-Silurian rocks of the Girilambone and Wagga Anticlinorial Zones (Felton, 1981). The synclinorial zone is exposed in an elongate N-S belt which extends from Canbelego in the N to MINERAL HILL (Deposit No.8) in the S.
Two main rock groups occur in the Canbelego area - the Girilambone Beds and the Cobar Supergroup.
The Girilambone Beds, including the Ballast beds, are considered to be Cambrian-Ordovician in age, and constitute basement to the Cobar-Mineral Hill region. The beds are a metamorphosed turbidite sequence of micaceous quartz arenite, feldspathic arenite, phyllite, chert, and some altered mafic volcanics and intrusions.
The sequence is complexly folded and shows evidence of up to four periods of deformation.
Mafic volcanics and gabbros occur within the Girilambone Beds several km S of Canbelego at the Canbelego copper mine.
The Girilambone Beds are host to many of the smaller gold deposits of the Canbelego field, mainly in fault breccia zones, some in veins.

The Cobar Supergroup is an extensive group of rocks of latest Silurian-Early Devonian age which includes both deep-water and shallow-water sediments. The deeper water sediments are mainly restricted to the Cobar Block; in the Mineral Hill Synclinorial Zone the Supergroup is

represented by a relatively thin, shallow marine shelf sequence of predominantly siltstone, sandstone, and felsic volcanics. The sequence is termed Kopyje Group. The Kopyje Group overlies Girilambone Beds with marked unconformity.
The Kopyje Group is host to the principal gold mineralisation at Canbelego and is a correlative of deeper water sediments which host base metal and gold mineralisation at Cobar and Elura.

REGIONAL SUCCESSION: CANBELEGO SYNCLINORIUM
PRINCIPAL SOURCES: Felton (1981).

In the Canbelego region the Kopyje Group (Dk on Canbelego 1:100 000 geological map) comprises:-
1./ Baledmund Formation (Dkb) (Early Devonian) (max. thickness 500 m) - basal unit of lithic polymictic and oligomictic conglomerate and quartz-lithic arenite, laminated and massive siltstone, calcareous in part, quartz-lithic arenite, rhyolitic vitric tuff and crystal-lithic tuff, cherty siltstone, limestone. The formation includes:-
i) Mount Boppy Conglomerate Member (Dkbp) (max. thickness 200 m) - basal unit of formation, representing fluvial to shallow marine outwash fans. Member comprises massive and bedded quartz-lithic conglomerate with chloritic matrix, grading upwards to coarse arenite, and containing abundant fragments of Girilambone Beds.
The comglomerate member is host to the largest deposit of the field, Mount Boppy, which occurs within or immediately above the conglomerate, and to some smaller deposits.
ii) Sarona Downs Tuff Member (Dkbs) (average thickness 200 m) - rhyolitic crystal-lithic and vitric tuff.
iii) Boomerang Tank Limestone Member (Dkbo) (estimated thickness 200 m) - bioclastic calcarenite.

The Baledmund Formation is overlain by and partly interfingers with:-
2./ Florida Volcanics (Dkf) (Early Devonian) (max. thickness 1000 m) - rhyolitic and rhyodacitic lithic crystal tuff, breccia, agglomerate, rhyolite lava, siltstone, dacite. The formation includes:-
i) Dicksons Road Dacite Member(Dkfd) - flow-foliated porphyritic dacite.
The basal part of the Florida Volcanics was deposited in shallow marine conditions; most of the remainder of the unit is subaerial.
The volcanics appear to have transgressed the sedimentary sequence from the E.

STRUCTURE: CANBELEGO SYNCLINORIUM
PRINCIPAL SOURCES: Gilligan (1978a,b). Felton (1981).

The Siluro-Devonian rocks are folded into a series of large scale, en echelon S- and SE-plunging anticlines and synclines, although plunge reversals are common. Degree of fold oppression is highly variable. The principal deposit at Canbelego, Mount Boppy, lies on a tight syncline; other folds in the region are open. Fold geometry was apparently strongly influenced by basement topography. The cleavage-forming deformation in the Devonian rocks can be correlated with the last major deformation event D4 in the basement rocks (Gilligan, 1978a).

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Markham & Basden (1974), Gilligan (1977, 1978a, 1980) Markham (1982).

Gold(-lead-zinc-silver) (and separate copper) mineralisation at Canbelego occur in the Girilambone Beds, in the basal part of the Baledmund Formation, and at the faulted contact between the two units. The bulk of mineralisation is associated with fault breccia zones and many deposits are stratigraphically close to the unconformity.
Minor vein, disseminated, and residual mineralisation also occur.

i) Gold occurs in the Girilambone Beds in siliceous, generally N-trending fault breccia zones immediately below the unconformity at North Mount Boppy, Hidden Treasure, Canbelego King, Birthday, East Mount Boppy, and possibly also Bakers. The Girilambone Beds host minor vein mineralisation at Newhaven and Jack Locks.
ii) Considerable gold, silver (and minor base metal) mineralisation is localised within or stratigraphically immediately above the basal conglomerate of the Baledmund Formation at Mount Boppy (largest deposit of field), where gold occurs in siliceous fault breccia, and at smaller vein and disseminated deposits at Boppy Boulder, Boppy Blocks, and Reid & Rankens.
iii) Gold occurs in fault breccia zones that represent the contact between Girilambone Beds and Baledmund Formation at Mount Boppy South, West Boppy, and possibly also Hardwicks and Wealth of Nations.

OREBODY: Bakers
Mineralisation occurred in probable fault breccia in quartz-mica schist of Girilambone Beds.

OREBODY: Birthday

Ore occurred in two parallel fault breccia zones in Girilambone Beds. Enclosing rocks are brecciated, siliceous, iron-stained quartzite, and laminated schistose arenite. Disseminated pyrite is present in overlying conglomerate.

OREBODY: Boppy Blocks

Gold was associated with residual manganese and iron oxides adjacent to a fault in quartz-pebble conglomerate and quartzite of the basal Baledmund Formation.

OREBODY: Boppy Boulder

Discovery site of the Canbelego field. Vein and disseminated ore occurred, possibly in a fault zone, in quartzite, lithic sandstone, and fossiliferous siltstone of the Baledmund Formation immediately overlying the basal conglomerate.

OREBODY: Canbelego King

Ore occurred in fault breccia (phyllite breccia) in Girilambone Beds. Enclosing rocks are quartz-mica schist and laminated metagreywacke.

OREBODY: East Mount Boppy

Ore was contained in an apparent fault breccia zone in Girilambone Beds. Enclosing rocks are crenulated phyllite and laminated quartz-mica schist.

OREBODY: Hardwicks

Gold was contained in quartz veins associated with manganese oxides in a fault zone within siltstones of the Baledmund Formation 30 m E of the ?faulted contact with Girilambone Beds. Enclosing lithologies also include quartz-pebble conglomerate, phyllite, fractured and veined quartzite and schistose lithic arenite.

OREBODY: Hidden Treasure

Fault breccia in laminated quartzite, Girilambone Beds.

OREBODY: Jack Locks

Ore occurred in a quartz vein in laminated quartz-mica schist, phyllite, and chert of the Girilambone Beds. Vein quartz and chert carry limonite after pyrite; fractures in chert are infilled with limonite.

OREBODY: Mount Boppy

PRINCIPAL SOURCES: Gilligan (1977, 1978a, 1980), Markham (1982).

Mount Boppy accounted for almost all of recorded production from the Canbelego field. Mineralisation was localised in an essentially conformable fault breccia zone between the basal conglomerate and the overlying siltstone/sandstone sequence of the Baledmund Formation. The deposit lies approximately 1 km along strike from a sequence of felsic volcanics (Florida Volcanics). Sedimentary pyrite occurs in bands in the siltstone.

The orebody occurs in a tightly infolded, S-plunging syncline which plunges to a depth of 210 m over a horizontal interval of 300 m. Ore zones were in the keel and eastern limb, and to a lesser extent the western limb, of the syncline. The western lode was apparently truncated by post-ore faulting. Minor lodes were contained in ?siliceous breccia zones which cut the unconformable contact. Breccia zones resulted from strong faulting which apparently occurred at the unconformity during or after folding.

The lode material is fault breccia. In the oxidised zone this consists of siliceous highly auriferous 'lode chert' characterised by stockwork quartz veining. Free gold was present in the breccia and in the quartz veins. At depth a variety of fault breccia types occurs along with net-veined siliceous siltstone. The dominant breccia types are :-

i) sulphide-deficient quartz-carbonate breccia consisting of fragments of chert, siliceous siltstone, chloritic siltstone, and occasional polymictic conglomerate and basement rock fragments healed by quartz-carbonate (calcite or siderite), and

ii) sulphide-chert breccia consisting of fragments of chert, siliceous siltstone and irregular patches of massive sulphide (usually sphalerite and galena) healed by quartz-minor carbonate.

Sulphides also occur as veinlets in chert and discrete euhedra in the quartz matrix.

In addition, minor quantities of brecciated and net-veined polymictic conglomerate and basement rock occur.

The textures of the primary lode material suggest formation as a result of brittle deformation of a sulphide-bearing chert (probably grading to a siliceous siltstone) accompanied and followed by remobilisation of quartz, carbonate, and sulphides into spaces between breccia fragments (Gilligan, 1978a).

The sulphides characteristically show evidence of plastic flow and deformation twinning.

OREBODY: Mount Boppy South
Ore occurred in two parallel, vertically-dipping siliceous fault-breccia zones which define faults that cut the keel of a S-plunging syncline. The faults cross the contact between Girilambone Beds and Baledmund Formation. Fault zones approximately parallel the axial plant of D4 folds. Enclosing rocks are conglomerate (Baledmund Formation) and quartz-mica schist (Girilambone Beds).

OREBODY: Newhaven
Ore occurred in a quartz vein within Girilambone Beds about 200 m W of a contact with Florida Volcanics. Vein material consisted of phyllite with numerous quartz stringers (130 cm wide) and an ill-defined quartz reef (30 cm wide). Enclosing rocks are schistose sandstone.

OREBODY: North Mount Boppy
Ore occurred in fault breccia in Girilambone Beds. Lode formation is phyllite breccia, quartz-filled breccia, and brecciated metagreywacke. Enclosing rocks are laminated quartzite and phyllite.
This was the only orebody in Girilambone Beds where workings extended below level of oxidation.
Production appparently nil.

OREBODY: Reid & Rankens
Ore apparently occurred disseminated in laminated quartzite of Girilambone Beds and also in overlying basal conglomerate of thinly developed outlier of Baledmund Formation. Strike of conglomerate = 310 deg.

OREBODY: Wealth Of Nations
Mineralisation occurred disseminated in conglomerate of the Baledmund Formation at the faulted contact with Girilambone Beds. The basement rocks - laminated quartz and quartz-mica schist, and phyllite - also contain limonite after pyrite. Country rocks are intensely fractured.

OREBODY: West Bopppy
Ore occurred in faulted contact zone between Girilambone Beds and Baledmund Formation. Host breccia is auriferous iron-stained siliceous breccia which contains fractured chert clasts, encloses patches of gossanous limonite and is cut by quartz veins, and is anomalous in copper, lead, zinc, and silver. The siliceous breccia is adjacent to fault breccia composed of rock fragments of the Girilambone Beds (phyllite breccia).
Enclosing rocks are crenulated mica schist.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Andrews E.C., 1915
The Canbelego, Budgery and Budgerygar mines. Part II of the Cobar copper and gold-field.
Geological Survey of New South Wales. Mineral Resources
18

Felton E.A., 1981
Geology of the Canbelego 1:100 000 sheet, 8134.
Geological Survey of New South Wales
1v

Gilligan L.B., 1975
The Little Boppy prospect, near Canbelego.
Geological Survey of New South Wales. Report
GS1975/150

Gilligan L.B., 1977
The Mount Boppy gold mine: an unusual type of gold deposit.
Geological Survey of New South Wales. Quarterly Notes
28 P1-9

Gilligan L.B., 1978
The geology and mineralization of the Canbelego area with special reference to the Mount Boppy gold deposit.
Geological Survey of New South Wales. Report
GS1978/382

Gilligan L.B., 1978
A preliminary metallogenic study of the Cobar 1:250 000 sheet.
Geological Survey of New South Wales. Report
GS1978/332

Gilligan L.B., 1980
Mine data sheets to accompany the Cobar 1:250 000 metallogenic map.
Geological Survey of New South Wales. Report
GS1980/097

Gilligan L.B., 1983
The Mount Boppy gold deposit - ductile and brittle deformation of a stratiform exhalative deposit. IN Lithosphere dynamics and evolution of continental crust. 6th Aust. Geol. Convention, Canberra 1983. Abstracts.
Geological Society of Australia
9 P311-312

Jaquet J.B., 1906
Mount Boppy goldfield.
New South Wales. Department of Mines. Annual Report
1905 P69-70

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Pogson D.J., 1976
Descriptions of geology and mineralization 9. The geology of the Bobadah-Mineral Hill area. IN Gilligan L.B., Markham N.L. & Suppel D.W. (eds) - Ore deposits of the Lachlan Fold Belt, New South Wales.
25th International Geological Congress. Excursion Guide
15C P31-33

Pogson D.J., Felton E.A.. 1978
Reappraisal of geology, Cobar-Canbelego-Mineral Hill region, central western New South Wales.
Geological Survey of New South Wales. Quarterly Notes
33 P1-14

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

oooooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 8 MINERAL HILL

DEPOSIT IDENTIFICATION:

COMMODITIES: Au, Cu, Pb, Ag, Zn

DISTRIBUTION:
Record covers field occupying E-W area 1 km x 600 m between Parkers Hill, Mineral Hill, and Mount Marshall.

OREBODIES:
5001, Mineral Hill (D), Eastern, Iodide, Mount Marshall, Parkers Hill, Western

MINES:
5001, Eastern, Mineral Hill, Parkers Hill, Western

GROUP: -

COMMENTS:
Record includes regional setting of Mineral Hill Synclinorial Zone.

LOCATION:

LATITUDE: 32 35 LONGITUDE: 146 59
250K SHEET: SI55 2 100K SHEET: 8233

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Cobar
LOCAL GOVERNMENT AREA (LGA): Bogan

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD	COMMENTS
1908	Prospecting	
1980	Geophysics	Extension To Known Mineralisation

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
5001	5001	Operating	Open-Cut
Mineral Hill (D)	Mineral Hill	Historical	Underground
Mineral Hill (D)	Mineral Hill	Operating	Open-Cut
Eastern	Eastern	Operating	Open-Cut
Parkers Hill	Parkers Hill	Historical	Underground
Western	Western	Possible	Open-Cut

COMPANIES:

OREBODY: 5001

PRESENT OPERATORS:
Triako Resources Ltd

PRESENT OWNERS:	EQUITY%
Cyprus Mines Corp.	10.00
Triako Resources Ltd	90.00

OREBODY: Mineral Hill (D)

PRESENT OPERATORS:
Triako Resources Ltd

PRESENT OWNERS:	EQUITY%
Cyprus Mines Corp.	10.00
Triako Resources Ltd	90.00

OREBODY: Eastern

PRESENT OPERATORS:
Triako Resources Ltd

PRESENT OWNERS:	EQUITY%
Cyprus Mines Corp.	10.00
Triako Resources Ltd	90.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 73
Average recovered grade from Iodide 6 g/t Au

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: 1911-1925, 1989-,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION			
June 1988	342	6.7	2,291	Economic Demonstrated (Indicated)	In-Situ	o/c	Eastern and 5001, 'gold ore'
June 1988	353	3.6	1,271	Economic Demonstrated (Indicated)	In-Situ	o/c	Eastern and 5001, 'copper ore'

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Mineral Hill Synclinorial Zone
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Mineral Hill Volcanics - Middle-?Late Silurian
LITHOLOGY: Felsic pyroclastics, associated sediments.
RELATIONSHIP TO MINERALISATION: Mineralisation comprises disseminated Cu-Au sulphide ore in pyroclastic unit; and vein, disseminated and lensoid Pb-Ag(-Cu-Au) in overlying altered sedimentary unit.

FORMATION NAME & AGE: Talingaboolba Formation - Late Silurian
LITHOLOGY: Sandstone, shale, siltstone, conglomerate.
RELATIONSHIP TO MINERALISATION: Immediately overlies mineralised volcanics/sediments.

FORMATION NAME & AGE: Ootha Group - Middle-Late Silurian
LITHOLOGY: Volcano-sedimentary.
RELATIONSHIP TO MINERALISATION: Includes Mineral Hill Volcanics and Talingaboolba Formation.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Felsic Extrusive,
SIGNIFICANT: Volcanogenic Sedimentary

STRUCTURAL FEATURES:

SIGNIFICANT: Shearing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

MAJOR: Stratigraphic Boundary

IGNEOUS ACTIVITY:

MAJOR: Volcanism (Felsic)

METAMORPHISM:
Metamorphic grade of the Mineral Hill Volcanics is very low greenschist facies. Metamorphism of Talingaboolba Formation is restricted to the minor growth of white mica.

ALTERATION:

OREBODY: Mineral Hill (D)
Host rocks adjacent to mineralisation are altered with silicification, chloritisation and sericitisation. Jasperiod apparently formed by silica alteration of limestone.

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Auriferous stratabound volcanogenic massive base metal sulphides in felsic-intermediate volcanics.

STYLE:

MAJOR: Discordant

AGE OF MINERALISATION: Palaeozoic Late Silurian

DIMENSIONS/ORIENTATION:

OREBODY: Mineral Hill (D)

	MIN	AVE	MAX
DEPTH OXIDATION (m)	15.0		60.0

ORE TEXTURE:

NATURE OF MINERALISATION:
PRIMARY ORE: Breccia, Dissemination, Vein (Reef),
SECONDARY ORE: Supergene Enrichment

MINERALOGY:

OREBODY: Mineral Hill (D)
Sulphide zone: i) copper-gold association: pyrite, chalcopyrite, (sphalerite, galena, bismuth, bismuthinite, bornite, marcasite, arsenopyrite, gold). Free gold occurs in chalcopyrite interstitial to fractured subhedral/anhedral pyrite.
ii) lead-zinc-silver association: galena, sphalerite, tetrahedrite, magnetite, (chalcopyrite, bornite, famatinite, hematite, idaite, gold, ?electrum, silver).
Oxidised zone: Sulphates and carbonates of lead and copper, (anglesite, cerussite, malachite, azurite and chalcanthite), halides of silver (iodyrite, cerargyrite, embolite and iodian bromyrite) and bindheimite (lead antimonite) are abundant. Chrysocolla, cuprite, native copper, pryomorphite, and supergene covellite, chalcocite, and digenite occur locally.

CONTROLS OF MINERALISATION:
Controls are i) lithological:- association with felsic volcanics, and ii) structural - localisation in veins and breccia zones (possibly result of remobilisation of original disseminated mineralisation - see 'GENETIC MODELS'.

GENETIC MODELS:
PRINCIPAL SOURCES: Markham & Basden (1974), Fleming (1976).

Markham & Basden (1974) and Fleming (1976) favoured a multi-stage origin of remobilisation of originally volcanic exhalative orebodies.

Fleming (1976): both the high-grade Pb-Ag-Cu-Au and the lower grade Cu-Au mineralisation appear to have resulted from a single phase of ore formation originating from the main vent of a volcanic centre (Mount Marshall), related to late-stage volcanism centred on subsidiary vents at Mineral Hill and Parkers Hill. The higher grade Pb-Ag rich mineralisation is thought to be a product of volcanic exhalative activity; the copper-rich zones may represent former feeder zones or stockwork.
Mineralisation was remobilised during subsequent deformation and redeposited in quartz veins in the fragmental tuffs and in breccia zones in the jasperoid bodies.

Markham & Basden (1974): Pb:Zn and Cu:Pb:Zn ratios and metal zonation are consistent with volcanic exhalative origin. Disseminated form of mineralisation may have resulted from a high rate of sedimentation compared with the rate of sulphide precipitation.
Ore was subsequently remobilised into its present form.

Recent exploration has confirmed an epithermal setting for the gold mineralisation (Elf Aquitaine Triako Mines Ltd).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Mineral Hill (D)

PRINCIPAL SOURCES: Brunker (1968, 1973), Markham & Basden (1974), Fleming (1976), Pogson & Felton (1978), Markham (1982), Elf Aquitaine Triako Mines Ltd (1986), Guy (1986).

SUMMARY

Mineral Hill lies in the southern part of the Mineral Hill Synclinorial Zone. Mineralisation comprises disseminated copper-gold sulphide ore in felsic volcanics and vein, disseminated and lensoid lead-silver (-copper-gold) sulphides in overlying altered tuffs and limestones, localised at the upper contact of the Middle-?Late Silurian Mineral Hill Volcanics. Past production has been derived entirely from the enriched supergene zone.

REGIONAL SETTING: MINERAL HILL SYNCLINORIAL ZONE
PRINCIPAL SOURCES: Brunker (1968, 1973), Markham & Basden (1974).

The Mineral Hill Synclinorial Zone is a narrow structural zone which is possibly connected to the Cobar Block NW of the exposed synclinorial sequence. The zone is considered to have developed as a volcanic rift resulting from crustal extension (Scheibner, 1976).
The rocks of the zone are exposed in four NNW-trending sub-continuous belts. CANBELEGO (Deposit No.7) lies at the northern tip of the northernmost belt, Mineral Hill near the southern extremity.
Similar smaller mineral deposits are associated with felsic pyroclastic/sedimentary sequences throughout the synclinorial zone.
The synclinorial sequence is flanked by Cambrian-Ordovician (Girilambone Beds) and ?Early Silurian (Ballast Beds) basement rocks of the Girilambone Anticlinorial Zone and Canbelego Block to the E, and the Canbelego and Bobadah Composite Blocks to the W.
The Mineral Hill Synclinorial Zone and Cobar Block contain Silurian and Devonian sediments and felsic volcanics which are separated from the older complexes mostly by unconformities.
Deformation within the zone is highly variable although there has apparently been only one period of cleavage-forming deformation. Localised zones of more intense deformation occur in the Mineral Hill region in the southern part of the zone.

REGIONAL SUCCESSION: MINERAL HILL SYNCLINORIAL ZONE
PRINCIPAL SOURCES: Brunker (1973), Markham & Basden (1974), Pogson & Felton (1978).

1./ Oo.na Group (Suo on Nymagee 1:250 000 geological map) (Late Silurian -Early Devonian), comprising:-
i) Mineral Hill Volcanics (Late Silurian) (possibly equivalent to Mount Hope Volcanics in Cobar Block) - rhyolite, rhyolitic to dacitic ashfall and ashflow tuff, minor possible toscanite, agglomerate, dacite, claystone, tuffaceous siltstone, calcareous sediments; deposited in both shallow marine and terrestrial environments. The area of outcrop of the volcanics is restricted to two belts 13 km x 2.5 km and 9 km x 4 km. The unit is host to the Mineral Hill auriferous base-metal sulphide mineralisation. Overlain with erosional disconformity by:-
ii) Talingaboolba Formation (Early Devonian) - conglomerate, breccia, sandstone, shale, grey-green siltstone, claystone, limestone.
2./ Kopyje Group and equivalents (Early Devonian) - rhyolite, tuff, sandstone, shale, limestone, conglomerate, siltstone. Overlain by:-
3./ Babinda Volcanics and equivalents (Sbv) (Early Devonian) - intrusive felsic volcanics, rhyolite tuffs, interbedded sediments.
4./ Barrow Range Beds and equivalents (Dlb) (Early Devonian) - conglomerate, siltstone, sandstone, calcarenite.
Stratigraphic relationships of 2./, 3./, 4./ not certain.

The sequence was deformed during the mid Devonian Tabberabberan Orogeny during the late stages of which the rocks in the Mineral Hill area were block faulted along normal NW to NNW faults. The westerly area of mineralisation (see 'LOCAL SETTING: MINERALISATION' below) is associated with a major NW-trending shear zone.

GEOLOGICAL SETTING: MINERAL HILL
PRINCIPAL SOURCES: Fleming (1976), Markham (1982), Guy (1986).

The Mineral Hill Volcanics consists of a lower pyroclastic section and an upper sedimentary section. From the base, the formation comprises:-
i) fine-grained vitric tuff unit; gradationally overlain by:-
ii) fragmental tuff unit (180 m thick); includes lapilli tuff and volcanic breccia; overlain by:-
iii) sedimentary unit (120 m); includes tuffaceous chert and siltstone, shale, limestone.
The volcanics and overlying Talingaboolba Formation are folded into an

anticline plunging shallowly SE. Dips are 20-30 deg.
Mineralisation occurs in the two upper units of the Mineral Hill Volcanics adjacent to the contact between volcanics and overlying sediments of the Talingaboolba Formation.
Mineralised areas are disposed in a broad curved zone which follows the surface trace of the folded contact zone.
The contact zone in the mineralised area is marked by development of jasperiodal gossan chert, partly replacing limestone, with dimensions 750 m x 120 m surface extent, and 105+ m depth.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Fleming (1976), Markham (1982), Elf Aquitaine Triako Mines Ltd (1986), Guy (1986).

The Mineral Hill deposit consists of two main areas of lead-silver (copper-gold) sulphide mineralisation. The easterly area includes the historical Parkers Hill lead-silver(-copper) mine and the Eastern base metal-gold-silver orebody, the subject of current exploration/mining operations. The westerly area includes the historical Mineral Hill lead-silver-gold field, of which the principal gold producer was the Iodide mine, and the Western and 5001 base metal-gold-silver orebodies, also the subject of current operations. Gold was also produced from low-grade copper(-gold) mineralisation in unaltered tuffs at Mount Marshall.
Mineralisation is apparently zoned upwards from relatively low-grade copper-rich ore in the volcanics through to more massive lead-zinc rich ore in the sedimentary/jasperoid units. The zones are:-
i) disseminated pyrite-gold in vitric tuff;
ii) copper-gold in disseminations and quartz veins, and lead-zinc in quartz veins, in lapilli tuff;
iii) lead-zinc-silver(-copper-gold) in disseminations, veinlets, and massive stratiform pyritic lenses in jasperiod bodies and associated silicified tuffs.
Gold mineralisation in the Eastern, Western and 5001 orebodies occurs in high-grade veins and disseminated zones associated with NW-trending, steep SW-dipping breccia zones. Some high-grade sections of the mineralisation are apparently constrained to steeply-pitching shoots within the breccia zones.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Brunker R.L., 1968
Nymagee 1:250 000 geological series map. Sheet SI 55-02. 1st edition.
Geological Survey of New South Wales
1v

Brunker R.L., 1973
Explanatory notes on the Nymagee, New South Wales 1:250 000 geological series map. Sheet SI55-2.
Geological Survey of New South Wales
1v

Elf Aquitaine Triako Mines Ltd, 1986
Gold at Mineral Hill.
New South Wales. Department of Mineral Resources. Minfo
11 P1-4

Fleming A., 1976
Descriptions of geology and mineralization 11. Geology and mineralization at the Mineral Hill prospect. IN Gilligan L.B., Markham N.L. & Suppel D.W. (eds) - Ore deposits of the Lachlan Fold Belt, New South Wales.
25th International Geological Congress. Excursion Guide
15C P34-35

Grant J.N., 1973
Mineral Hill prospect (base-metals), Exploration Licence 151, County Kennedy, New South Wales. Final Report. Kennecott Explorations (Aust) Ltd.
Geological Survey of New South Wales. Report
GS1973/178

Guy B.B., 1986
The Mineral Hill gold occurrence. IN Geological setting of precious metals in New South Wales. One-day symposium, Sydney, October 1986. Abstracts.
Geological Society of Australia
18

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.

Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

McClatchie L., 1971
Base metal mineralization at Mineral Hill, central western New South Wales.
Geological Survey of New South Wales. Memoirs (Geology)
11

Pogson D.J., Felton E.A., 1978
Reappraisal of geology, Cobar-Canbelego-Mineral Hill region, central western New South Wales.
Geological Survey of New South Wales. Quarterly Notes
33 P1-14

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 9 PARKES (GOONUMBLA)

DEPOSIT IDENTIFICATION:

SYNONYMS: Goonumbla

COMMODITIES: Cu, Au

DISTRIBUTION:
Record covers 3 major and 6 minor centres of mineralisation distributed across an area 9 km x 6 km, W of Goonumbla township. Nos. 157 (Endeavour 22), 161 on Narromine metallogenic map.

OREBODIES:
Parkes (Goonumbla) (D), Endeavour 20, Endeavour 22, Endeavour 26, Endeavour 27, Endeavour 28, Endeavour 28Ne, Endeavour 31, Endeavour 31Ne, Endeavour 37

MINES:
Endeavour 22, Endeavour 26, Endeavour 28, Parkes (Goonumbla)

GROUP: -

COMMENTS:
Includes regional setting of Girilambone Anticlinorial Zone.

LOCATION:

LATITUDE: 32 57 LONGITUDE: 148 6
250K SHEET: SI55 3 100K SHEET: 8532

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Orange
LOCAL GOVERNMENT AREA (LGA): Parkes

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1977	Geochemistry
1977	Geophysics
1977	Geology

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Parkes (Goonumbla) (D)	Parkes (Goonumbla)	Possible	Open-Cut
Endeavour 22	Endeavour 22	Possible	Open-Cut
Endeavour 26	Endeavour 26	Possible	Open-Cut
Endeavour 28	Endeavour 28	Possible	Open-Cut

COMPANIES:

OREBODY: Parkes (Goonumbla) (D)

PRESENT OPERATORS:
North Broken Hill Peko Ltd

PRESENT OWNERS:	EQUITY%
North Broken Hill Peko Ltd	100.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 0

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: -,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION			
June 1987	1,171	2.7	3,162	Paramarginal Demonstrated	Recoverable	o/c	Shallow oxidised ore, E 22, E 27; cut-off grade 1.0 g/t Au
June 1987	1,610	2.2	3,542	Paramarginal Demonstrated	Recoverable	o/c	Shallow oxidised ore, E 22, E 27; cut-off grade 0.75 g/t Au
June 1988	7,700	0.7	5,544	Paramarginal Demonstrated	In-Situ	o/c	Endeavour 27
June 1988	9,000	0.2	1,440	Paramarginal Demonstrated	In-Situ	o/c	Endeavour 26N
June 1988	13,100	0.6	7,205	Paramarginal Demonstrated	In-Situ	o/c	Endeavour 22
June 1988	25,200	0.6	15,876	Paramarginal Demonstrated	In-Situ	u/g	Endeavour 26N
June 1988	29,800	0.5	14,304	Paramarginal Demonstrated	In-Situ	o/c	Total Endeavours 22, 26N, 27 open-cut

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Girilambone Anticlinorial Zone
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Wombin Volcanics - Latest Ordovician-Early Silurian
LITHOLOGY: Altered porphyritic tuffs and lavas, monzonite and monzodiorite intrusives; minor sediments.
RELATIONSHIP TO MINERALISATION: Porphyry copper-gold mineralisation occurs in vertical pipe-like bodies of vein and disseminated sulphides, associated with quartz monzonite porphyry intrusives into altered andesitic volcanics.

GEOCHRONOLOGY:

Jones (1985): Wombin Volcanics dated at 423, 427 my, i.e. Middle Silurian.
Krynen & others (1989a): Wombin Volcanics dated at 430+-6, 435+-6 my minimum, i.e. Early Silurian.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Intermediate Intrusive,
SIGNIFICANT: Intermediate Extrusive

STRUCTURAL FEATURES:

MAJOR: Fracturing,
SIGNIFICANT: Fold Axis

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

MAJOR: Intrusive Contact

IGNEOUS ACTIVITY:

MAJOR: Sub-Volcanism (Intermediate),
SIGNIFICANT: Volcanism (Intermediate)

METAMORPHISM:

Low grade.

ALTERATION:

OREBODY: Parkes (Goonumbla) (D)

Mineralisation occurs in the core of a zone of intense potassic alteration and quartz stockwork veining. The potassic zone is fringed and in part overprinted by zones of phyllic (quartz-sericite-pyrite) and propylitic (epidote-chlorite-pyrite) alteration away from the high grade core.
Potassic alteration occurs as veins, vein envelopes, blebs and matrix flooding of K-feldspar-secondary biotite-carbonate.

OREBODY: Endeavour 20

Comprises pervasive pink K-feldspar flooding and development of secondary biotite, overprinted by a weak quartz-sericite-chlorite phase.
Later gypsum-anhydrite veining crosscuts all earlier mineralising and alteration phases below a vertical depth of 175 m.

OREBODY: Endeavour 22
Potassic alteration occurs in a cylindrical zone centred on quartz monzonite porphyry and extending laterally 80-200 m. Potassic zone is surrounded by a broad (200 m-wide) zone of propylitic alteration.

OREBODY: Endeavour 26
PRINCIPAL SOURCES: Heithersay (1986).

Heithersay (1986): mineralisation occurs in the core of a hydrothermal alteration system comprising in the core a zone of strong potassic alteration and stockwork quartz veining, which is fringed and in part overprinted by phyllic and propylitic zones.
The potassic zone is divided into three symmetric subzones, from the outermost in:-
i) biotite potassium feldspar subzone,
ii) outer potassium feldspar subzone,
iii) inner potassium feldspar subzone.

Heithersay (1986) identified a 10-stage alteration sequence:-
1./ Albitisation of feldspars, alteration of biotite to chlorite, quartz, calcite, fluorite.
2./ Development of biotite, accompanied by anhydrite, alkali feldspar, magnetite.
Stages 1 and 2 are represented in the biotite potassium feldspar subzone.
3./ and 4./ Development of vein stockworks containing quartz, alkali feldspar, anhydrite, fluorite, biotite, apatite, rutile, sericite, carbonate, plus bornite, chalcopyrite, hematite.
Stages 3 and 4 are represented in the outer potassium feldspar subzone, which pervades the Mosaic Porphyry, BQM, and adjacent volcanics, but not the Square Porphyry. Zone averages 100 m in width. Veins make up to 20% by volume of total rock. The outer potassium feldspar subzone is the most intensely altered and mineralised halo of the deposit.
5./ Magmatic/hydrothermal brecciation and vein dyke development.
By the end of Stage 5 the main body of mineralisation was present.
6./ and 7./ Development of vein stockworks containing quartz, alkali feldspar, biotite, anhydrite, chalcopyrite (stage 6), or milky quartz, minor anhydrite, fluorite, bornite, chalcopyrite (stage 7).
Stages 5, 6, and 7 are represented in the inner potassium feldspar subzone which is confined to the Square Porphyry. Vein density, alteration intensity and mineralised grades are lower than in the other subzones.
8./ Overprinting of quartz-sericite-pyrite+-chalcopyrite alteration.
Veins and vein envelopes combine to form an assymetric phyllic or quartz sericite zone up to 100 m wide. Phyllic alteration is fracture controlled.
9./ and 10./ Cross-cutting veins of carbonate-sulphate-zeolites (stage 9) and anhydrite to gypsum (stage 10).

OREBODY: Endeavour 27
Less intense than at Endeavours 22, 26. Potassic zone passes into weak propylitic. Alteration minerals include hornblende, biotite.

OREBODY: Endeavour 28
Mineralisation is associated with weak quartz-sericite alteration which forms the northern end of the main linear alteration zone.

OREBODY: Endeavour 31
Mineralisation is associated with fracture-controlled potassic alteration.

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Porphyry copper-gold in high level volcanic to subvolcanic zone.

STYLE:

MAJOR: Discordant

MORPHOLOGY: Pipe-Like

AGE OF MINERALISATION: Palaeozoic Early Silurian, Palaeozoic

Middle Silurian, Palaeozoic Late Ordovician

DIMENSIONS/ORIENTATION:

OREBODY: Parkes (Goonumbla) (D)

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			1300.0
DEPTH OXIDATION	(m)	10.0		35.0
DEPTH OF COVER	(m)			60.0

OREBODY: Endeavour 22

		MIN	AVE	MAX
DEPTH OF COVER	(m)	20.0		45.0

OREBODY: Endeavour 26

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			1300.0

OREBODY: Endeavour 27

		MIN	AVE	MAX
STRIKE LENGTH	(m)			30.0
VERTICAL DEPTH	(m)			175.0

ORE TEXTURE:

NATURE OF MINERALISATION:
PRIMARY ORE: Breccia, Dissemination, Pipe, Stockwork, Vein (Reef)

MINERALOGY:

OREBODY: Parkes (Goonumbla) (D)
Sulphide zone: bornite, chalcocite, chalcopyrite. Grainsize ranges from fine disseminated in the andesites and porphyries to coarse in broader quartz veins and breccias. Gold occurs as fine grains of free gold in host rock or quartz vein and as fine (< 5 microns) inclusions in sulphides. Gold content is strongly correlated with copper content. Pyrite, galena, sphalerite are associated with chloritisation in fault zones.

OREBODY: Endeavour 20
Sulphide zone: disseminated bornite, chalcopyrite and chalcocite.

OREBODY: Endeavour 22
Bornite-chalcocite dominates in vein stockworks; gradational to chalcopyrite (-bornite-chalcocite) in outer disseminated mineralisation. Quartz dominates in gangue in stockwork zone; calcite dominant in disseminated zone.

OREBODY: Endeavour 26
Sulphides: strongly correlated with alteration zoning. Bornite, chalcocite, (chalcopyrite, negligible pyrite), occur in the most heavily mineralised outer potassium feldspar subzone. Chalcopyrite, (bornite, pyrite) occur in the biotite potassium feldspar subzone. Chalcopyrite-pyrite (latter up to 4%) predominates in quartz-sericite (phyllic) zone.
BQM: oligoclase to andesine (20-35%), K-feldspar, biotite (5-10%), hornblende (5-10%), quartz (3-10%), apatite, sphene, magnetite.
Square Porphyry: albite to oligoclase (20-30%), K-feldspar (perthitic orthoclase) (latter two together up to 10%), quartz (up to 13%).

OREBODY: Endeavour 31
Sulphide zone: bornite, chalcopyrite, (gold, silver).

CONTROLS OF MINERALISATION:
Structural, provided by regional faults, ? local syncline.

GENETIC MODELS:
PRINCIPAL SOURCES: Jones (1985), Heithersay (1986).

Jones (1985): high-level volcanic to subvolcanic porphyry copper-gold system, formed in a continental margin-arc environment.
Petrological studies, age determinations, and whole-rock geochemical data indicate the intrusive and extrusive rocks at Goonumbla have been derived from a common magma source, represented by the Endeavour 31 mafic monzonite intrusion, and form a comagmatic suite in the calc-alkaline range.
Cyclic alternation from andesitic-dioritic to trachytic-monzonitic composition has occurred at least three times, with most of the copper-gold mineralisation being deposited toward the end of the second

trachytic-monzonitic phase.
The deposits are located in the centre of a former caldera interpreted to have formed largely by a process of collapse in a tensional tectonic regime.
The quartz monzonite porphyries were intruded to a high level in the volcanic pile and in terms of the strato-volcano model would sit just below the epithermal zone normally associated with fumarolic activity.
The high level of intrusion resulted in intense fracturing of the volcanics with subsequent formation of mineralized quartz vein stockworks.
Hydrothermal solutions were low in sulphur. (Jones, 1985).

Heithersay (1986): Endeavour 26 is a multiphase focussed porphyry copper-gold system according to the model of Burnham (1979, referred to by Heithersay, 1986), in which separate intermineral intrusives were formed by sequential intrusion of progressively fluid-depleted batches of magma:-
i) emplacement of the Mosaic Prophyry into the solidified part of the BQM stock, accompanied and preceded by permeation of fluids with an initially high sodium content,
ii) second boiling of the Mosaic Porphyry, and fracturing of outer carapace and adjacent volcanics, thereby allowing access by magmatic-derived hydrothermal fluids,
iii) reaction of fluids with magnetite-rich trachyte, producing biotite alteration,
iv) intense microfracturing, change to more oxidising fluids, favouring potassium feldspar alteration (Stage 3),
v) repeated fracturing and fluid flow; massive deposition of silica + sulphides (Stage 4),
vi) emplacement of the Square Porphyry, followed by a weaker repetition of the preceding hydrothermal cycle, suggesting that volatiles had been depleted from parent melt.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Parkes (Goonumbla) (D)

PRINCIPAL SOURCES: Jones (1985), Heithersay (1986), Sherwin, Clarke & Krynen (1987), Krynen, Sherwin & Clarke (1989a,b).
SUMMARY

Parkes (Goonumbla) lies in an anticlinorial structure along the eastern margin of the Girilambone Anticlinorial Zone. Porphyry copper-gold mineralisation occurs in vertical pipe-like bodies of vein and disseminated sulphides, associated with quartz monzonite porphyry intrusives into altered andesitic volcanics of the latest Ordovician-earliest Silurian Wombin Volcanics.

REGIONAL GEOLOGICAL SETTING: GIRILAMBONE ANTICLINORIAL ZONE
PRINCIPAL SOURCES: Bowman & others (1982), Jones (1985).

Goonumbla occurs within a thick sequence of calc-alkaline volcanic rocks spanning an age range from Early Ordovician to Early Silurian.
According to Jones (1985) the sequence was formed in a continental margin-arc environment at the eastern margin of a trough which was formed by tensional separation of Ordovician basement blocks now represented by the Girilambone and Young Anticlinorial Zones.
Bowman & others (1982), in accordance with the tectonic framework of New South Wales proposed by Scheibner (1976), favour formation in a volcanic arc environment (Molong Volcanic Arc) at the edge of a microcontinent (Parkes Terrace) formed by separation of a Girilambone basement block from the Australian continent (Bowman & others, 1982).

In the Scheibner (1976) model, basement rocks to the arc succession are metamorphosed sediments and basalts of the Girilambone group which accumulated as a flysch wedge (trench complex) at the then continental margin and were deformed during the Delamerian Orogeny (Middle Cambrian -Early Ordovician). During the Early Ordovician part of the newly-accreted Girilambone complex separated to form a microntinent, the Parkes Terrace (continuous with the Molong Microcontinent further S).
A volcanic arc, the Molong Volcanic Arc, developed at the leading edge of the Parkes Terrace.
Thick sequences of andesitic lavas, tuffs, and ignimbrites accumulated on the arc during the Ordovician. Fine sediments accumulated in a trough (Initial Cowra Trough - Tomingley Siltstone, Mugincoble Chert) which opened as a result of arc splitting, and on the Parkes Terrace (Cotton Formation).
The volcanic sequence was folded during the Benambran and Quidongan Orogenies (Late Ordovician-Early Silurian). The Parkes Thrust forms the anticlinorial/synclinorial zone boundary.

REGIONAL SUCCESSION: WEST OF PARKES THRUST
PRINCIPAL SOURCES: Sherwin, Clarke & Krynen (1987), Krynen, Sherwin &

Clarke (1989a).

1./ Nelungaloo Volcanics (Onv in Krynen & others, 1989a) (Early Ordovician) - andesitic lava, arkose, volcanic conglomerate, cherty siltstone; includes Yarrimbah Chert Member.
2./ Goonumbla Volcanics (Ogv) (Late Ordovician) - plagioclase-pyroxene -oxide-phyric andesitic lavas, lesser pyroclastic and volcanogenic epiclastic deposits, limestone; includes Gunningbland Shale Member and Billabong Creek Limestone Member. Conformably overlain by:-
3./ Wombin Volcanics (Owv) (latest Ordovician-Early Silurian) - altered, fractured, porphyritic tuffs and lavas (dacite, trachyte, andesite, rhyolite); monzonite, monzodiorite intrusives; minor sediments. Host to Goonumbla porphyry copper-gold deposits.
4./ Cotton Formation (C) (Late Ordovician-Early Silurian) - siltstone; deepwater facies equivalent of Goonumbla-Wombin Volcanics.
5./ Forbes Group (Sfg) (Middle-Late Silurian) - conglomerate, sandstone, mudstone.

Folding in the Goonumbla region is more open than that E of the Parkes Thrust in the Tumut Synclinorial Zone. Regional structure is dominated by the Forbes Anticline which has a sigmoidal axial trace and plunges S. Goonumbla lies near the axial zone of the fold. Regional dip is moderate W.

GEOLOGICAL SETTING: PARKES (GOONUMBLA)
PRINCIPAL SOURCES: Jones (1985).

Jones (1985) divided the Wombin Volcanics in the Goonumbla area into a lower trachytic unit and an upper andesitic unit. The lower unit consists of trachytic flows and pyroclastics with interbedded lenses of mafic tuff and agglomerate.
The upper unit consists of porphyritic andesitic flows, bedded ash tuffs, and coarse explosive pyroclastics. Jones (1985) postulated that the volcanics were deposited in a collapse caldera with a diameter of approximately 22 km.
The volcanics were intruded by a series of long, thin, discontinuous mafic monzonite and mafic quartz monzonite bodies, which were emplaced along the rim of the caldera to form what is now a large truncated ring dyke. Lithologies are transitional to monzodiorite, diorite, and gabbro.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Jones (1985).

Mineralisation is associated with small, pipe-like bodies of quartz-rich monzonite porphyry which formed as late-stage differentiates of the monzonitic magma and intruded up or near the contact zones of larger earlier intrusions.
The smaller bodies activated cells of intense hydrothermal activity which resulted in the formation of the porphyry copper-gold deposits. The ore zones comprise vertical pipe-like bodies of higher grade vein stockworks grading to lower grade disseminated zones in the andesites and quartz monzonite porphyries. Stockworks are localised along porphyry/andesite contacts in zones of most intense fracturing.
Small splitic quartz monzonite dykelets postdate the porphyries but are considered to be associated with the main mineralising event.

OREBODY: Endeavour 20

Mineralisation occurs within and about a small subporphyritic monzonite intrusion (Jones, 1985).
(Jones, 1985).

OREBODY: Endeavour 22

Orebody is located near centre of caldera. Volcanic lithologies comprise crystal-lithic tuffs, ash-fall tuffs, and agglomerates in the pyroclastic suite and porphyritic andesites and thin hornblende porphyry layers in the flow rocks.
Three varieties of intrusives occur: quartz monzonite porphyry, gabbro, and post-ore basalt dykes.
The sequence is dislocated on the W side of the deposit by a N-S fault. Host porphyry occurs as two subparallel lensoidal masses.
Mineralisation is dispersed in porphyry and andesites.

OREBODY: Endeavour 26

PRINCIPAL SOURCES: Heithersay (1986).

Host volcanic sequence consists of altered trachytic to trachyandesitic pyroclastics exhibiting variation in grainsize and texture indicative of rapid facies changes.
Three categories of intrusive rocks have been distinguished (Heithersay, 1986): premineral, mineralised, and post-mineral.
The earliest monzodiorite intrusive apparently forms a pipe 170 m in diameter NW of the mineral body. Three intrusives are associated with

mineralisation, termed biotite quartz monzonite (BQM), Mosaic Porphyry, and Square Porphyry. BQM forms the base and eastern wall of the orebody. The Mosaic and Square Porphyries occupy the core of the mineralised zone and are flanked by a zone of stockwork quartz veining up to 100 m wide in the upper levels. The Mosaic Porphyry is highly altered and mineralised and is apparently intruded and partly replaced by the Square Porphyry, which is moderately altered and mineralised.
Porphyries and wall-rock volcanics are cut by hydrothermal veins and associated trachytic breccia and by post-mineral monzonite porphyry dykes.

OREBODY: Endeavour 27

Orebody occurs higher in the sequence than Endeavour 22. Host volcanics are predominantly andesitic, with a higher proportion of flow rocks than at Endeavours 22, 26, where volcanics are mainly pyroclastic. Quartz monzonite body is large and coherent compared with those at Endeavours 22, 26. Porphyry is fine-grained at margin.
Porphyry occurs in an embayment in a larger mafic monzonite intrusion.
Hydrothermal breccia occurs in centre of porphyry.
Mineralisation is concentrated in stockwork, associated with central breccia. (Jones, 1985).

OREBODY: Endeavour 28

Low-grade chalcopyrite-pyrite occurs within a more siliceous phase of the Endeavour 26 eastern biotite quartz monzonite intrusion.

OREBODY: Endeavour 31

Mineralisation occurs within an intrusive breccia at the northern contact of the mafic monzonite intrusion.
Geochemical data and geological interpretation indicate that this stock, which is weakly mineralised in contrast to other mafic monzonites, is the parent body from which the mineralising quartz-rich phases at Endeavours 26, 28NE, 20 and 31 were derived. (Jones, 1985).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Bowman H.N., Richardson S.J., Dolanski J., 1980
Narromine, New South Wales, 1:250 000 metallogenic map. Sheet SI 55-3.
Geological Survey of New South Wales
1v

Bowman H.N., Richardson S.J., Dolanski J., 1982
Narromine 1:250 000 metallogenic series map. Sheet SI 55-3 - mine data sheets and metallogenic study.
Geological Survey of New South Wales
1v

Bowman H.N., Hobbs J.J., Barron L.M., 1983
The Goonumbla copper district northwest of Parkes.
Geological Survey of New South Wales. Records
21(2) M11-28

Clarke I., 1983
The Forbes-Parkes-Peak Hill-Tomingley gold belt - a compilation from exploration reports.
Geological Survey of New South Wales. Report
GS1983/076

Clarke I., 1985
Petrology of igneous rocks associated with gold and copper mineralization in the Parkes area.
Geological Survey of New South Wales. Report
GS1985/121

Clarke I., Krynen J., 1985
Gold in the Parkes area. IN Seminar: New South Wales, the potential for development. Abstracts.
AMF and Department of Mineral Resources. Report
GS1985/292 P16-19

Clarke I., 1987
Early Palaeozoic shoshonitic volcanism associated with gold and copper mineralization in the Parkes area, New South Wales. IN Proceedings, Pacific Rim Congress 87, Gold Coast, Queensland, August 1987.
AusIMM
1v P697-700

Heithersay P.S., 1986
Endeavour 26 North copper-gold deposit, Goonumbla, NSW - paragenesis and alteration zonation. IN Berkman D.A.(ed) - 13th CMMI Congress, Singapore

May 1986. Publications Volume 2. Geology and exploration.
13th Congress of Council of Mining & Metallurgical Institutions & AusIMM
3(2) P181-189

Jones G.J., 1985
The Goonumbla porphyry copper deposits, New South Wales.
Economic Geology
80(3) P591-613

Krynen J.P., Clarke I., Sherwin L., 1986
Geological setting of gold and copper mineralization in the Parkes area.
Geological Survey of New South Wales. Report
GS1986/059

Krynen J.P., Sherwin L., Clarke I., 1989
1. Stratigraphy and structure. IN Clarke I. & Sherwin L. (eds) - Geological setting of gold and copper deposits in the Parkes area, New South Wales.
Geological Survey of New South Wales. Records
23(1)

Krynen J.P., Sherwin L., Clarke I., 1989
Geological map of the Parkes area, scale 1:100 000 (parts of Sheets 8431, 8432, 8531 and 8532).
Geological Survey of New South Wales
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

Sherwin L., Clarke I., Krynen J.P., 1987
Revision of stratigraphic units in the Forbes-Parkes-Tomingley district.
Geological Survey of New South Wales. Quarterly Notes
67 P1-23

Tenison Woods K., 1983
Interpretation of regional aeromagnetic and gravity data for the Forbes and Narromine 1:250 000 sheets.
Geological Survey of New South Wales. Report
GS1983/200

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 10 PEAK HILL-TOMINGLEY

DEPOSIT IDENTIFICATION:

COMMODITIES: Au, Cu

DISTRIBUTION:
Record covers N-S line of deposits 40 km long between Tomingley (N) and Alectown (S). Nos. 79-87 (Tomingley), 89-98 (Peak Hill), 168-174 (Trewilga), 175-195 (Alectown) on Narromine metallogenic map.

OREBODIES:
Peak Hill-Tomingley (D), Alectown, Bobby Burns-Great Eastern (PH), Cemetery Reef (PH), Crown Of Peak Hill (PH), Myall, Paddys Flat (PH), Peak Hill, Tomingley, Trewilga, Wythes & Mooneys (PH)

MINES:
Alicks Paddock, Australia, Bachelors, Black Snake, Bobby Burns, Centenary, Coleman & Glasheen, Coleman & Party, Comet, Crowhurst & Sons, Crown Of Peak Hill (Golden Crown), Dead Bird, Dewar & Mcfarlane, Emu Reef, Frazer & Coleman, Frazer & Farquharson, Frazer & Ward, Great Britain, Great Eastern, Happy Valley, Live Bird, Monte Carlo, Myall United, Myall United (McPhails), Paddys Flat, Patons, Peak Hill, Peak Hill Proprietary, Sharpes, Sherlaw & Jones, Snows, Stockmans, The Bluff, Trewilga, Turners, Who'd A Thought It, Wythes & Mooneys

GROUP: Parkes Thrust Group

COMMENTS:
See Deposit No.11 PARKES for regional setting of Tumut Synclinorial Zone (N) and of Parkes Thrust group; Deposit No.23 GUNDAGAI for regional setting of Tumut Synclinorial Zone.

LOCATION:

LATITUDE: 32 44 LONGITUDE: 148 11
250K SHEET: SI55 3 100K SHEET: 8532

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Dubbo
LOCAL GOVERNMENT AREA (LGA): Narromine

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1893	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Alectown	Comet	Historical	Underground
Alectown	Australia	Historical	Underground
Alectown	Emu Reef	Historical	Underground
Alectown	Happy Valley	Historical	Underground
Alectown	Happy Valley	Historical	Surface
Alectown	Trewilga	Historical	Surface
Alectown	Great Britain	Historical	Underground
Alectown	Stockmans	Historical	Underground
Alectown	Stockmans	Historical	Open-Cut
Alectown	Sherlaw & Jones	Historical	Underground
Alectown	Live Bird	Historical	Underground
Alectown	Dead Bird	Historical	Surface
Alectown	Bachelors	Historical	Underground
Alectown	Bachelors	Historical	Surface
Alectown	Sharpes	Historical	Underground
Alectown	Sharpes	Historical	Surface
Alectown	Snows	Historical	Underground
Alectown	Alicks Paddock	Historical	Underground
Alectown	Alicks Paddock	Historical	Open-Cut
Alectown	Alicks Paddock	Historical	Surface
Bobby Burns-Great Eastern (PH)	Great Eastern	Historical	Underground

Bobby Burns-Great Eastern (PH)	Great Eastern	Historical	Open-Cut
Bobby Burns-Great Eastern (PH)	Bobby Burns	Historical	Underground
Bobby Burns-Great Eastern (PH)	Bobby Burns	Historical	Open-Cut
Cemetery Reef (PH)	Frazer & Farqunarson	Historical	Underground
Cemetery Reef (PH)	Frazer & Ward	Historical	Underground
Cemetery Reef (PH)	Coleman & Glasheen	Historical	Underground
Cemetery Reef (PH)	Frazer & Coleman	Historical	Underground
Cemetery Reef (PH)	Coleman & Party	Historical	Underground
Cemetery Reef (PH)	Dewar & Mcfarlane	Historical	Underground
Crown Of Peak Hill (PH)	Crown Of Peak Hill (Golden Crown)	Historical	Open-Cut
Crown Of Peak Hill (PH)	Crown Of Peak Hill (Golden Crown)	Historical	Underground
Myall	Myall United (McPhails)	Historical	Underground
Paddys Flat (PH)	Paddys Flat	Historical	Underground
Paddys Flat (PH)	Paddys Flat	Historical	Open-Cut
Paddys Flat (PH)	Paddys Flat	Historical	Surface
Peak Hill	Peak Hill Proprietary	Historical	Underground
Peak Hill	Peak Hill Proprietary	Historical	Open-Cut
Tomingley	Centenary	Historical	Underground
Tomingley	Crowhurst & Sons	Historical	Underground
Tomingley	Patons	Historical	Underground
Trewilga	Monte Carlo	Historical	Underground
Trewilga	Monte Carlo	Historical	Surface
Trewilga	The Bluff	Historical	Underground
Trewilga	The Bluff	Historical	Surface
Trewilga	Black Snake	Historical	Underground
Trewilga	Black Snake	Historical	Surface
Trewilga	Turners	Historical	Underground
Trewilga	Turners	Historical	Surface
Trewilga	Who'd A Thought It	Historical	Underground
Wythes & Mooneys (PH)	Wythes & Mooneys	Historical	Underground

COMPANIES:

OREBODY: Peak Hill

PRESENT OWNERS:	EQUITY%
Alkane Exploration N L	50.00
Molopo Australia Ltd.	50.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 4,095
Average recovered grade (Peak Hill) approximately 6.0 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: 1883-1912, 1988-,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Tumut Synclinorial Zone
SUB-PROVINCE: Tumut Synclinorial Zone (N)

HOST ROCKS:

FORMATION NAME & AGE: Mingelo Volcanics - Late Ordovician
LITHOLOGY: Altered plagioclase-(pyroxene)-phyric andesitic lavas and lesser pyroclastics.
RELATIONSHIP TO MINERALISATION: Host to disseminated gold-copper at Peak Hill and vein gold at Myall and Trewilga (some orebodies).

FORMATION NAME & AGE: Cotton Formation - Late Ordovician-Early Silurian
LITHOLOGY: Shale, siltstone, intercalated limestone.
RELATIONSHIP TO MINERALISATION: Host to vein gold at Tomingley and Trewilga (some orebodies). Overlies Mingelo Volcanics adjacent to disseminated mineralisation at Peak Hill.

FORMATION NAME & AGE: Mugincoble Chert - Late Ordovician
LITHOLOGY: Chert, siltstone.
RELATIONSHIP TO MINERALISATION: Host to vein gold at Alectown.

FORMATION NAME & AGE: Nash Hill Volcanics - Late Ordovician
LITHOLOGY: Altered intermediate porphyritic volcanics, volcanoclastics.
RELATIONSHIP TO MINERALISATION: Host to vein mineralisation at Daveys Diggings and Sherlaw & Jones.

GEOCHRONOLOGY:

Age of host sequence:-
- Late Silurian-Early Devonian (Chapman & Degeling, 1981);
- Late Silurian-Early Devonian (Bowman & Richardson, 1983);
- Late Silurian (Cordery, 1986);
- Late Ordovician-Early Silurian (Clarke, 1989).

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Intermediate Extrusive, Volcanogenic Sedimentary,
MINOR: Alluvium

STRUCTURAL FEATURES:

MAJOR: Faulting, Shearing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

SIGNIFICANT: Fault/Fault, Stratigraphic Boundary

IGNEOUS ACTIVITY:

MAJOR: Volcanism (Intermediate),
SIGNIFICANT: Sub-Volcanism (Intermediate)

METAMORPHISM:

Host sequence was regionally metamorphosed to greenschist facies prior to alteration.

ALTERATION:

OREBODY: Alectown

Primary mineralisation was associated with quartz-sericite-arsenopyrite wall rock alteration.

OREBODY: Myall

Mineralisation was associated with significant wall rock alteration.

OREBODY: Peak Hill

PRINCIPAL SOURCES: Bowman & Richardson (1983), Cordery (1986).

Cordery (1986): Twelve lateral and vertical alteration zones are developed peripheral to a major fracture-controlled conduit.
The hypogene alteration sequence in order of increasing intensity is: propylitic, argillic (sub-zones a,b), phyllic (sub-zones a,b,c), advanced argillic, silicic (sub-zones a,b).
See 'MINERALOGY' for alteration mineral assemblages.

The alteration sequence is superimposed by a zone of oxidation.
Gold is enriched at the base of the oxidised zone and within the zone of silicic alteration. The silicic sub-zone a is essentially an open space-filling vein composed of quartz-barite-pyrite and accompanied by intense silicification of the immediate wall rocks.
The silicic sub-zone b is essentially a highly silicified and mineralised variety of the phyllic sub-zone b. Open space textures are rare, and fracturing, brecciation, and ghosts of schistosity are common.
Peak Hill has similar alteration zoning pattern and style of mineralisation to TEMORA (GIDGINBUNG) (Deposit No. 16).
Chemically, alteration is characterised by increased Si, Al, K, Fe, S, Au, Sb, As, Tl, Ag, and reduced Cu.

OREBODY: Tomingley

Wall rock alteration was not significant.

OREBODY: Trewilga

Wall rock alteration not significant.

DEPOSIT CHARACTERISTICS:

TYPES:

MAJOR: Disseminated/quartz stockwork epithermal gold in altered intermediate volcanics.
SIGNIFICANT: Auriferous quartz veins in intermediate volcanics.
MINOR: Auriferous quartz veins in low to intermediate grade metasediments. Alluvial.

MORPHOLOGY: Pipe-Like, Tabular

AGE OF MINERALISATION: Palaeozoic Late Ordovician

DIMENSIONS/ORIENTATION:

OREBODY: Alectown

		MIN	AVE	MAX
DEPTH OF COVER	(m)	6.0		15.0
DEPTH OXIDATION	(m)		25.0	
TRUE WIDTH	(m)			12.0
STRIKE LENGTH	(m)			2000.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		E,(W)
STRIKE		320-015		

OREBODY: Bobby Burns-Great Eastern (PH)

		MIN	AVE	MAX
STRIKE LENGTH	(m)	61.0		95.0
TRUE WIDTH	(m)	15.0		30.0
VERTICAL DEPTH	(m)	92.0		173.0

OREBODY: Cemetery Reef (PH)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			183.0
TRUE WIDTH	(cm)			50.0
VERTICAL DEPTH	(m)			26.0
		ANGLE (deg.)		DIRECTION
DIP		80		E
STRIKE		355		

OREBODY: Myall

		MIN	AVE	MAX
STRIKE LENGTH	(m)	200.0		457.0
TRUE WIDTH	(cm)	100.0	250.0	600.0
VERTICAL DEPTH	(m)			229.0
DEPTH OXIDATION	(m)		100.0	
		ANGLE (deg.)		DIRECTION
DIP		65-75		E
PITCH				S
STRIKE		345		

OREBODY: Paddys Flat (PH)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			1500.0
TRUE WIDTH	(m)			300.0
VERTICAL DEPTH	(m)			46.0

OREBODY: Peak Hill

		MIN	AVE	MAX
STRIKE LENGTH	(m)			220.0
TRUE WIDTH	(m)			70.0
VERTICAL DEPTH	(m)			250.0
DEPTH OXIDATION	(m)		40.0	90.0

OREBODY: Tomingley

		MIN	AVE	MAX
STRIKE LENGTH	(m)			120.0
TRUE WIDTH	(cm)			500.0
VERTICAL DEPTH	(m)			120.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		S
STRIKE		170		E

OREBODY: Trewilga

		MIN	AVE	MAX

DEPTH OXIDATION	(m)			50.0
STRIKE LENGTH	(m)			100.0
VERTICAL DEPTH	(m)	49.0		
		ANGLE (deg.)		DIRECTION
DIP		70-90		E
STRIKE		330-360		

OREBODY: Wythes & Mooneys (PH)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			56.0
TRUE WIDTH	(m)			10.0
VERTICAL DEPTH	(m)			110.0

ORE TEXTURE:

NATURE OF MINERALISATION:

PRIMARY ORE: Dissemination, Lode (Alteration Zone), Multiple Veins, Pipe, Vein (Reef),

SECONDARY ORE: Detrital (Alluvial), Supergene Enrichment

MINERALOGY:

OREBODY: Bobby Burns-Great Eastern (PH)

Sulphide zone: pyrite, tennantite, gold.

OREBODY: Cemetery Reef (PH)

Sulphide zone: pyrite, gold.

OREBODY: Myall

Reefs consisted of massive quartz with only a small amount of other minerals. In the primary zone the quartz is reported to have contained about 0.5-3% pyrite. Ore grades decreased with depth.

OREBODY: Peak Hill

PRINCIPAL SOURCES: Bowman & others (1980, 1982), Cordery (1986).

Pre-alteration assemblage of host rocks = chlorite-sodic plagioclase-sericite-epidote-actinolite-carbonate-magnetite.

Sulphide zone (ore): pyrite, tennantite, enargite, chalcopyrite, bowrite, chalcocite, covellite (the latter two are probably in part secondary). Disseminated pyrite makes up 3-10% average, maximum 25%, of the altered rock. Gold occurs as native gold and gold telluride, associated with pyrite. Copper occurs as tennantite coating on pyrite, and as enargite in part replacing pyrite. Copper may post-date the gold-pyrite deposition.

ALTERATION ASSEMBLAGES:-

i) propylitic zone - sericite-chlorite+-paragonite, kaolinite, Fe oxide.
ii) argillic zone - paragonite-kaolinite+-chlorite, sericite, quartz. Pyrite in sub-zone b.
iii) phyllic zone - sericite-quartz-pyrite+-paragonite, kaolinite in sub-zone b; barite, alunite in sub-zone c.
iv) advanced argillic zone - pyrophyllite-quartz+-barite, alunite, jarosite.
v) silicic zone - quartz-pyrite-barite+-alunite, sericite.

Oxidised zone: quartz-sericite-Fe oxide-jarosite+-pyrophyllite, barite, wavellite.

OREBODY: Tomingley

Sulphide zone: pyrite.
Oxide zone: free gold.

OREBODY: Trewilga

Sulphide zone: pyrite, auriferous pyrite, tetrahedrite, arsenopyrite, (gold).
Oxide zone: malachite, azurite, chalcocite, cuprite, argentojarosite, (pyrolusite).

OREBODY: Wythes & Mooneys (PH)

Sulphide zone: gold, pyrite, tennantite.

CONTROLS OF MINERALISATION:

Controls are mainly structural, provided by regional fracture zone. Lithological control provided by nature of host rocks (intermediate volcanics).

GENETIC MODELS:

PRINCIPAL SOURCES: Chapman & Degeling (1981), Bowman & others (1982), Cordery (1986), Clarke (1989).

Bowman & others (1982): porphyry copper-gold deposit. The host rocks are interpreted as being the remains of a (?Late Silurian) emergent dacitic volcano built on Early Ordovician andesitic basement. By the Late Silurian, the andesite had become an island arc and by Early Devonian had sunk below sea level.

Chapman & Degeling (1981): mineralisation was associated with a hydrothermal system generated by a cooling magma chamber of subvolcanic intrusive. Boiling of the hydrothermal fluids caused precipitation of sulphides, gold, and silica, thereby forming porous silica-pyrite pods with relatively high gold content in the core of the system and lower grade disseminations of pyrite containing gold in the outer zones.

Both Bowman & others (1982) and Chapman & Degeling (1981) inferred that mineralisation was broadly coeval with volcanism.

Clarke (1989): volcanic epithermal deposit, related to subvolcanic intrusion of probable monzonitic composition, and subjected to substantial post-mineralisation deformation. Clarke (op.cit) compared Peak Hill with the high sulphur-type, epithermal-transitional-to-porphyry system of Bonham (1986), or with the acid-sulphate volcanic-hosted epithermal model of Heald & others (1987). (Latter two references given by Clarke, 1989).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Peak Hill-Tomingley (D)

PRINCIPAL SOURCES: Bowman & others (1980, 1982), Markham (1982). Clarke (1989), Krynen & others (1989a,b).

SUMMARY

Peak Hill and Tomingley lie in the northern part of the Tumut Anticlinorial Zone on the postulated northern extension of the Parkes Fault. Mineralisation comprised disseminated gold-copper deposits in strongly altered Late Ordovician andesitic volcanics at Peak Hill (Mingelo Volcanics), and at Daveys Diggings and Sherlaw & Jones (Nash Hill Volcanics), vein gold deposits in the Mingelo Volcanics at Trewilga and Myall, vein gold and derived alluvial deposits in the overlying Late Ordovician tuffaceous/lithic siltstone and sandstone (Cotton Formation) at Tomingley and Trewilga, and vein gold deposits in the Mugincoble Chert at Alectown.

REGIONAL SETTING: PEAK HILL-TOMINGLEY

PRINCIPAL SOURCES: Bowman & others (1982), Cordery (1986), Sherwin & others (1987), Krynen & others (1989a,b).

According to Krynen & others (1989b) Peak Hill lies on the eastern limb of an anticline, the Peak Hill Anticlinorium. Late Ordovician-Early Silurian volcanics - the Mingelo Volcanics - are exposed in the core of the anticlinorium and are overlain by Late Ordovician sediments of the Cotton Formation.

The Late Ordovician-Early Silurian volcanic sequence comprises a basal relatively unaltered volcanic conglomerate overlain by strongly altered and sheared rocks (Mingelo Volcanics). The conglomeratic andesitic wackes are interpreted as mass-flow deposits that accumulated at the base of the fore-arc slope of the Goonumbla Volcanic Complex (Cordery, 1986).
The altered rocks are host to the main mineralisation at Peak Hill.
The altered rocks are overlain by laminated tuffaceous sediments of the Cotton Formation, which are host to vein mineralisation at Tomingley and Trewilga, and to minor vein mineralisation at Peak Hill.
The Ordovician-Silurian sequence strikes N-S, dips steeply E, and is believed to face generally E.
A dominant N-S regional trend is offset by NW and NE oblique faults.
The N-S Parkes Fault is postulated to pass to the E of Tomingley-Peak Hill within the sedimentary sequence (Cotton Formation).
At least three periods of deformation can be identified in the Peak Hill area.

OREBODY: Alectown

The orebody refers to a belt of alluvial and shallow vein and/or multiple vein deposits and one possible disseminated deposit in a NNE belt 23 km long to the E and N of Alectown.
The primary deposits included Comet, Happy Valley, Great Britain, Emu Reef, Stockmans, Sherlaw & Jones, Sharpes, Daveys Diggings, Snows, Pride of Alectown, and Birds Nest. Host rocks are metamorphosed siltstone, slate, andesite, tuff, and sandstone of the Mugincoble Chert, and altered volcanics of the Nash Hill Volcanics.
At Sherlaw & Jones, the largest reef producer, multiple quartz veins were controlled by a joint system striking 080 deg.
Three types of veins occurred: in order of abundance, milky quartz

with trace carbonate, quartz-chlorite, quartz-carbonate-chlorite.
The alluvial deposits included Alicks Paddock, and the Live Bird, Dead Bird, and Bachelors leads. Thickness of alluvial gravel = 15-23 m.

OREBODY: Cemetery Reef (PH)
Host rocks were feldspathic and lithic-feldspathic tuff, and felsic lava.

OREBODY: Myall
The orebody is located 3 km S of Tomingley and 14 km N of Peak Hill. Mineralisation occurred in two prominent quartz reefs, the Main Reef and the Queen Reef, within intermediate volcanic host rock (Mingelo Volcanics). The reefs were approximately parallel and separated by 18 m of country rock.

OREBODY: Paddys Flat (PH)
Wash thickness = 15-45 cm.

OREBODY: Peak Hill
GEOLOGICAL SETTING: PEAK HILL
PRINCIPAL SOURCES: Markham & Basden (1974), Bowman & others (1980), Chapman & Degeling (1981), Bowman & others (1982), Markham (1982), Cordery (1986), Clarke (1989), Krynen & others (1989a,b).

The country rocks in the Peak Hill area are Late Ordovician andesitic volcanics, greywacke, turbidite, tuffaceous and calcareous conglomerate (Goonumbla Volcanics and Cotton Formation).
At Peak Hill these units are overlain and intruded by strongly hydrothermally altered and highly sheared dacitic tuffs, lavas, and related intrusions of the Mingelo Volcanics (Krynen & others, 1989a).
The altered rocks directly overlie volcanic conglomerate that is only marginally affected by alteration, and are overlain by laminated sedimentary rocks (Bowman & others, 1982). Cordery (1986) describes the host rocks as andesitic conglomeratic wackes containing fragments of plagioclase-pyroxene-phyric volcanics and pyroclastics set in a matrix of plagioclase crystal and lithic debris.
The sequence strikes N-S, dips steeply E, and probably faces E.
Cleavage is defined by alignment of chlorite, and strikes N-S, dips E and W. Thickness of the altered sequence = 450 m.
Bowman & others (1982) identified intrusive dacitic volcanics within the host formation, with which the mineralisation is particularly associated.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Chapman & Degeling (1981), Bowman & others (1982), Markham (1982), Cordery (1986), Clarke (1989).

The Peak Hill field comprises a series of eight disseminated gold-copper orebodies within a roughly elliptical zone 1200 m long and up to 600 m wide within a belt of altered rocks over 2 km long.
The largest orebody was Peak Hill itself; other Peak Hill orebodies are identified in this report by the suffix (PH) on the orebody name.

The main alteration zone is developed within a major meridional shear zone coincident with an antiformal hinge zone and an andesitic/siltstone contact. The eastern boundary of the alteration zone is sharp and is presumed to be faulted; the western boundary is gradational and shows the transition from highly altered rocks through less altered, finally to undeformed, relatively fresh andesitic volcanics.

Gold mineralisation is localised in zones of more intense alteration and breccia pipe formation at the intersections of regionally important NW fractures and the main shear zone. The main Peak Hill orebody lies in the western part of the zone; Lamberts, Great Eastern, Crown, and Bobby Burns lie along a NW lineament to the E, passing through the centre of the alteration zone.
Mineralisation is mostly disseminated; vein-type quartz is rare.
Alluvial deposits were worked at the Golden Hole lead and Paddys Flat.

OREBODY: Tomingley
The Tomingley orebodies are the northernmost deposits of the Parkes Fault gold belt. Mineralisation embraces a zone, striking 170 deg and dipping steeply E, of short narrow quartz veins hosted by laminated and cleaved siltstone of the Cotton Formation. The veins apparently lie on the same reef which has been offset by faulting.
S-pitching ore shoots were formed by weathering.
Pyroxene-phyric volcanic rocks (augite andesite) occur on the mine dumps and were reportedly closely associated with the ore zones.
Total width of vein system = up to 40 m.

OREBODY: Trewilga
Trewliga consisted of a clustering of small vein and derived alluvial deposits between 7 and 12 km S of Peak Hill. Host rocks are

metasediments and conglomerate of the Cotton Formation and andesite and fine-grained tuff of the Mingelo Volcanics. Lithologies include (volcaniclastic) shale, sandstone, siltstone, conglomerate, greywacke, andesitic lavas. Mineralisation, at least at two localities, was associated with zones of multiple quartz veining in a shear zone parallel to axial plane cleavage; veining was localised within siltstone or at siltstone/volcanogenic sandstone contacts.
One of the orebodies, Black Snake, apparently lay near the axis of a major S-plunging anticline with an E-dipping axial plane. The anticline is considered to be near isoclinal; axial plane cleavage strikes 140 deg.

OREBODY: Wythes & Mooneys (PH)
Host rock was reportedly dacite.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Bowman H.N., Richardson S.J., 1977
A brief investigation of the Peak Hill disseminated copper-gold deposit.
Geological Survey of New South Wales. Report
GS1977/278

Bowman H.N., Richardson S.J., 1978
A brief examination of the Peak Hill disseminated gold district.
Geological Survey of New South Wales. Report
GS1978/278

Bowman H.N., Richardson S.J., Dolanski J., 1980
Narromine, New South Wales, 1:250 000 metallogenic map. Sheet SI 55-3.
Geological Survey of New South Wales
1v

Bowman H.N., Richardson S.J., Dolanski J., 1982
Narromine 1:250 000 metallogenic series map. Sheet SI 55-3 - mine data sheets and metallogenic study.
Geological Survey of New South Wales
1v

Bowman H.N., Richardson S.J., 1983
Alteration zoning at the Peak Hill disseminated copper-gold deposit.
Geological Survey of New South Wales. Records
21(2) M75-84

Chapman J., Degeling P.R., 1981
Some disseminated gold deposits in New South Wales.
Geological Survey of New South Wales. Report
GS1981/567

Clarke I., 1983
The Forbes-Parkes-Peak Hill-Tomingley gold belt - a compilation from exploration reports.
Geological Survey of New South Wales. Report
GS1983/076

Clarke I., 1985
Primary mineralization in the Forbes-Parkes-Peak Hill-Tomingley gold belt.
Geological Survey of New South Wales. Report
GS1985/123

Clarke I., 1989
4. Primary deposits in the Forbes-Parkes-Peak Hill-Tomingley gold belt. IN Clarke I. & Sherwin L. (eds) - Geological setting of gold and copper deposits in the Parkes area, New South Wales.
Geological Survey of New South Wales. Records
23(1)

Clarke I., Sherwin L., 1989
Geological setting of gold and copper deposits in the Parkes area, New South Wales.
Geological Survey of New South Wales. Records
23(1)

Cordery G., 1986
Epithermal alteration zonation at Peak Hill. In Geological setting of precious metals in New South Wales. One-day symposium, Sydney, October 1986. Abstracts.
Geological Society of Australia
18

Krynen J.P., Sherwin L., Clarke I., 1989

1. Stratigraphy and structure. IN Clarke I. & Sherwin L. (eds) - Geological setting of gold and copper deposits in the Parkes area, New South Wales.
Geological Survey of New South Wales. Records
23(1)

Krynen J.P., Sherwin L., Clarke I., 1989
Geological map of the Parkes area, scale 1:100 000 (parts of Sheets 8431, 8432, 8531 and 8532).
Geological Survey of New South Wales
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Sherwin L., Clarke I., Krynen J.P., 1987
Revision of stratigraphic units in the Forbes-Parkes-Tomingley district.
Geological Survey of New South Wales. Quarterly Notes
67 P1-23

Tenison Woods K., 1983
Interpretation of regional aeromagnetic and gravity data for the Forbes and Narromine 1:250 000 sheets.
Geological Survey of New South Wales. Report
GS1983/200

Tenison Woods K., 1989
2. Regional geophysics. IN Clarke I. & Sherwin L. (eds) - Geological setting of gold and copper deposits in the Parkes area, New South Wales.
Geological Survey of New South Wales. Records
23(1)

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 11 PARKES

DEPOSIT IDENTIFICATION:

SYNONYMS: Billabong, Bushman, London-Victoria

COMMODITIES: Au

DISTRIBUTION:
Record covers vein and deep lead fields which occupy NNE-trending zone extending N from Tichborne and centred on Parkes. Nos. 30-90 on Forbes metallogenic map.

OREBODIES:
Parkes (D), Baden-Powell, Beargamil, Ben Nevis, Birthday, Bonnie Dundee, Bread & Dripping, Buchanan/Phoenix, Bushman, Bushmans (New Bushmans Hill), Currajong, Dayspring, Federal/Possum, Growlers, Hazelbank, Homeward Bound, Kables , Koh-I-Noor , London , London-Victoria, McGregors, McGuiggans, Mount Morgan, Nibblers, Nibblers Hill, No Mistake/Reids Gully, Old Ramsays, Pukka, Scrubby Plains, Secret, Tichborne, Tichborne/Wapping Butcher, Welcome, Welcome (Wild Cat)

MINES:
All Nations, Baden-Powell, Band Of Hope, Ben Nevis, Birthday, Blue Reef, Bonnie Dundee, Buchanan, Bushman, Bushmans, Caledonian Hill, Currajong, Dayspring, Fairy, Federal, Frenchmans, Fulton, Gersbachs, Gladstone, Great Northern, Hazelbank, Homeward Bound, Kables, Koh-I-Noor, Lady Jersey, Little Bushman, Little Wonder, London, London-Victoria, Majors, McGregors, McGuiggans, McGuiggans North, McGuiggnas South, McMillans, Melbourne, Mount Pleasant, New Bushmans Hill, New Haven, Nibblers, Nibblers Hill, No Mistake, Paddys Flat/Yarran, Phoenix (Haselhurst), Pioneer, Possum, Possum Gully, Pukka, Ramsays, Reids Gully, Richardsons, Sardine, Scrub, Scrubby Plains, Secret, Shallow Rush, Shaws, Staples, Sydney Clinker, Tearaway, Tichborne, Victoria, Wapping Butcher, Welcome, Well Tried

GROUP: Parkes Thrust Group

COMMENTS:
Record includes regional setting of Tumut Synclinorial Zone (N) and of Parkes Thrust group. See Deposit No.23 GUNDAGAI for regional setting of Tumut Synclinorial Zone.

LOCATION:

LATITUDE: 33 8 LONGITUDE: 148 11
250K SHEET: SI55 7 100K SHEET: 8531

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Orange
LOCAL GOVERNMENT AREA (LGA): Parkes

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1862	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Baden-Powell	Baden-Powell	Historical	Underground
Ben Nevis	Ben Nevis	Historical	Underground
Birthday	Birthday	Historical	Underground
Birthday	Birthday	Historical	Surface
Bonnie Dundee	Bonnie Dundee	Historical	Underground
Buchanan/Phoenix	Buchanan	Historical	Underground
Buchanan/Phoenix	Phoenix (Haselhurst)	Historical	Underground
Bushman	Bushman	Historical	Underground
Bushman	Shallow Rush	Historical	Underground
Bushman	Little Bushman	Historical	Underground
Bushman	Great Northern	Historical	Underground

Bushman	Possum Gully	Historical	Underground
Bushman	Sardine	Historical	Underground
Bushmans (New Bushmans Hill)	Bushmans	Historical	Underground
Bushmans (New Bushmans Hill)	New Bushmans Hill	Historical	Underground
Dayspring	Currajong	Historical	Underground
Dayspring	Homeward Bound	Historical	Underground
Dayspring	Dayspring	Historical	Underground
Dayspring	Pioneer	Historical	Underground
Federal/'Possum	Gladstone	Historical	Underground
Federal/'Possum	Mount Pleasant	Historical	Underground
Federal/'Possum	Possum	Historical	Underground
Federal/'Possum	Caledonian Hill	Historical	Underground
Federal/'Possum	Federal	Historical	Underground
Hazelbank	Hazelbank	Historical	Underground
Homeward Bound	Homeward Bound	Historical	Underground
Kables	Kables	Historical	Underground
Koh-I-Noor	Koh-I-Noor	Historical	Underground
London	London	Historical	Underground
London	All Nations	Historical	Underground
London	Little Wonder	Historical	Underground
London	Sydney Clinker	Historical	Underground
London-Victoria	Band Of Hope	Historical	Underground
London-Victoria	Victoria	Historical	Underground
London-Victoria	London	Historical	Underground
London-Victoria	London	Historical	Open-Cut
London-Victoria	Shaws	Possible	Open-Cut
London-Victoria	Shaws	Historical	Open-Cut
London-Victoria	New Haven	Historical	Underground
London-Victoria	New Haven	Historical	Open-Cut
London-Victoria	Majors	Historical	Underground
London-Victoria	Majors	Historical	Open-Cut
London-Victoria	Gersbachs	Historical	Open-Cut
London-Victoria	London-Victoria	Operating	Open-Cut
McGregors	McGregors	Historical	Underground
McGregors	McGregors	Historical	Surface
McGuiggans	McGuiggans North	Historical	Underground
McGuiggans	McGuiggnas South	Historical	Underground
Nibblers	Nibblers	Historical	Underground
Nibblers Hill	Nibblers Hill	Historical	Underground
Nibblers Hill	Nibblers Hill	Historical	Open-Cut
No Mistake/Reids Gully	No Mistake	Historical	Underground
No Mistake/Reids Gully	Reids Gully	Historical	Underground
Old Ramsays	Ramsays	Historical	Underground
Pukka	Pukka	Historical	Underground
Scrubby Plains	Scrubby Plains	Historical	Unknown
Secret	Secret	Historical	Underground
Tichborne	Lady Jersey	Historical	Underground
Tichborne	Scrub	Historical	Underground
Tichborne	McMillans	Historical	Underground
Tichborne	Staples	Historical	Underground
Tichborne	Blue Reef	Historical	Underground
Tichborne	McGuiggans	Historical	Underground
Tichborne/Wapping Butcher	Wapping Butcher	Historical	Underground
Tichborne/Wapping Butcher	Well Tried	Historical	Underground
Tichborne/Wapping Butcher	Tichborne	Historical	Underground
Tichborne/Wapping Butcher	Fairy	Historical	Underground
Welcome	Welcome	Historical	Underground
Welcome	Frenchmans	Historical	Underground
Welcome	Tearaway	Historical	Underground
Welcome	Melbourne	Historical	Underground
Welcome	Fulton	Historical	Underground
Welcome	Richardsons	Historical	Underground
Welcome	Paddys Flat/Yarran	Historical	Underground
Welcome (Wild Cat)	Welcome	Historical	Underground

COMPANIES:

OREBODY: London-Victoria

PRESENT OPERATORS:
B H P Gold Mines Ltd

PRESENT OWNERS:	EQUITY%
B H P Gold Mines Ltd	100.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 11,309
Average recovered grade reef deposits 60-100 g/t Au, locally 300 g/t, median around 35 g/t Au. London-Victoria 4.5 g/t Au

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1915-1952), 1862-1867, 1871-1914, 1989-,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION			
May 1988	65	3.2	208	Economic Demonstrated	In-Situ	o/c	London-Victoria
May 1988	1,375	2.3	3,121	Economic Demonstrated	Recoverable	o/c	London-Victoria
Dec 1987	313	2.7	829	Paramarginal Demonstrated	In-Situ	o/c	Shaws

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Tumut Synclinorial Zone
SUB-PROVINCE: Tumut Synclinorial Zone (N)

HOST ROCKS:

FORMATION NAME & AGE: Parkes Volcanics - Late Ordovician
LITHOLOGY: Altered intermediate volcaniclastics with some lavas - interbedded andesitic and trachytic tuffs, crystal tuffs, porphyritic flows, breccia, chert, possible andesitic intrusions.
RELATIONSHIP TO MINERALISATION: Host to gold-quartz mineralisation in single and multiple vein systems in steeply-dipping fault/shear zones at London-Victoria, Mount Morgan, Nibblers Hill, Macgregors, ?Birthday, and smaller orebodies.

FORMATION NAME & AGE: Nash Hill Volcanics - Late Ordovician
LITHOLOGY: Altered intermediate porphyritic volcanics - mainly flow brecciated lavas porphyritic in plagioclase, and pyroxene and/or hornblende.
RELATIONSHIP TO MINERALISATION: Host to gold-quartz mineralisation in single and multiple vein systems in steeply-dipping fault/shear zones at Bushmans (New Bushmans Hill) (part), Buchanan/Phoenix, Bonnie Dundee, Federal/Possum, and smaller orebodies.

FORMATION NAME & AGE: Cotton Formation - Late Ordovician-Early Silurian
LITHOLOGY: Argillaceous sediments - variegated and banded slate (chert), and siltstone; limestone; intraformational debris-flow deposits - conglomerate, massive feldspathic sandstone.
RELATIONSHIP TO MINERALISATION: Host to gold-quartz veins in variably-dipping oblique fault/shear zones, mostly at sediment/volcanic contacts, at Dayspring, Homeward Bound, Currajong, Pioneer, Bushmans (NBH), Koh-i-noor, Ben Nevis, London-Victoria(Band of Hope,New Haven).

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to alluvial and deep lead deposits.

GEOCHRONOLOGY:

Age of mineralisation:-
Mineralisation evidently related to second phase of deformation, which may have occurred during Late Silurian-Early Devonian, Middle Devonian, or Carboniferous (Clarke, 1989; Krynen & others, 1989a).
Middle Devonian or Carboniferous age of deformation and mineralisation considered most likely (Clarke, 1989; Krynen & others, 1989a).

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Alluvium, Clastic Sedimentary, Intermediate Extrusive,
SIGNIFICANT: Volcanogenic Sedimentary

STRUCTURAL FEATURES:

MAJOR: Faulting, Shearing,
SIGNIFICANT: Fold Axis

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

MAJOR: Stratigraphic Boundary

IGNEOUS ACTIVITY:

MAJOR: Volcanism (Intermediate)

METAMORPHISM:
Regional metamorphic grade is lower greenschist facies.

ALTERATION:

OREBODY: Parkes (D)
PRINCIPAL SOURCES: Clarke (1989).

Volcanic host rocks are pervasively altered, with localised zones of chloritisation, sericitisation, pyritisation, K-feldspar flooding, carbonatisation, and silicification. Within the Parkes area, sericitisation is generally more intensive southwards.
Alteration minerals are: carbonate, chlorite, sericite, quartz, pyrite. Siliceous ironstone (jasperoid) is closely associated with the altered rocks.
Hydrothermal quartz in the form of stockworks and veinlets also occurs.

OREBODY: Bonnie Dundee
Host andesites were hydrothermally altered.

OREBODY: Buchanan/Phoenix
Host rocks were hydrothermally altered.

OREBODY: Bushmans (New Bushmans Hill)
Insignificant.

OREBODY: Dayspring
Insignificant.

OREBODY: Federal/'Possum
Mineralisation was associated with hydrothermal alteration, with strong pyrite development in the slates and andesite.

OREBODY: London-Victoria
Mineralisation is associated with a wide zone of strong hydrothermal alteration. Alteration minerals are chlorite, pyrite and fine-grained sericite. The nature of the alteration zone changes along strike. At the northern end of the line of lode, the zone is relatively narrow (up to 15 m wide) with several easterly offshoots. Further S, in the vicinity of London mine, the zone is up to 35 km wide and the easterly offshoots are less pronounced.
A fault breccia exposed in the Shaws open cut is sericitic, alkali feldspar-rich and auriferous. Southwards, the breccia zone broadens to 80 m in width S of the Victoria mine. An adjacent sericitic, non-brecciated but auriferous zone occurs E of the breccia zone, and further to the E lies a zone of anomalous Pb-Zn-Ag.
Gold values of 0.1-0.5 ppm Au have been recorded from the alteration zone.

OREBODY: McGregors
Insignificant.

OREBODY: Nibblers Hill
Wall rock alteration was significant.

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Deep lead.
Auriferous quartz veins in structurally controlled sites in altered intermediate volcanics/volcanogenic sediments/non-volcanic sediments.
SIGNIFICANT: Alluvial.

STYLE:

MAJOR: Discordant

DIMENSIONS/ORIENTATION:

OREBODY: Parkes (D)

	MIN	AVE	MAX

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			304.0
		ANGLE (deg.)		DIRECTION
DIP		80		E;NE
STRIKE		360;315		

OREBODY: Baden-Powell

		MIN	AVE	MAX
STRIKE LENGTH	(m)			18.0
VERTICAL DEPTH	(m)			23.0
		ANGLE (deg.)		DIRECTION
DIP				W
STRIKE		180		

OREBODY: Ben Nevis

		MIN	AVE	MAX
STRIKE LENGTH	(m)	1500.0		3000.0
VERTICAL DEPTH	(m)			62.0
		ANGLE (deg.)		DIRECTION
STRIKE		075		

OREBODY: Bonnie Dundee

		MIN	AVE	MAX
TRUE WIDTH	(cm)	10.0		90.0
		ANGLE (deg.)		DIRECTION
STRIKE		180		

OREBODY: Buchanan/Phoenix

		MIN	AVE	MAX
TRUE WIDTH	(cm)			100.0
VERTICAL DEPTH	(m)			150.0
		ANGLE (deg.)		DIRECTION
DIP		40-60		E
STRIKE		180;135		

OREBODY: Bushman

		MIN	AVE	MAX
STRIKE LENGTH	(m)			4500.0
VERTICAL DEPTH	(m)	27.0		48.0
		ANGLE (deg.)		DIRECTION
STRIKE		110;60		

OREBODY: Bushmans (New Bushmans Hill)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			300.0
TRUE WIDTH	(cm)	30.0		60.0
VERTICAL DEPTH	(m)			280.0
DEPTH OXIDATION	(m)			120.0
		ANGLE (deg.)		DIRECTION
DIP		40		N
STRIKE		105		

OREBODY: Dayspring

		MIN	AVE	MAX
STRIKE LENGTH	(m)			345.0
TRUE WIDTH	(cm)	100.0		200.0
VERTICAL DEPTH	(m)			122.0
		ANGLE (deg.)		DIRECTION
DIP		64		N
STRIKE		130		

OREBODY: Federal/'Possum

		MIN	AVE	MAX
STRIKE LENGTH	(m)	18.0		48.0
TRUE WIDTH	(cm)	25.0		40.0
VERTICAL DEPTH	(m)			66.0
DEPTH OF COVER	(m)			17.0
		ANGLE (deg.)		DIRECTION
DIP				SE
STRIKE		020-045		

OREBODY: Homeward Bound

		MIN	AVE	MAX
STRIKE LENGTH	(m)			150.0

TRUE WIDTH	(cm)			46.0
VERTICAL DEPTH	(m)			61.0
		ANGLE (deg.)		DIRECTION
STRIKE		050		

OREBODY: Koh-I-Noor

		MIN	AVE	MAX
STRIKE LENGTH	(m)			600.0
TRUE WIDTH	(cm)	30.0		100.0
VERTICAL DEPTH	(m)			304.0
		ANGLE (deg.)		DIRECTION
DIP				S
STRIKE		090		

OREBODY: London

		MIN	AVE	MAX
STRIKE LENGTH	(m)			3000.0
VERTICAL DEPTH	(m)	26.0		60.0
		ANGLE (deg.)		DIRECTION
STRIKE		075		

OREBODY: London-Victoria

		MIN	AVE	MAX
STRIKE LENGTH	(m)		100.0	2000.0
TRUE WIDTH	(m)	2.0		15.0
VERTICAL DEPTH	(m)			43.0
DOWN-DIP DEPTH	(m)			100.0
DEPTH OXIDATION	(m)			45.0
		ANGLE (deg.)		DIRECTION
DIP		80		W
STRIKE		008		

OREBODY: McGregors

		MIN	AVE	MAX
STRIKE LENGTH	(m)			100.0
VERTICAL DEPTH	(m)			15.0
		ANGLE (deg.)		DIRECTION
STRIKE		010		

OREBODY: McGuiggans

		MIN	AVE	MAX
STRIKE LENGTH	(m)			3000.0
VERTICAL DEPTH	(m)	14.0		48.0
		ANGLE (deg.)		DIRECTION
STRIKE		030		S

OREBODY: Nibblers Hill

		MIN	AVE	MAX
STRIKE LENGTH	(m)			180.0
TRUE WIDTH	(cm)	70.0	100.0	600.0
VERTICAL DEPTH	(m)			53.0
		ANGLE (deg.)		DIRECTION
DIP		65-80		E
STRIKE		020		

OREBODY: No Mistake/Reids Gully

		MIN	AVE	MAX
STRIKE LENGTH	(m)			3000.0
VERTICAL DEPTH	(m)			37.0
		ANGLE (deg.)		DIRECTION
STRIKE		045;120		

OREBODY: Scrubby Plains

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			29.0

OREBODY: Tichborne

		MIN	AVE	MAX
STRIKE LENGTH	(m)	10.0	30.0	100.0
TRUE WIDTH	(cm)	30.0	60.0	80.0
VERTICAL DEPTH	(m)	30.0		155.0
		ANGLE (deg.)		DIRECTION
DIP				E,W

STRIKE	320-360	

OREBODY: Tichborne/Wapping Butcher

		MIN	AVE	MAX
STRIKE LENGTH	(m)			2000.0
TRUE WIDTH	(m)			60.0
VERTICAL DEPTH	(m)	22.0		39.0
		ANGLE (deg.)		DIRECTION
STRIKE		165		

OREBODY: Welcome

		MIN	AVE	MAX
STRIKE LENGTH	(m)			4500.0
VERTICAL DEPTH	(m)		30.0	43.0
		ANGLE (deg.)		DIRECTION
STRIKE		155		

OREBODY: Welcome (Wild Cat)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			168.0
TRUE WIDTH	(cm)	60.0		120.0
VERTICAL DEPTH	(m)			90.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		
STRIKE		045		

ORE TEXTURE:
Disseminated

NATURE OF MINERALISATION:
PRIMARY ORE: Fault/Shear-Filling, Lode (Alteration Zone), Multiple Veins, Vein (Reef),
SECONDARY ORE: Deep Lead, Detrital (Alluvial), Supergene Enrichment

MINERALOGY:

OREBODY: Parkes (D)
Sulphide zone: auriferous pyrite, arsenopyrite, tetrahedrite, galena, chalcopyrite, sphalerite, pyrrhotite. Mined ore carried 15–30% pyrite. Grades decreased at depth.
Gangue: quartz, calcite.

OREBODY: Bushmans (New Bushmans Hill)
Sulphide ore: gold, auriferous pyrite. Gold values were significantly enriched in the oxidised zone. Within the vein gold was concentrated close to the wall rock andesite.

OREBODY: Dayspring
Sulphide zone: gold, quartz, calcite, arsenopyrite, pyrite, galena, chalcopyrite, (tetrahedrite).

OREBODY: London–Victoria
Sulphide zone: gold, sericite, auriferous pyrite, alkali feldspar, (pyrrhotite, chalcopyrite, galena); veins: quartz, carbonate, albite, alkali feldspar, pyrite.
Pyrite content is generally up to 10%, higher in high grade gold zones. In unweathered rock, gold occurs as inclusions and fracture fillings in pyrite, and as fine–grained free gold in the veins and altered rock.

OREBODY. McGregors
Gold, pyrite.

OREBODY: Welcome (Wild Cat)
Oxide zone: gold, copper carbonates.

CONTROLS OF MINERALISATION:
Vein deposits are strongly structurally controlled, controls being provided by longitudinal and oblique shear/fault zones, and stratigraphic contacts.
Association with intermediate volcanic host rocks indicates lithological control.

GENETIC MODELS:
PRINCIPAL SOURCES: Bowman (1977), Markham (1982), Clarke (1985a, 1989).

1./ Andrews (1910) distinguished two lines of lode gold deposits: those associated with the 'intrusive' Bushman Andesite and those associated with crush zones. Both Andrews (1910) and Bowman (1977) suggested that deposits of the first group were genetically related to intrusion of the

andesite. Andrews (op.cit) postulated replacement of country rock by quartz as the major mechanism for emplacement of the quartz veins.
2./ Markham (1982) considered the mineralisation to be volcanogenic hydrothermal, the source of the hydrothermal solutions being the andesitic magma.
3./ Clarke (1985a, 1989) discounted contemporaneous formation of gold-quartz veins and andesite as the andesite is now considered more likely to be volcanic rather than intrusive (see 'GEOLOGICAL SETTING OF MINERALISATION' below).
Clarke (1989) proposed a metahydrothermal origin in which the ultimate source of the gold was the Late Ordovician-earliest Silurian mantle-derived shoshonitic magmas, but the auriferous veins formed late in the deformation history. The two-stage model is as follows:-

i) Late Ordovician-?earliest Silurian submarine volcanic exhalative activity in the Initial Cowra Trough released gold-enriched fluids into seawater. Chemical and physical conditions were favourable for precipitation and wide dispersal of gold/sulphide particles along with sediments of clastic, biogenic or other derivation. Such a process would yield a volcanic-sedimentary sequence anomalously enriched in gold.
ii) Volcanic-sedimentary rocks were folded during first stage of deformation, which was contemporaneous with volcanism.
iii) Second stage of deformation produced longitudinal fault/shear zones. Hydrothermal activity associated with accompanying greenschist facies metamorphism remobilised and concentrated the gold in quartz vein deposits in favourable shear/fault/fracture zones and saddle structures in the high strain zone that developed adjacent to the Parkes Thrust.
iv) Vein emplacement was chiefly by hydraulic fracture, in which fluid pressure reaches the critical point where mesoscopic fracture occurs by propagation of microcracks already in the rock. The quartz-healed breccias of the gold belt are intepreted as hydrothermal breccias.

Clarke (1989) cites the following features in support of the meta-hydrothermal model:
a) Rock geochemical data indicate that the element association at London-Victoria is typical of epithermal deposits.
b) The close association of volcanics with marine sediments indicates a marine environment of eruption for the volcanics.
c) Anomalous concentrations of gold in the Mugincoble Chert (time-equivalent lateral facies variant of the Cotton Formation associated with the gold belt volcanic units) could be due to dispersal of fine-grained sulphide/gold particles from the site of exhalative fluid discharge down the slope of the volcanic arc, and deposition on the deep sea floor.
d) Comparison of Parkes-Forbes with PEAK HILL (Deposit No.10) and PARKES (GOONUMBLA) (Deposit No.9), where a magmatic source for the metals is indicated, suggests that a Late Ordovician shoshonitic magmatic source for the gold in the exhaled fluids elsewhere along the volcanic arc seems plausible.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Parkes (D)

PRINCIPAL SOURCES: Bowman (1976, 1977), Clarke (1985a), Sherwin & others (1987), Clarke (1989), Clarke & Sherwin (1989), Krynen & others (1989a,b).
SUMMARY

The Forbes-Parkes-Peak Hill-Tomingley gold belt lies within the Tumut Synclinorial Zone adjacent to the boundary with the Girilambone Anticlinorial Zone. The gold belt - the Parkes Thrust group of deposits - comprises a line of numerous small to large gold-quartz deposits of predominantly vein-type with some disseminated and minor stratabound deposits, in Late Ordovician altered andesitic volcanics (Nash Hill Volcanics, Parkes Volcanics, and Daroobalgie Volcanics) and slate Cotton Formation), plus rich alluvial deep lead deposits.
The four most productive reefs of the Parkes field are Buchanan/Phoenix, Bushmans (New Bushmans Hill), Dayspring, and London-Victoria.

GEOLOGICAL SETTING: TUMUT SYNCLINORIAL ZONE (N)
PRINCIPAL SOURCES: Markham & Basden (1974), Bowman (1976, 1977), Sherwin & others (1987), Krynen & others (1989a).

The northern part of the Tumut Synclinorial Zone contains Ordovician volcanics and volcaniclastic sediments of the Molong Volcanic Arc, conglomerate and fine sediments of the Parkes Terrace, and fine sediments and basalt of the Initial Cowra Trough; overlain by Silurian shallow marine and Devonian continental sequences of the Forbes and Hervey Groups respectively (Bowman, 1976, 1977).

According to the Scheibner (1976) model, the Parkes Terrace was a microcontinent in the Early Ordovician, separated from the Australian continent by a marginal sea (Wagga Marginal Basin).
At the eastern edge of the microcontinent a volcanic arc developed (Molong Volcanic Arc). The Molong Volcanic Arc is represented in the gold belt by the Parkes Volcanics and equivalents (see 'REGIONAL SUCCESSION' below).

W of the gold belt, the arc volcanics are represented by the Nelungaloo Volcanics, Goonumbla Volcanics, and Wombin Volcanics.
Contemporaneously with volcanism, sediments now consisting of variegated and banded slate (Cotton Formation, including the former Tomingley Siltstone) were deposited on the Parkes Terrace in extensive submarine fan depositional systems in a frontal oceanic basin bordering the developing Goonumbla-Wombin volcanic centre on its eastern side (Krynen & others, 1989a).

During the Late Ordovician the arc split under tension, opening the Initial Cowra Trough. Banded slate, chert, schist, and mafic volcanics were deposited on the floor of the trough and were overlain by an interbedded chert and siltstone sequence (Mugincoble Chert).
The unit may be a deep water basinal chert facies equivalent of the basal part of the Cotton Formation (Krynen & others, 1989a; Bowman, 1977). The Ordovician rocks were deformed during the Benambran and Quidongan Orogonies (Late Ordovician-Early Silurian).

GEOLOGICAL SETTING: PARKES THRUST GROUP
PRINCIPAL SOURCES: Clarke (1989), Krynen & others (1989a,b).

The Ordovician rocks are exposed in a broad N-trending zone on both sides of the boundary between the Girilambone Anticlinorial Zone and the Tumut Synclinorial Zone. The boundary is represented in part by the Parkes Thrust, major regional reverse fault along which rocks of the gold belt to the E were thrust over rocks of the Goonumbla volcanic centre (Krynen & others, 1989a).
The Parkes Thrust separates zones of greatly differing styles of deformation and mineralisation (Clarke, 1985b, 1987).
W of the thrust, folding is broad and open; structure is dominated by a broad regional anticline, the Forbes Anticline.
E of the thrust, deformation was much more intense.
The gold belt is a zone of high strain, characterised by tight longitudinal upright folding with strongly developed axial plane cleavage. The volcanic units tend to form the cores of anticlines bounded by synclines and/or longitudinal faults. Clarke (1989) considers that the longitudinal faulting and shearing, which parallel the regional trend, were controlled mainly by the difference in competency between the volcanic and non-volcanic rocks: faulting developed as a result of flexural slip along contacts between more competent volcanic rocks and less competent non-volcanic rocks.

REGIONAL SUCCESSION: EAST OF PARKES THRUST
PRINCIPAL SOURCES: Bowman (1976), Sherwin & others (1987), Krynen & others (1989a,b).

1./ Middleton Member (Omm in Krynen & others, 1989b) (Middle Ordovician) bedded chert, siltstone. Conformably overlain by:-
2./ Parkes Volcanics (Opv) and probable equivalents Nash Hill Volcanics (Ona), Daroobalgie Volcanics (Odv) Back Yamma Volcanics (Obv), Mingelo Volcanics (Oph); (alphaQ6L on Forbes metallogenic map) (Late Ordovician) - intermediate porphyritic volcanics, volcaniclastics.
NOTE: Nash Hill Volcanics includes the former Bushman Andesite at Parkes; Daroobalgie Volcanics includes the former Bushman Andesite at Forbes (Sherwin & others, 1987). The volcanic units apparently represent products from discrete volcanic centres. The volcanic units are thought to be time equivalent to the Goonumbla Volcanics, but are regarded as separate formations in separated areas (Clarke, 1985b, 1987). The Daroobalgie Volcanics may be slightly younger than the other units (Krynen & others, 1989a).
A regional geochemical study by Clarke (1985b, 1987) has shown that most Ordovician-Silurian volcanics in the Parkes region belong to a potassium-rich shoshonitic magma.
3./ Mugincoble Chert (Omc, Krynen & others, 1989b; Q5L2, Forbes metallogenic map) (Late Ordovician) - chert, phyllite, siltstone.
4./ Cotton Formation (Ocf; Q4L2) (Late Ordovician-Early Silurian) - variegated and banded slate and siltstone, limestone.
May be interbedded with volcanic units.

ASSOCIATED MINERALISATION: PARKES THRUST GROUP
PRINCIPAL SOURCES: Clarke (1985a, 1989), Krynen & others (1989b).

The vein deposits, which accounted for the bulk of primary production at Parkes and FORBES (Deposit No.12) can be categorised on the basis of:

i) host rock (volcanic or non-volcanic), ii) orientation (near vertical longitudinal or steeply-dipping oblique), iii) type of mineralisation multiple veins in shear zones or discrete quartz veins), iv) strike length (long or short), and v) degree of alteration (Clarke, 1989).

i) The vein deposits were hosted by either non-volcanic siltstone or volcanic rocks that may include lava, volcanic conglomerate, or volcanic sandstone. NOTE: The 'intrusive' andesite of Andrews (1910) and Bowman (1977), the Bushman Andesite, is now considered more likely to be volcanic and was renamed Daroobalgie Volcanics at Forbes and included in Nash Hill Volcanics at Parkes (Sherwin & others, 1987; Krynen & others, 1989a).
In most cases mineralisation lay at or close to a contact between volcanic and non-volcanic rocks. Deposits were more numerous in the finer clastic rocks, presumably because these were less competent and more permeable than the lavas and coarse clastics and allowed greater access to mineralising fluids (Clarke, 1989).

ii) Most of the mineralisation was associated with the near-vertical longitudinal faults and shears; significant mineralisation was also localised in moderately steeply-dipping fault systems oblique to the regional longitudinal trend. The oblique faults post-date the main deformation that produced the tight folding and longitudinal faulting.

iii) The larger proportion of deposits comprised poddy multiple veins; others were discrete veins.

iv) The reefs occurred as either short (<100 m strike length) or long (100-5000 m) veins, the longer veins being the most important.

v) On the basis of relative production, the more important vein deposits were associated with pervasive wall rock alteration, and these deposits were invariably hosted by volcanic rocks that may be lavas or fine-grained volcaniclastics.

On the basis of the above characteristics, the vein deposits fall into six main groups:-
1./ Multiple veins with long strike length in longitudinal shear zones in altered volcanic host rocks. Includes the two largest orebodies of the gold belt - London-Victoria at Parkes and Lachlan at Forbes.
2./ Multiple veins with long strike length in longitudinal shear zones in sedimentary (non-volcanic) host; wall rock alteration not significant. Includes Marys Dream and Cooks at Forbes, Reids Gully and New Haven at Parkes, and some orebodies at Tomingley, Alectown, and Trewilga.
3./ Multiple veins with short strike length in longitudinal shear zones in sedimentary (non-volcanic) host; wall rock alteration not significant. Includes Band of Hope (London-Victoria line of lode) at Parkes, and some orebodies at Trewilga and Alectown.
4./Multiple veins with long strike length in oblique shear zones in sedimentary (non-volcanic) host; wall rock alteration not significant. Principal examples are Dayspring, Homeward Bound, Currajong, and Pioneer (Dayspring line) at Parkes.
5./ Discrete quartz veins with long strike length in oblique shear zones in sedimentary (non-volcanic) host; wall rock alteration not significant. Includes the Bushmans (New Bushmans Hill) and Ben Nevis orebodies at Parkes.
6./ Discrete quartz veins with long strike length in longitudinal shear zones in altered volcanic host. Principal example is Myall at Tomingley.
Other styles of mineralisation represented in the gold belt include:
i) disseminated - Peak Hill, and ii) stratabound (saddle reefs) - Magpie and Staples at Forbes.

GEOLOGICAL SETTING: PARKES
PRINCIPAL SOURCES: Bowman (1976, 1977), Markham (1982), Sherwin & others (1987), Clarke (1989), Krynen & others (1989a,b).

The orebodies of the Parkes field lie within a NNE-striking belt of volcanics and sediments bounded by the Parkes Thrust to the W and the Marys Dream Fault to the E (Krynen & others, 1989b).
Alternating longitudinal belts of volcanics and sediments have been interpreted by Krynen & others (1989a,b) as a series of tight to isoclinal folds in which volcanic units are exposed in anticlinorial cores, and overlying sediments (Cotton Formation) are exposed in intervening synclines. The main folds mapped by Krynen & others (1989b), from W to E, are: McGuiggans Syncline, Parkes Anticline, Tichborne Syncline, and Nash Hill Anticlinorium.
The Parkes Volcanics, consisting of intermediate volcaniclastics with some lavas, delineate the axis of the Parkes Anticline in the western part of the gold belt. The time equivalent Nash Hill Volcanics, consisting of intermediate porphyritic lavas and flow breccias, lie on the limbs of the Nash Hill Anticlinorium (sediments assigned to the

Middleton Member are exposed along the axis) in the eastern part of the field (Krynen & others, 1989b).

The sequence is much folded and faulted. In addition to the Parkes Thrust and Marys Dream Fault, the most significant longitudinal fault for gold mineralisation is the London-Victoria Fault. The latter is a major fault/shear zone which parallels the Parkes Thrust, dipping E @ an average of 60 deg, 2 km to the E of the thrust. The London-Victoria line of gold mineralisation is associated with the London-Victoria Fault which truncates the line of lode at its southern end.

Most of the principal orebodies of the field fall along one of several lines of mineralisation. In the western part of the field the London-Victoria line is associated with Parkes Volcanics along and adjacent to the London-Victoria Fault. The Parkes Volcanics are also host in part to Mount Morgan, Nibblers Hill, Macgregors, and ?Birthday.

A major line of mineralisation associated with the Nash Hill Volcanics forms the northeastern part of the field. The principal orebodies are Bushmans (New Bushmans Hill), Buchanan/Phoenix, Federal/Possum, Bonnie Dundee, and Federal.

Many orebodies were localised in siltstone (Cotton Formation) at or near contacts with volcanics or volcaniclastic sediments. The principal examples are Bushmans (New Bushmans Hill), which crosses the contact of Nash Hill Volcanics and Cotton Formation; the Dayspring line, including Dayspring, Homeward Bound, Currajong, and Pioneer; and Koh-i-noor.

OREBODY: Baden-Powell

Mineralisation was localised at a contact between andesite (assigned to Nash Hill Volcanics) and tuffaceous slate.

OREBODY: Ben Nevis

The Ben Nevis lead parallelled the London lead about 1 km to the north. The lead was narrow but widened and steepened downstream.

OREBODY: Bonnie Dundee

The Bonnie Dundee (and Buchanan/Phoenix) lodes were located within the Parkes township immediately NW of the railway station and S of the Bushmans lode. Host rocks are altered andesite (Nash Hill Volcanics).

OREBODY: Buchanan/Phoenix

Historically the most productive reefs of the Parkes field.
Buchanan/Phoenix reefs were located a short distance NW of the Parkes Railway Station. Buchanan lode parallelled Bonnie Dundee immediateley W of the latter. Phoenix was a cross-lode, displacing Buchanan by 10 m at its northern end. The lodes occured in a fault zone in altered andesite (Nash Hill Volcanics).

OREBODY: Bushman

The Bushman lead and its tributaries Shallow Rush, Little Bushman, Great Northern, Possum Gully, and Sardine, make up the lead system which occurred in the immediate vicinity of the township of Parkes. The channelway heads in crushed andesite W of Parkes, passes under Parkes and continues along Goobang Creek, giving a total length of nearly 8 km. The channel apparently drained into a large basin. The lead dipped downstream; the depth of auriferous gravel increased from 5-6 m near the head to 28 m at the easternmost extremity.

OREBODY: Bushmans (New Bushmans Hill)

The second most productive reef of the field.
The Bushmans vein system was located at Bushmans Hill on the northern outskirts of Parkes. Mineralisation was localised in an oblique fault zone. The vein transgressed andesitic volcanics of the Nash Hill Volcanics and slate and tuffaceous sandstone of the Cotton Formation. The Nash Hill Volcanics crop out in a narrow NNE-trending belt in the eastern part of the field; Cotton Formation is exposed in a belt in the central part of the field and the Parkes Volcanics occur in the western part of the field.
Mineralisation was enriched at the junction of N-dipping offshoot veins. There appear to have been two main shoots at depth. The main vein was displaced by two N-striking, E-dipping, faults about 200 m apart. The throw on the western fault is about 75 m in a dextral sense.

OREBODY: Dayspring

The third most productive reef of the Parkes field.
The orebody refers to a group of lodes - Dayspring, Homeward Bound, Currajong and Pioneer - which occurred at the northern extremity of the belt of Nash Hill Volcanics.
Pioneer lode was the first discovery of reef mineralisation at Parkes. Country rocks include a volcaniclastic sequence of siltstone, sandstone

and conglomerate (Cotton Formation), plus porphyritic lava (Nash Hill Volcanics). The rocks are well bedded, and may lie on the western limb of an antiform (Clarke, 1989).
Mineralisation was localised on oblique NW-trending faults.
Ore zones apparently comprised ill-defined zones of quartz and quartz-calcite stockwork, brecciation, shearing, and alteration, which tapered down-dip and westwards.
Total width of vein system at Pioneer = 10 m.

OREBODY: Federal/'Possum
The orebody refers to the minor lodes of a group of deposits within an area 1-3 km S of Parkes. The Baden-Powell and the major Koh-i-noor lodes also occur in this area but are described seperately (OREBODIES Baden-Powell and Koh-i-noor).
The Federal/'Possum reefs were associated with Nash Hill Volcanics, lying at the southern end of the line of major andesite-hosted orebodies (Bushmans, Buchanan/Phoenix).
Mineralisation occured both in andesites and adjacent slates and phyllites of the Cotton Formation; some veins were localised along slate /andesite contacts. Veins were aligned on N-S and E-W trends.
Total width of vein system at 'Possum = 6 m.

OREBODY: Homeward Bound
Homeward Bound lies 14 km NNE of Parkes in a fault zone in an area containing slates, cherts, andesitic tuffs (Mugincoble Chert) together with amygdaloidal and fine-grained andesites (Nash Hill Volcanics).

OREBODY: Koh-I-Noor
Koh-i-noor was a cross-lode hosted by tuffaceous sandstone and slate of the Cotton Formation between Parkes Volcanics to the W and Nash Hill Volcanics to the E.
Ore zones were reported to be more or less horizontally disposed.

OREBODY: London
The London lead system comprised the main London lead, and tributaries Little Wonder, All Nations, and Sydney Clinker, which entered the main channel from the south. The leads lay immediately W of the London-Victoria line of primary gold-quartz mineralisation, which formerly formed part of a prominent narrow N-S ridge from which drainage channels flowed both E and W. The lower portion of the channel was very steep. A second, mostly barren, channel lay 30 m stratigraphically below the main lead. (Markham, 1982).

OREBODY: London-Victoria
PRINCIPAL SOURCES: Bowman (1977), Markham (1982), Clarke (1985a, 1989).

Historically the fourth most productive reef of the Parkes field.
The London-Victoria line of lode trends N-S approximately 5 km SW of Parkes. The line is flanked both to the E and W by deep leads which apparently derived their gold content from the London-Victoria lode deposits. The lode mineralisation occurs as a series of large overlapping lenses in a shear zone within a zone of sericitic alteration up to 100 m wide E of and adjacent to the London-Victoria Fault.
The width of the shear/lode zone is variable up to 46 m.
The London-Victoria Fault parallels the Parkes Fault (Thrust) 2 km E of the latter, and dips E @ 45-85 deg. The fault extends for at least 9 km, partly concealed by Tertiary alluvium. The alteration zone is cut off by the London-Victoria Fault.

The lode zone parallels the line of andesite-hosted deposits (OREBODIES Bushmans and Buchanan/Phoenix) 3.5 km W of the latter, but is hosted entirely by strongly cleaved and tightly folded phyllitic volcaniclastic sediments within Parkes Volcanics. The quartz lenses were elongate parallel to cleavage of the host rocks, and displayed a form of augen or boudinage structure.
Altered slates adjacent to the lenses were impregnated with a network of quartz veinlets over a zone 3-9 m wide and carried gold values of 0.1-0.5 ppm Au.

OREBODY: McGregors
Occurred near the Parkes Fault 11 km N of Parkes. Total width of vein system = 25 m. Host rocks were aphanatic andesite and medium-grained dacite tuff (Parkes Volcancs). Limestone occurrence was also reported.

OREBODY: McGuiggans
The McGuiggan lead was one of the few leads to be traced both to the N and S of Goobang Creek; most of the Parkes leads ceased to be payable S of Goobang Creek. Further southwards the gutter became less well defined, the gravel developed 'gilgai' appearance and gold values were scattered. The source of the gold was presumably primary deposits of OREBODY Tichborne/McGuiggan.

OREBODY: Nibblers Hill

Nibblers Hill was located at the head of the Fulton lead (a tributary of the Welcome system). Mineralisation occurred in a multiple vein system localised at the contact between porphyritic (extrusive) andesite and schistose slate. The main vein was approximately parallel to bedding, which strikes 010-020 deg and dips steeply E and W. Country rocks, which also include banded chert and volcaniclastic sandstone, are cleaved, locally altered, brecciated and veined. Cleavage strikes 0-015 deg and dips vertically to steeply W. The southern extension of the main lode is truncated by a fault.

OREBODY: No Mistake/Reids Gully

No Mistake was the first lead worked at Parkes and drained westwards apparently from the same belt of volcanics in which the Bushman system originated, several km to the north. Thickness of auriferous gravel = 30 cm. Reids Gully was a tributary which entered the main channel from the S.

OREBODY: Scrubby Plains

This is a portion of the alluvial plain of the Billabong Creek near the township of Tichborne. The alluvium consisted of yellow ferruginous and white sandy clays, pipe-clay, and minor quartz-pebble gravel, partly cemented with ironstone and containing disseminated gold.

OREBODY: Tichborne

The orebody refers to a group of minor vein deposits in the southern part of the Parkes field at and to the N of Tichborne. The lodes are: McGuiggans, Scrub, Staples, and Blue Reef, which were located at the head of McGuiggans lead; and Lady Jersey and McMillans, which occurred in the alluvium of the Tichborne/Wapping Butcher lead system.
With the exception of Lady Jersey which was developed in andesite, the lodes occurred within grey-green phylitic slate/fine sandstone or at slate/andesite contacts.
Scrub and McGuiggans occurred in fault zones related to a southern extension of the London-Victoria Fault.
Total width of vein systems ranged from 5-10 m.

OREBODY: Tichborne/Wapping Butcher

The lead system was the most southerly of the Parkes lead deposits and included Wapping Butcher, Tichborne, Well Tried and Fairy leads. Fairy lead and Wapping Butcher were apparently tributary to Tichborne, entering it at its eastern end at the same point from the S and N respectively. Bowman (1976) shows Tichborne as a tributary of Wapping Butcher, but the channel depth along Tichborne is greater.
Well Tried lay to the N of Wapping Butcher.
Depth to auriferous gravel along Wapping Butcher varied from 15-22 m, gravel thickness ranged between 60 and 500 cm.
Rock types present in the alluvium included yellow clay, quartz gravel, partially decomposed conglomerate of quartz, ironstone and rock fragments, coarse sand, and auriferous conglomerate.
Very large quartz boulders and blocks of conglomerate ('clinker') occurred at the base of the Wapping Butcher channel; coarse gold was frequently associated with the boulders.

OREBODY: Welcome

A closely branched lead system, of which the Welcome represents the main channel. The leads were relatively shallow and terminated beneath Goobang Creek.

OREBODY: Welcome (Wild Cat)

Ore occurred in lenticular shoots in andesite.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Andrews E.C., 1910
The Forbes-Parkes goldfield.
Geological Survey of New South Wales. Mineral Resources
13

Bowman H.N., 1976
Forbes, New South Wales, 1:250 000 metallogenic map. Sheet SI 55-7.
Geological Survey of New South Wales
1v

Bowman H.N., 1977
Forbes 1:250 000 metallogenic map SI 55-7 - mine data sheets and metallogenic study.
Geological Survey of New South Wales
1v

Clarke I., 1983
The Forbes-Parkes-Peak Hill-Tomingley gold belt - a compilation from exploration reports.
Geological Survey of New South Wales. Report
GS1983/076

Clarke I., 1985
Petrology of igneous rocks associated with gold and copper mineralization in the Parkes area.
Geological Survey of New South Wales. Report
GS1985/121

Clarke I., Krynen J., 1985
Gold in the Parkes area. IN Seminar: New South Wales, the potential for development. Abstracts.
AMF and Department of Mineral Resources. Report
GS1985/292 P16-19

Clarke I., 1985
Primary mineralization in the Forbes-Parkes-Peak Hill-Tomingley gold belt.
Geological Survey of New South Wales. Report
GS1985/123

Clarke I., 1987
Early Palaeozoic shoshonitic volcanism associated with gold and copper mineralization in the Parkes area, New South Wales. IN Proceedings, Pacific Rim Congress 87, Gold Coast, Queensland, August 1987.
AusIMM
1v P697-700

Clarke I., 1989
4. Primary deposits in the Forbes-Parkes-Peak Hill-Tomingley gold belt. IN Clarke I. & Sherwin L. (eds) - Geological setting of gold and copper deposits in the Parkes area, New South Wales.
Geological Survey of New South Wales. Records
23(1)

Clarke I., Sherwin L., 1989
Geological setting of gold and copper deposits in the Parkes area, New South Wales.
Geological Survey of New South Wales. Records
23(1)

Gilfillan J., Garman M.R.W., 1984
The London-Victoria gold prospect, Parkes, NSW. IN Geoscience in the development of natural resources. 7th Australian Geological Convention, Sydney, 1984. Abstracts.
Geological Society of Australia
12 P187-188

Govett G.J.S., Dobos V.J., Smith S., 1984
Exploration rock geochemistry for gold, Parkes. New South Wales, Australia.
Journal of Geochemical Exploration
21(1-3) P175-191

Hall D., 1986
Exploration geochemistry of the London-Victoria gold deposit at Parkes. IN Geological setting of precious metals in New South Wales. One-day symposium, Sydney, October 1986. Abstracts.
Geological Society of Australia
18

Krynen J.P., Clarke I., Sherwin L., 1986
Geological setting of gold and copper mineralization in the Parkes area.
Geological Survey of New South Wales. Report
GS1986/059

Krynen J.P., Sherwin L., Clarke I., 1989
1. Stratigraphy and structure. IN Clarke I. & Sherwin L. (eds) - Geological setting of gold and copper deposits in the Parkes area, New South Wales.
Geological Survey of New South Wales. Records
23(1)

Krynen J.P., Sherwin L., Clarke I., 1989
Geological map of the Parkes area, scale 1:100 000 (parts of Sheets 8431, 8432, 8531 and 8532).
Geological Survey of New South Wales
1v

Markham N.L., Basden H., 1974

The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Rolan L., 1984
A petrographic and geochemical study of wallrock alteration around gold mineralization at Parkes, New South Wales. M.Appl.Sc. thesis.
University of New South Wales. Unpublished
1v

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

Sherwin L., Clarke I., Krynen J.P., 1987
Revision of stratigraphic units in the Forbes-Parkes-Tomingley district.
Geological Survey of New South Wales. Quarterly Notes
67 P1-23

Slansky E., 1986
London-Victoria mine area: mineral distribution in five diamond drill holes.
Geological Survey of New South Wales. Report
GS1986/119

Tenison Woods K., 1983
Interpretation of regional aeromagnetic and gravity data for the Forbes and Narromine 1:250 000 sheets.
Geological Survey of New South Wales. Report
GS1983/200

Tenison Woods K., 1989
2. Regional geophysics. IN Clarke I. & Sherwin L. (eds) - Geological setting of gold and copper deposits in the Parkes area, New South Wales.
Geological Survey of New South Wales. Records
23(1)

oooooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 12 FORBES

DEPOSIT IDENTIFICATION:

SYNONYMS: Lachlan

COMMODITIES: Au

DISTRIBUTION:
Record covers vein and deep lead fields occupying narrow NNE-trending zone extending from just S of Forbes to just S of Tichborne. Nos. 94-116 on Forbes metallogenic map.

OREBODIES:
Forbes (D), Bald Hill, Bald Hill (Deep Lead), Boyles, Britannia, Caledonian, Cooks, Dead Dog, Judds, King, Lachlan, Magpie, Marys Dream, Queens, Rise & Shine, South, Staples, Thompsons

MINES:
Apex, Bald Hill, Boyles, Boyles (Trafalgar), Britannia, Caledonian, Cooks, Cripples Reef, Dead Dog, Federal (Iakwa), Grassatts, Judds, King, Lachlan, Madmans, Magpie (Eldorado), Marys Dream, Marys Dream (Stricklands), Mathieson, Nil Desperandum, North, North Lachlan, Penningtons, Queen, Rise & Shine (Penningtons), South, Staples, Thompsons, Toss Of A Penny, Trafalgar, Trojan, Union, Victoria

GROUP: Parkes Thrust Group

COMMENTS:
See Deposit No.11 PARKES for regional setting of Tumut Synclinorial Zone (N) and of Parkes Thrust group; Deposit No.23 GUNDAGAI for regional setting of Tumut Synclinorial Zone.

LOCATION:

LATITUDE: 33 23 LONGITUDE: 148 1
250K SHEET: SI55 7 100K SHEET: 8531

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Orange
LOCAL GOVERNMENT AREA (LGA): Forbes

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD	COMMENTS
1861	Prospecting	
1896		Extension To Known Mineralisation

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Bald Hill	Bald Hill	Historical	Underground
Bald Hill	Bald Hill	Historical	Open-Cut
Bald Hill (Deep Lead)	Bald Hill	Historical	Underground
Boyles	Boyles (Trafalgar)	Historical	Underground
Boyles	Apex	Historical	Underground
Britannia	Britannia	Historical	Underground
Britannia	Trojan	Historical	Underground
Caledonian	Victoria	Historical	Unknown
Caledonian	Union	Historical	Unknown
Caledonian	Caledonian	Historical	Unknown
Caledonian	Mathieson	Historical	Unknown
Cooks	Cooks	Historical	Underground
Dead Dog	Dead Dog	Historical	Underground
Judds	Judds	Historical	Unknown
King	King	Historical	Underground
Lachlan	Nil Desperandum	Historical	Underground
Lachlan	Nil Desperandum	Possible	Underground
Lachlan	Lachlan	Completed	Tailings Re-Treatment
Lachlan	Lachlan	Historical	Underground
Lachlan	Lachlan	Possible	Underground
Lachlan	North Lachlan	Possible	Underground

Lachlan	North Lachlan	Historical	Underground
Lachlan	Federal (Iakwa)	Possible	Underground
Lachlan	Federal (Iakwa)	Historical	Underground
Lachlan	Bald Hill	Historical	Open-Cut
Lachlan	Bald Hill	Historical	Underground
Lachlan	Boyles (Trafalgar)	Historical	Underground
Lachlan	Apex	Historical	Underground
Magpie	Magpie (Eldorado)	Historical	Underground
Marys Dream	Marys Dream (Stricklands)	Historical	Underground
Marys Dream	Cripples Reef	Historical	Underground
Marys Dream	Toss Of A Penny	Historical	Underground
Queens	Queen	Historical	Underground
Rise & Shine	Rise & Shine (Penningtons)	Historical	Underground
South	Britannia	Historical	Underground
South	South	Historical	Underground
South	North	Historical	Underground
South	Madmans	Historical	Underground
South	Grassatts	Historical	Underground
Staples	Staples	Historical	Underground
Thompsons	Thompsons	Historical	Placer

COMPANIFS:

OREBODY: Forbes (D)

PRESENT OPERATORS:
Epoch Mining NL

PRESENT OWNERS:	EQUITY%
Epoch Mining NL	100.00

OREBODY: Lachlan

PRESENT OPERATORS:
Lachlan Valley Gold Mines Pty Ltd.

PRESENT OWNERS:	EQUITY%
Lachlan Valley Gold Mines Pty Ltd.	100.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 14,876
Average recovered grade (reef deposits) mostly within range 10-40 g/t Au; deep lead deposits 4.5-25 g/t Au, average 10 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1884-1890), 1861-1869, 1875, 18?8-1?10,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Tumut Synclinorial Zone
SUB-PROVINCE: Tumut Synclinorial Zone (N)

HOST ROCKS:

FORMATION NAME & AGE: [illegible] - Late Ordovician
LITHOLOGY: Altered intermediate [illegible] volcanics upper chilled margin, possible submarine lava or shallow sill-like intrusion
RELATIONSHIP TO MINERALISATION: Host to principal line of mineralisation of field in veins and stockwork mineralisation in steeply-dipping fault/shear zones.

FORMATION NAME & AGE: Cotton Formation - Late Ordovician-Early Silurian
LITHOLOGY: Variegated and banded slate and siltstone, debris-flow conglomerates, sandstone.

RELATIONSHIP TO MINERALISATION: Host to vein mineralisation in steeply-dipping fault zone at Marys Dream line of lode and to stratabound orebodies at Magpie and Staples.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to alluvial and deep lead deposits.

GEOCHRONOLOGY:
See Deposit No. 11 PARKES.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Alluvium, Clastic Sedimentary, Intermediate Extrusive,
MINOR: Volcanogenic Sedimentary

STRUCTURAL FEATURES:

MAJOR: Faulting, Fold Axis, Shearing,
MINOR: Fold Axis

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

MAJOR: Stratigraphic Boundary

IGNEOUS ACTIVITY:

MAJOR: Volcanism (Intermediate)

METAMORPHISM:
Regional metamorphic grade is greenschist facies.

ALTERATION:

OREBODY: Forbes (D)
See Deposit No. 11 PARKES.

OREBODY: Britannia
Hydrothermal alteration of the host andesite is characteristic, with alteration of feldspar, development of abundant pyrite and local widespread replacement of host rock by quartz-sulphide veinlets.

OREBODY: Lachlan
Mineralisation was associated with extensive wall rock alteration = silica, pyrite, and carbonate replacement.

OREBODY: Marys Dream
Wall rock alteration was not significant.

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Deep lead.
Auriferous quartz veins in structurally controlled sites in altered intermediate volcanics/volcanogenic sediments/non-volcanic sediments.
SIGNIFICANT: Alluvial.
MINOR: Stratabound conformable auriferous quartz veins (saddle reefs) in sediments.

STYLE:

MAJOR: Discordant, MINOR: Stratabound

DIMENSIONS/ORIENTATION:

OREBODY: Forbes (D)

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			186.0
		ANGLE (deg.)		DIRECTION
DIP				E,W
PITCH		25		N,S
STRIKE		350-030		

OREBODY: Bald Hill

		MIN	AVE	MAX
STRIKE LENGTH	(m)			204.0
TRUE WIDTH	(m)			6.0
VERTICAL DEPTH	(m)			70.0

		ANGLE (deg.)		DIRECTION
DIP		70		S
STRIKE		290		

OREBODY: Bald Hill (Deep Lead)

		MIN	AVE	MAX
TRUE WIDTH	(m)	4.5		15.0
VERTICAL DEPTH	(m)	60.0		80.0
		ANGLE (deg.)		DIRECTION
STRIKE		330		

OREBODY: Boyles

		MIN	AVE	MAX
STRIKE LENGTH	(m)			100.0
TRUE WIDTH	(cm)	30.0	100.0	150.0
VERTICAL DEPTH	(m)	36.0		52.0
		ANGLE (deg.)		DIRECTION
DIP		45-50		E
STRIKE		350		

OREBODY: Britannia

		MIN	AVE	MAX
STRIKE LENGTH	(m)			120.0
TRUE WIDTH	(cm)	15.0	30.0	100.0
VERTICAL DEPTH	(m)			86.4
DEPTH OXIDATION	(m)			53.0
		ANGLE (deg.)		DIRECTION
DIP		65-80		W
STRIKE		030		

OREBODY: Caledonian

		MIN	AVE	MAX
STRIKE LENGTH	(m)			3600.0
VERTICAL DEPTH	(m)			24.0
		ANGLE (deg.)		DIRECTION
STRIKE		180;245-315		

OREBODY: Dead Dog

		MIN	AVE	MAX
STRIKE LENGTH	(m)			1200.0

OREBODY: Judds

		MIN	AVE	MAX
STRIKE LENGTH	(m)			300.0
TRUE WIDTH	(cm)			100.0
		ANGLE (deg.)		DIRECTION
STRIKE		020		

OREBODY: King

		MIN	AVE	MAX
STRIKE LENGTH	(m)			900.0
TRUE WIDTH	(m)			20.0

OREBODY: Lachlan

		MIN	AVE	MAX
STRIKE LENGTH	(m)		46.0	1524.0
TRUE WIDTH	(m)	0.7	2.5	13.0
VERTICAL DEPTH	(m)	45.0		183.0
DEPTH OXIDATION	(m)	46.0		70.0
DEPTH OF COVER	(m)			12.0
		ANGLE (deg.)		DIRECTION
DIP		60		W
PITCH		20-45		N,S
STRIKE		020		

OREBODY: Magpie

		MIN	AVE	MAX
STRIKE LENGTH	(m)			150.0
TRUE WIDTH	(cm)	20.0		120.0
VERTICAL DEPTH	(m)			50.0
		ANGLE (deg.)		DIRECTION
PLUNGE		20		S
STRIKE		180		

OREBODY: Marys Dream

		MIN	AVE	MAX
STRIKE LENGTH	(m)	60.0		110.0
TRUE WIDTH	(cm)	30.0		130.0
VERTICAL DEPTH	(m)	45.0		72.0
DEPTH OXIDATION	(m)			61.0
		ANGLE (deg.)		DIRECTION
DIP				E
STRIKE		010		

OREBODY: Queens

		MIN	AVE	MAX
STRIKE LENGTH	(m)			1800.0
TRUE WIDTH	(m)			7.5
VERTICAL DEPTH	(m)	33.0		36.0
		ANGLE (deg.)		DIRECTION
STRIKE		315		

OREBODY: Rise & Shine

		MIN	AVE	MAX
STRIKE LENGTH	(m)			400.0
DEPTH OXIDATION	(m)			30.0
		ANGLE (deg.)		DIRECTION
STRIKE		020		

OREBODY: South

		MIN	AVE	MAX
STRIKE LENGTH	(m)		450.0	3000.0
TRUE WIDTH	(m)			105.0
VERTICAL DEPTH	(m)	33.0		65.0
		ANGLE (deg.)		DIRECTION
STRIKE		180;280-300		

OREBODY: Staples

		MIN	AVE	MAX
STRIKE LENGTH	(m)			100.0
		ANGLE (deg.)		DIRECTION
STRIKE		180		

OREBODY: Thompsons

		ANGLE (deg.)	DIRECTION
STRIKE		180	

ORE TEXTURE:

Disseminated

NATURE OF MINERALISATION:

PRIMARY ORE: Breccia, Fault/Shear-Filling, Lode (Alteration Zone), Multiple Veins, Saddle Reef, Stockwork, Vein (Reef),
SECONDARY ORE: Deep Lead, Detrital (Alluvial), Supergene Enrichment

MINERALOGY:

OREBODY: Forbes (D)
Sulphide zone: auriferous pyrite, arsenopyrite.

OREBODY: Bald Hill
Gold, pyrite, quartz.

OREBODY: Boyles
Sulphide zone: gold, pyrite, arsenopyrite.
Gangue: quartz, calcite, native arsenic.

OREBODY: Britannia
Sulphide zone: auriferous pyrite, arsenopyrite, gold, silver, chalcopyrite, bornite, chalcocite, covellite, (sphalerite, galena).
Oxide zone: copper carbonates.
Gold occurred as small blebs and stringers within pyrite and also as discrete grains in the gangue and altered country rock.
Grades were low and irregular below the oxidised zone.

OREBODY: Judds
Gold, quartz.

OREBODY: Lachlan

Sulphide zone: gold, quartz, calcite, auriferous pyrite, arsenopyrite, (native arsenic, magnetite). Ore averaged 15–30% pyrite.

OREBODY: Marys Dream
Sulphide zone: gold, auriferous pyrite, arsenopyrite, galena.

OREBODY: Rise & Shine
Gold, quartz.

CONTROLS OF MINERALISATION:
See Deposit No. 11 PARKES.

GENETIC MODELS:
See Deposit No. 11 PARKES.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Forbes (D)
See 'GEOLOGICAL SETTING OF MINERALISATION', Deposit No. 11 PARKES for regional data and general data on mineralisation of the Parkes Thrust group of deposits.

GEOLOGICAL SETTING: FORBES
PRINCIPAL SOURCES: Bowman (1976, 1977), Markham (1982), Sherwin & others (1987), Krynen & others (1989a,b).

The orebodies of the Forbes field lie within a NNE-trending belt of volcanics and sediments bounded by the Parkes Thrust to the W and a major longitudinal fault, the Marys Dream Fault, to the E.

The host sequence (shown as Q5L2 on Narromine metallogenic map) comprises intermediate volcanics, named Daroobalgie Volcanics by Krynen & others (1989a) (Odv in Krynen & others, 1989b), and argillaceous sediments of the Cotton Formation (Ocf in Krynen & others, 1989b).
The sequence is tightly folded along NNE-trending axes.
The volcanics are exposed in anticlinorial cores, principally in the Bald Hill Anticline in the western part of the field.

Gold mineralisation occurs at the upper contacts of the volcanics on both limbs of the Bald Hill Anticline.
Most of the primary deposits of the field lie along two main lines of mineralisation associated with NNE-trending faults.
The Lachlan line of lode, in the southwestern part of the field, is hosted by volcanics and sediments along a fault on the western limb of the Bald Hill Anticline.
The Marys Dream line of lode, in the northeastern part of the field, is hosted by sediments along the Marys Dream Fault.

OREBODY: Bald Hill
Part of Lachlan line of lode.
Host rock is andesite in contact with tuffaceous sandstone.
Host andesite is now assigned to the Daroobalgie Volcanics (Krynen & others, 1989a) (formerly 'intrusive' Bushman Andesite of Bowman, 1977).

OREBODY: Bald Hill (Deep Lead)
The lead lay N along strike from Thompsons lead, with which it may have been connected. Gold content was evidently derived from the northerly continuation of the Lachlan line of reef mineralisation.
Host conglomerate comprised decomposed breccia, clay, quartz and andesite boulders. Ore grainsize was extremely fine. Average thickness of auriferous zone = 0.75 m. The channel was reportedly up to 60 m wide.

OREBODY: Boyles
Part of Lachlan line of lode.
Mineralisation occurred in a massive vein in andesite (Daroobalgie Volcanics) in contact with schistose slates.
Gold occurred in short, steeply S-dipping shoots.
The lode had a gossanous outcrop.

OREBODY: Britannia
Country rocks are andesite (Daroobalgie Volcanics) in contact with schistose slate.
The andesite has been fractured and sheared along a dominant jointing or fracture direction trending about 150 deg. Mineralisation occurred in one or two prominent quartz veins parallelling the above structural trend, within a more extensive zone of altered andesite containing numerous quartz stringers up to 3 cm in width. Mineralisation was associated with large lenses of pyritic ore along the course of the lode. Total width of lode system = 10 m. The Britannia was apparently the source of gold in the deep leads in the tributaries of the South lead system.

OREBODY: Caledonian

The Caledonian group of leads lay to the NE of the South group and comprised the main channel - the Caledonian lead - which drained southwards into the Lachlan River, and subsidiary channels Mathieson, Union and Victoria leads, which entered the main channel from the W. The lead system derived its gold from auriferous reefs in andesite in the vicinity of the Forbes Railway Station, where the channels originated. The main lead was well defined but lower grade downstream of the Victoria/Caledonian junction. Ore grainsize was very coarse.

OREBODY: Dead Dog

Dead Dog lead lay 1 km E of and roughly parallel to the Bald Hill lead.

OREBODY: Judds

Mineralisation occurred in a large quartz mass with a strike similar to that of the enclosing micaceous slates (Cotton Formation).
Total width of lode system = 10 m.

OREBODY: King

Lead lay parallel to Queens lead about 1.5 km to SW. Host gravel comprised angular quartz, and minor slate cobbles and pebbles in a yellow clay matrix.

OREBODY: Lachlan

PRINCIPAL SOURCES: Bowman (1976, 1977), Clarke (1989), Krynen & Clarke (1985).

The Lachlan line of lode is a fault zone which extends northwards from Boyles for a strike length of 7.5 km. For most of its length the fault zone separates the Cotton Formation from the Daroobalgie Volcanics on the western limb of the Bald Hill Anticline.

The Lachlan line of lode was discovered by tracing worked out deep leads upstream to a small ironstone outcrop. Most of the underlying lode was concealed by thick alluvial cover. Mineralisation was localised along the contact zone between augite andesite and highly cleaved slates. A felsite dyke divided the lode near the surface. Ore occurred in large lensoidal bodies along the lode, the wider zone widths corresponding to zones of intense alteration of the host andesite.

Andrews (1910) described a progressive replacement of host rock by quartz-sulphide material, from a network of tiny veinlets through to complete replacement. Quartz-healed breccia composed of angular fragments of country rock in a quartz-supported matrix was interpreted by Andrews as partial replacment but has more recently been interpreted as hydrothermal breccia (Clarke, 1989; see 'GENETIC MODELS').

OREBODY: Magpie

Mineralisation occurred in two parallel saddle reefs between schistose slate (overlying) and tuffaceous sandstone (underlying) of the Cotton Formation, which are folded into a gently S-plunging anticline.
The richest ore was in the hinge zone of the fold and overall the western limb was more productive than the eastern one.

OREBODY: Marys Dream

The Marys Dream line of lode is a NE-trending zone extending for about 4 km 13 km NNE of Forbes, coinciding with a a major NNE-trending fault, the Marys Dream Fault (Krynen & others, 1989b).
Mineralisation was distributed in small rich pods, principally at Marys Dream (Stricklands), Cripples Reef, and Toss of a Penny lodes.
Host rocks are fine-grained sediments of the Cotton Formation comprising thinly-bedded phyllitic siltstones/claystones with a well developed slaty cleavage approximately parallel to bedding and dipping steeply mainly to the east.
The line of lode was a multiply-veined shear zone about 150-250 m wide in which quartz veins were apparently disposed in a number of separate lines about 15 m apart. Most veins were less than 10 m long and parallelled the cleavage direction; some were cross-cutting.
Total width of vein system = 15 m at Marys Dream, 5 m at Cripples Reef.
Payable gold was confined to the oxidised zone.

OREBODY: Queens

Lead lay 9 km NE of Forbes.

OREBODY: Rise & Shine

Host rocks were schistose slates of the Cotton Formation.

OREBODY: South

The discovery lead of the field. The South group of leads was the most southerly of the deep lead systems, terminating beneath the present day

course of the Lachlan River. The group comprised the main channel - the South lead - and several subsidiary channels North, Madmans, Grassatts, and Britannia leads, which entered the main lead from the W.
The subsidiary channels were short but rich tributaries which headed in the Britannia reef deposit whence they derived their gold content.
Gold content of the main South lead was derived mainly from auriferous reefs to the N (?NW), but was enriched below the points of intake of the tributaries. (Markham, 1982).
The leads were characterised by a rich central gutter from which most of the production was obtained. The gutter was narrow and steep, deepening southwards (downstream). Host sediments were reported to be coarse river gravel, sands and locally thick clay units.
Average thickness of auriferous zone = 0.75 m. Large boulders were plentiful in the channel.

OREBODY: Staples

The Staples reef lay 2.5 km N along strike from Magpie and occurred in a similar geological setting but may have been on a different fold structure. The saddle reef was 6 m wide and had steeply dipping limbs. Payable gold was restricted to the apex.

OREBODY: Thompsons

The lead originated in andesite in the same area as Mathiesons but flowed northwards and may have been a tributary of the Bald Hill channel. The possible northerly extension of the Thompsons lead could have received gold from the Lachlan line of reef mineralisation.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Andrews E.C., 1910
The Forbes-Parkes goldfield.
Geological Survey of New South Wales. Mineral Resources
13

Bowman H.N., 1976
Forbes, New South Wales, 1:250 000 metallogenic map. Sheet SI 55-7.
Geological Survey of New South Wales
1v

Bowman H.N., 1977
Forbes 1:250 000 metallogenic map SI 55-7 - mine data sheets and metallogenic study.
Geological Survey of New South Wales
1v

Clarke I., 1983
The Forbes-Parkes-Peak Hill-Tomingley gold belt - a compilation from exploration reports.
Geological Survey of New South Wales. Report
GS1983/076

Clarke I., 1985
Petrology of igneous rocks associated with gold and copper mineralization in the Parkes area.
Geological Survey of New South Wales. Report
GS1985/121

Clarke I., 1985
Primary mineralization in the Forbes-Parkes-Peak Hill-Tomingley gold belt.
Geological Survey of New South Wales. Report
GS1985/123

Clarke I., 1989
4. Primary deposits in the Forbes-Parkes-Peak Hill-Tomingley gold belt.
IN Clarke I. & Sherwin L. (eds) - Geological setting of gold and copper deposits in the Parkes area, New South Wales.
Geological Survey of New South Wales. Records
23(1)

Clarke I., Sherwin L., 1989
Geological setting of gold and copper deposits in the Parkes area, New South Wales.
Geological Survey of New South Wales. Records
23(1)

Krynen J.P., Clarke I., 1985
Geological setting of gold mineralization in the Bald Hill area near Forbes.
Geological Survey of New South Wales. Report
GS1985/122

Krynen J.P., Sherwin L., Clarke I., 1989
1. Stratigraphy and structure. IN Clarke I. & Sherwin L. (eds) - Geological setting of gold and copper deposits in the Parkes area, New South Wales.
Geological Survey of New South Wales. Records
23(1)

Krynen J.P., Sherwin L., Clarke I., 1989
Geological map of the Parkes area, scale 1:100 000 (parts of Sheets 8431, 8432, 8531 and 8532).
Geological Survey of New South Wales
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Sherwin L., Clarke I., Krynen J.P., 1987
Revision of stratigraphic units in the Forbes-Parkes-Tomingley district.
Geological Survey of New South Wales. Quarterly Notes
67 P1-23

Tenison Woods K., 1983
Interpretation of regional aeromagnetic and gravity data for the Forbes and Narromine 1:250 000 sheets.
Geological Survey of New South Wales. Report
GS1983/200

Tenison Woods K., 1989
2. Regional geophysics. IN Clarke I. & Sherwin L. (eds) - Geological setting of gold and copper deposits in the Parkes area, New South Wales.
Geological Survey of New South Wales. Records
23(1)

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 13 GRENFELL

DEPOSIT IDENTIFICATION:

SYNONYMS: Weddin Mountain, Emu Creek, Tyagong

COMMODITIES: Au, Sn

DISTRIBUTION:
Record covers veins in field 5 km x 5 km at Grenfell and alluvial deposits in 2 areas, within and E of the primary field, and 7 km S of Grenfell. Nos. 199-210, 213, 223, 225, 230, 232-41, 243-249 on Forbes metallogenic map.

OREBODIES:
Grenfell (Reef) (D), Chance Gully, Consols, Enterprise, Eureka (Evening Star), Eureka Flat, Four Mile, Grenfell (Alluvial) (D), Homeward Bound, Lawsons Gully, Lawsons Hill, Main Grenfell, Milkmans, Native Bear, Peep Of Day, Quartz Hill, Quondong, Secret, Seven Mile, Star Gully, Star Gully (Alluvial), Stuarts Gully, Surprise, Two Mile, Young Farmer, Young O'Brien

MINES:
Band Of Hope, Brittania, Chance Gully, Consols (O'Briens), Daleys, Day Dawn, Dead Mans, Dreamers, Enterprise, Eureka (Evening Star), Eureka Flat, Floyds, Four Mile, Frenchmans, Golden Paint, Grenfell, Homeward Bound, Lawsons Gully, Lawsons Hill, Little Reef, Lucknow, Main Grenfell Lead, Milkmans, Native Bear Lead, New Welcome, Oriental, Outward Bound, Peep Of Day, Pipes, Prussian, Quartz Hill, Quondong, Result, Scotts & Baileys, Secret, Seven Mile, Star Gully, Star Gully Lead, Stuarts Gully, Surprise, Two Mile, Victory, Welcome, Western Reef, White Rose, Who'd Have Thought It, Williams, Wilsons, Young Farmer, Young O'Brien

GROUP: -

COMMENTS:
See Deposit No.25 YOUNG-WOMBAT for regional setting of Young Anticlinorial Zone.

LOCATION:

LATITUDE: 33 54 — LONGITUDE: 148 10
250K SHEET: SI55 7 — 100K SHEET: 8530

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Orange
LOCAL GOVERNMENT AREA (LGA): Weddin

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1865	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Chance Gully	Chance Gully	Historical	Underground
Consols	Consols (O'Briens)	Historical	Underground
Consols	Consols (O'Briens)	Historical	Open-Cut
Consols	Daleys	Historical	Underground
Consols	Daleys	Historical	Open-Cut
Consols	Dreamers	Historical	Underground
Consols	Dreamers	Historical	Open-Cut
Consols	Prussian	Historical	Underground
Consols	Prussian	Historical	Open-Cut
Enterprise	Enterprise	Historical	Underground
Enterprise	Enterprise	Historical	Surface
Enterprise	Victory	Historical	Underground
Enterprise	Victory	Historical	Surface
Enterprise	Band Of Hope	Historical	Underground
Enterprise	Band Of Hope	Historical	Surface

Enterprise	New Welcome	Historical	Underground
Enterprise	New Welcome	Historical	Surface
Enterprise	Welcome	Historical	Underground
Enterprise	Welcome	Historical	Surface
Enterprise	Who'd Have Thought It	Historical	Underground
Enterprise	Who'd Have Thought It	Historical	Surface
Enterprise	Result	Historical	Underground
Enterprise	Result	Historical	Surface
Enterprise	Floyds	Historical	Underground
Enterprise	Floyds	Historical	Surface
Eureka (Evening Star)	Eureka (Evening Star)	Historical	Underground
Eureka (Evening Star)	Eureka (Evening Star)	Historical	Open-Cut
Eureka Flat	Eureka Flat	Historical	Underground
Eureka Flat	Eureka Flat	Historical	Surface
Four Mile	Four Mile	Historical	Underground
Homeward Bound	Lucknow	Historical	Open-Cut
Homeward Bound	Lucknow	Historical	Underground
Homeward Bound	Homeward Bound	Historical	Open-Cut
Homeward Bound	Homeward Bound	Historical	Underground
Homeward Bound	Dead Mans	Historical	Open-Cut
Homeward Bound	Dead Mans	Historical	Underground
Homeward Bound	Little Reef	Historical	Open-Cut
Homeward Bound	Little Reef	Historical	Underground
Homeward Bound	Western Reef	Historical	Open-Cut
Homeward Bound	Western Reef	Historical	Underground
Homeward Bound	Brittania	Historical	Open-Cut
Homeward Bound	Brittania	Historical	Underground
Homeward Bound	Wilsons	Historical	Open-Cut
Homeward Bound	Wilsons	Historical	Underground
Homeward Bound	Frenchmans	Historical	Underground
Homeward Bound	Frenchmans	Historical	Open-Cut
Homeward Bound	Outward Bound	Historical	Open-Cut
Homeward Bound	Outward Bound	Historical	Underground
Lawsons Gully	Lawsons Gully	Historical	Underground
Lawsons Hill	Golden Paint	Historical	Underground
Lawsons Hill	Golden Paint	Historical	Surface
Lawsons Hill	Lawsons Hill	Historical	Underground
Lawsons Hill	Lawsons Hill	Historical	Surface
Lawsons Hill	White Rose	Historical	Underground
Lawsons Hill	White Rose	Historical	Surface
Lawsons Hill	Scotts & Baileys	Historical	Underground
Lawsons Hill	Scotts & Baileys	Historical	Surface
Main Grenfell	Main Grenfell Lead	Historical	Underground
Milkmans	Milkmans	Historical	Underground
Native Bear	Native Bear Lead	Historical	Underground
Peep Of Day	Peep Of Day	Historical	Underground
Quartz Hill	Quartz Hill	Historical	Underground
Quondong	Quondong	Historical	Underground
Secret	Secret	Historical	Surface
Seven Mile	Seven Mile	Historical	Underground
Star Gully	Star Gully	Historical	Underground
Star Gully (Alluvial)	Star Gully Lead	Historical	Underground
Stuarts Gully	Stuarts Gully	Historical	Underground
Surprise	Surprise	Historical	Underground
Two Mile	Two Mile	Historical	Underground
Young Farmer	Young Farmer	Historical	Underground
Young Farmer	Young Farmer	Historical	Open-Cut
Young O'Brien	Oriental	Historical	Unknown
Young O'Brien	Young O'Brien	Historical	Unknown
Young O'Brien	Williams	Historical	Unknown
Young O'Brien	Grenfell	Historical	Unknown
Young O'Brien	Pipes	Historical	Unknown

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 10,028
Average recovered grade (reef deposits) 27 g/t Au, range <15->60 g/t Au; alluvial deposits up to 60 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: 1866-1935,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Young Anticlinorial Zone
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Lawsons Gully Porphyry - Early Devonian
LITHOLOGY: Quartz-feldspar porphyry.
RELATIONSHIP TO MINERALISATION: Host to primary mineralisation in single and multiple parallel vein systems.

FORMATION NAME & AGE: Unnamed Metasedimentary Sequence (Q5L2) - Late Ordovician
LITHOLOGY: Phyllite, schist, micaceous and silty sandstone and siltstone, limestone, minor andesite.
RELATIONSHIP TO MINERALISATION: Intruded by mineralised porphyries.

FORMATION NAME & AGE: Grenfell Granite - Early Devonian
LITHOLOGY: Siliceous muscovite-biotite granite.
RELATIONSHIP TO MINERALISATION: Intrudes mineralised porphyries close to deposit.

FORMATION NAME & AGE: Unnamed - Tertiary
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to alluvial orebodies.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Alluvium, Felsic Porphyry,
SIGNIFICANT: Clastic Sedimentary,
MINOR: Granitic

STRUCTURAL FEATURES:

MAJOR: Fracturing,
SIGNIFICANT: Faulting

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

MAJOR: Intrusive Contact

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Granite), Sub-Volcanism (Felsic Porphyry)

METAMORPHISM:
Regional metamorphic grade is greenschist facies.

ALTERATION:

OREBODY: Grenfell (Reef) (D)
The auriferous veins apparently formed by siliceous alteration of quartz-feldspar porphyry as indicated by gradational contacts from vein quartz to altered and silicified porphyry (Bowman, 1977).

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Auriferous quartz veins in felsic porphyry intrusives.
Alluvial.

STYLE:

MAJOR: Conformable, Discordant, Stratabound

MORPHOLOGY: Lenticular

AGE OF MINERALISATION: Cainozoic Tertiary, Palaeozoic Early Devonian

DIMENSIONS/ORIENTATION:

OREBODY: Grenfell (Reef) (D)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			300.0
TRUE WIDTH	(cm)		100.0	300.0
VERTICAL DEPTH	(m)			219.0
DEPTH OXIDATION	(m)			113.0
		ANGLE (deg.)		DIRECTION
DIP		45-80; 75-90		NW; E,W
STRIKE		045; 180		

OREBODY: Chance Gully

		MIN	AVE	MAX
STRIKE LENGTH	(m)			900.0

OREBODY: Consols

		MIN	AVE	MAX
TRUE WIDTH	(m)	3.0		
VERTICAL DEPTH	(m)			219.0
		ANGLE (deg.)		DIRECTION
DIP		55-70		NW
STRIKE		045		

OREBODY: Enterprise

		MIN	AVE	MAX
STRIKE LENGTH	(m)			200.0
VERTICAL DEPTH	(m)			108.0
		ANGLE (deg.)		DIRECTION
DIP		70		NW
STRIKE		045		

OREBODY: Eureka (Evening Star)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			300.0
VERTICAL DEPTH	(m)			7.0
		ANGLE (deg.)		DIRECTION
DIP		65; 75-90		W; N,S
STRIKE		345; 90		

OREBODY: Eureka Flat

		MIN	AVE	MAX
STRIKE LENGTH	(m)			700.0

OREBODY: Four Mile

		MIN	AVE	MAX
STRIKE LENGTH	(m)			800.0

OREBODY: Grenfell (Alluvial) (D)

		MIN	AVE	MAX
STRIKE LENGTH	(m)	300.0		2000.0
TRUE WIDTH	(cm)	9.0		45.0
DEPTH OF COVER	(m)	9.0	24.0	60.0

OREBODY: Homeward Bound

		MIN	AVE	MAX
STRIKE LENGTH	(m)			213.0
TRUE WIDTH	(cm)			100.0
VERTICAL DEPTH	(m)			135.0
		ANGLE (deg.)		DIRECTION
DIP		50-70		NW
STRIKE		035		

OREBODY: Lawsons Gully

		MIN	AVE	MAX
STRIKE LENGTH	(m)			850.0
DEPTH OF COVER	(m)			31.5

OREBODY: Lawsons Hill

		MIN	AVE	MAX
STRIKE LENGTH	(m)			300.0
VERTICAL DEPTH	(m)			180.0

		ANGLE (deg.)		DIRECTION
STRIKE		045		

ORE BODY: Main Grenfell

		MIN	AVE	MAX
DEPTH OF COVER	(m)	9.0		24.0

OREBODY: Milkmans

		MIN	AVE	MAX
STRIKE LENGTH	(m)			600.0
DEPTH OF COVER	(m)			150.0

OREBODY: Native Bear

		MIN	AVE	MAX
STRIKE LENGTH	(m)			300.0
TRUE WIDTH	(m)			15.0
DEPTH OF COVER	(m)			72.0

OREBODY: Peep Of Day

		MIN	AVE	MAX
STRIKE LENGTH	(m)			500.0

OREBODY: Quartz Hill

		MIN	AVE	MAX
TRUE WIDTH	(cm)			100.0
VERTICAL DEPTH	(m)			108.0
		ANGLE (deg.)		DIRECTION
STRIKE		180		

OREBODY: Quondong

		MIN	AVE	MAX
DEPTH OF COVER	(m)			60.0

OREBODY: Secret

		ANGLE (deg.)		DIRECTION
DIP		75-90		E,W
STRIKE		350		

OREBODY: Seven Mile

		MIN	AVE	MAX
STRIKE LENGTH	(m)			2000.0
DEPTH OF COVER	(m)			60.0

OREBODY: Star Gully

		MIN	AVE	MAX
STRIKE LENGTH	(m)			9.0
TRUE WIDTH	(cm)			100.0
VERTICAL DEPTH	(m)			18.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		W
STRIKE		180		

OREBODY: Star Gully (Alluvial)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			450.0
DEPTH OF COVER	(m)	10.0		24.0

OREBODY: Stuarts Gully

		MIN	AVE	MAX
AREA	(m)			500.0

OREBODY: Surprise

		MIN	AVE	MAX
STRIKE LENGTH	(m)			100.0
VERTICAL DEPTH	(m)			10.0
		ANGLE (deg.)		DIRECTION
STRIKE		340		

OREBODY: Two Mile

		MIN	AVE	MAX
STRIKE LENGTH	(m)			900.0
DEPTH OF COVER	(m)			54.0

OREBODY: Young Farmer

		MIN	AVE	MAX
TRUE WIDTH	(cm)			30.0
VERTICAL DEPTH	(m)			33.0
		ANGLE (deg.)		DIRECTION
STRIKE		180		

OREBODY: Young O'Brien

		MIN	AVE	MAX
TRUE WIDTH	(cm)			180.0
VERTICAL DEPTH	(m)			53.0
		ANGLE (deg.)		DIRECTION
DIP				E;N
STRIKE		045;090		

ORE TEXTURE:
Disseminated, Free Milling, Oxidised

NATURE OF MINERALISATION:
PRIMARY ORE: Multiple Veins, Vein (Reef),
SECONDARY ORE: Detrital (Alluvial), Supergene Enrichment

MINERALOGY:

OREBODY: Grenfell (Reef) (D)
Sulphide ore: gold, quartz, pyrite, arsenopyrite, chalcopyrite, galena.
Gangue: calcite.
Gold grades varied widely among reefs and declined at depth, the latter effect probably as a result of supergene processes.

OREBODY: Enterprise
Sulphide ore: gold, pyrite, (arsenopyrite, chalcopyrite).

OREBODY: Grenfell (Alluvial) (D)
Gold was locally accompanied by cassiterite, derived from the Grenfell Granite.

OREBODY: Homeward Bound
Sulphide ore: gold, arsenopyrite, pyrite.

OREBODY: Milkmans
Gold is accompanied by cassiterite.

OREBODY: Star Gully
Sulphide ore: gold, (cassiterite).

OREBODY: Star Gully (Alluvial)
Gold was accompanied by cassiterite.

GENETIC MODELS:
Hydrothermal: associated with intrusion of Early Devonian porphyry dykes and sills (Bowman, 1977).
Secondary deposits produced by weathering of veins in Ordovician metasediments and intrusive porphyry sills (Bowman, 1977).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Grenfell (Reef) (D)
PRINCIPAL SOURCES: Bowman (1976, 1977), Markham (1982).
SUMMARY

Grenfell lies near the central western margin of the Young Anticlinorial Zone. Gold production has come equally from reef and alluvial sources. Primary mineralisation occurred in veins within Early Devonian quartz-feldspar porphyry sills intruded into Late Ordovician metasediments. Secondary mineralisation occurred in a group of leads in the vicinity of Grenfell which derived their gold from the porphyry-hosted reefs, and in a second group of leads to the E and S of Grenfell which probably derived their gold from reefs hosted by the Ordovician metasediments or by serpentinite. Primary mineralisation in the metasediments is small.

GEOLOGICAL SETTING: GRENFELL
PRINCIPAL SOURCES: Bowman (1976, 1977).

1./ Late Ordovician metasediments (Q5L2 on Forbes metallogenic map) form

a NNE-striking belt of undifferentiated quartzose greywacke, chert, slate, quartzite, phyllite, schist, micaceous and silty sandstone and siltstone, with limestone lenses and minor andesite.
In the Scheibner (1976) model, the sequence was originally deposited in a marginal sea environment of the Initial Cowra Trough (formed by splitting of the Molong Volcanic Arc) and deformed during the Benambran Orogeny. The Ordovician strata are overlain E of Grenfell by Silurian volcanics of the Yass-Canberra Rise and by Devonian sediments.
2./ The Ordovician metasediments have been intruded at Grenfell by a suite of NNE-trending bodies of dark green quartz-feldspar porphyry. The intrusives, which are considered to be of Early Devonian age (Bowman, 1977), occur as thick sills up to 4 km long and 300 m wide.
3./ The porphyries and metasediments are intruded immediately to the NE of Grenfell by the Grenfell Granite (alpha4L1 on Forbes metallogenic map) (Early Devonian) - siliceous, muscovite-biotite granite.
4./ A narrow belt of serpentinite enclosed by Ordovician metasediments S of Grenfell (Tyagong Serpentinite, SL1) may represent upper mantle which was emplaced in the Early Devonian ?during closure of the Tumut Trough Bowman (1977).

A major NNE fault displaces Grenfell Granite N of Grenfell and marks the boundary with the Tumut Synclinorial Zone.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Markham & Basden (1974), Bowman (1977), Markham (1982).

Primary mineralisation at Grenfell occurred in 24 parallel (and minor cross-cutting) reefs, consisting of single or multiple vein systems.
The principal reefs were enclosed entirely within quartz-feldspar porphyry. Reefs and host sills parallel regional strike.
Vein formation by replacement of porphyry along zones of fissuring/fracturing is indicated by i) gradation of the quartz vein material into highly altered, silicified porphyry at depth and ii) sharp definition of one vein wall compared with gradational contact between vein and country rock on the other wall.
Porphyries and reefs have been displaced by numerous small horizontal and vertical post-lode faults.
Lesser primary mineralisation was hosted by metasediments and by granite. Although the metasediment-hosted reefs were not significant for primary gold, they are considered to have been the source of a large proportion of the alluvial gold of the Grenfell field.

OREBODY: Chance Gully
Source of alluvial gold was probably veins in Ordovician slates, possibly serpentinite.

OREBODY: Consols
Host rock is dark green quartz-feldspar porphyry. Consols was the first reef to be worked and possibly the most productive of the field. Gold content declined below 152 m where quartz vein material became associated with calcite and the nature of the mineralisation changed to an irregular zone of quartz replacement of highly altered volcanic rock.

OREBODY: Enterprise
Host rock is quartz-feldspar porphyry.
Total width of vein system = 200 m.
Faults strike 140 deg.

OREBODY: Eureka (Evening Star)
Host rocks are fine to medium quartz-lithic sandstone, slate and phyllite. Veins were disposed in two cross-cutting sets.
Total width of vein system = 15 m.

OREBODY: Eureka Flat
Alluvial gold was derived from the Eureka and Surprise vein deposits in slates and from veins within the serpentinites.

OREBODY: Four Mile
Source of alluvial gold was probably minor (unexploited) veins in Ordovician slates.

OREBODY: Grenfell (Alluvial) (D)
PRINCIPAL SOURCES: Markham (1982).

Host alluvium comprised basal auriferous gravel from 30-45 cm thick, overlain by varying thickness of Tertiary to Recent sediment.
The Lawsons Gully, Main Grenfell and Star Gully leads close to the reef deposits have clearly derived the bulk of their gold from weathering of porphyry-hosted vein deposits. By contrast the Quondong lead and its associated tributaries including Two Mile and Milkmans traverse dominantly Ordovician sediments and their gold content is likely to

have been derived from reefs present in these rocks. To the S the Seven Mile lead and associated Eureka Flat, Peep of Day and Chance Gully leads are likewise incised in dominantly Ordovician sediments with their gold content likely to have been derived from quartz reefs present either within these sediments or associated with the prominent belt of serpentinite rocks that occurs immediately to the S.

OREBODY: Homeward Bound
Host rock is quartz-feldspar porphyry.
Horizontal and vertical faults strike 120 deg.

OREBODY: Lawsons Gully
Lead drained westwards. Gradient of lead = 1:3.
Source of alluvial gold was almost certainly reefs within an intrusive porphyry.

OREBODY: Lawsons Hill
Host rock is quartz-feldspar porphyry. Faults strike 120 deg.
Total width of parallel vein system = 100 m.

OREBODY: Main Grenfell
Alluvial gold was almost certainly derived from porphyry.

OREBODY: Milkmans
Source of alluvial gold was probably small quartz veins in Ordovician slates; cassiterite was probably derived from Grenfell Granite.

OREBODY: Native Bear
Source of alluvial gold was probably small veins in Ordovician slate.
Average thickness of auriferous gravel = 6 cm.

OREBODY: Peep Of Day
Source of alluvial gold was probably veins in Ordovician slates.

OREBODY: Quartz Hill
Host rock is light brown tuffaceous sandstone.
Total width of vein system = 5 m.

OREBODY: Quondong
Source of gold was possibly veins in Ordovician slates.

OREBODY: Secret
Host rocks are fine sandstone, phyllite, slate.

OREBODY: Seven Mile
Depth of floor of lead increased westwards.
Alluvial gold was probably derived by weathering of veins within Ordovician slates and within serpentinite.

OREBODY: Star Gully
Host rocks are Grenfell Granite and slate.

OREBODY: Star Gully (Alluvial)
Most of the alluvial gold was derived from veins in the porphyry.
The cassiterite and a small proportion of the gold was derived from Grenfell Granite.

OREBODY: Stuarts Gully
Source of alluvial gold was possibly serpentinite.

OREBODY: Surprise
Host lithologies are sandstone, slate and phyllite.
Total width of vein system = 10 m.

OREBODY: Two Mile
Source of alluvial gold was possibly small reefs in Ordovician sediments.

OREBODY: Young Farmer
Host rocks are Ordovician slates.

OREBODY: Young O'Brien
Host rock is dark green quartz-feldspar porphyry.
Mineralisation occurred in two cross-cutting vein sets.
Faults strike 130 deg; horizontal faults occur as well.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Bowman H.N., 1976
Forbes, New South Wales, 1:250 000 metallogenic map. Sheet SI 55-7.

Geological Survey of New South Wales
1v

Bowman H.N., 1977
Forbes 1:250 000 metallogenic map SI 55-7 - mine data sheets and metallogenic study.
Geological Survey of New South Wales
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Mulholland C. St J., 1935
Geological survey of the Grenfell goldfield.
Geological Survey of New South Wales. Report
GS1935/002

Ryall A.W., 1974
Geology of the Grenfell area, New South Wales. B.A. thesis.
Macquarie University. Unpublished
1v

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

oooooooooooooooooooooooooooooooooooooo

DEPOSIT: 14 WEST WYALONG

DEPOSIT IDENTIFICATION:

SYNONYMS: Wyalong

COMMODITIES: Au

DISTRIBUTION:
Record covers 12 main and 13 minor reefs clustered in zone 6 km x 5 km between the towns of Wyalong and West Wyalong. Nos. 185-196 on Forbes metallogenic map.

OREBODIES:
West Wyalong (D), Called Back, Klondyke, Mallee Bull, Pine Hill, Pine Ridge, Pioneer, Santa Claus & Klinks, Summergills, Western West Wyalong

MINES:
Ante-Up, Balaclava, Bantam & Lady, Barrier, Brickkiln, Called Back, Christmas Gift, Christmas Gift Block, Currajong, Daisy, Day Dawn, Easter Gift (Dead Rabbit), Erins Isle, Gatlaus, Great Southern, Harrys Find, Hill Top, Junction, Just In Time, Klondyke, Lady Mary, Lucknow, Maiee, Miners Right, Miscellaneous Group, Mouse Trap, Neelds No. 1, New South Wales (Klinks, Lighthouse), Perrys, Perseverance, Pine Hill, Pine Ridge, Princess, Santa Claus, Shamrock, Shamrock & Thistle, Stanleys Blow, Summergills, The Pioneer, True Blue, Waratah

GROUP: Gilmore Fault Zone Group

COMMENTS:
See Deposit No.20 ADELONG for regional setting of Wagga Anticlinorial Zone; No.16 TEMORA (GIDGINBUNG) for regional setting of Gilmore Fault Zone group.

LOCATION:

LATITUDE: 33 55 LONGITUDE: 147 12
250K SHEET: SI55 7 100K SHEET: 8330

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Orange
LOCAL GOVERNMENT AREA (LGA): Bland

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1893	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Called Back	Lady Mary	Historical	Underground
Called Back	Called Back	Historical	Underground
Called Back	Balaclava	Historical	Underground
Klondyke	Shamrock	Historical	Underground
Klondyke	Klondyke	Historical	Underground
Klondyke	Klondyke	Completed	Tailings Re-Treatment
Klondyke	Brickkiln	Historical	Underground
Klondyke	Gatlaus	Historical	Underground
Mallee Bull	Perseverance	Historical	Underground
Mallee Bull	True Blue	Historical	Underground
Mallee Bull	True Blue	Completed	Tailings Re-Treatment
Mallee Bull	Junction	Historical	Underground
Mallee Bull	Bantam & Lady	Historical	Underground
Mallee Bull	Daisy	Historical	Underground
Mallee Bull	Neelds No. 1	Historical	Underground
Mallee Bull	Neelds No. 1	Completed	Tailings Re-Treatment
Mallee Bull	Maiee	Historical	Underground
Mallee Bull	Lucknow	Historical	Underground
Pine Hill	Pine Hill	Historical	Underground
Pine Ridge	Pine Ridge	Historical	Underground

Pioneer	The Pioneer	Historical	Underground
Pioneer	Christmas Gift Block	Historical	Underground
Pioneer	Christmas Gift	Historical	Underground
Pioneer	Easter Gift (Dead Rabbit)	Historical	Underground
Pioneer	Great Southern	Historical	Underground
Santa Claus & Klinks	New South Wales (Klinks, Lighthouse)	Historical	Underground
Santa Claus & Klinks	Harrys Find	Historical	Underground
Santa Claus & Klinks	Santa Claus	Historical	Underground
Santa Claus & Klinks	Erins Isle	Historical	Underground
Santa Claus & Klinks	Shamrock & Thistle	Historical	Underground
Santa Claus & Klinks	Waratah	Historical	Underground
Santa Claus & Klinks	Ante-Up	Historical	Underground
Santa Claus & Klinks	Princess	Historical	Underground
Summergills	Miners Right	Historical	Underground
Summergills	Stanleys Blow	Historical	Underground
Summergills	Summergills	Historical	Underground
Summergills	Day Dawn	Historical	Underground
Summergills	Just In Time	Historical	Underground
Western West Wyalong	Currajong	Historical	Underground
Western West Wyalong	Barrier	Historical	Underground
Western West Wyalong	Mouse Trap	Historical	Underground
Western West Wyalong	Miscellaneous Group	Historical	Underground
Western West Wyalong	Perrys	Historical	Underground
Western West Wyalong	Hill Top	Historical	Underground

COMPANIES:

OREBODY: West Wyalong (D)

PRESENT OPERATORS:
Cluff Minerals (Australia) Pty Ltd

PRESENT OWNERS:	EQUITY%
Alkane Exploration N L	50.00
Cluff Resources Pacific Ltd.	50.00

OREBODY: Klondyke

PRESENT OPERATORS:
Cluff Minerals (Australia) Pty Ltd

PRESENT OWNERS:	EQUITY%
Alkane Exploration N L	50.00
Cluff Resources Pacific Ltd.	50.00

OREBODY: Mallee Bull

PRESENT OPERATORS:
Cluff Minerals (Australia) Pty Ltd

PRESENT OWNERS:	EQUITY%
Alkane Exploration N L	50.00
Cluff Resources Pacific Ltd.	50.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 14,104
Average recovered grade generally >30 g/t Au, mostly in range 45÷55 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

YEAR	PRODUCTION	
1987	110	Tailings re-treatment
1988	29	tailings re-treatment

MAIN PRODUCTION PERIODS: (1936-1945), 1894-1915, 1987-1988,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Wagga Anticlinorial Zone
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Wyalong Granodiorite - Late Silurian
LITHOLOGY: Hornblende-biotite granodiorite.
RELATIONSHIP TO MINERALISATION: Host to principal mineralisation in complex quartz-carbonate veins in shear zones.

FORMATION NAME & AGE: Bland Diorite - Late Ordovician-Early Silurian
LITHOLOGY: Diorite, norite, hornblende schist.
RELATIONSHIP TO MINERALISATION: Host to minor mineralisation at small unnamed deposits in eastern part of field.

FORMATION NAME & AGE: Wagga Metamorphics - Late Ordovician
LITHOLOGY: Siltstone, subgreywacke, quartzite, impure sandstone, black (carbonaceous) shale; slate, phyllite; chlorite, knotted, quartz-mica, and graphitic schists.
RELATIONSHIP TO MINERALISATION: Host to mineralisation in slate & sandstone at Pine Ridge and Pine Hill.

GEOCHRONOLOGY:
Bland Diorite dated at Late Ordovician-Early Silurian (K-Ar); and Wyalong Granodiorite at Late Silurian (K-Ar) (Rowley, 1975, reported by Bowman, 1977).

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Granitic,
MINOR: Intermediate Intrusive, Metasedimentary

STRUCTURAL FEATURES:

MAJOR: Faulting, Shearing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

SIGNIFICANT: Intrusive Contact

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Granodiorite),
SIGNIFICANT: Plutonism (Diorite)

METAMORPHISM:
Regional metamorphic grade (Wagga Metamorphics) is low greenschist facies. The Wyalong Granodiorite has a weakly developed contact metamorphic aureole.

ALTERATION:

OREBODY: West Wyalong (D)
A zone of prominent wallrock alteration was reportedly developed adjacent to the veins, in addition to the zone of crushed granodiorite containing the reefs. Epidote, chlorite replacing biotite, and secondary quartz were recorded from tne alteration zone (Markham & Basden, 1974).

OREBODY: Mallee Bull

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Auriferous quartz veins in granitoid adjacent to mafic/intermediate intrusives.

STYLE:

MAJOR: Discordant

MORPHOLOGY: Lenticular

AGE OF MINERALISATION: Palaeozoic Late Silurian

DIMENSIONS/ORIENTATION:

OREBODY: West Wyalong (D)

		MIN	AVE	MAX
TRUE WIDTH	(cm)	3.0	40.0	100.0
STRIKE LENGTH	(m)			2100.0
VERTICAL DEPTH	(m)			396.0
DEPTH OXIDATION	(m)			50.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		E
STRIKE		20-30		

OREBODY: Called Back

		MIN	AVE	MAX
STRIKE LENGTH	(m)			700.0
TRUE WIDTH	(cm)	15.0	75.0	100.0
VERTICAL DEPTH	(m)			73.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		E
STRIKE		050		

OREBODY: Klondyke

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			140.0
STRIKE LENGTH	(m)			300.0
TRUE WIDTH	(cm)			100.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		E
STRIKE		030		

OREBODY: Mallee Bull

		MIN	AVE	MAX
DEPTH OXIDATION	(m)			50.0
VERTICAL DEPTH	(m)			396.0
TRUE WIDTH	(cm)		30.0	200.0
STRIKE LENGTH	(m)			2100.0
		ANGLE (deg.)		DIRECTION
DIP		55-80		E
PLUNGE		75-90		S
STRIKE		020		

OREBODY: Pine Hill

		MIN	AVE	MAX
STRIKE LENGTH	(m)			20.0
TRUE WIDTH	(cm)		15.0	
VERTICAL DEPTH	(m)			21.0
		ANGLE (deg.)		DIRECTION
DIP		80		E
STRIKE		015		

OREBODY: Pine Ridge

		MIN	AVE	MAX
TRUE WIDTH	(cm)		15.0	
STRIKE LENGTH	(m)			600.0
		ANGLE (deg.)		DIRECTION
DIP		80		E
STRIKE		020		

OREBODY: Pioneer

		MIN	AVE	MAX
STRIKE LENGTH	(m)			600.0
TRUE WIDTH	(cm)		20.0	
		ANGLE (deg.)		DIRECTION
DIP		75-90		N
STRIKE		280		

OREBODY: Santa Claus & Klinks

		MIN	AVE	MAX
STRIKE LENGTH	(m)			400.0
TRUE WIDTH	(cm)		60.0	
VERTICAL DEPTH	(m)			210.0
		ANGLE (deg.)		DIRECTION
DIP		17-45		E
STRIKE		010-017		

OREBODY: Summergills

		MIN	AVE	MAX

		MIN	AVE	MAX
STRIKE LENGTH	(m)			945.0
TRUE WIDTH	(cm)		30.0	
VERTICAL DEPTH	(m)			93.0
		ANGLE (deg.)		DIRECTION
DIP				SE
STRIKE		045		

OREBODY: Western West Wyalong

		MIN	AVE	MAX
DEPTH OXIDATION	(m)			50.0
STRIKE LENGTH	(m)			2500.0
TRUE WIDTH	(cm)		300.0	
		ANGLE (deg.)		DIRECTION
DIP		75-90		E
STRIKE		010-025		

ORE TEXTURE:
Disseminated

NATURE OF MINERALISATION:
PRIMARY ORE: Multiple Veins, Vein (Reef),
SECONDARY ORE: Supergene Enrichment

MINERALOGY:

OREBODY: West Wyalong (D)
Sulphide ore: auriferous pyrite, free gold, (galena, native copper, sphalerite, chalcopyrite).
Oxide ore: native copper, copper carbonate, (cerussite, pyrolusite).
Some gold in the oxidised zone occurred in pink opaline quartz.
Gangue: white or milky quartz, colloidal silica, calcite, gypsum.
Gold was very finely divided; values were high in the presence of pyrite, and much of the gold probably occurred as fine inclusions in the s[illegible]ide mineral (Markham & Basden, 1974).

CONTROLS OF MINERALISATION:
Control is mainly structural: main channels are shear zones; spurs are tensional openings (Markham, 1982).

GENETIC MODELS:
PRINCIPAL SOURCES: Bowman (1977), Markham (1982).

Hydrothermal: associated with intrusion of the Wyalong Granodiorite; the gold may have been derived from the Bland Diorite (Bowman, 1977).
Markham (1982): 'The gold mineralisation of the Wyalong Field is clearly of hydrothermal vein type with the ore solutions being localised along favourable structural directions within the quartz-mica diorite host.
The veins do not appear to have formed by infilling of open fissures but have formed, at least in part, by metasomatism aong with accompanying hydrothermal alteration of the wallrock. The source of the solutions is not definitely known but has probably been derived ultimately from the same magmatic source as the quartz diorite host itself.'

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: West Wyalong (D)
PRINCIPAL SOURCES: Markham & Basden (1974), Bowman (1976, 1977), Markham (1982), Suppel & others (1986).
SUMMARY

West Wyalong lies near the eastern margin of the north-central part of the Wagga Anticlinorial Zone, close to the known northern limit of the Gilmore Fault Zone.
Mineralisation comprised a series of lenticular complex quartz-carbonate reefs which occupy prominent zones of intense crushing or shearing in the Late Silurian Wyalong Granodiorite. Minor mineralisation was hosted by the Bland Diorite and Wagga Metamorphics.

GEOLOGICAL SETTING: WEST WYALONG
PRINCIPAL SOURCES: Bowman (1976, 1977), Suppel & others (1986).

The Wyalong Granodiorite (gamma3L2 on Forbes metallogenic map) is one of a number of late-kinematic granitoid plutons of the Bowning Orogeny which intrude the Wagga Metamorphic Belt in a submeridional belt parallel to the Gilmore Fault Zone.
The Wyalong Granodiorite appears to straddle the fault zone (Suppel & others, 1986). Wagga Metamorphics (Q3L1) occur 4 km W of West Wyalong.

The Wyalong Granodiorite is foliated, medium-grained, and has a weakly developed contact metamorphic aureole. Some chemical analyses indicate an S-type character, but the host rocks of the goldfield may belong to a different, I-type phase (Suppel & others, 1986). Hornblende is an important constituent of the host granitoid, which in one of the lodes (Klondyke) is petrologically quartz-mica diorite.

The granodiorite intrudes mafic to intermediate intrusives and metamorphosed andesites, the Bland Diorite (alphaL), 3 km E and SE of the deposit. Lithologies of the Bland Diorite are norite, diorite, andesite and metamorphosed equivalents, including hornblende schist, that have been altered and partially assimilated by granite intrusion. A belt of volcanics, sediments, and volcaniclastics flanking the Gilmore Fault Zone between West Wyalong and TEMORA (GIDGINBUNG) (Deposit No.16) may be genetically related to the diorite.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Markham & Basden (1974), Bowman (1977), Markham (1982).

Gold mineralisation occurred in a series of small to very large veins occupying portions of chloritised shear or crush zones within foliated granodiorite. Minor mineralisation occurred in the Bland Diorite and in slate of the Wagga Metamorphics.
Veins were complex in detail and thinned and thickened rapidly in both horizontal and vertical directions. Gold distribution was irregular but in general richer values were found at intersections of the main mineralised channels with subsidiary structures, or 'spur' veins, which died out in the country rock.
The subsidiary channels showed characteristics of tensional openings, whereas the main channels were shear fillings.

OREBODY: Called Back
Host is Wyalong Granodiorite.

OREBODY: Klondyke
Host rock is quartz-mica diorite.

OREBODY: Mallee Bull
Subsidiary channels were well developed. Veins commonly split and rejoined. Total width of line of lode = 40 m.

OREBODY: Pine Hill
Mineralisation was localised in indurated slate and fine green lithic sandstone near intrusive contact with Bland Diorite.
Granodiorite occurs at depth.
Total width of line of mineralisation = 10 m.

OREBODY: Pine Ridge
Very high-grade mineralisation was localised in indurated slate and green lithic sandstone near intrusive contact with Bland Diorite.
Total width of line of mineralisation = 30 m.

OREBODY: Pioneer
Total width of line of mineralisation = 10 m.

OREBODY: Summergills
Mineralisation consisted of several parallel veins.
Total width of line of lode = 20 m.

OREBODY: Western West Wyalong
Mineralisation comprised several parallel lodes.
Total width of line of lode = 630 m.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Bowman H.N., 1976
Forbes, New South Wales, 1:250 000 metallogenic map. Sheet SI 55-7.
Geological Survey of New South Wales
1v

Bowman H.N., 1977
Forbes 1:250 000 metallogenic map SI 55-7 - mine data sheets and metallogenic study.
Geological Survey of New South Wales
1v

Chapman J., 1986
Disseminated gold deposits along the Gilmore Suture. IN Geological setting of precious metals in New South Wales. One-day symposium, Sydney, October 1986. Abstracts.
Geological Society of Australia

Chapman J., Ferguson A., Suppel D.W., 1986
Gold deposits of the West Wyalong-Temora-Adelong district.
Geological Survey of New South Wales. Report
GS1986/162

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Suppel D.W., Watkins J.J., Warren A.Y.E. , Chapman J. , Tenison Woods K.L., 1985
The geology and gold deposits of the West Wyalong-Temora-Adelong district.
IN Seminar: New South Wales, the potential for development. Abstracts.
AMF and Department of Mineral Resources. Report
GS1985/292 P20-23

Suppel D.W., Warren A.Y.E., Watkins J.J. , Chapman J. , Tenison Woods K.L., Barron L., 1986
A reconnaissance study of the geology and gold deposits of the West Wyalong - Temora - Adelong district.
Geological Survey of New South Wales. Quarterly Notes
64 P1-23

Tenison Woods K.L., 1985
Qualitative interpretation of the regional geophysics of the Cootamundra 1:250 000 sheet, with reference to gold mineralization in the Wyalong-Adelong district.
Geological Survey of New South Wales. Report
GS1985/238

Watt J.A., 1899
Report on the Wyalong goldfield.
New South Wales. Department of Mines. Mineral Resources
5

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 15 BARMEDMAN-REEFTON

DEPOSIT IDENTIFICATION:

COMMODITIES: Au

DISTRIBUTION:
Record covers 15 collinear reefs along 5 km strike length on NNW line of lode at Barmedman, and numerous small collinear reefs along 3 km strike length at Reefton, 10 km SSE from Barmedman. Nos. 5-10, 30 on Cootamundra metallogenic map.

OREBODIES:
Barmedman-Reefton (D), Barnetts, Black Angel, Fiery Cross, Hard To Find, Hassetts, Letts, Moonlight, Morellis, Neversweat, Phoenix, Prospecting, Quails, Reefton, Showground, White Cross, Wrights

MINES:
Ada, Barnetts, Black Angel, Fanny Park, Fiery Cross, Hard To Find, Hassetts, Hunted To Death, Italians, Jacksons, Letts, Moonlight, Morellis, Neversweat, North Hard To Find No.1, North Hard To Find No.2, Phoenix, Pioneer (Enterprise), Pride Of Reefton, Prospecting, Quails, White Cross, Wrights

GROUP: Gilmore Fault Zone Group

COMMENTS:
See Deposit No.9 PARKES (GOONUMBLA) for regional setting of Girilambone Anticlinorial Zone; Deposit No.16 TEMORA (GIDGINBUNG) for regional setting of Gilmore Fault Zone group.

LOCATION:

LATITUDE: 34 9	LONGITUDE: 147 24
250K SHEET: SI55 11	100K SHEET: 8329

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Wagga Wagga
LOCAL GOVERNMENT AREA (LGA): Temora

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1870	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Barnetts	Barnetts	Historical	Underground
Black Angel	Black Angel	Historical	Underground
Fiery Cross	Fiery Cross	Historical	Underground
Fiery Cross	Fanny Park	Historical	Underground
Fiery Cross	Ada	Historical	Underground
Fiery Cross	Hunted To Death	Historical	Underground
Fiery Cross	Italians	Historical	Underground
Fiery Cross	Jacksons	Historical	Underground
Hard To Find	Hard To Find	Historical	Underground
Hard To Find	North Hard To Find No.1	Historical	Underground
Hard To Find	North Hard To Find No.2	Historical	Underground
Hassetts	Hassetts	Historical	Underground
Letts	Letts	Historical	Underground
Moonlight	Moonlight	Historical	Underground
Morellis	Morellis	Historical	Underground
Neversweat	Neversweat	Historical	Underground
Phoenix	Phoenix	Historical	Underground
Prospecting	Prospecting	Historical	Underground
Quails	Quails	Historical	Underground
Reefton	Pioneer (Enterprise)	Historical	Underground
Reefton	Pioneer (Enterprise)	Historical	Surface
Reefton	Pride Of Reefton	Historical	Underground
Reefton	Pride Of Reefton	Historical	Surface
White Cross	White Cross	Historical	Underground

COMPANIES:

OREBODY: Barmedman-Reefton (D)

PRESENT OPERATORS:
Paragon Resources N L

PRESENT OWNERS:	EQUITY%
Base Resources Ltd.	40.00
Paragon Resources N L	60.00

OREBODY: Showground

PRESENT OPERATORS:
Cra Exploration Pty Ltd.

PRESENT OWNERS:	EQUITY%
Cra Exploration Pty Ltd.	40.00
Lachlan Resources N L.	60.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 1,052

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: 1870-1903,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Girilambone Anticlinorial Zone
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Unnamed Sed-Volcanic Sequence (T2L4) - Late Sil-Early Dev
LITHOLOGY: Volcaniclastics, shale, quartzo-feldspathic sandstone, conglomerate, minor pyroclastics.
RELATIONSHIP TO MINERALISATION: Mineralisation occurred in veins in structural sites in slate units adjacent to underlying intermediate volcanics.

FORMATION NAME & AGE: Unnamed Volcanic Complexes - Late Ordovician-Early Silurian
LITHOLOGY: Intermediate volcanics: andesitic and latitic pyroclastics and lavas.
RELATIONSHIP TO MINERALISATION: Underlie host sediments close to mineralisation.

FORMATION NAME & AGE: Unnamed Granites - Late Silurian, Early Devonian
LITHOLOGY: Tourmaline granite, gneissic granite.
RELATIONSHIP TO MINERALISATION: Intrude sedimentary-volcanic sequence in deposit region.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Clastic Sedimentary

STRUCTURAL FEATURES:

MAJOR: Faulting

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

SIGNIFICANT: Intrusive Contact

IGNEOUS ACTIVITY:

MAJOR: Volcanism (Intermediate),
SIGNIFICANT: Plutonism (Diorite)

METAMORPHISM:
? Low greenschist facies.

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Auriferous quartz veins in intermediate to high-grade metasediments associated with intermdiate intrusive adjacent to granitoid.

STYLE:

SIGNIFICANT: Conformable, Discordant

AGE OF MINERALISATION: Palaeozoic Early Devonian, Palaeozoic Late Silurian

DIMENSIONS/ORIENTATION:

OREBODY: Fiery Cross

		MIN	AVE	MAX
STRIKE LENGTH	(m)			152.0
TRUE WIDTH	(cm)			600.0
VERTICAL DEPTH	(m)		66.0	91.0
		ANGLE (deg.)		DIRECTION
DIP		70		E
STRIKE		180		

OREBODY: Hard To Find

		MIN	AVE	MAX
STRIKE LENGTH	(m)			610.0
TRUE WIDTH	(cm)	2.0		30.0
VERTICAL DEPTH	(m)			60.0
		ANGLE (deg.)		DIRECTION
STRIKE		90		

OREBODY: Neversweat

		MIN	AVE	MAX
STRIKE LENGTH	(m)			49.0
TRUE WIDTH	(cm)	15.0		30.0
VERTICAL DEPTH	(m)			33.0
		ANGLE (deg.)		DIRECTION
STRIKE		45		

OREBODY: Phoenix

		MIN	AVE	MAX
STRIKE LENGTH	(m)			244.0
TRUE WIDTH	(cm)	30.0		50.0
VERTICAL DEPTH	(m)			67.0
		ANGLE (deg.)		DIRECTION
DIP		90		
STRIKE		310		

OREBODY: Reefton

		MIN	AVE	MAX
STRIKE LENGTH	(m)			183.0
TRUE WIDTH	(cm)	38.0		41.0
VERTICAL DEPTH	(m)			107.0
		ANGLE (deg.)		DIRECTION
DIP				E
STRIKE		330		

ORE TEXTURE:

NATURE OF MINERALISATION:
PRIMARY ORE: Dissemination, Vein (Reef)

MINERALOGY:

OREBODY: Barmedman-Reefton (D)
Sulphide ore: gold, pyrite, galena, arsenopyrite.
Gangue: quartz, generally free of other minerals.

CONTROLS OF MINERALISATION:

Deposit is structurally controlled on both regional and local scales.

GENETIC MODELS:

Gold may have been derived by remobilisation from underlying volcanics during the Benambran Orogeny (Suppel & others, 1986), or from mafic/intermediate intrusives (Fitzpatrick, 1979).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Barmedman-Reefton (D)
PRINCIPAL SOURCES: Markham & Basden (1974), Fitzpatrick (1976, 1979), Markham (1982), Suppel & others (1986).
SUMMARY

Barmedman and Reefton lie to the E of the Gilmore Fault Zone in the southern part of the Girilambone Anticlinorial Zone.
Mineralisation at both deposits occurred in quartz veins hosted by thick sequences of Late Silurian (?-Early Devonian) argillaceous sediments with minor felsic volcanics overlying ?Ordovician-Silurian intermediate volcanic sequences (Suppel & others, 1986). Rocks of the underlying volcanic complexes occur a short distance to the NW of Barmedman; disseminated gold mineralisation occurs in the volcanics at the Showground prospect (Suppel & others, 1986).

GEOLOGICAL SETTING: BARMEDMAN-REEFTON
PRINCIPAL SOURCES: Fitzpatrick (1976, 1979), Suppel & others (1986).

The host sedimentary sequence is included with T2L4 on Cootamundra metallogenic map; is shown as T in Suppel & others (1986).
The sequence comprises deformed volcaniclastics, shale, siltstone, sandstone, conglomerate and phyllite, and crops out discontinuously over a belt up to 15 km wide E of the Gilmore Fault Zone between Temora West Wyalong. Regional strike of bedding and cleavage are NW.
The sequence may be equivalent to more extensive volcano-sedimentary rocks which flank the southern portion of the Gilmore Fault Zone (Suppel & others, 1986).

The volcano-sedimentary sequence is intruded to the W of Barmedman by an unnamed partially gneissic granite of Silurian age (gamma2-3L2 on Cootamundra metallogenic map).
Two Early Devonian granite plutons occur E of Barmedman and SE of Reefton (gamma3-4L4).
The pluton E of Barmedman is roughly circular and probably fault-bounded on its western margin. It is a coarse-grained tourmaline granite which has produced minor contact metamorphic effects in ?Early Devonian sediments and is probably a high level intrusive (Suppel & others,1986).
S of this granite and NE of Reefton are three small gabbro intrusions of ?Early Devonian age which have produced high grade hornfelsing of sediments (Suppel & others, 1986).

The pluton SE of Reefton is irregular in shape and is a complex of phases of different compositions and different magnetic characteristics.
Minor contact metamorphic effects have been produced.
The granite abuts the Springdale Rift on its eastern margin.

The Silurian volcano-sedimentary succession may have been deposited in a shallow water marginal plateau environment on the Bogan Gate Terrace over Molong Volcanic Arc basement (Scheibner, 1976).

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Markham & Basden (1974), Fitzpatrick (1979), Markham (1982).

Mineralisation occurred entirely within quartz veins of variable strike in slate, altered siltstone and sandstone. Strike of the line of reefs is NNW, parallel to major regional structural trends. Principal veins parallelled cleavage of the host sediments but some cross-reefs were also important producers. Diorite intrusive was reported from the Fiery Cross workings at Barmedman.

OREBODY: Fiery Cross
Fiery Cross, Hunted to Death, Fanny Park, Jacksons and Ada were considered to lie on the same reef, and Letts, Black Angel and Wrights to be diverging branches (Fitzpatrick, 1979). Quails, Neversweat and Italians were nearby.
Diorite was reported to intrude the host sediments, and was in part mineralised (Fitzpatrick, 1979).

OREBODY: Neversweat
Lode was reported to be a cross-vein.

OREBODY: Phoenix
Vein strike parallelled that of host sediments.

OREBODY: Reefton
Line of veins extended over total strike length of 3 km.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Chapman J., 1986
Disseminated gold deposits along the Gilmore Suture. IN Geological setting of precious metals in New South Wales. One-day symposium, Sydney, October 1986. Abstracts.
Geological Society of Australia
18

Chapman J., Ferguson A., Suppel D.W., 1986
Gold deposits of the West Wyalong-Temora-Adelong district.
Geological Survey of New South Wales. Report
GS1986/162

Fitzpatrick K.R., 1976
Cootamundra, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-11, 1st edition.
Geological Survey of New South Wales
1v

Fitzpatrick K.R., 1979
Cootamundra, New South Wales, 1:250 000 metallogenic series map, Sheet SI 55-11: mine data sheets and metallogenic study.
Geological Survey of New South Wales
1v

Gilligan L.B., 1980
The Reefton gold field near Temora.
Geological Survey of New South Wales. Report
GS1980/11

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

Suppel D.W., Watkins J.J., Warren A.Y.E. , Chapman J. , Tenison Woods K.L., 1985
The geology and gold deposits of the West Wyalong-Temora-Adelong district. IN Seminar: New South Wales, the potential for development. Abstracts.
AMF and Department of Mineral Resources. Report
GS1985/292 P20-23

Suppel D.W., Warren A.Y.E., Watkins J.J. , Chapman J. , Tenison Woods K.L., Barron L., 1986
A reconnaissance study of the geology and gold deposits of the West Wyalong - Temora - Adelong district.
Geological Survey of New South Wales. Quarterly Notes
64 P1-23

Tenison Woods K.L., 1985
Qualitative interpretation of the regional geophysics of the Cootamundra 1:250 000 sheet, with reference to gold mineralization in the Wyalong-Adelong district.
Geological Survey of New South Wales. Report
GS1985/238

oooooooooooooooooooooooooooooooooooooo

DEPOSIT: 16 TEMORA (GIDGINBUNG)

DEPOSIT IDENTIFICATION:

SYNONYMS: Gidginbung

COMMODITIES: Au, Ag, Cu, As

DISTRIBUTION:
Deposit is situated on a low ridge which is split into two hills, a northern hill and a southern hill. Ore zone is on the southern hill associated with a 2 km x 1 km alteration zone which forms the spine of the ridge.

OREBODIES:
Temora (Gidginbung) (D)

MINES:
Temora (Gidginbung)

GROUP: Gilmore Fault Zone Group

COMMENTS:
Record includes regional setting of Gilmore Fault Zone group; see Deposit No.9 PARKES (GOONUMBLA) for regional setting of Girilambone Anticlinorial Zone.

LOCATION:

LATITUDE: 34 20 LONGITUDE: 147 28
250K SHEET: SI55 11 100K SHEET: 8329

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Wagga Wagga
LOCAL GOVERNMENT AREA (LGA): Temora

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1983	Geology
1983	Geochemistry
1983	Drilling

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Temora (Gidginbung) (D)	Temora (Gidginbung)	Operating	Open-Cut

COMPANIES:

OREBODY: Temora (Gidginbung) (D)

PRESENT OPERATORS:
Paragon Gold Pty Ltd

PRESENT OWNERS:	EQUITY%
Paragon Resources N L	100.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 0

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

YEAR	PRODUCTION
1987	1,346
1988	1,616

MAIN PRODUCTION PERIODS: 1987-,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION		
Dec 1988	230	2.1	472	Economic Demonstrated (Measured)	Recoverable s	Stockpile
Dec 1988	3,110	2.6	8,179	Economic Demonstrated (Measured)	Recoverable o/c	Oxide ore, cut-off grade 1.5 g/t Au

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Girilambone Anticlinorial Zone
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Unnamed Volcanic Complexes - Late Ordovician-Early Silurian
LITHOLOGY: Intermediate volcanics: andesitic and latitic pyroclastics and lavas, minor basaltic andesite, latite, associated micromonzonite, microsyenite.
RELATIONSHIP TO MINERALISATION: Gold is disseminated within a series of irregular zones of intense silicification at the core of an advanced argillic alteration system within andesitic volcanics.

FORMATION NAME & AGE: Unnamed Sedimentary Rocks - Late Ordovician
LITHOLOGY: Banded cherts, siltstone.
RELATIONSHIP TO MINERALISATION: Sequence is spatially associated with mineralised volcanic complex.

GEOCHRONOLOGY:

K-Ar dating on alunite yielded age of alteration ?=age of mineralisation of 422+-2 my (Early-Late Silurian boundary) (Thompson & others, 1986). If this interpretation is correct, then the epithermal deposits associated with the Gilmore Fault Zone, together with those at PEAK HILL (Deposit No.10), are amongst the oldest typically epithermal disseminated gold deposits documented.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Intermediate Extrusive

STRUCTURAL FEATURES:

MAJOR: Faulting

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

MAJOR: Volcanism (Intermediate)

METAMORPHISM:

Regional metamorphic grade is greenschist facies.

ALTERATION:

OREBODY: Temora (Gidginbung) (D)

PRINCIPAL SOURCES: Thompson & others (1986), Binns & Eames (1988).

Mineralisation occurs at the silicic core of strong hydrothermal alteration.
Alteration zonation, in order of decreasing intensity, is:-
1./ Silicified (mineralised) core: characterised by pervasive silicification consisting of microcrystalline silica. Pseudomorphous ghosts of feldspar phenocrysts indicate that original material was andesitic lava or tuff. Silica is cut by several generations of quartz veins varying from chalcedonic to coarse white vuggy quartz. Veins are restricted to silicified zone. Minor minerals accompanying quartz are pyrophyllite, diaspore, alunite, barite, pyrite in sulphide zone; and rutile with hematite and jarosite in oxidised

quartz. Alunite and barite are associated with the coarser quartz veins and as disseminations within silica, where alunite is pseudomorphous after feldspar phenocrysts.
2./ Advanced argillic zone: pyrophyllite, quartz, alunite, (diaspore, pyrite, kaolinite). Crystalline alunite is disseminated through the foliated quartz-pyrophyllite rock and forms distinctive veins. The zone is extensive, locally covers 2 sq km.
3./ Intermediate argillic zone: kaolinite, mica-illite, quartz, montmorillonite. Zone contains mineralised quartz veins.
4./ Propylitic zone: chlorite, calcite, pyrite, epidote. Zone is regional, more intense near deposit.

Alteration trends from andesite: decreasing CaO, MgO, FeO, Na2O contents, increasing Al2O3, K2O, Na2O contents, increasing feldspar destruction. Plagioclase is progressively replaced by albite+calcite +epidote in propylitic zone, by kaolinite+illite in intermediate argillic zone, and by alunite+quartz in advanced argillic/quartz zones. Accompanied by increasing density of weakly mineralised, fractured and silicified quartz veins surrounded by narrow argillic alteration selvages.

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Disseminated/quartz stockwork epithermal gold in altered intermediate volcanics.

STYLE:

MAJOR: Discordant, Stratabound

MORPHOLOGY: Lenticular

AGE OF MINERALISATION: Palaeozoic Middle Silurian

DIMENSIONS/ORIENTATION:

OREBODY: Temora (Gidginbung) (D)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			500.0
TRUE WIDTH	(m)			300.0
VERTICAL DEPTH	(m)			100.0
		ANGLE (deg.)		DIRECTION
PLUNGE				S
STRIKE		340		

ORE TEXTURE:
Oxidised, Primary

NATURE OF MINERALISATION:
PRIMARY ORE: Dissemination

MINERALOGY:

OREBODY: Temora (Gidginbung) (D)
PRINCIPAL SOURCES: Thompson & others (1986).

Sulphide zone: quartz, pyrite, enargite, loellingite, (covellite, tennantite, argentite, native silver, chlorargyrite (formerly cerargyrite), iodargyrite (formerly iodirite)). Pyrite content can be up to 20%; copper grades (enargite) average 0.1-0.2%. Gold occurs both free and as inclusions in quartz, pyrite, enargite, and loellingite. Ag:Au = 2.3:1, but varies from <1:1 in the northern part of the deposit to 10:1 at the deeper southern end.

Oxide zone: free gold (<15 microns across), goethite, hematite, alunite, pyrophyllite and diaspore in limonitic veins and fractures. Gold is evenly distributed, possibly as a result of supergene effects.

Metal association: arsenic, usually <1000 ppm, up to 1%; barium, usually 500-3000 ppm, higher corresponding to local occurrence of barite; antimony, usually <15 ppm, >100 ppm in hydrothermal breccia; lead and zinc, usually low, but 500-1000 ppm on the periphery corresponding to occurrence of minor sphalerite and galena. Tellurium, thallium, mercury not detected at significant levels.

CONTROLS OF MINERALISATION:
PRINCIPAL SOURCES: Thompson & others (1986).

1./ Cross-cutting relationship of mineralised pyrite-enargite veinlets

and quartz veinlets indicates that primary mineralisation post-dated the main phase of silicification.
2./ Enargite-pyrite association and high-sulphur ore and alteration mineral assemblage (barite, alunite, jarosite) indicate a high oxidised sulphur content for the mineralisation relative to its metal content.
3./ The presence of mineralised hydrothermal breccias, hydrofracturing in veins and zones of silicification, and numerous vugs in coarse quartz veins suggests that the system may have boiled periodically at or below the level of mineralisation.
4./ The presence of pyrophyllite and diaspore suggests a temperature of formation in the range 260-280 deg C. Similar temperatures (270-300 deg C) have been indicated by decrepitation studies.
5./ The temperature range 260-300 deg C implies a minimum depth of formation of between 600-900 m (assuming no CO2 and 0-10% salinity).

GENETIC MODELS:
PRINCIPAL SOURCES: Thompson & others (1986).

High sulphur-type gold-copper epithermal deposit related to the upper levels of a porphyry copper system. The temperature range is in the upper temperature range for epithermal deposits corresponding to the deeper parts of an epithermal system. (Thompson & others, 1986).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Temora (Gidginbung) (D)
PRINCIPAL SOURCES: Fitzpatrick (1979), Suppel & others (1986), Thompson & others (1986).
SUMMARY

Temora (Gidginbung) is situated E of the Gilmore Fault Zone on the southwestern margin of the Girilambone Anticlinorial Zone. The deposit consists of a series of irregular mineralised zones of silicification enveloped by advanced argillic alteration within intermediate volcanics.

REGIONAL SETTING: GILMORE FAULT ZONE GROUP
PRINCIPAL SOURCES: Fitzpatrick (1976, 1979), Degeling (1982), Suppel & others (1986).

The Gilmore Fault Zone is a major tectonic feature delineated by regional geological, aeromagnetic and gravity data. The known extent of the fault zone is from near West Wyalong in the N to near Adelong in the S. The fault zone forms the boundary between geological provinces with very different geological histories - the Wagga Anticlinorial Zone in the W and the Girilambone Anticlinorial Zone and Tumut Synclinorial Zone in the E (Suppel & others, 1986).

To the W of the fault zone the Wagga Metamorphic Belt is an extensive NW-trending belt of metamorphosed tightly-folded and steeply-dipping deep-water flysch sediments (Q3L on Cootamundra metallogenic map, Fitzpatrick, 1976). The sequence was deposited by turbidity currents in the Wagga Marginal Basin during the Ordovician, and deformed during the Benambran Orogeny (Late Ordovician-Early Silurian) (Fitzpatrick, 1979).
During the Silurian, the metamorphic belt was extensively intruded by syn- and late-kinematic mainly S-type granite batholiths (gamma2-3L1 on Cootamundra metallogenic map, Fitzpatrick, 1976).
Silurian granitoids are prominent in the eastern part of the anticlinorial zone flanking the fault zone, where they are disposed in broadly en echelon NW-trending zones.

E of the fault zone Ordovician metavolcanic and metasedimentary strata of the Molong Volcanic Arc and Molong Microcontinent form basement to an extensive sequence of Silurian volcanics and associated sediments which were deposited on the Bogan Gate Terrace (southern part of Girilambone Anticlinorial Zone) and in the Tumut Trough (Fitzpatrick, 1979).
The Molong Microcontinent and Molong Volcanic Arc may have underthrust the Wagga Marginal Basin during the Benambran Orogency, forming the Gilmore Fault Zone (Suppel & others, 1986).
The Tumut Trough evolved during the Silurian by rifting of the western edge of the Molong Volcanic Arc, influenced by the pre-existing Gilmore Fault Zone (Suppel & others, 1986).

REGIONAL SUCCESSION: EAST OF GILMORE FAULT ZONE
PRINCIPAL SOURCES: Suppel & others (1986).

1./ Intermediate volcanic complexes (Late Ordovician-Early Silurian).
Not distinguished on Cootamundra metallogenic map (Fitzpatrick, 1976), but unit includes andesite/diorite exposed SE of West Wyalong.
The complexes comprise andesitic and latitic pyroclastics and lavas, and

minor basaltic andesites and latites, intruded by micromonzonite and microsyenite dykes. The volcanic complexes occur close to the Late Ordovician sediments. The volcanics may be related to the Molong Volcanic Arc (cf PARKES (GOONUMBLA), Deposit No.9); alternatively at least some of the Silurian rocks may be related to early rifting of the Tumut Trough (Suppel & others, 1986).
The volcanic complexes are conformably overlain by:-

2./ Sedimentary-volcanic sequences (Late Silurian-?Early Devonian) - comprising a series of volcaniclastics, shale, quartzofeldspathic sandstone, conglomerate and minor pyroclastics north of Temora, and an ?equivalent sequence of siltstone, phyllite, sandstone, carbonaceous siltstone and chert overlain by micaceous sediments S of the Springdale Rift. The sequences are shown as T2L4 undifferentiated Bogan Gate Terrace sequence on the Cootamundra metallogenic map (Fitzpatrick, 1976) and mapped as Jackalass Slate and Bumbolee Creek Formation on the Tumut 1:100 000 sheet to the S (Basden, 1982).

The Tumut Trough was closed and the fill deformed and metamorphosed during the Bowning Orogeny (Late Silurian-Early Devonian) (Fitzpatrick, 1979).

3./ The Silurian rocks were intruded by I-type granites (Early Devonian) (gamma3-4L on Cootamundra metallogenic map, Fitzpatrick, 1976), and diorite and gabbro intrusions, and overlain by associated felsic volcanics and shallow marine sediments.

ASSOCIATED GOLD MINERALISATION: GILMORE FAULT ZONE
PRINCIPAL SOURCES: Fitzpatrick (1979), Degeling (1982).

Gold mineralisation occurs close to the Gilmore Fault Zone in a variety of geological settings. W of the fault zone:
i) large vein deposits in Late Silurian granites which have intruded mafic igneous rocks (WEST WYALONG, ADELONG, Deposit Nos 14, 20);
ii) vein deposits hosted by metasediments of the Wagga Metamorphic Belt (SEBASTOPOL-JUNEE REEFS, Deposit No.18).
iii) disseminated gold in granite intruding mafic rocks (possibly extensions or equivalents of the mafic complex at Adelong (Mount Adrah).
E of the fault zone:
iv) vein gold in Silurian sediments (BARMEDMAN-REEFTON, Deposit No.15)
v) vein mineralisation associated with monzodiorite which could be part of a Silurian volcanic complex (TEMORA, Deposit No. 17) (Suppel & others, 1986).
vi) disseminated epithermal mineralisation in altered and andesitic volcanics of the Ordovician-Silurian volcanic complexes (Temora (Gidginbung), DOBROYDE, Deposit No. 19 - although the age of the volcanics here is uncertain (Suppel & others, 1986), and the Showground prospect).
vii) minor gold mineralisation is spatially related to Early Devonian intrusives.

GEOLOGICAL SETTING: TEMORA (GIDGINBUNG)
PRINCIPAL SOURCES: Suppel & others (1986), Thompson & others (1986).

Temora (Gidginbung) occurs within a sequence of steeply-folded, foliated (subvertical, NNW trend), moderately E-dipping intermediate volcanics and volcaniclastics. Lithologies are predominantly massive feldspar porphyritic andesite with lesser amounts of coarse to fine intermediate fragmental and dacitic volcanic rocks.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Suppel & others (1986), Thompson & others (1986).

Mineralisation is associated with two parallel irregular elongate NNW-trending zones of intense chalcedonic silica alteration which form the core of an advanced argillic alteration system. The two surface zones are continuous at depth. The siliceous cores are enveloped by zones of decreasing alteration intensity, through advanced intermediate argillic to propylitic.
The deposit has been downthrown to the SW by a NW-trending fault which bounds the ore zone on its NE margin.
Several types of brecciation occur: primary pyroclastic tuff breccias; tectonic breccias; hydrothermal breccias (limited in extent but generally well mineralised); and crackle breccias, in which the host rocks have been repeatedly fractured and silicified. A zone of brecciation occurs at or near the base of the major siliceous alteration zone. There are several generations of quartz veining, but no major veins.

The main ore zone comprises a fractured and quartz-veined chalcedonic lens 90 m thick containing most of the economic gold in oxidised mineralisation, underlain by a lens containing primary ore. The lenses

are joined in the E by a chalcedonic ?feeder zone.
The totally oxidised zone is relatively shallow (5–15 m), but partial oxidation extends to 90 m and is broadly coincident with the base of siliceous alteration and economic mineralisation. Fractures and veins are totally oxidised within this zone, but kernels of pyritic quartz remain surrounded by bleached or hematitic quartz.
The gold is concentrated in limonitic stringers and joints.
Primary mineralisation occurs within fractured and brecciated siliceous rock containing sinuous stringer pyrite and disseminated pyrite.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Basden H., 1982
Preliminary report on the geology of the Tumut 1:100 000 sheet area, southern New South Wales.
Geological Survey of New South Wales. Quarterly Notes
46 P1-18

Binns R.A., Eames J.C., 1988
Geochemistry of wallrock alteration at the Temora gold deposit, New South Wales. IN Bicentennial Gold 88, Extended Abstracts.
Geological Society of Australia. Abstracts
23 P422-424

Chapman J., 1986
Disseminated gold deposits along the Gilmore Suture. IN Geological setting of precious metals in New South Wales. One-day symposium, Sydney, October 1986. Abstracts.
Geological Society of Australia
18

Chapman J., Ferguson A., Suppel D.W., 1986
Gold deposits of the West Wyalong-Temora-Adelong district.
Geological Survey of New South Wales. Report
GS1986/162

Degeling P.R., 1982
Mine data sheets and metallogenic study of the Wagga Wagga 1:250 000 metallogenic series map, Sheet SI 55-15.
Geological Survey of New South Wales
1v

Fitzpatrick K.R., 1976
Cootamundra, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-11, 1st edition.
Geological Survey of New South Wales
1v

Fitzpatrick K.R., 1979
Cootamundra, New South Wales, 1:250 000 metallogenic series map, Sheet SI 55-11: mine data sheets and metallogenic study.
Geological Survey of New South Wales
1v

Lessman J.L., 1985
The Temora project. Lecture, AusIMM, Sydney Branch, Sydney, November 1985.
AusIMM. Sydney Branch
1v

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

Suppel D.W., Watkins J.J., Warren A.Y.E., Chapman J., Tenison Woods K.L., 1985
The geology and gold deposits of the West Wyalong-Temora-Adelong district. IN Seminar: New South Wales, the potential for development. Abstracts.
AMF and Department of Mineral Resources. Report
GS1985/292 P20-23

Suppel D.W., Warren A.Y.E., Watkins J.J., Chapman J., Tenison Woods K.L., Barron L., 1986
A reconnaissance study of the geology and gold deposits of the West Wyalong - Temora - Adelong district.
Geological Survey of New South Wales. Quarterly Notes
64 P1-23

Tenison Woods K.L., 1985
Qualitative interpretation of the regional geophysics of the Cootamundra 1:250 000 sheet, with reference to gold mineralization in the Wyalong-Adelong district.
Geological Survey of New South Wales. Report
GS1985/238

Thompson J.F.H., Lessman J., Thompson A.J.B., 1986
The Temora gold-silver deposit: a newly recognized style of high sulfur mineralization in the Lower Paleozoic of Australia.
Economic Geology
81(3) P732-738

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 17 TEMORA

DEPOSIT IDENTIFICATION:

SYNONYMS: Mother Shipton Hill

COMMODITIES: Au

DISTRIBUTION:
Record covers at least 30 parallel reefs concentrated in an area 2 km x 2 km SE of Temora, called Mother Shipton Hill. The Temora deep lead extended from the reef area N for 6 km. Nos. 32-343 on Cootamundra metallogenic map.

OREBODIES:
Temora (D), Temora (Deep Lead), Temora (Reef)

MINES:
Adams & Nugents, Agnes, All Nations (Flag Of All Nations), Amelia, Bagleys & Penningtons, Bourkes, Bourkes (South Australian), Bowes, Buckleys, Caledonian, Craig & Pollocks, Cross, Cunninghams, Currys, Currys Hill, Davorsons, Deutschers, Dunns, Durkins, Eureka, Finlays, Fly-Away, Foleys, Fosters, Frenchmans, Golden Belt, Golden Garter, Golden Gate, Gusts, Hibernia, Hidden Star, Hidden Treasure, IXL, Keating & Hayes, Lady Mary, Louisa, Maloneys, McCormacks, McDowells, McPhersons, Morning Star, Mother Shipton, Murrays, Parkers, Penmans, Prince Of Wales, Richs, Shamrock, Taylors, Thomas, Tynans, Warnocks

GROUP: Gilmore Fault Zone Group

COMMENTS:
See Deposit No.9 PARKES (GOONUMBLA) for regional setting of Girilambone Anticlinorial Zone; Deposit No.16 TEMORA (GIDGINBUNG) for regional setting of Gilmore Fault Zone group.

LOCATION:

LATITUDE: 34 27 LONGITUDE: 147 32
250K SHEET: SI55 11 100K SHEET: 8429

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Wagga Wagga
LOCAL GOVERNMENT AREA (LGA): Temora

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1880	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Temora (Deep Lead)	Frenchmans	Historical	Underground
Temora (Deep Lead)	Frenchmans	Historical	Open-Cut
Temora (Deep Lead)	Frenchmans	Historical	Surface
Temora (Deep Lead)	Murrays	Historical	Underground
Temora (Deep Lead)	Murrays	Historical	Open-Cut
Temora (Deep Lead)	Murrays	Historical	Surface
Temora (Deep Lead)	Foleys	Historical	Underground
Temora (Deep Lead)	Foleys	Historical	Open-Cut
Temora (Deep Lead)	Foleys	Historical	Surface
Temora (Deep Lead)	Golden Gate	Historical	Underground
Temora (Deep Lead)	Golden Gate	Historical	Open-Cut
Temora (Deep Lead)	Golden Gate	Historical	Surface
Temora (Deep Lead)	Hidden Treasure	Historical	Underground
Temora (Deep Lead)	Hidden Treasure	Historical	Open-Cut
Temora (Deep Lead)	Hidden Treasure	Historical	Surface
Temora (Deep Lead)	Bourkes	Historical	Underground
Temora (Deep Lead)	Bourkes	Historical	Open-Cut
Temora (Deep Lead)	Bourkes	Historical	Surface
Temora (Deep Lead)	Buckleys	Historical	Underground

Temora (Deep Lead)	Buckleys	Historical	Open-Cut
Temora (Deep Lead)	Buckleys	Historical	Surface
Temora (Deep Lead)	Thomas	Historical	Underground
Temora (Deep Lead)	Thomas	Historical	Open-Cut
Temora (Deep Lead)	Thomas	Historical	Surface
Temora (Deep Lead)	Adams & Nugents	Historical	Underground
Temora (Deep Lead)	Adams & Nugents	Historical	Open-Cut
Temora (Deep Lead)	Adams & Nugents	Historical	Surface
Temora (Deep Lead)	Bagleys & Penningtons	Historical	Underground
Temora (Deep Lead)	Bagleys & Penningtons	Historical	Open-Cut
Temora (Deep Lead)	Bagleys & Penningtons	Historical	Surface
Temora (Deep Lead)	Bowes	Historical	Underground
Temora (Deep Lead)	Bowes	Historical	Open-Cut
Temora (Deep Lead)	Bowes	Historical	Surface
Temora (Deep Lead)	Currys	Historical	Underground
Temora (Deep Lead)	Currys	Historical	Open-Cut
Temora (Deep Lead)	Currys	Historical	Surface
Temora (Deep Lead)	Craig & Pollocks	Historical	Underground
Temora (Deep Lead)	Craig & Pollocks	Historical	Open-Cut
Temora (Deep Lead)	Craig & Pollocks	Historical	Surface
Temora (Deep Lead)	Deutschers	Historical	Underground
Temora (Deep Lead)	Deutschers	Historical	Open-Cut
Temora (Deep Lead)	Deutschers	Historical	Surface
Temora (Deep Lead)	Durkins	Historical	Underground
Temora (Deep Lead)	Durkins	Historical	Open-Cut
Temora (Deep Lead)	Durkins	Historical	Surface
Temora (Deep Lead)	Finlays	Historical	Underground
Temora (Deep Lead)	Finlays	Historical	Open-Cut
Temora (Deep Lead)	Finlays	Historical	Surface
Temora (Deep Lead)	Fly-Away	Historical	Underground
Temora (Deep Lead)	Fly-Away	Historical	Open-Cut
Temora (Deep Lead)	Fly-Away	Historical	Surface
Temora (Deep Lead)	Fosters	Historical	Underground
Temora (Deep Lead)	Fosters	Historical	Open-Cut
Temora (Deep Lead)	Fosters	Historical	Surface
Temora (Deep Lead)	Golden Garter	Historical	Underground
Temora (Deep Lead)	Golden Garter	Historical	Open-Cut
Temora (Deep Lead)	Golden Garter	Historical	Surface
Temora (Deep Lead)	Keating & Hayes	Historical	Underground
Temora (Deep Lead)	Keating & Hayes	Historical	Open-Cut
Temora (Deep Lead)	Keating & Hayes	Historical	Surface
Temora (Deep Lead)	McCormacks	Historical	Underground
Temora (Deep Lead)	McCormacks	Historical	Open-Cut
Temora (Deep Lead)	McCormacks	Historical	Surface
Temora (Deep Lead)	McDowells	Historical	Underground
Temora (Deep Lead)	McDowells	Historical	Open-Cut
Temora (Deep Lead)	McDowells	Historical	Surface
Temora (Deep Lead)	Maloneys	Historical	Underground
Temora (Deep Lead)	Maloneys	Historical	Open-Cut
Temora (Deep Lead)	Maloneys	Historical	Surface
Temora (Deep Lead)	Parkers	Historical	Underground
Temora (Deep Lead)	Parkers	Historical	Open-Cut
Temora (Deep Lead)	Parkers	Historical	Surface
Temora (Deep Lead)	Taylors	Historical	Underground
Temora (Deep Lead)	Taylors	Historical	Open-Cut
Temora (Deep Lead)	Taylors	Historical	Surface
Temora (Deep Lead)	Tynans	Historical	Underground
Temora (Deep Lead)	Tynans	Historical	Open-Cut
Temora (Deep Lead)	Tynans	Historical	Surface
Temora (Reef)	Morning Star	Historical	Underground
Temora (Reef)	Morning Star	Historical	Open-Cut
Temora (Reef)	Morning Star	Historical	Surface
Temora (Reef)	Eureka	Historical	Underground
Temora (Reef)	Eureka	Historical	Open-Cut
Temora (Reef)	Eureka	Historical	Surface
Temora (Reef)	Shamrock	Historical	Underground
Temora (Reef)	Shamrock	Historical	Open-Cut
Temora (Reef)	Shamrock	Historical	Surface
Temora (Reef)	Lady Mary	Historical	Underground
Temora (Reef)	Lady Mary	Historical	Open-Cut
Temora (Reef)	Lady Mary	Historical	Surface
Temora (Reef)	Caledonian	Historical	Underground
Temora (Reef)	Caledonian	Historical	Open-Cut
Temora (Reef)	Caledonian	Historical	Surface
Temora (Reef)	Prince Of Wales	Historical	Underground
Temora (Reef)	Prince Of Wales	Historical	Open-Cut
Temora (Reef)	Prince Of Wales	Historical	Surface
Temora (Reef)	Hidden Star	Historical	Underground
Temora (Reef)	Hidden Star	Historical	Open-Cut
Temora (Reef)	Hidden Star	Historical	Surface
Temora (Reef)	Louisa	Historical	Underground
Temora (Reef)	Louisa	Historical	Open-Cut

Temora (Reef)	Louisa	Historical	Surface
Temora (Reef)	IXL	Historical	Underground
Temora (Reef)	IXL	Historical	Open-Cut
Temora (Reef)	IXL	Historical	Surface
Temora (Reef)	Agnes	Historical	Underground
Temora (Reef)	Agnes	Historical	Open-Cut
Temora (Reef)	Agnes	Historical	Surface
Temora (Reef)	All Nations (Flag Of All Nations)	Historical	Underground
Temora (Reef)	All Nations (Flag Of All Nations)	Historical	Open-Cut
Temora (Reef)	All Nations (Flag Of All Nations)	Historical	Surface
Temora (Reef)	Amelia	Historical	Underground
Temora (Reef)	Amelia	Historical	Open-Cut
Temora (Reef)	Amelia	Historical	Surface
Temora (Reef)	Bourkes (South Australian)	Historical	Underground
Temora (Reef)	Bourkes (South Australian)	Historical	Open-Cut
Temora (Reef)	Bourkes (South Australian)	Historical	Surface
Temora (Reef)	Cross	Historical	Underground
Temora (Reef)	Cross	Historical	Open-Cut
Temora (Reef)	Cross	Historical	Surface
Temora (Reef)	Cunninghams	Historical	Underground
Temora (Reef)	Cunninghams	Historical	Open-Cut
Temora (Reef)	Cunninghams	Historical	Surface
Temora (Reef)	Currys Hill	Historical	Underground
Temora (Reef)	Currys Hill	Historical	Open-Cut
Temora (Reef)	Currys Hill	Historical	Surface
Temora (Reef)	Davorsons	Historical	Underground
Temora (Reef)	Davorsons	Historical	Open-Cut
Temora (Reef)	Davorsons	Historical	Surface
Temora (Reef)	Dunns	Historical	Underground
Temora (Reef)	Dunns	Historical	Open-Cut
Temora (Reef)	Dunns	Historical	Surface
Temora (Reef)	Golden Belt	Historical	Underground
Temora (Reef)	Golden Belt	Historical	Open-Cut
Temora (Reef)	Golden Belt	Historical	Surface
Temora (Reef)	Gusts	Historical	Underground
Temora (Reef)	Gusts	Historical	Open-Cut
Temora (Reef)	Gusts	Historical	Surface
Temora (Reef)	Hibernia	Historical	Underground
Temora (Reef)	Hibernia	Historical	Open-Cut
Temora (Reef)	Hibernia	Historical	Surface
Temora (Reef)	McPhersons	Historical	Underground
Temora (Reef)	McPhersons	Historical	Open-Cut
Temora (Reef)	McPhersons	Historical	Surface
Temora (Reef)	Mother Shipton	Historical	Underground
Temora (Reef)	Mother Shipton	Historical	Open-Cut
Temora (Reef)	Mother Shipton	Historical	Surface
Temora (Reef)	Penmans	Historical	Underground
Temora (Reef)	Penmans	Historical	Open-Cut
Temora (Reef)	Penmans	Historical	Surface
Temora (Reef)	Richs	Historical	Underground
Temora (Reef)	Richs	Historical	Open-Cut
Temora (Reef)	Richs	Historical	Surface
Temora (Reef)	Warnocks	Historical	Underground
Temora (Reef)	Warnocks	Historical	Open-Cut
Temora (Reef)	Warnocks	Historical	Surface

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 4,619
Average recovered grade primary ore 77 g/t Au; alluvial ore 23 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1894-1906), 1880-1890,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Girilambone Anticlinorial Zone
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Temora Diorite - Early-Middle Silurian
LITHOLOGY: Monzodiorite.
RELATIONSHIP TO MINERALISATION: Host to primary mineralisation in quartz veins.

FORMATION NAME & AGE: Unnamed Sed-Volcanic Sequence (T2L4) - Late Sil-Early Dev
LITHOLOGY: Volcaniclastics, shale, quartzofeldspathic sandstone, conglomerate, minor pyroclastics.
RELATIONSHIP TO MINERALISATION: Intruded by mineralised monzodiorite and cut by barren quartz veins.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to deep lead.

GEOCHRONOLOGY:

The unnamed sequence enclosing the volcanic complex has been assigned a Silurian age from fossil localities that are probably near the top of the sequence (corals from the sedimentary and tuffaceous units near Temora and between Barmedman and West Wyalong) (Suppel & others, 1986). The monzodiorite was considered probably Devonian by Fitzpatrick (1979). Walker (1985, reported by Suppel & others, 1986) stated that palaeomagnetic determinations yielded an Early-Middle Silurian age for the intrusion.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Alluvium, Intermediate Intrusive

STRUCTURAL FEATURES:

MAJOR: Faulting

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Diorite), Volcanism (Intermediate)

DEPOSIT CHARACTERISTICS:

TYPES:

MAJOR: Deep lead.
SIGNIFICANT: Auriferous quartz veins in intermediate intrusive.

STYLE:

MAJOR: Discordant, SIGNIFICANT: Stratabound

MORPHOLOGY: Flat-Lying, Lenticular

AGE OF MINERALISATION: Palaeozoic Silurian, Cainozoic Tertiary

DIMENSIONS/ORIENTATION:

OREBODY: Temora (Deep Lead)

		MIN	AVE	MAX
DEPTH OF COVER	(m)	12.0		61.0
STRIKE LENGTH	(m)			6000.0
VERTICAL DEPTH	(m)	15.0	30.0	122.0
TRUE WIDTH	(m)	3.0		30.0
		ANGLE (deg.)		DIRECTION
STRIKE		160		

OREBODY: Temora (Reef)

		MIN	AVE	MAX
TRUE WIDTH	(cm)	5.0		400.0
STRIKE LENGTH	(m)			600.0
VERTICAL DEPTH	(m)			107.0

	ANGLE (deg.)	DIRECTION
DIP	75-90	
STRIKE	110-116	

ORE TEXTURE:
Oxidised

NATURE OF MINERALISATION:
PRIMARY ORE: Multiple Veins,
SECONDARY ORE: Deep Lead

MINERALOGY:

OREBODY: Temora (Deep Lead)
Free gold. Grains and nuggets were coarse-grained and jagged and angular, often with associated quartz fragment, indicating a nearby source.

OREBODY: Temora (Reef)
Sulphide ore: gold, pyrite, arsenopyrite, galena, bismutite, chalcopyrite.
Gold was notably coarse-grained.

CONTROLS OF MINERALISATION:
Regional control by Gilmore Fault Zone. Primary mineralisation locally controlled by the host monzodiorite intrusion. Veins have diverse orientations (Suppel & others, 1986).

GENETIC MODELS:
PRINCIPAL SOURCES: Lishmund (1972), Suppel & others (1986).

Suippel & others (1986): veins could be the result of late-stage magmatic hydrothermal activity.
Lishmund (1972): the deep lead is an ill-defined zone in which sedimentation was mainly in the silt/clay range. Gravel containing gold derived from the diorite (coarse grainsize indicates nearby source) was deposited in irregular patches mainly in sudden lateral influxes of detritus introduced by small tributary leads.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Temora (D)
PRINCIPAL SOURCES: Lishmund (1972), Fitzpatrick (1976, 1979), Markham (1982), Suppel & others (1986).
SUMMARY

Temora lies E of the Gilmore Fault Zone in the southernmost part of the Girilambone Anticlinorial Zone. About three-quarters of production was derived from deep lead deposits; the remainder from primary reef ore. Primary mineralisation was associated with a monzodiorite intrusive into a Late Silurian(?-Early Devonian) sedimentary-volcanic sequence.
The monzodiorite may be part of a nearby Silurian volcanic complex (Suppel & others, 1986).

GEOLOGICAL SETTING: TEMORA
PRINCIPAL SOURCES: Fitzpatrick (1976, 1979), Suppel & others (1986).

The sedimentary-volcanic sequence (included with T2L4 on Cootamundra metallogenic map; shown as T in Suppel & others, 1986) comprises strongly deformed volcaniclastics, shale, quartzofeldspathic sandstone, conglomerate, minor pyroclastics.
The volcanic complex includes andesitic lavas and tuffs, plus sediments. Andesitic pillow lavas crop out close to the mineralised diorite, indicating proximity to a volcanic centre. The occurrence of corals and volcaniclastic conglomerate indicates a shallow marine environment of deposition (Suppel & others, 1986).

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Lishmund (1972), Fitzpatrick (1979), Markham (1982).

The host to mineralisation was a monzodiorite body (piL2 on Cootamundra metallogenic map), 5 km x 1 km elongate in a N-S direction.
The monzodiorite may be part of an adjacent volcanic complex (Suppel & others, 1986).
?Devonian granite intrudes the sedimentary-volcanic sequence several km N of the diorite body.

OREBODY: Temora (Deep Lead)
PRINCIPAL SOURCES: Lishmund (1972), Fitzpatrick (1979), Markham (1982).

Approximately three-quarters of production from Temora was won from secondary deposits which formed by reworking of the reef mineralisation.

The Temora lead was formed in a Tertiary stream channel which rose in the vicinity of Mother Shipton Hill (site of primary mineralisation) and trended NNW along the margin of the diorite body. Depth of bedrock increased from the minimum at the head of the lead to the maximum at its northernmost extent.

The alluvial material comprised gravel with interbedded sand, silt, and red, yellow, and white clay, containing nodules of silica with magnesium and lime. The alluvium was generally soft and porous, though locally cemented by limonite. Gold was in the gravel layers which occurred at several levels throughout the lead, giving rise to the so-called 'false bottoms'. The basement surface was uneven and in places highly weathered, forming 'pipe clay' or swelling schists. The distribution of gold was irregular, apparently more continuous across the lead than along it. Higher values often coincided with junctions between tributaries and the main stream.
Thickness of individual beds = 5-500 cm.

OREBODY: T((Reef)
PRINCIPAL SOURCES: Lishmund (1972), Fitzpatrick (1979), Markham (1982).

The reefs were concentrated in a small area - Mother Shipton Hill - at the southern extremity of the diorite body. At least 30 subvertical reefs were worked, disposed in several parallel lines. Some production was from cross reefs. The quartz vein system extended into the sedimentary country rock, but only reefs in diorite were auriferous.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Chapman J., 1986
Disseminated gold deposits along the Gilmore Suture. IN Geological setting of precious metals in New South Wales. One-day symposium, Sydney, October 1986. Abstracts.
Geological Society of Australia
18

Chapman J., Ferguson A., Suppel D.W., 1986
Gold deposits of the West Wyalong-Temora-Adelong district.
Geological Survey of New South Wales. Report
GS1986/162

Fitzpatrick K.R., 1976
Cootamundra, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-11, 1st edition.
Geological Survey of New South Wales
1v

Fitzpatrick K.R., 1979
Cootamundra, New South Wales, 1:250 000 metallogenic series map, Sheet SI 55-11: mine data sheets and metallogenic study.
Geological Survey of New South Wales
1v

Lishmund S.R., 1972
Geology and mining history of the Temora gold field.
Geological Survey of New South Wales. Records
14(2) P133-157

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Suppel D.W., Watkins J.J., Warren A.Y.E., Chapman J., Tenison Woods K.L., 1985
The geology and gold deposits of the West Wyalong-Temora-Adelong district. IN Seminar: New South Wales, the potential for development. Abstracts.
AMF and Department of Mineral Resources. Report
GS1985/292 P20-23

Suppel D.W., Warren A.Y.E., Watkins J.J., Chapman J., Tenison Woods K.L., Barron L., 1986
A reconnaissance study of the geology and gold deposits of the West Wyalong - Temora - Adelong district.

Geological Survey of New South Wales. Quarterly Notes
64 P1-23

Tenison Woods K.L., 1985
Qualitative interpretation of the regional geophysics of the Cootamundra 1:250 000 sheet, with reference to gold mineralization in the Wyalong-Adelong district.
Geological Survey of New South Wales. Report
GS1985/238

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 18 SEBASTOPOL-JUNEE REEFS

DEPOSIT IDENTIFICATION:

SYNONYMS: Junee Reefs

COMMODITIES: Au

DISTRIBUTION:
Record covers 25 parallel reefs in two NW zones 5 km x 4 km at Sebastopol and 4 km x 3 m at Junee Reefs 12 km along strike to the S. Nos. 70-78 on Cootamundra metallogenic map.

OREBODIES:
Sebastopol-Junee Reefs (D), Barren Syndicate, Evening Star, Heffernan, Homeward Bound, Maid Of Judah, Morning Star, Rockdale, The Doctors, The Dust Holes, Walletts

MINES:
Barren Syndicate, Evening Star, Homeward Bound, Just-In-Time, Maid Of Judah, Morning Star, Rockdale, The Doctors, The Dust Holes, Walletts

GROUP: Gilmore Fault Zone Group

COMMENTS:
See Deposit No.20 ADELONG for regional setting of Wagga Anticlinorial Zone; Deposit No.16 TEMORA (GIDGINBUNG) for regional setting of Gilmore Fault Zone group.

LOCATION:

LATITUDE: 34 35 LONGITUDE: 147 32
250K SHEET: SI55 11 100K SHEET: 8428

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Wagga Wagga
LOCAL GOVERNMENT AREA (LGA): Temora

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1869	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Barren Syndicate	Barren Syndicate	Historical	Underground
Evening Star	Evening Star	Historical	Underground
Homeward Bound	Homeward Bound	Historical	Underground
Maid Of Judah	Maid Of Judah	Historical	Underground
Morning Star	Morning Star	Historical	Underground
Rockdale	Rockdale	Historical	Underground
The Doctors	The Doctors	Historical	Underground
The Dust Holes	The Dust Holes	Historical	Underground
The Dust Holes	Just-In-Time	Historical	Underground
Walletts	Walletts	Historical	Underground
Walletts	Walletts	Historical	Surface

COMPANIES:

OREBODY: Sebastopol-Junee Reefs (D)

PRESENT OWNERS:	EQUITY%
National Resources Exploration Ltd	76.00
Range Resources Ltd.	14.00

OREBODY: Morning Star

PRESENT OPERATORS:
National Resources Exploration Ltd.

PRESENT OWNERS:	EQUITY%
Nicron Resources Ltd.	6.25
National Resources Exploration Ltd.	75.00
Petrocarb Exploration N L.	6.25
Range Resources Ltd.	12.50

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 476
Recorded grades of up to >31 g/t Au (Evening Star); up to 62 g/t Au (Morning Star)

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1904-1935), 1869-1898,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Wagga Anticlinorial Zone
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Wagga Metamorphics (O3L) - Late Ordovician
LITHOLOGY: Siltstone, subgreywacke, impure sandstone, quartzite; slate, phyllite; chlorite, knotted, quartz-mica and graphitic schists.
RELATIONSHIP TO MINERALISATION: Mineralisation at Sebastopol occurred in veins in high grade metasedimentary zones related to granite intrusion.

FORMATION NAME & AGE: ?Wantabadgery Granite - Late Silurian?-Early Devonian
LITHOLOGY: Gneissic biotite granite, tourmaline granite.
RELATIONSHIP TO MINERALISATION: Host to mineralisation in veins at Junee Reefs; intrudes metasediments adjacent to mineralisation at Sebastopol.

GEOCHRONOLOGY:

Wantabadgery Granite dated at 377, 394, and 401 my (K-Ar), i.e. Late Silurian-Early Devonian (Evernden & Richards, 1962, reported by Fitzpatrick, 1979). Granite at Sebastopol-Junee Reefs is apparently a separate body (Fitzpatrick, 1979), but may be of similar age.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Granitic, Metasedimentary

STRUCTURAL FEATURES:

SIGNIFICANT: Faulting, Jointing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

MAJOR: Intrusive Contact

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Granite)

METAMORPHISM:

Regional grade is greenschist facies. The metasediment-hosted reefs at Sebastopol were localised in higher grade zones related to granite intrusion.

DEPOSIT CHARACTERISTICS:

TYPES:

MAJOR: Auriferous quartz veins in granitoid.
Auriferous quartz veins in metasediments adjacent to granitoid.

STYLE:

MAJOR: Conformable, SIGNIFICANT: Discordant

MORPHOLOGY: Lenticular

AGE OF MINERALISATION: Palaeozoic Late Silurian

DIMENSIONS/ORIENTATION:

OREBODY: Sebastopol-Junee Reefs (D)

		MIN	AVE	MAX
TRUE WIDTH	(cm)		50.0	300.0
DEPTH OXIDATION	(m)			67.0
STRIKE LENGTH	(m)			335.0
VERTICAL DEPTH	(m)			110.0
		ANGLE (deg.)		DIRECTION
DIP		60; 60		SW; S
STRIKE		315; 90		

OREBODY: Barren Syndicate

		MIN	AVE	MAX
STRIKE LENGTH	(m)			3.0
VERTICAL DEPTH	(m)			30.0
TRUE WIDTH	(m)			6.0

OREBODY: Evening Star

		MIN	AVE	MAX
STRIKE LENGTH	(m)			46.0
TRUE WIDTH	(cm)		300.0	500.0
VERTICAL DEPTH	(m)			91.0
		ANGLE (deg.)		DIRECTION
DIP		70-80		SW; S
STRIKE		315; 285		

OREBODY: Hefternan

		MIN	AVE	MAX
STRIKE LENGTH	(m)			55.0
VERTICAL DEPTH	(m)			24.0

OREBODY: Homeward Bound

		MIN	AVE	MAX
STRIKE LENGTH	(m)			122.0
TRUE WIDTH	(cm)			400.0
		ANGLE (deg.)		DIRECTION
DIP		60; 70		SE; S
STRIKE		315; 85		

OREBODY: Maid Of Judah

		MIN	AVE	MAX
STRIKE LENGTH	(m)			61.0
VERTICAL DEPTH	(m)	30.0		

OREBODY: Morning Star

		MIN	AVE	MAX
STRIKE LENGTH	(m)			335.0
TRUE WIDTH	(cm)	1.0	100.0	300.0
VERTICAL DEPTH	(m)			110.0
		ANGLE (deg.)		DIRECTION
DIP		62; 60-65		W; S
STRIKE		315; 90		

OREBODY: Rockdale

		MIN	AVE	MAX
TRUE WIDTH	(cm)	30.0		60.0
VERTICAL DEPTH	(m)			61.0
		ANGLE (deg.)		DIRECTION
DIP		75-80		WSW; S
STRIKE		160; 60-70		

OREBODY: The Doctors

		MIN	AVE	MAX
STRIKE LENGTH	(m)			762.0
TRUE WIDTH	(cm)		100.0	200.0
VERTICAL DEPTH	(m)			61.0
		ANGLE (deg.)		DIRECTION
DIP		77		SW
STRIKE		155		

OREBODY: The Dust Holes

		MIN	AVE	MAX
STRIKE LENGTH	(m)			503.0
TRUE WIDTH	(cm)		30.0	100.0
VERTICAL DEPTH	(m)			98.0
DEPTH OXIDATION	(m)			38.0
		ANGLE (deg.)		DIRECTION
DIP		60		S
STRIKE		70		

OREBODY: Walletts

		MIN	AVE	MAX
STRIKE LENGTH	(m)			122.0
TRUE WIDTH	(cm)	15.0		46.0
		ANGLE (deg.)		DIRECTION
DIP		75-80		S
STRIKE		55-60		

ORE TEXTURE:
Banded/Laminated, Free Milling, Oxidised

NATURE OF MINERALISATION:
PRIMARY ORE: Multiple Veins, Vein (Reef),
SECONDARY ORE: Supergene Enrichment

MINERALOGY:

OREBODY: Sebastopol-Junee Reefs (D)
Sulphide ore: gold, pyrite, galena, chalcopyrite, sphalerite. Grade decreased with depth. Sulphide minerals were distributed in planes parallel to the vein walls.
Oxide ore: malachite, azurite.
Gangue: quartz, (tourmaline).

CONTROLS OF MINERALISATION:
Deposit shows strong structural control: strike of reefs and line of lode parallel host bedding and schistosity; reefs are collinear along a NW trend parallel to the main regional structural trend and to the Gilmore Fault Zone.

GENETIC MODELS:
PRINCIPAL SOURCES: Raggatt (1972), Suppel & others (1986).

Raggatt (1972) considered the reefs to be fissure veins, associated with the closing phase of Late Ordovician igneous activity.

Suppel & others (1986): the Sebastopol reefs were possibly formed by hydrothermal processes associated with regional metamorphism and granite generation during the Benambran Orogeny (end of Ordovician), or later in the Silurian.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Sebastopol-Junee Reefs (D)
PRINCIPAL SOURCES: Raggatt (1972), Markham & Basden (1974), Fitzpatrick (1976, 1979), Markham (1982), Suppel & others (1986).
SUMMARY

Sebastopol and Junee Reefs lie near the eastern margin of the Wagga Anticlinorial Zone close to the Gilmore Fault Zone.
Mineralisation comprised a series of quartz veins in Late Silurian biotite-muscovite granite (Junee Reefs) and in Late Ordovician metasediments of the Wagga Metamorphic Belt within the granite contact zone (Sebastopol).

GEOLOGICAL SETTING: SEBASTOPOL-JUNEE REEFS
PRINCIPAL SOURCES: Fitzpatrick (1976, 1979).

The Wagga Metamorphics (Q3L on Cootamundra metallogenic map) are represented in the region by NW-striking, moderately to steeply

SW-dipping phyllites, quartz-mica schists and knotted schists. Immediately E of Sebastopol the metamorphics are in faulted contact across the Gilmore Fault Zone with Late Silurian volcano-sedimentary sequences of the Tumut Synclinorial Zone (T2L4 on Cootamundra metallogenic map; T in Suppel & others, 1986).
To the S and W the metamorphics are intruded by a Late Silurian concordant foliated syntectonic granite batholith, the Wantabadgery Granite (gamma2-3L1 on Cootamundra metallogenic map).
A small elongate pluton possibly related to the Wantabadgery Granite but of different composition (Fitzpatrick, 1979), extends from 2 km SSE of Sebastopol to Junee. The pluton hosts most of the gold workings in the Junee area. The pluton is medium to fine-grained gneissic biotite granite characterised by tourmaline-rich phases and graphic pegmatites.
Latites, basalts and andesites of unknown affiliation occur E of Junee.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Raggatt (1972), Markham & Basden (1974), Fitzpatrick (1979), Markham (1982).

The reefs at both deposits have similar orientation, consisting of two sets of veins, one set aligned along the regional NW structural trend and a second set trending E-W.

SEBASTOPOL
At Sebastopol the principal veins are conformable with bedding and schistosity of the host metasediments. The subsidiary veins join the main veins on their footwall side with rarely any indication of displacement or intersection of one set by the other. The veins exhibit a sheeted structure parallel to the vein walls, which locally have the form of two or more parallel veins separated by beds of knotted schist or quartz-mica schist. Sulphide minerals are also distributed in planes of similar orientation.
Raggat (1972) considered the veins to be fissure veins and noted evidence of much post-lode movement in the form of slickensiding on the vein walls and along the partings of the quartz filling.

JUNEE REEFS
The Junee Reefs veins occur entirely within gneissic granite. Mineralisation was localised within a small granite offshoot near the eastern margin of the host pluton. The offshoot consists largely of fine-grained granite with local development of graphic tourmaline-bearing pegmatite, greisen, and quartz-tourmaline rock. The pegmatites and quartz-tourmaline veins strike parallel to the gold veins and carried minor gold mineralisation. W of the mineralised offshoot the main granite phase is coarser-grained, distinctly gneissic and carries abundant biotite. Unlike Sebastopol, the two sets of reefs were of equal importance but were less persistent and more variable in thickness than those at Sebastopol.

OREBODY: Evening Star
Evening Star lies NW of Morning Star on the same mineralisation trend. Rock types present are predominantly quartz schist on the footwall of the main vein and knotted schist on the hanging wall.

OREBODY: Homeward Bound
Consisted of two parallel reefs about 37 m apart.

OREBODY: Morning Star
The discovery reef of the field. Total width of line of lode = 21 m. Orebody consisted of a principal vein and three subparallel veins on the hanging wall side.

OREBODY: Rockdale
Strike length included in The Doctors. Orebody is either an extension of The Doctors or a separate reef closely parallel to it in strike.

OREBODY: The Doctors
The vein consisted of two segments each about 152 m long separated by about 91 m of barren ground. Strike length also includes Rockdale.

OREBODY: The Dust Holes
Reef occurred as a series of parallel disjointed lengths. Dump material indicates considerable lithological variation in host granite, from biotite-rich to biotite-poor, and gneissic to non-gneissic; coarse-grained graphic granite is also present.

OREBODY: Walletts
Mineralisation occurred in two veins 6 m apart.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Chapman J., 1986
Disseminated gold deposits along the Gilmore Suture. IN Geological setting of precious metals in New South Wales. One-day symposium, Sydney, October 1986. Abstracts.
Geological Society of Australia
18

Chapman J., Ferguson A., Suppel D.W., 1986
Gold deposits of the West Wyalong-Temora-Adelong district.
Geological Survey of New South Wales. Report
GS1986/162

Fitzpatrick K.R., 1976
Cootamundra, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-11, 1st edition.
Geological Survey of New South Wales
1v

Fitzpatrick K.R., 1979
Cootamundra, New South Wales, 1:250 000 metallogenic series map, Sheet SI 55-11: mine data sheets and metallogenic study.
Geological Survey of New South Wales
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Raggatt H.G., 1972
Geology and gold deposits of the Sebastopol-Junee Reefs area.
Geological Survey of New South Wales. Records
14(2) P93-131

Suppel D.W., Watkins J.J., Warren A.Y.E. , Chapman J. , Tenison Woods K.L., 1985
The geology and gold deposits of the West Wyalong-Temora-Adelong district.
IN Seminar: New South Wales, the potential for development. Abstracts.
AMF and Department of Mineral Resources. Report
GS1985/292 P20-23

Suppel D.W., Warren A.Y.E., Watkins J.J. , Chapman J. , Tenison Woods K.L., Barron L., 1986
A reconnaissance study of the geology and gold deposits of the West Wyalong - Temora - Adelong district.
Geological Survey of New South Wales. Quarterly Notes
64 P1-23

Tenison Woods K.L., 1985
Qualitative interpretation of the regional geophysics of the Cootamundra 1:250 000 sheet, with reference to gold mineralization in the Wyalong-Adelong district.
Geological Survey of New South Wales. Report
GS1985/238

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 19 DOBROYDE

DEPOSIT IDENTIFICATION:

COMMODITIES: Au, Ba

DISTRIBUTION:

OREBODIES:
Dobroyde (D)

MINES:
Dobroyde

GROUP: Gilmore Fault Zone Group

COMMENTS:
See Deposit No.23 GUNDAGAI for regional setting of Tumut Synclinorial Zone; Deposit No.16 TEMORA (GIDGINBUNG) for regional setting of Gilmore Fault Zone group.

LOCATION:

LATITUDE: 34 45	LONGITUDE: 147 39
250K SHEET: SI55 11	100K SHEET: 8428

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Wagga Wagga
LOCAL GOVERNMENT AREA (LGA): Junee

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1986	Geology
1986	Drilling
1986	Geochemistry

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Dobroyde (D)	Dobroyde	Possible	Open-Cut

COMPANIES:

OREBODY: Dobroyde (D)

PRESENT OPERATORS:
Little River Goldfields N L.

PRESENT OWNERS:	EQUITY%
Little River Goldfields N L.	100.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 0

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: -,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION	
June 1988	34	4.8	163	Paramarginal Demonstrated	Recoverable u/g

June 1988 892	2.0	1,784	Paramarginal	Demonstrated	Recoverable o/c	Cut-off grade 0.5 g/t Au
June 1988 926	2.1	1,945	Paramarginal	Demonstrated	Recoverable	Total of open-cut and underground resources

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Tumut Synclinorial Zone
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Unnamed Volcanic Complexes - ?Ord-Sil Or Late Sil-Early Dev
LITHOLOGY: Altered andesitic and minor felsic volcanics.
RELATIONSHIP TO MINERALISATION: Gold is disseminated in altered intermediate volcanic complex overlying sedimentary-volcanic sequence.

FORMATION NAME & AGE: ?Bumbolee Ck Fm, Jackalass Slate Equivalents - L.Sil-?E.Dev
LITHOLOGY: Volcaniclastics, shale, sandstone, conglomerate, siltstone, phyllite, schist.
RELATIONSHIP TO MINERALISATION: Underlies mineralised volcanic complex.

GEOCHRONOLOGY:
The age of the host volcanics at Dobroyde is not known. Although tentatively correlated with the ?Ordovician-Silurian volcanics further to the N (e.g. at TEMORA, TEMORA (GIDGINBUNG), Deposit Nos. 16, 17), the volcanics could alternatively be correlated with the nearby Silurian or ?Early Devonian sequences (Suppel & others, 1986).

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Intermediate Extrusive

STRUCTURAL FEATURES:

MAJOR: Faulting

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

MAJOR: Volcanism (Intermediate),
MINOR: Volcanism (Felsic)

METAMORPHISM:
Low grade.

ALTERATION:

OREBODY: Dobroyde (D)
Host volcanics are strongly altered. Assemblage = quartz, gypsum, kaolinite, sericite, barite, pyrite, (alunite, illite, adularia, pyrophyllite). Propylitic assemblages of carbonate, chlorite+ serpentinite+-epidote have been recorded away from the area of more advanced alteration (Suppel & others, 1986).

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Disseminated/quartz stockwork epithermal gold in altered intermediate volcanics.

STYLE:

MAJOR: Stratabound

AGE OF MINERALISATION: Palaeozoic Silurian

DIMENSIONS/ORIENTATION:

OREBODY: Dobroyde (D)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			300.0
TRUE WIDTH	(m)			40.0

ORE TEXTURE:
Disseminated

NATURE OF MINERALISATION:
PRIMARY ORE: Dissemination

MINERALOGY:

OREBODY: Dobroyde (D)
Gold is strongly associated with barium. Barium values in the percent range generally are accompanied by higher gold values. Barium is also widespread away from the main gold zone and was used in exploration as a pathfinder for gold. Anomalous arsenic (>50 ppm) is associated with the main mineralised zone.

CONTROLS OF MINERALISATION:
Control is mainly stratigraphic: mineralisation is associated with a volcanic complex.

GENETIC MODELS:
Suppel & others (1986): volcanic epithermal. The predominant alteration minerals of gypsum and kaolinite together with significant barium suggest a moderately low temperature of formation, possibly below 200 deg C, in contrast to the temperature range indicated for TEMORA (GIDGINBUNG) (Deposit No.16) of 260-300 deg C.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Dobroyde (D)
PRINCIPAL SOURCES: Suppel & others (1986).
SUMMARY

Dobroyde lies to the E of the Gilmore Fault Zone in the Tumut Synclinorial Zone. Disseminated gold mineralisation is associated with a strongly altered sequence of predominantly andesitic and minor silicic volcanics.

GEOLOGICAL SETTING: DOBROYDE
PRINCIPAL SOURCES: Suppel & others (1986).

The volcanics occur within a terrain of Late Silurian(?-Early Devonian) sedimentary-volcanic rocks which are shown as ?T2L4 on Cootamundra metallogenic map; as T in Suppel & others (1986). The latter unit is continuous with formations mapped as Bumbolee Creek Formation and Jackalass Slate in the Tumut 1:100 000 sheet area to the SE (Basden, 1982).
The affiliation of the mineralised volcanic sequence is not known (see 'GEOCHRONOLOGY').

The Silurian rocks comprise a monotonous sequence of siltstone, phyllite, sandstone, carbonaceous siltstone, and chert, overlain by micaceous sediments. Minor volcanics occur. Regional strike is NNW. Shallow open folds are characteristic, and cleavage, where present, is consistently at a high angle to bedding. Although generally lacking in sedimentary structures, parts of Bouma sequences are recognisable in some areas and it is considered that much of the unit may be turbiditic (Suppel & others, 1986).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Basden H., 1982
Preliminary report on the geology of the Tumut 1:100 000 sheet area, southern New South Wales.
Geological Survey of New South Wales. Quarterly Notes
46 P1-18

Chapman J., 1986
Disseminated gold deposits along the Gilmore Suture. IN Geological setting of precious metals in New South Wales. One-day symposium, Sydney, October 1986. Abstracts.
Geological Society of Australia
18

Chapman J., Ferguson A., Suppel D.W., 1986
Gold deposits of the West Wyalong-Temora-Adelong district.

Geological Survey of New South Wales. Report
GS1986/162

Fitzpatrick K.R., 1976
Cootamundra, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-11, 1st edition.
Geological Survey of New South Wales
1v

Fitzpatrick K.R., 1979
Cootamundra, New South Wales, 1:250 000 metallogenic series map, Sheet SI 55-11: mine data sheets and metallogenic study.
Geological Survey of New South Wales
1v

Suppel D.W., Watkins J.J., Warren A.Y.E. , Chapman J. , Tenison Woods K.L., 1985
The geology and gold deposits of the West Wyalong-Temora-Adelong district. IN Seminar: New South Wales, the potential for development. Abstracts.
AMF and Department of Mineral Resources. Report
GS1985/292 P20-23

Suppel D.W., Warren A.Y.E., Watkins J.J. , Chapman J. , Tenison Woods K.L., Barron L., 1986
A reconnaissance study of the geology and gold deposits of the West Wyalong - Temora - Adelong district.
Geological Survey of New South Wales. Quarterly Notes
64 P1-23

Tenison Woods K.L., 1985
Qualitative interpretation of the regional geophysics of the Cootamundra 1:250 000 sheet, with reference to gold mineralization in the Wyalong-Adelong district.
Geological Survey of New South Wales. Report
GS1985/238

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 20 ADELONG

DEPOSIT IDENTIFICATION:

COMMODITIES: Au

DISTRIBUTION:
Record covers 12 main reefs along several parallel lines of lode in a NNW zone 4 km x 1 km extending N from Adelong. Nos. 55, 129, 131-140 on Wagga Wagga metallogenic map.

OREBODIES:
Adelong (D), Adelong Creek, Caledonian, Camp, Currajong, Donkey Hill, Gibraltar, Lady Mary, Middle Reef, Nuggety Gully, Old Reef, Victoria

MINES:
Adelong Creek, Adelong United, Annetts, Caledonian, Camp, Challenger, Challenger Extended, Currajong, Donkey Hill, Flagstaff, Fletchers, Gibraltar, Great Victoria, Lady Claire, Lady Mary, Little Victoria, Long Tunnel, New Caledonian, North Williams, Nuggetty Gully, Our Own, Prowse & Woodwards, Prowses, Research, Union, Williams

GROUP: Gilmore Fault Zone Group

COMMENTS:
Record includes regional setting of Wagga Anticlinorial Zone; see Deposit No.16 TEMORA (GIDGINBUNG) for regional setting of Gilmore Fault Zone group.

LOCATION:

LATITUDE: 35 19   LONGITUDE: 148 4
250K SHEET: SI55 15   100K SHEET: 8527

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Wagga Wagga
LOCAL GOVERNMENT AREA (LGA): Tumut

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1857	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Adelong Creek	Adelong Creek	Historical	Dredging &/Or Sluicing
Caledonian	Caledonian	Historical	Underground
Caledonian	New Caledonian	Historical	Underground
Camp	Camp	Historical	Underground
Currajong	Currajong	Historical	Underground
Currajong	Long Tunnel	Historical	Underground
Donkey Hill	Donkey Hill	Historical	Underground
Donkey Hill	Lady Claire	Historical	Underground
Donkey Hill	Fletchers	Historical	Underground
Donkey Hill	Prowses	Historical	Underground
Gibraltar	Gibraltar	Historical	Underground
Lady Mary	Lady Mary	Historical	Underground
Nuggety Gully	Nuggetty Gully	Historical	Underground
Nuggety Gully	Nuggetty Gully	Historical	Sluicing
Old Reef	Challenger	Historical	Underground
Old Reef	Challenger	Possible	Underground
Old Reef	Challenger Extended	Historical	Underground
Old Reef	Prowse & Woodwards	Historical	Underground
Old Reef	Our Own	Historical	Underground
Old Reef	Adelong United	Historical	Underground
Victoria	Great Victoria	Historical	Underground
Victoria	Flagstaff	Historical	Underground
Victoria	Union	Historical	Underground
Victoria	North Williams	Historical	Underground
Victoria	Annetts	Historical	Underground

Victoria	Research	Historical	Underground
Victoria	Little Victoria	Historical	Underground
Victoria	Williams	Historical	Underground

COMPANIES:

OREBODY: Adelong (D)

PRESENT OPERATORS:
Pan Australian Mining Ltd

PRESENT OWNERS:	EQUITY%
G I O Of N S W	30.00
Pan Australian Mining Ltd	70.00

OREBODY: Old Reef

PRESENT OPERATORS:
Pan Australian Mining Ltd

PRESENT OWNERS:	EQUITY%
G I O Of N S W	30.00
Pan Australian Mining Ltd	70.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 21,234
Average recovered grade (reef ore) 45-60 g/t Au, locally up to 122 g/t Au (Donkey Hill); decreased at depth to 15-31 g/t Au. Grade of Gibraltar (most productive reef) 30-45 g/t Au. Average alluvial grade 0.3 g/cubic m Au, plus rich patches.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1930-1939), 1857-1927,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION			
June 1987	35	2.0	70	Submarginal Demonstrated	In-Situ	t	Tailings
June 1987	287	5.4	1,550	Submarginal Demonstrated	In-Situ	o/c	Challenger; established by previous operator

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Wagga Anticlinorial Zone
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Unnamed Mafic Dykes
LITHOLOGY: Hornblende and biotite lamprophyre, hornblende gabbro, hornblende diorite.
RELATIONSHIP TO MINERALISATION: Mineralisation occurred in veins in, near, and on the contacts of mafic dykes in association with aplite and microgranite phases of host granite.

FORMATION NAME & AGE: Wondalga Granodiorite - Late Silurian(?-Early Devonian)
LITHOLOGY: Granodiorite, adamellite; foliated and gneissic tonalite, quartz diorite; aplite, microgranite.
RELATIONSHIP TO MINERALISATION: Intruded by mineralised mafic dykes, which were emplaced along contacts of late-stage aplite and microgranite dykes with main granite phase. Some mineralisation also in felsic dykes.

FORMATION NAME & AGE: Avenall Basic Intrusive Cplex (Incl. Adelong Norite) - M.Sil

LITHOLOGY: Picrite, gabbro, norite, hornblendite.
RELATIONSHIP TO MINERALISATION: Adelong Norite is a possible roof pendant in Wondalga Granodiorite adjacent to mineralisation.

FORMATION NAME & AGE: Nacka Nacka Metabasic Igneous Complex - ?Ordovician
LITHOLOGY: Metagreywacke, andesitic ?metabasalt, ?metadiorite, ?metagabbro, amphibolite.
RELATIONSHIP TO MINERALISATION: Large roof pendant in Wondalga Granodiorite; possibly genetically related to the mineralised mafic dykes; possibly primary source of the gold.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to alluvial mineralisation.

GEOCHRONOLOGY:

Wondalga Granodiorite: 315+-4 my (K-Ar) on biotite (reported by Degeling 1982); 402-414 my (312 age rejected) (reported by Markham & Basden, 1974). The younger age (315) is considered to represent a reheating event after original crystallisation, possibly during deformation associated with movement along the Gilmore Fault Zone. Intrusive relationships indicate a Late Silurian-Early Devonian age, i.e. around 410 my (Degeling, 1982).

Box Hill Norite (possible equivalent of Adelong Norite): 416+-6 my (reported by Basden, 1982).

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Granitic, Mafic Intrusive

STRUCTURAL FEATURES:

SIGNIFICANT: Faulting, Jointing, Shearing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

MAJOR: Intrusive Contact

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Diorite), Plutonism (Gabbro), Plutonism (Granite)

METAMORPHISM:

Wagga Metamorphics - mostly lower greenschist facies, produced under low pressure, high temperature conditions (Vallance, 1967, reported by Degeling, 1982). Metamorphic grade adjacent to granite is up to granulite facies (Vallance, op.cit). The Nacka Nacka Metabasic Igneous Complex is regionally metamorphosed to up to lower granulite facies (Langley, 1972, reported by Degeling, 1982).

ALTERATION:

OREBODY: Adelong (D)
Mafic dykes have been altered by the cooling granite, deuteric processes, and by hydrothermal (mineralising) fluids. Alteration minerals are biotite, chlorite, carbonate, quartz. Granite adjacent to veins is hydrothermally altered - assemblage is quartz-muscovite. Other wallrock alteration minerals are pyrite, sericite.

OREBODY: Caledonian
Extensive silicification. Host granite is extensively sheared and altered; fractured feldspars are filled with quartz and transgressed by calcite veins; biotite is partly replaced by calcite.

OREBODY: Gibraltar
Silicification and sericitisation.

OREBODY: Victoria
Sericite-carbonate-pyrite-chlorite.

DEPOSIT CHARACTERISTICS:

TYPES:

MAJOR: Auriferous quartz veins associated with mafic intrusive in granitoid.
SIGNIFICANT: Alluvial.

STYLE:

MAJOR: Discordant

MORPHOLOGY: Lenticular

AGE OF MINERALISATION: Cainozoic Tertiary, Palaeozoic Middle Carboniferous, Palaeozoic Middle Devonian

DIMENSIONS/ORIENTATION:

OREBODY: Adelong (D)

		MIN	AVE	MAX
TRUE WIDTH	(cm)	10.0	100.0	600.0
STRIKE LENGTH	(m)			1066.0
VERTICAL DEPTH	(m)			400.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		E,W; SE
STRIKE		340-350; 30		

OREBODY: Adelong Creek

		MIN	AVE	MAX
STRIKE LENGTH	(m)			10000.0
VERTICAL DEPTH	(m)		9.0	18.0
DEPTH OF COVER	(m)	5.0		6.0
		ANGLE (deg.)		DIRECTION
STRIKE		180		

OREBODY: Caledonian

	ANGLE (deg.)	DIRECTION
DIP	75-90	E, W
STRIKE	180	

OREBODY: Currajong

		MIN	AVE	MAX
STRIKE LENGTH	(m)			366.0
VERTICAL DEPTH	(m)			98.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		E, W
STRIKE		340		

OREBODY: Donkey Hill

		MIN	AVE	MAX
STRIKE LENGTH	(m)			610.0
VERTICAL DEPTH	(m)			152.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		E
STRIKE		350		

OREBODY: Gibraltar

		MIN	AVE	MAX
STRIKE LENGTH	(m)			457.0
VERTICAL DEPTH	(m)			366.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		SE
STRIKE		30		

OREBODY: Old Reef

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			335.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		E, W
STRIKE		180		

OREBODY: Victoria

	ANGLE (deg.)	DIRECTION
DIP	75-90	E, W
STRIKE	340-350	

ORE TEXTURE:
Disseminated, Massive

NATURE OF MINERALISATION:
PRIMARY ORE: Dissemination, Vein (Reef),
SECONDARY ORE: Detrital (Alluvial), Supergene Enrichment

MINERALOGY:

OREBODY: Adelong (D)
Sulphide ore: gold, pyrite, chalcopyrite, sphalerite, arsenopyrite, (pyrrhotite, galena). Gold occurred both as free gold and as very fine inclusions in pyrite.

OREBODY: Donkey Hill
Chalcopyrite had a fracture-filling/replacement habit as opposed to the granular habit of pyrite.

OREBODY: Victoria
Gold occurred intergranular to pyrite.

CONTROLS OF MINERALISATION:
PRINCIPAL SOURCES: Langley (1972), reported by Degeling (1982).

Deposit is structurally controlled on a regional scale: location is close to a major regional fault zone, the Gilmore Fault Zone; both reefs and mafic dykes parallel regional structural NW trends.
On a local scale the prime control was also structural: contacts between late-stage felsic dykes and the host granite provided the loci for intrusion of the mafic dykes. Contacts between mafic dykes and granite in turn provided the site for localisation of auriferous quartz veins. Emplacement of the quartz veins was controlled by shearing along the contact zones.
Interaction between mineralising fluids and the mafic dyke rock mineral assemblage may have provided a chemical environment conducive to the precipitation of gold, thereby exerting a chemical control on mineralisation as well.

GENETIC MODELS:
PRINCIPAL SOURCES: Langley (1972), reported by Degeling (1982).

Langley (1972) measured background gold values of up to 0.01 g/t Au in rocks from the Nacka Nacka Metabasic Igneous Complex and considered them to be possible source rocks for the gold in the Adelong reefs.
Alternatively the gold may have been derived from the Ordovician flysch of which the Wagga Metamorphics are composed.
Langley (1972) suggested that the mafic dykes were the products of the action of volatile materials from the Wondalga Granodiorite on the mafic rocks of the Nacka Nacka Complex, and postulated the following sequence:-
1./ Metamorphism of a sequence of marine basalts and sediments (Nacka Nacka Metabasic Igneous Complex).
2./ Intrusion of a gabbroic body (Adelong Norite) into the metamorphosd mafic belt after the main regional metamorphism.
3./ Emplacement of the main Wondalga granitic mass.
4./ Leaching and remobilisation of gold from the metamorphosed volcano-sedimentary sequence and its concentration in the volatile fraction of the granite magma.
5./ Intrusion of a suite of mafic dykes during late stages of cooling of the granite.
6./ Transport of gold in hydrothermal solution and precipitation in veins in fissures in structrually controlled zones along intrusive contacts in response to changing chemical environment as a result of fluid/wallrock interaction.
7./ Supergene enrichment.
8./ Weathering and alluvial reconcentration.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Adelong (D)
PRINCIPAL SOURCES: Degeling (1977), Basden (1982), Degeling (1982), Markham (1982), Suppel & others (1986).
SUMMARY

Adelong lies near the eastern margin of the southern part of the Wagga Anticlinorial Zone, close to the known southern limit of the Gilmore Fault Zone. Mineralisation occurred in a series of discontinuous quartz veins spatially related to lamprophyre, gabbro, and diorite dykes which intrude the Siluro-Devonian Wondalga Granodiorite.

REGIONAL SETTING: WAGGA ANTICLINORIAL ZONE
PRINCIPAL SOURCES: Degeling (1977), Basden (1982), Degeling (1982), Suppel & others (1986).

The Wagga Anticlinorial Zone is the present day representation of the Wagga Marginal Basin and subsequent Wagga-Girilambone Arch. It comprises a belt of Ordovician metasedimentary rocks - the Wagga Metamorphics - (Q3L on Wagga Wagga and Cootamundra metallogenic maps) - originally flysch deposits of the Wagga Marginal Basin, extensively intruded by

granitoid batholiths.
Granitic rocks are prominent in the eastern part of the zone.
The anticlinorial zone is bounded by major fault zones (possibly collisional sutures) to the E – Gilmore Fault Zone – and the W – Kiewa Thrust.

In the Scheibner (1976) model, a west Pacific-type active plate margin existed at the eastern edge of the Australian plate in the Late Cambrian –Early Ordovician.
The Wagga Marginal Basin was a marginal sea which lay between the plate margin and a postulated rifted crustal block, the Molong Microcontinent.
In the Ordovician a volcanic arc, the Molong Volcanic Arc, developed on the site of the postulated microcontinent. W of the arc, the Wagga Marginal Basin received turbiditic sedimentation and a thick uniform sequence of alternating shales and subgreywackes accumulated.
The basin sequence was deformed and metamorphosed during the Benambran Orogeny (Late Ordovician–Early Silurian), forming the Wagga–Omeo Metamorphic Belt. Anatectic S-type granites were formed in areas of ultrametamorphism. The Gilmore Fault Zone marking the eastern boundary of the anticlinorial zone may be a collisional suture zone which formed during the Benambran Orogeny, possibly as a result of underthrusting of the Molong Microcontinent and Volcanic Arc beneath the Wagga Marginal Basin (Scheibner, 1982, 1985; reported by Suppel & others, 1986).

Granite plutonism continued through the Silurian; the Late Silurian Ellerslie and Wondalga Granodiorites (gamma3L2, gamma3L1 respectively on Wagga Wagga metallogenic map), which are hosts to gold mineralisation at BATLOW (Deposit No.21) and Adelong respectively, may have been related to the Molong Volcanic Arc and arc basement (Basden, 1982).
Host to WEST WYALONG (Deposit No. 14) was the Late Silurian Wyalong Granodiorite, which appears to straddle the Gilmore Fault Zone (Suppel & others, 1986).

The metasediments of the Wagga–Omeo Metamorphic Belt are foliated, steeply dipping, and isoclinally folded about NNW axes, as a result of at least three episodes of intense deformation (Barnes, 1972, reported by Degeling, 1982). The sequence consists of alternating shales and subgreywackes. Lithologies range from relatively unmetamorphosed siltstones, sandstones, and quartzites to slates (including carbonaceous slate), phyllites and schists (including chlorite, knotted, quartz–mica and graphitic schists).

The Wondalga and Ellerslie Granodiorites are syn-late kinematic I-type contact aureole granites occurring at the northern end of a broad, meridionally elongate, partly fault-bounded synkinematic batholith (Green Hills Granodiorite and equivalents, gamma2L4). The Green Hills Granodiorite intrudes Wagga Metamorphics and is intruded by the Ellerslie Granodiorite. The Wondalga and Green Hills Granodiorites have a faulted eastern boundary – Gilmore Fault Zone – with sediments of the Tumut Synclinorial Zone. (Basden, 1982).

Regional structural trends are NNW.

ASSOCIATED MINERALISATION: WAGGA ANTICLINORIAL ZONE
PRINCIPAL SOURCES: Degeling (1982), Suppel & others (1986).

The Wagga Anticlinorial Zone is characterised by numerous, mostly small hydrothermal vein gold deposits, but the major concentration of gold mineralisation is along the eastern margin of the zone where a line of gold deposits is associated with the Gilmore Fault Zone. The major historical deposits were Adelong, WEST WYALONG (Deposit No. 14), and SEBASTOPOL-JUNEE REEFS (Deposit No. 18).

Primary gold mineralisation in the Wagga Anticlinorial Zone occurs in four geological associations (Degeling, 1982):–
i) late-stage mafic dyke association, e.g. Adelong, BATLOW (Deposit No. 21);
ii) association with a major structural lineament;
iii) association with transition from greenschist to amphibolite facies metamorphism;
iv) feldspathic dyke association.

GEOLOGICAL SETTING: ADELONG
PRINCIPAL SOURCES: Degeling (1977), Basden (1982), Degeling (1982).

Adelong mineralisation is associated with mafic dykes in the host granodiorite. Several large mafic belts ?=roof pendants occur in the granodiorite in the deposit region.
The Wondalga and Ellerlsie Granodiorites enclose a linear NW-trending mafic roof pendant – Nacka Nacka Metabasic Igneous Complex – comprising metabasalt, metagreywake, and amphibolite, which may represent an island arc volcanic assemblage of Middle Ordovician age related to the Wagga

Metamorphics or to the Kiandra Beds (Basden, 1982; Degeling, 1982). The eastern margin of the metamafic belt is about 2 km W of Adelong. A possible branch of the Gilmore Fault Zone runs along the western margin of the Nacka Nacka Complex.
The Wondalga Granodiorite also encloses noritic stocks of the Avenall Basic Intrusive Complex, which may also be roof pendants. The Adelong Norite occurs less than 1 km S of the gold mineralisation.

The Wondalga Granodiorite is a differentiated intrusion comprising a sheared, mylonitised marginal zone of foliated and gneissic tonalite, quartz diorite, and granodiorite, in contact with Nacka Nacka Complex, surrounding a more massive interior of adamellite and granodiorite.
Both phases have been intruded by late-stage aplite and microgranite dykes. (Langley, 1972, reported by Degeling, 1982).

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Degeling (1977, 1982), Markham (1982).

Mineralisation is associated with a suite of NNW-trending mafic dykes emplaced along contacts between the late felsic intrusives and the main, inner granite host. Exceptional is Gibraltar where the mafic dykes were intruded along joint planes completely within microgranite.
Rock types in the mafic dyke suite include hornblende gabbro, hornblende diorite, and hornblende and biotite lamprophyres (Degeling, 1982).
At least three phases of lamprophyre intrusion have been distinquished (Markham, 1982). The earliest phase is schistose and contains quartz-chlorite-calcite veinlets with Fe and Zn sulphides.

Auriferous quartz veins fill fissures along contacts between mafic dyke and host, or as at Donkey Hill and Lady Mary, occupy joints and shear zones within mafic dyke.
Granite adjacent to reefs is sheared and altered; movement along the main channelways is indicated by slickensiding and alignment of micas.

Reefs are distributed along two main trends i) 340-350 deg strike, steep E or W dip (Currajong, Caledonian, Victoria, Middle and Old Reefs) ii) 30 deg strike, steep SW dip (Gibraltar, Lady Mary).
All reefs have been affected by post-ore faulting.

OREBODY: Adelong Creek
Thickness of auriferous gravel = 3 m.

OREBODY: Caledonian
A northerly extension of the Old Reef. Mineralisation was associated with a lamprophyre dyke along contact between aplite dyke and adamellite.

OREBODY: Currajong
Orebody occurred in micaceous lamprophyre dykes along granite/aplite contact. Mineralisation comprised at least two subparallel reefs.

OREBODY: Donkey Hill
Orebody consisted of at least three separate quartz veins: Donkey Hill, Midde Reef, and Fletchers. Ore occurred as a fracture-filling lode along minor shear zones and joints within bulges in a hornblende diorite dyke. Numerous lamprophyric dykes are present; lamprophyric material (biotite-albite-carbonate metamorphic rocks) is found marginal to the diorite dyke bulge.

OREBODY: Gibraltar
The most important and productive line of the field. Mineralisation occurred in quartz-carbonate veins in micaceous lamprophyre dykes within aplitic microgranite. Generally only schistose dykes were ore-bearing.
A number of individual lodes were present, occupying a series of sub-parallel channels along two major joint systems which strike 30 deg and 75 deg and dip steeply SE. Veins generally consisted of a main channelway with a number of branch or spur veins, some of which rejoined the main channel to form a bay.
Disseminated or stockwork-type mineralisation occurred in zones of intense replacement of granite by quartz veinlets containing some Fe and Zn sulphides.

OREBODY: Old Reef
The discovery reef of the field. Hosted by mica lamprophyre dykes intruded along aplite/adamellite contact. At least two narrow quartz lodes were present.
The more aplitic wallrocks appear to have been recrystallised and now comprise a quartz-feldspar assemblage with finely disseminated opaque material.

OREBODY: Victoria
The most important line on the Victoria Hill overlooking Adelong.

Hosted by mica lamprophyre dykes in adamellite. Dyke rocks with actinolite-biotite assemblage carry the least carbonate and quartz of all the Adelong dyke rocks. Langley (1972) suggested that carbonate and quartz were used in the formation of actinolite.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Basden H., 1982
Preliminary report on the geology of the Tumut 1:100 000 sheet area, southern New South Wales.
Geological Survey of New South Wales. Quarterly Notes
46 P1-18

Chapman J., 1986
Disseminated gold deposits along the Gilmore Suture. IN Geological setting of precious metals New South Wales. One-day symposium, Sydney, October 1986. Abstract
Geological Society of Australia
18

Chapman J., Ferguson A., Suppel D.W., 1986
Gold deposits of the West Wyalong-Temora-Adelong district.
Geological Survey of New South Wales. Report
GS1986/162

Degeling P.R., 1977
Wagga Wagga, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-15 (plus parts of SI 55-14, SJ 55-02, SJ 55-03), 1st edition.
Geological Survey of New South Wales
1v

Degeling P.R., 1982
Mine data sheets and metallogenic study of the Wagga Wagga 1:250 000 metallogenic series map, Sheet SI 55-15.
Geological Survey of New South Wales
1v

Harper L.F., 1916
The Adelong goldfield.
Geological Survey of New South Wales. Mineral Resources
21

Kenny E.J., 1938
Notes on certain mines at Adelong and Gundagai.
New South Wales. Department of Mines. Annual Report
1937 P111-112

Langley W.V., 1972
The geology of Adelong north. B.Sc. (Hons) thesis.
University of Sydney. Unpublished
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

Suppel D.W., Watkins J.J., Warren A.Y.E., Chapman J., Tenison Woods K.L., 1985
The geology and gold deposits of the West Wyalong-Temora-Adelong district. IN Seminar: New South Wales, the potential for development. Abstracts.
AMF and Department of Mineral Resources. Report
GS1985/292 P20-23

Suppel D.W., Warren A.Y.E., Watkins J.J., Chapman J., Tenison Woods K.L., Barron L., 1986
A reconnaissance study of the geology and gold deposits of the West Wyalong - Temora - Adelong district.
Geological Survey of New South Wales. Quarterly Notes
64 P1-23

Tenison Woods K.L., 1985
Qualitative interpretation of the regional geophysics of the Cootamundra 1:250 000 sheet, with reference to gold mineralization in the Wyalong-Adelong district.
Geological Survey of New South Wales. Report
GS1985/238

ooooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 21 TUMBARUMBA-BATLOW

DEPOSIT IDENTIFICATION:

SYNONYMS: Reedy Flat

COMMODITIES: Au, Sn

DISTRIBUTION:
Tumbarumba field = two main NE-trending deep leads approx 20 and 10 km long, minor reefs. Nos. 206-221, 299-305 on Wagga Wagga metall. map. Batlow field = primary deposits in small area NW of town and alluvials NE of town. Nos. 202-205.

OREBODIES:
Tumbarumba-Batlow (D), Batlow (Alluvial), Batlow (Reef), Burra Creek, Sesame, Tumbarumba, Walshs

MINES:
Adelong Creek, Back Creek, Bald Hill, Burra Creek, Cherry Hill, Gilmore Creek, Isabella Creek, Lagoon Gully, Laurel Hill, Leykaufes, Mannus Creek, Pound Creek, Quartzville, Reedy Flat Creek, Sesame (L'Aiglon), Surface Hill, Tarcutta Creek, Tumbarumba, Union Jack, Vyners Creek, Walshs Dyke (Mutooroo)

GROUP: -

COMMENTS:
See Deposit No.20 ADELONG for regional setting of Wagga Anticlinorial Zone.

LOCATION:

LATITUDE: 35 47 LONGITUDE: 148 3
250K SHEET: SI55 15 100K SHEET: 8526

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Albury
LOCAL GOVERNMENT AREA (LGA): Tumbarumba

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1855	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Batlow (Alluvial)	Adelong Creek	Historical	Alluvial
Batlow (Alluvial)	Reedy Flat Creek	Historical	Alluvial
Batlow (Alluvial)	Gilmore Creek	Historical	Alluvial
Burra Creek	Bald Hill	Historical	Underground
Burra Creek	Burra Creek	Historical	Dredging &/Or Sluicing
Sesame	Sesame (L'Aiglon)	Historical	Underground
Tumbarumba	Laurel Hill	Historical	Underground
Tumbarumba	Laurel Hill	Historical	Open-Cut
Tumbarumba	Laurel Hill	Historical	Sluicing
Tumbarumba	Leykaufes	Historical	Underground
Tumbarumba	Leykaufes	Historical	Open-Cut
Tumbarumba	Leykaufes	Historical	Dredging &/Or Sluicing
Tumbarumba	Lagoon Gully	Historical	Underground
Tumbarumba	Lagoon Gully	Historical	Open-Cut
Tumbarumba	Lagoon Gully	Historical	Dredging &/Or Sluicing
Tumbarumba	Tarcutta Creek	Historical	Dredging &/Or Sluicing
Tumbarumba	Cherry Hill	Historical	Underground
Tumbarumba	Cherry Hill	Historical	Open-Cut
Tumbarumba	Cherry Hill	Historical	Dredging &/Or Sluicing
Tumbarumba	Back Creek	Historical	Underground
Tumbarumba	Back Creek	Historical	Surface
Tumbarumba	Vyners Creek	Historical	Dredging &/Or Sluicing
Tumbarumba	Pound Creek	Historical	Dredging &/Or Sluicing
Tumbarumba	Isabella Creek	Historical	Dredging &/Or Sluicing

Tumbarumba	Surface Hill	Historical	Underground
Tumbarumba	Surface Hill	Historical	Open-Cut
Tumbarumba	Surface Hill	Historical	Dredging &/Or Sluicing
Tumbarumba	Quartzville	Historical	Underground
Tumbarumba	Mannus Creek	Historical	Dredging &/Or Sluicing
Tumbarumba	Union Jack	Historical	Underground
Tumbarumba	Union Jack	Historical	Open-Cut
Tumbarumba	Tumbarumba	Historical	Underground
Tumbarumba	Tumbarumba	Historical	Open-Cut
Tumbarumba	Tumbarumba	Historical	Dredging &/Or Sluicing
Walshs	Walshs Dyke (Mutooroo)	Historical	Open-Cut

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 4,549
Average recovered grade reef ore at Batlow 15 g/t Au (Sesame), 7.5 g/t (Walshs).

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1911-1918), (1922-1940), 1859-1910,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Wagga Anticlinorial Zone
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Unnamed - Tertiary
LITHOLOGY: Conglomerate.
RELATIONSHIP TO MINERALISATION: Host to deep lead mineralisation in basal conglomerate of fluviatile sediments underlying Tertiary basalt flows.

FORMATION NAME & AGE: Green Hills Granodiorite - Middle Silurian
LITHOLOGY: Muscovite-biotite granite.
RELATIONSHIP TO MINERALISATION: Host to relatively minor primary mineralisation at Tumbarumba.

FORMATION NAME & AGE: Ellerslie Granodiorite -Late Silurian(?-Early Devonian)
LITHOLOGY: Biotite granite and granodiorite.
RELATIONSHIP TO MINERALISATION: Host to relatively minor primary mineralisation at Batlow.

FORMATION NAME & AGE: Nacka Nacka Metabasic Igneous Complex - ?Ordovician
LITHOLOGY: Metagreywacke, andesitic ?metabasalt, ?metadiorite, ?metagabbro, amphibolite.
RELATIONSHIP TO MINERALISATION: Mafic pendant in Ellerslie Granodiorite adjacent to Batlow reef mineralisation; possible primary source of the gold.

FORMATION NAME & AGE: Unnamed - Recent
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to Recent alluvial deposits.

GEOCHRONOLOGY:

Green Hills Granodiorite dated at 406+-6, 419+-6, and 422+-6 my (K-Ar on biotite) (Webb, 1980, reported by Basden, 1982).
However, the ages probably reflect deformation events subsequent to crystallisation (Basden, 1982).
Ellerslie Granodiorite dated at 404+-6 my, which reflects a thermal or deformational event subsequent to crystallisation (Webb, 1980, reported by Basden, 1982).

Basalt dated at 22-18 my (Wellman & McDougall, 1974, reported by Degeling, 1982).

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Alluvium, Granitic,
MINOR: Granitic

STRUCTURAL FEATURES:

MAJOR: Faulting, Shearing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

MAJOR: Intrusive Contact

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Granodiorite), Volcanism (Mafic)

METAMORPHISM:
Regional metamorphic grade of Wagga Metamorphic Belt sediments is low greenschist facies (Degeling, 1982).

ALTERATION:

OREBODY: Walshs
Shearing of granite has produced sericite schist, and chloritic schist where mafic segregations were present. Subsequently portions of the sheared material were replaced by pyritic silica.

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Deep lead.
Alluvial.
SIGNIFICANT: Auriferous quartz veins in granitoid.
Auriferous quartz veins associated with mafic intrusive in granitoid.

STYLE:

MAJOR: Stratabound, SIGNIFICANT: Discordant, MINOR: Discordant

MORPHOLOGY: Flat-Lying

AGE OF MINERALISATION: Cainozoic Recent Quaternary, Cainozoic Miocene Tertiary, Palaeozoic Late Silurian

DIMENSIONS/ORIENTATION:

OREBODY: Sesame

		MIN	AVE	MAX
STRIKE LENGTH	(m)			130.0
TRUE WIDTH	(m)			18.0
VERTICAL DEPTH	(m)			63.0
		ANGLE (deg.)		DIRECTION
DIP		70		E
STRIKE		350		

OREBODY: Tumbarumba

		MIN	AVE	MAX
DEPTH OF COVER	(m)		70.0	80.0
STRIKE LENGTH	(m)			2200.0
		ANGLE (deg.)		DIRECTION
DIP				S
STRIKE		35-80		

OREBODY: Walshs

		MIN	AVE	MAX
STRIKE LENGTH	(m)			150.0
TRUE WIDTH	(m)			75.0
VERTICAL DEPTH	(m)			40.0
		ANGLE (deg.)		DIRECTION
STRIKE		025		

ORE TEXTURE:
Disseminated, Free Milling, Oxidised

NATURE OF MINERALISATION:
PRIMARY ORE: Multiple Veins, Vein (Reef),
SECONDARY ORE: Deep Lead, Detrital (Alluvial), Supergene Enrichment

MINERALOGY:

OREBODY: Batlow (Reef)
Sulphide zone: gold, pyrite.
Gold abundance was closely related to pyrite distribution.

OREBODY: Tumbarumba
Sulphide zone (reef): gold, (pyrite, arsenopyrite, cassiterite).

CONTROLS OF MINERALISATION:
PRINCIPAL SOURCES: Degeling (1982), Markham (1982).

Degeling (1982): 'Although detailed geological information regarding the gold deposits at Batlow is lacking, they seem to be genetically similar to the deposits at Adelong', where according to Langley (1972, reported by Degeling, 1982) the mafic dyke/granite contacts provided the major physical control on mineralisation (see 'CONTROLS OF MINERALISATION', ADELONG (Deposit No. 20)).
Primary gold mineralisation at Tumbarumba is apparently related to the intrusion of Silurian granitic rocks.

Secondary mineralisation was controlled by climate, geomorphology, and the distribution of basalt flows, and hence indirectly by structure.
Deep leads formed in southerly flowing streams.

GENETIC MODELS:
PRINCIPAL SOURCES: Degeling (1982), Markham (1982).

Degeling (1982): 'it is assumed that the gold deposits at Batlow had a similar origin to those at Adelong'.

Markham (1982): primary mineralisation at Tumbarumba was magmatic hydrothermal, the veins being emplaced within both granite and sediments.
The comparatively high proportion of alluvial relative to primary gold recovered suggests that the gold either originally occurred in the form of a small number of rich gold reefs, now largely removed by erosion, or that granite contained largely disseminated gold mineralisation, the weathering of the granite releasing this gold to be subsequently concentrated in the Tertiary alluvials (Markham, 1982).
The gold has also been redistributed in more recent times: Recent alluvial and eluvial deposits formed both from the shedding of gold from primary quartz reefs, and, especially in the case of Tumbarumba and Tarcutta Creeks, from the redistribution of deep lead gold.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Tumbarumba-Batlow (D)
PRINCIPAL SOURCES: Willis (1972), Markham & Basden (1974), Degeling (1977), Basden (1982), Degeling (1982), Markham (1982).
SUMMARY

The Tumbarumba and Batlow goldfields lie in the southern part of the Wagga Anticlinorial Zone. Primary mineralisation comprised auriferous quartz-sulphide veins in granite of the Middle Silurian Green Hills Granodiorite at Tumbarumba, and the Siluro-Devonian Ellerslie Granodiorite at Batlow.
The bulk of production from both fields was derived from secondary deposits. At Tumbarumba these comprised Tertiary deep leads preserved under a locally extensive cover of basalt flows over the granite terrain, and more recent alluvial deposits derived from reworking of the deep leads or the reefs.

At Batlow alluvial deposits occurred in channels which traversed mafic terrain of the Nacka Nacka Metabasic Igneous Complex to the E of the granite-hosted reef deposits.

GEOLOGICAL SETTING: TUMBARUMB
PRINCIPAL SOURCES: Degeling (1977 ... 982), Degeling (1982).

The western part of the deposit region ...ses steeply folded and highly deformed mica schists, slates, and quartzites of the Late Ordovician Wagga Metamorphics (Q3L on Wagga Wagga metallogenic map), representing metamorphosed flysch of the Wagga Marginal Basin.
The sequence is intruded in the E and S by the syn-kinematic Green Hills Granodiorite (gamma2L4).
The eastern fault-controlled granite/sediment contact is part of a major NNW-trending lineament.

The Green Hills Granodiorite is intruded to the N by the syn-late kinematic Ellerslie Granodiorite (gamma3L2); the latter is in contact on its eastern margin with a belt of mafic rocks, Nacka Nacka Metabasic Igneous Complex (Q3L + deltaL2), which extends from S of Batlow to W of Adelong and may be a roof pendant related to the Wagga Marginal Basin (Basden, 1982), or a highly metamorphosed equivalent of the Kiandra Beds (Degeling, 1982).

Tertiary basalts are extensive along the contact between Green Hills Granodiorite and metasediments, and overlying the granite terrain to the N and E of Tumbarumba. The intrusive contact apparently controlled distribution of the basalts (Markham, 1982).

OREBODY: Batlow (Alluvial)

Alluvial gold occurred in present-day stream channels which traverse the metamafic belt E of Batlow. The main localities were Reedy Flat Creek about 3 km NE of Batlow, the upper, eastern branch of Adelong Creek, Mudhole Creek, and Gilmore Creek.

OREBODY: Batlow (Reef)

PRINCIPAL SOURCES: Markham & Basden (1974), Degeling (1977, 1982), Markham (1982).

The reef deposits (Sesame, Walshs) occurred in a narrow belt of Ellerslie Granodiorite adjacent to contacts with Green Hills Granodiorite to the SW and Nacka Nacka Metabasic Igneous Complex to the NE.

Mineralisation occurred in narrow quartz-pyrite veinlets within a locally sheared and altered gneissic granite. The host granite contains locally abundant segregations or xenoliths of schistose material which may be remnant fragments of sedimentary and mafic igneous rocks originally part of the mafic belt which the granite intruded. Dump material from the Sesame mine includes examples of a hybrid rock consisting of fine-grained mafic igneous rock intruded by and partly assimilated by quartz-hornblende granodiorite (Markham, 1982).
Total length of line of lode = 5 km.

OREBODY: Sesame

PRINCIPAL SOURCES: Degeling (1982), Markham (1982).

Mineralisation occured in irregular and elongate lenses of quartz occupying 'pressure slacks' within a shear zone up to 2.5 m wide in hornblende-biotite granite. The shear zone contains both laminated quartz sheets which appear to fill fissures, and masses of quartz which apparently replaced the granitic wallrock (Kenny, 1936, 1950; reported by Degeling, 1982).
Disseminated pyrite was distributed within both the quartz and the associated wallrock. A dark green schistose rock is prominent on the hanging wall of the mineralised zone, and may have developed from the alteration of mafic segregations in the host granite (Kenny, op.cit). Alternatively, the green schistose rock could be an altered mafic dyke, as lamprophyric dykes are known to occur in the host granite (Degeling, 1982).

OREBODY: Tumbarumba

PRINCIPAL SOURCES: Willis (1972), Basden (1982), Degeling (1982), Markham (1982).

The host to primary mineralisation, the Green Hills Granodiorite, is a mainly massive, Cooma type, regional aureole S-type granite associated with medium- to high-grade regional metamorphism (Vallance, 1954, reported by Basden, 1982). A local foliation is defined by the orientation of micas, metasedimentary inclusions, and feldspar phenocrysts in the more porphyritic phases (Degeling, 1982).
Numerous dolerite dykes and sills intrude the granite in the deposit region.
The granite terrain is overlain by extensive cappings of Tertiary olivine-bearing plateau basalt. Cappings may consist of one or more flows.

The main reef deposits were at Quartzville (The Island); mineralisation comprised a number of subparallel veins in granodiorite.

The deep leads were associated with the basal conglomerate of fluvial sediments - sand, conglomerate, lignite beds - of channels underlying the Tertiary basalt. The basal conglomerate was apparently originally widespread on a comparatively level bedrock in which no definite deep gutter has been found, although occasional undulations occur. Gold was disseminated throughout the conglomerate but in payable quantities in irregular patches only. (Willis, 1972; Degeling, 1982).

The main deep lead was Laurel Hill, which was made up of a series of discontinuous outcrops over 22 km, between Laurel Hill and Tumbarumba. The general course of the Tertiary channel trended NNE parallel to the present course of Tumbarumba Creek. (Markham, 1982).

Gold-bearing sands and gravels in eluvial and alluvial sediments in a NNE-trending present-day stream channel system have been extensively worked along Tumbarumba and Burra Creeks, with lesser production from Paddys River and Mannus, Tarcutta and Pound Creeks. (Markham, 1982).

OREBODY: Walshs

Mineralisation occurred in biotite granite and ?lamprophyric dyke.
Total length of line of lode = 1 km.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Basden H., 1982
Preliminary report on the geology of the Tumut 1:100 000 sheet area, southern New South Wales.
Geological Survey of New South Wales. Quarterly Notes
46 P1-18

Booker F.W., 1950
The Laurel Hill-Tumbarumba alluvial deep lead.
New South Wales. Department of Mines. Geological Report
1939-1945 P20-23

Carne J.E., 1896
Report on an auriferous deposit at Batlow.
New South Wales. Department of Mines. Annual Report
1895 Appendix 10 P138-139

Degeling P.R., 1977
Wagga Wagga, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-15 (plus parts of SI 55-14, SJ 55-02, SJ 55-03), 1st edition.
Geological Survey of New South Wales
1v

Degeling P.R., 1982
Mine data sheets and metallogenic study of the Wagga Wagga 1:250 000 metallogenic series map, Sheet SI 55-15.
Geological Survey of New South Wales
1v

Kenny E.J., 1936
Batlow gold prospects.
New South Wales. Department of Mines. Annual Report
1935 P81-83

Kenny E.J., 1950
Sesame gold mine, Batlow.
New South Wales. Department of Mines. Geological Report
1939-1945 P10-11

Langley W.V., 1972
The geology of Adelong north. B.Sc. (Hons) thesis.
University of Sydney. Unpublished
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Willis J.L., 1972
Mining history of the Tumbarumba gold field.
Geological Survey of New South Wales. Bulletin
23

Wood L.A.I., 1971
The geology of the Batlow district, N.S.W. B.Sc. (Hons) thesis.
University of Sydney. Unpublished
1v

DEPOSIT: 22 KIANDRA

DEPOSIT IDENTIFICATION:

COMMODITIES: Au

DISTRIBUTION:
Nos. 310-324 on Wagga Wagga metallogenic map, Nos 230-236 on Canberra metallogenic map.

OREBODIES:
Kiandra (D), Charcoal, Four Mile, Kiandra (Deep Lead), New Chum Hill, Nine Mile, Six Mile, Surface Hill, Sutherland, Three Mile, Township Hill

MINES:
All Nations, Basalt Hill, Charcoal, Cornishmens, Empress, Four Mile Creek, Giandarra, Homeward Bound, Luttrels, New Chum Hill, Nine Mile Creek, North Bloomfield, Pattinson & Wincklers, Robyns Tunnel, Scotts Gully, South Bloomfield, Surface Hill, Sutherland, Three Mile, Township Hill, Weselmans Tunnel, Whipstick Gully

GROUP: -

COMMENTS:
See Deposit No.48 ARALUEN-MAJORS CREEK for regional setting of Molong-South Coast Anticlinorial Zone (S).

LOCATION:

LATITUDE: 35 52 LONGITUDE: 148 30
250K SHEET: SI55 15 100K SHEET: 8526

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Cooma
LOCAL GOVERNMENT AREA (LGA): Snowy River

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1859	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Charcoal	Charcoal	Historical	Surface
Charcoal	Charcoal	Historical	Underground
Four Mile	Four Mile Creek	Historical	Underground
Four Mile	Four Mile Creek	Historical	Open-Cut
Four Mile	Four Mile Creek	Historical	Sluicing
Kiandra (Deep Lead)	Homeward Bound	Historical	Underground
Kiandra (Deep Lead)	Homeward Bound	Historical	Sluicing
Kiandra (Deep Lead)	Robyns Tunnel	Historical	Underground
Kiandra (Deep Lead)	Robyns Tunnel	Historical	Dredging &/Or Sluicing
Kiandra (Deep Lead)	Giandarra	Historical	Placer (Dredging)
Kiandra (Deep Lead)	Giandarra	Historical	Underground
Kiandra (Deep Lead)	Luttrels	Historical	Underground
Kiandra (Deep Lead)	Luttrels	Historical	Dredging &/Or Sluicing
Kiandra (Deep Lead)	All Nations	Historical	Underground
Kiandra (Deep Lead)	All Nations	Historical	Dredging &/Or Sluicing
Kiandra (Deep Lead)	Cornishmens	Historical	Underground
Kiandra (Deep Lead)	Cornishmens	Historical	Sluicing
Kiandra (Deep Lead)	Pattinson & Wincklers	Historical	Underground
Kiandra (Deep Lead)	Pattinson & Wincklers	Historical	Sluicing
Kiandra (Deep Lead)	Whipstick Gully	Historical	Underground
Kiandra (Deep Lead)	Whipstick Gully	Historical	Dredging &/Or Sluicing
Kiandra (Deep Lead)	Weselmans Tunnel	Historical	Underground
Kiandra (Deep Lead)	Weselmans Tunnel	Historical	Dredging &/Or Sluicing
Kiandra (Deep Lead)	Basalt Hill	Historical	Underground
Kiandra (Deep Lead)	Basalt Hill	Historical	Dredging &/Or Sluicing
Kiandra (Deep Lead)	North Bloomfield	Historical	Underground
Kiandra (Deep Lead)	North Bloomfield	Historical	Open-Cut

Kiandra (Deep Lead)	North Bloomfield	Historical	Sluicing
Kiandra (Deep Lead)	South Bloomfield	Historical	Underground
Kiandra (Deep Lead)	South Bloomfield	Historical	Open-Cut
Kiandra (Deep Lead)	South Bloomfield	Historical	Sluicing
Kiandra (Deep Lead)	Empress	Historical	Underground
Kiandra (Deep Lead)	Empress	Historical	Sluicing
Kiandra (Deep Lead)	Scotts Gully	Historical	Underground
Kiandra (Deep Lead)	Scotts Gully	Historical	Sluicing
Kiandra (Deep Lead)	Charcoal	Historical	Underground
New Chum Hill	New Chum Hill	Historical	Underground
New Chum Hill	New Chum Hill	Historical	Sluicing
Nine Mile	Nine Mile Creek	Historical	Underground
Nine Mile	Nine Mile Creek	Historical	Sluicing
Surface Hill	Surface Hill	Historical	Underground
Sutherland	Sutherland	Historical	Underground
Three Mile	Three Mile	Historical	Underground
Township Hill	Township Hill	Historical	Underground
Township Hill	Township Hill	Historical	Dredging &/Or Sluicing

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 4,600
Recovered grades 7.5-20 g/cubic m Au, alluvial and deep lead deposits; 25-92 g/t Au, average 54, 70 g/t Au, reef deposits.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1910-1926), 1860-1909,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Molong-South Coast Anticlinorial Zone(S)
SUB-PROVINCE: Tantangara Block

HOST ROCKS:

FORMATION NAME & AGE: Nine Mile Volcanics - Middle-Late Ordovician
LITHOLOGY: Andesitic volcanics, tuff, chert and sediments.
RELATIONSHIP TO MINERALISATION: Host to relatively minor vein mineralisation; underlies Cainozoic sediments host to derived placer deposits.

FORMATION NAME & AGE: Kiandra Beds - Middle-Late Ordovician
LITHOLOGY: Cherts, tuffs, andesitic volcanics.
RELATIONSHIP TO MINERALISATION: Includes Nine Mile Volcanics.

FORMATION NAME & AGE: Unnamed - Eocene
LITHOLOGY: Conglomerate.
RELATIONSHIP TO MINERALISATION: Host to Tertiary deep leads.

FORMATION NAME & AGE: Unnamed - Tertiary
LITHOLOGY: Basalt.
RELATIONSHIP TO MINERALISATION: Overlies Eocene deep leads.

GEOCHRONOLOGY:
Flora of host to deep lead dated at Late Eocene?-Oligocene (Gill & Sharp, 1957, reported by Markham, 1982).

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Alluvium, [illegible] Jiate Extrusive

STRUCTURAL FEATURES:

MAJOR: Faulting

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

MAJOR: Volcanism (Intermediate), Volcanism (Mafic),
SIGNIFICANT: Plutonism (Diorite)

METAMORPHISM:
Regional metamorphic grade is greenschist facies.

ALTERATION:

OREBODY: Kiandra (D)
Primary mineralisation was associated with zones of silicification. Host slate to some primary deposits was reported as strongly altered and in places extensively replaced by white quartz (Andrews, 1901).

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Deep lead.
Alluvial.
MINOR: Gold-bearing quartz veins in felsic volcanics.

STYLE:

SIGNIFICANT: Conformable, Stratabound

MORPHOLOGY: Flat-Lying, Lenticular

AGE OF MINERALISATION: Cainozoic Recent Quaternary, Cainozoic Eocene Tertiary, Palaeozoic Middle Ordovician, Palaeozoic Late Ordovician

DIMENSIONS/ORIENTATION:

OREBODY: Kiandra (D)

		MIN	AVE	MAX
DEPTH OF COVER	(m)			53.0
TRUE WIDTH	(m)	46.0		91.0
VERTICAL DEPTH	(m)	2.0		4.3

OREBODY: Three Mile

		MIN	AVE	MAX
STRIKE LENGTH	(m)			180.0

ORE TEXTURE:
Free Milling, Oxidised

NATURE OF MINERALISATION:
PRIMARY ORE: Vein (Reef),
SECONDARY ORE: Deep Lead, Detrital (Alluvial)

MINERALOGY:

OREBODY: Kiandra (D)
Sulphide ore (reef): gold, pyrite.
Gangue: quartz, calcite.

GENETIC MODELS:
PRINCIPAL SOURCES: Andrews (1901), Markham & Basden (1974), Degeling (1982), Markham (1982).

Primary mineralisation: hydrothermal (Degeling, 1982), possibly related to metamorphism (Degeling, 1982), or to the intrusion of granite (Andrews, 1901), or intermediate-mafic intrusives (Gilligan, reported by Degeling, 1982; Degeling, 1982), or to andesitic volcanism (Markham & Basden, 1974).
Degeling (1982): 'The reef gold deposits in the Kiandra Beds may be of volcanic origin, but some of them appear to be related to much younger, small intrusions of norite and monzonite in the area.' If so, they may have affinities with the class of gold deposits associated with small intermediate to mafic intrusives along the eastern margin of the Wagga Anticlinorial Zone (Gilmore Fault Zone) which includes ADELONG, REEFTON, SEBASTOPOL, and WEST WYALONG (Deposit Nos. 20, 15, 18, 14 respectively). (Degeling, 1982).
Although now mostly eroded, primary mineralisation associated with

intermediate to mafic intrusives could have supplied the estimated > 3000 kg of gold contained in the placer deposits (Degeling, 1982).

The deep lead deposits accumulated during fluvial sedimentation. Andrews (1901) postulated a northerly-flowing Tertiary drainage system; Gill & Sharp (1957) suggested that the ancestral stream system flowed S. However it is likely that the Kiandra lead may well represent the headwaters of several streams flowing both to the N and S, the original gradients being obscured by subsequent tilting and faulting (Markham, 1982).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Kiandra (D)

PRINCIPAL SOURCES: Andrews (1901), Gilligan (1974), Markham & Basden (1974), Gilligan (1975), Degeling (1977, 1982), Markham (1982).

SUMMARY

Kiandra lies within the Tantangara Block (of the Cotter Block) adjacent to the southwest margin of the Molong-South Coast Anticlinorial Zone(S). Gold production has been derived almost entirely from secondary deposits in Tertiary deep leads and Recent shallow alluvials in stream channels which traversed andesitic volcanic terrain (Nine Mile Volcanics) of the Ordovician Kiandra Beds.
Very minor reef mineralisation occurs in the volcanics.

GEOLOGICAL SETTING: KIANDRA
PRINCIPAL SOURCES: Gilligan (1974), Degeling (1977, 1982), Markham (1982).

1./ The oldest rocks in the deposit region are Middle Ordovician quartz sandstones with thin shale interbeds (Bolton Beds - Q8L1 on Wagga Wagga and Canberra metallogenic maps) of the Monaro Slope and Basin sequence, which occur to the E of Kiandra.
2./ These are overlain by a sequence of interbedded cherts and tuffs plus agglomerate (Temperance Formation - Q6L2), and andesitic volcanics, tuff, chert, and sediments (Nine Mile Volcanics - Q6L1) of Middle-Late Ordovician age, which together form the Kiandra Beds - Q6L.
The Kiandra Beds were deposited in mostly submarine environment on the southern extension of the Molong Volcanic Arc which developed at the edge of the Wagga Marginal Basin (Degeling, 1982).
The volcanics were deformed during the Benambran Orogeny (Late Ordovician-Early Silurian); the sequence is strongly folded and densely faulted. Two prominent elongate belts of intermediate to mafic igneous rocks, comprising variously monzonite, diorite, norite, and amphibolite, intrude the Ordovician rocks to the NW and S of Kiandra.
The Nine Mile Volcanics are host to the primary mineralisation at Kiandra, and bedrock to the secondary deposits.
3./ To the W the Kiandra Beds are overlain by Early Silurian sandstones, quartzites, slates, and phyllites (Tumut Pond Group - beta3L4) of the Tumut Synclinorial Zone.
4./ The sedimentary-volcanic succession is intruded to the S by the Happy Jacks Granite (gamma3L20) of the Late Silurian Kosciusko Batholith.

5./ N of Kiandra the Molong-South Coast Zone (S) is in faulted contact, along the NNE-trending Long Plain Fault, with the Middle-Late Silurian Goobarragandra Volcanics - B5L25 (felsic volcanics, basalt, andesitic volcanics) - of the Young Anticlinorial Zone. The NNE-trending block margin fault system apparently controlled the distribution of Tertiary plateau basalts with which the Kiandra lead is associated.

6./ Cainozoic plateau basalts form extensive cappings over the sedimentary-volcanic terrain, representing a number of episodes of basaltic outpourings (Markham, 1982).
Underlying the basalt flows and in part also interbedded with them in palaeo drainage channels are a sequence of Tertiary sediments. According to Gill & Sharp (1957, reported by Degeling, 1982), the sediments were deposited in rejuvenated streams on an ancient, possibly Cretaceous, peneplain. Sedimentation ranged from fluvial to lacustrine and shows evidence of cyclic sedimentation (Gill & Sharp, op.cit). Sedimentation was terminated by basaltic volcanism.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Andrews (1901), Degeling (1982), Markham (1982).

Mineralisation in the Kiandra field comprised mainly deep leads capped by Tertiary sediments and basaltic lava flows, shallow alluvials of Holocene age, and minor reef deposits.

According to Andrews (1901), the reefs were rarely in the form of true fissure veins. Three Mile and Charcoal occurred as zones of

silicification in slate which was reported to be strongly altered W of Kiandra and in places extensively replaced by white quartz (Andrews, 1901). Mineralised zones parallelled strike of the host rock.
Small bosses of granite and norite occur near Charcoal.
Sutherland comprised a series of pressure lenses of quartz in slate, up to 1 m long, 30 cm wide, and more or less conformable with bedding in a boudinage form. Surface Hill was localised in andesitic tuffs near a small monzonite boss. (Andrews, 1901; Degeling, 1982; Markham, 1982).

Deep lead deposits accumulated in the basal conglomerate during Cainozoic fluvial sedimentation. The placers were overlain by up to 53 m of Tertiary sediments and basalt flows. The sediments comprise basal conglomerate overlain by interbedded unconsolidated red and yellow sands, red and yellow clays, and up to three layers of lignite (Andrews, 1901; Degeling, 1982).
The lead has been extensively worked at separated localities where it has been exposed by erosion (Markham, 1982). The workings include Nine Mile, Four Mile, Township Hill, New Chum Hill, and Six Mile. The auriferous gravel was not confined to a narrow gutter but was distributed over an uneven bed of variable width (Andrews, 1901).
Gold was more or less regularly distributed over the length of the lead. High-grade Recent alluvials have been mined in association with the deep leads at Nine Mile Creek, Four Mile Creek, Pollocks Creek, the Eucumbene River in the vicinity of Kiandra, and Racecourse Creek (Markham, 1982).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Andrews E.C., 1901
Report on the Kiandra lead.
Geological Survey of New South Wales. Mineral Resources
10

Clift D.S.L., 1975
Gold dredging in New South Wales.
Geological Survey of New South Wales. Mineral Resources
41

Degeling P.R., 1977
Wagga Wagga, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-15 (plus parts of SI 55-14, SJ 55-02, SJ 55-03), 1st edition.
Geological Survey of New South Wales
1v

Degeling P.R., 1982
Mine data sheets and metallogenic study of the Wagga Wagga 1:250 000 metallogenic series map, Sheet SI 55-15.
Geological Survey of New South Wales
1v

Gill E.D., Sharp K.R., 1957
The Tertiary rocks of the Snowy Mountains, eastern Australia.
Geological Society of Australia. Journal
4(1) P21-40

Gilligan L.B., 1974
Canberra, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-16, 1st edition.
Geological Survey of New South Wales
1v

Gilligan L.B., 1975
Part I. Mine data sheets to accompany metallogenic map, Canberra 1:250 000 sheet. Sheet SI55-16.
Geological Survey of New South Wales
1v

Jeffery D.G., 1972
Geology of the Kiandra area, N.S.W. B.Sc. (Hons) thesis.
Australian National University. Unpublished
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report

Unpublished

Owen M., Wyborn D., 1979
Geology and geochemistry of the Tantangara and Brindabella 1:100 000 Sheet areas, New South Wales and Australian Capital Territory.
Bureau Mineral Resources, Australia. Bulletin
204

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 23 GUNDAGAI

DEPOSIT IDENTIFICATION:

COMMODITIES: Au, Ag, Pb, Zn, As, Asbestos, Cu, Mn

DISTRIBUTION:
Record covers approx 30 deposits in two zones: one 7 km x 7 km, NW of Gundagai and one 8 km x 7 km, S of Gundagai. Deposits collectively define a broad NNW zone centred 3km SW of Gundagai.
Nos.18-26,28-34,36,38,40-41,43-54 on W W metal.map.

OREBODIES:
Gundagai (D), Big Ben-Stoney Creek, Bushmans Daughter, Clarke & Wesley-Big Reef-Morning Star, Jackalass Lead, Kangaroo, Lady Milburn, Long Tunnel, Mount Parnassus, Mount Potter, Prince Of Wales, Princess Marina, Robinson & Rices, St Patricks, Stony Creek

MINES:
Big Ben, Big Ben Creek, Big Reef, Bushmans Daughter, Clarke & Wesley, Frewins, Jackalass Lead, Kangaroo, Kenny, Lady Milburn, Long Tunnel, Morning Star, Mount Parnassus, Mount Parnassus Tunnel, Mount Potter, Prince Of Wales, Princess Marina, Robinson & Rices, St Patricks, Star, Stoney Creek, Stony Creek, Sybil

GROUP: -

COMMENTS:
Record includes regional setting of Tumut Synclinorial Zone.

LOCATION:

LATITUDE: 35 4 LONGITUDE: 148 7
250K SHEET: SI55 15 100K SHEET: 8527

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Wagga Wagga
LOCAL GOVERNMENT AREA (LGA): Gundagai

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD	COMMENTS
1870	Prospecting	
1896		Extension To Known Mineralisation

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Big Ben-Stoney Creek	Big Ben	Historical	Underground
Big Ben-Stoney Creek	Big Ben Creek	Historical	Dredging &/Or Sluicing
Big Ben-Stoney Creek	Big Ben Creek	Historical	Surface
Big Ben-Stoney Creek	Stoney Creek	Historical	Placer (Dredging)
Bushmans Daughter	Bushmans Daughter	Historical	Open-Cut
Bushmans Daughter	Bushmans Daughter	Historical	Underground
Clarke & Wesley-Big Reef-Morning Star	Morning Star	Historical	Underground
Clarke & Wesley-Big Reef-Morning Star	Big Reef	Historical	Underground
Clarke & Wesley-Big Reef-Morning Star	Clarke & Wesley	Historical	Underground
Clarke & Wesley-Big Reef-Morning Star	Star	Historical	Underground
Jackalass Lead	Jackalass Lead	Historical	Open-Cut
Jackalass Lead	Jackalass Lead	Historical	Dredging &/Or Sluicing
Jackalass Lead	Jackalass Lead	Historical	Underground
Jackalass Lead	Jackalass Lead	Historical	Surface
Kangaroo	Kangaroo	Historical	Underground
Kangaroo	Kangaroo	Historical	Open-Cut
Lady Milburn	Lady Milburn	Historical	Underground
Long Tunnel	Long Tunnel	Historical	Underground
Long Tunnel	Kenny	Historical	Underground
Long Tunnel	Frewins	Historical	Underground
Mount Parnassus	Mount Parnassus	Historical	Open-Cut
Mount Parnassus	Mount Parnassus	Historical	Surface
Mount Parnassus	Mount Parnassus Tunnel	Historical	Open-Cut
Mount Parnassus	Mount Parnassus Tunnel	Historical	Surface

Mount Potter	Mount Potter	Historical	Underground
Prince Of Wales	Prince Of Wales	Historical	Underground
Prince Of Wales	Sybil	Historical	Underground
Princess Marina	Princess Marina	Historical	Underground
Robinson & Rices	Robinson & Rices	Historical	Underground
St Patricks	St Patricks	Historical	Underground
Stony Creek	Stony Creek	Historical	Underground
Stony Creek	Stony Creek	Historical	Open-Cut

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 1,269
Recovered grades 4.4-8 g/t Au, 26-39 g/t Au, 47-56 g/t Au, 80-94 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: 1896-1935,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Tumut Synclinorial Zone
SUB-PROVINCE: Gocup Block

HOST ROCKS:

FORMATION NAME & AGE: Long Tunnel Metabasic Igneous Complex - Silurian
LITHOLOGY: Metabasalt, andesite, diorite, minor keratophyre, serpentinite, sediments.
RELATIONSHIP TO MINERALISATION: Host to large vein deposits associated with serpentinite at Robinson & Rices and Long Tunnel.

FORMATION NAME & AGE: Frampton Volcanics - ?Early or Middle-Late Silurian
LITHOLOGY: Rhyolite, rhyodacitic tuff, andesite, volcaniclastic and polymictic conglomerate.
RELATIONSHIP TO MINERALISATION: Host to a large number of vein deposits, including Prince of Wales, Princess Marina, Bushmans Daughter, Mount Potter, Clarke & Wesley-Big Reef-Morning Star.

FORMATION NAME & AGE: Jackalass Slate - Middle-Late Silurian
LITHOLOGY: Andesitic to dacitic volcaniclastic slate and sandstone, phyllite, conglomerate, lithic tuff, minor andesitic lava.
RELATIONSHIP TO MINERALISATION: Host to a number of the mostly smaller vein deposits of the field, including Milburn, Big Ben-Stoney Creek, St Patricks.

FORMATION NAME & AGE: Gundagai Serpentinite - Cambrian-Early Ordovician
LITHOLOGY: Serpentinite.
RELATIONSHIP TO MINERALISATION: Host to a number of vein deposits, some associated with asbestos, some along contacts with Jackalass Slate, e.g. Mount Parnassus.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Felsic Extrusive, Mafic Igneous,
SIGNIFICANT: Volcanogenic Sedimentary,
MINOR: Alluvium

STRUCTURAL FEATURES:

SIGNIFICANT: Faulting, Shearing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

SIGNIFICANT: Fault/Fault, Intrusive Contact

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Ultramafic), Volcanism (Felsic), Volcanism (Mafic)

METAMORPHISM:
Regional metamorphic grade is greenschist facies.

ALTERATION:

OREBODY: Gundagai (D)
Mineralisation was associated with zones of strong chloritic alteration.

OREBODY: Long Tunnel
PRINCIPAL SOURCES: Degeling (1982), Markham (1982).

Mineralisation was associated with alteration zones in serpentinite and diorite. Two sets of ore mineral assemblages occurred (see 'MINERALOGY'), which correspond broadly with different alteration lithologies in the host serpentinite:- i) talc-rich lenses in tremolite rocks with quartz-sulphide veins; ii) talc-carbonate alteration zones containing coarse talc-antigorite schist with calcite-sulphide veins.

OREBODY: Princess Marina
Mineralisation was associated with zone of strong alteration = silicification, chloritisation. Quartz in the silicified zone was reported to be chalcedonic.
Gold concentrations were highest in the more intensely silicified zones.

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Auriferous quartz veins associated with mafic/ultramafic intrusive.
Auriferous lodes (alteration zones) associated with mafic/ultramafic intrusive.
Auriferous quartz veins in felsic volcanics/volcaniclastics.
MINOR: Deep lead.

STYLE:

MAJOR: Discordant

AGE OF MINERALISATION: Palaeozoic Early Devonian, Palaeozoic Middle Silurian, Palaeozoic Late Silurian

DIMENSIONS/ORIENTATION:

OREBODY: Big Ben-Stoney Creek

		MIN	AVE	MAX
STRIKE LENGTH	(m)			47.0
VERTICAL DEPTH	(m)			14.0

OREBODY: Bushmans Daughter

		MIN	AVE	MAX
STRIKE LENGTH	(m)			500.0
		ANGLE (deg.)		DIRECTION
STRIKE		180		

OREBODY: Clarke & Wesley-Big Reef-Morning Star

		MIN	AVE	MAX
STRIKE LENGTH	(m)			300.0
TRUE WIDTH	(cm)	5.0		130.0
VERTICAL DEPTH	(m)			30.0
		ANGLE (deg.)		DIRECTION
DIP		60-70		NE
STRIKE		305		

OREBODY: Jackalass Lead

		MIN	AVE	MAX
STRIKE LENGTH	(m)			3500.0
TRUE WIDTH	(cm)	5.0		20.0
VERTICAL DEPTH	(m)	13.0		25.0
		ANGLE (deg.)		DIRECTION
STRIKE		180		

OREBODY: Kangaroo

		MIN	AVE	MAX
TRUE WIDTH	(cm)			100.0
VERTICAL DEPTH	(m)			15.0
STRIKE LENETH	(m)			200.0
		ANGLE (deg.)		DIRECTION
STRIKE		30		

OREBODY: Lady Milburn

		MIN	AVE	MAX
STRIKE LENGTH	(m)			70.0
TRUE WIDTH	(cm)			100.0
VERTICAL DEPTH	(m)			73.0
		ANGLE (deg.)		DIRECTION
STRIKE		340		

OREBODY: Long Tunnel

		MIN	AVE	MAX
STRIKE LENGTH	(m)			200.0
TRUE WIDTH	(cm)			130.0
VERTICAL DEPTH	(m)			150.0
		ANGLE (deg.)		DIRECTION
DIP		45		SW
STRIKE		315		

OREBODY: Mount Parnassus

	ANGLE (deg.)	DIRECTION
STRIKE	315	

OREBODY: Mount Potter

		MIN	AVE	MAX
STRIKE LENGTH	(m)			9.1
TRUE WIDTH	(cm)			100.0
VERTICAL DEPTH	(m)			40.0
		ANGLE (deg.)		DIRECTION
DIP		70		S
STRIKE		90		

OREBODY: Prince Of Wales

		MIN	AVE	MAX
STRIKE LENGTH	(m)			500.0
TRUE WIDTH	(cm)			600.0
VERTICAL DEPTH	(m)			170.0
		ANGLE (deg.)		DIRECTION
DIP		60		NE
STRIKE		328		

OREBODY: Princess Marina

		MIN	AVE	MAX
STRIKE LENGTH	(m)			55.0
TRUE WIDTH	(cm)			500.0
VERTICAL DEPTH	(m)			64.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		W
STRIKE		340		

OREBODY: Robinson & Rices

		MIN	AVE	MAX
TRUE WIDTH	(cm)	15.0		400.0
		ANGLE (deg.)		DIRECTION
DIP		40		SW
STRIKE		315		

OREBODY: St Patricks

		MIN	AVE	MAX
TRUE WIDTH	(cm)	8.0		110.0
VERTICAL DEPTH	(m)			15.0

OREBODY: Stony Creek

		MIN	AVE	MAX
STRIKE LENGTH	(m)			16.0

TRUE WIDTH	(cm)		250.0
		ANGLE (deg.)	DIRECTION
STRIKE		180	

ORE TEXTURE:

NATURE OF MINERALISATION:
PRIMARY ORE: Fault/Shear-Filling, Lode (Alteration Zone), Multiple Veins, Vein (Reef),
SECONDARY ORE: Deep Lead, Detrital (Alluvial), Supergene Enrichment

MINERALOGY:

OREBODY: Gundagai (D)
Sulphide ore (felsic volcanic/volcaniclastic-associated reefs): quartz, calcite, pyrite, lesser amounts of galena, sphalerite, chalcopyrite; locally pyrrhotite, gold and bismuth tellurides.
Gold occurred in the free state, and as inclusions within or in solid solution with the sulphide minerals.
Mafic-associated deposits have a complex mineralogy - see OREBODY: Long Tunnel.

OREBODY: Bushmans Daughter
Host rocks are porphyritic felsic volcanics of the Frampton Volcanics.
Vein trend parallelled foliation and shearing of host rock.

OREBODY: Clarke & Wesley-Big Reef-Morning Star
Sulphide ore: gold, pyrite, arsenopyrite, (chalcopyrite).

OREBODY: Long Tunnel
PRINCIPAL SOURCES: Degeling (1982), Markham (1982).

Sulphide zone (talc-rich lenses): gold, pyrrhotite, minor pyrite, chalcopyrite, sphalerite, galena.
Gangue: quartz, tremolite.
Sulphide zone (talc-carbonate zones): gold, skutterudite, millerite, chalcopyrite, niccolite, pyrrhotite.
Skutterudite (gersdorffite?) occurred as coarse (up to 50 microns) zoned grains and as aggregates of very fine grains with rare millerite and chalcopyrite. Millerite contained small inclusions of violarite which also occurred adjacent to skutterudite in some aggregates.
Magnetite, pentlandite, and rare chalcopyrite and awaruite(?) occur as disseminations intergrown with antigorite and carbonate in the host rock, which also contains disseminated chromite.
Gangue: talc-antigorite, calcite.
Gold occurred disseminated in quartz and calcite in the elemental form and possibly in solid solution or fine particles in sulphides.
Other opaque minerals include chrome spinel, magnetite, heazlewoodite, pentlandite in altered serpentinite rock; chrome spinel, magnetite, cobaltite, pentlandite, niccolite in ferroan-dolomite veins; and pentlandite and marcasite in quartz-rich veins.

OREBODY: Prince Of Wales
Sulphide zone: gold, pyrite, (tetradymite (bismuth telluride), gold telluride (?calaverite), ?coloradoite (mercury telluride)).

OREBODY: Robinson & Rices
Sulphide zone: gold, pyrite, quartz, calcite. Gold occurred free in quartz and calcite, possibly also in solid solution in pyrite.
Free gold also occurred occasionally in serpentinite.
Oxide zone: gold, iron oxides. Gold values enriched.

CONTROLS OF MINERALISATION:
PRINCIPAL SOURCES: Degeling (1982).

Controls are i) structural: deposits are strongly associated with shear zones or zones of chloritic alteration; the majority of deposits are also associated with stratigraphic contact zones; ii) stratigraphic: deposits show preferential association with felsic volcanics and associated metasediments, or ultramafic units.

GENETIC MODELS:

PRINCIPAL SOURCES: Ashley (IN Markham & Basden, 1974), Degeling (1982).

Gold deposits in the Gundagai district are considered to be of mainly (meta)hydrothermal origin (Ashley, 1974; Degeling, 1982).
The source of the gold is considered to have been the mafic and ultramafic rocks of the oceanic crust underlying the sedimentary-volcanic complex of the Tumut Trough (Ashley, 1974; Degeling, 1982).

i) Deposits associated with ultramafic units could have originated during metamorphism and deformation, including shearing and thrust faulting, of the trough sequence, either by serpentinisation of peridotite (Jindalee Group) or from mafic to intermediate igneous rocks of the ophiolite suite (oceanic crust) during hydrous alteration coeval with serpentinisation and/or low-grade metamorphism. Gold may then have been deposited in a favourable physico-chemical environment at the contacts of the altered mafic to intermediate rocks and serpentinite, or may have migrated and been deposited at other serpentinite/country rock contacts or deposited within the ultramafic mass. Alternatively, gold was derived during low-grade metamorphism of sedimentary and volcanic rocks, hydrothermally transported, and deposited at contacts with serpentinite. (Ashley, 1974).

ii) Hydrothermal activity during the extrusion of either the andesitic or rhyodacitic volcanic rocks, with later remobilisation and deposition in shear zones may also have been important in gold concentration (Degeling, 1982).

iii) Deposits associated with the felsic volcanics may have been primary volcanic exhalative deposits or their remobilised derivatives, derived originally from underlying oceanic crustal material. Partial melting of gold-enriched mafic-ultramafic material could yield granitic magmas with high gold content, which would be subsequently concentrated in hydrothermal systems active during the waning stages of felsic volcanism and plutonic avtivity. (Degeling, 1982).

iv) Hydrothermal activity during later low-grade regional metamorphism may have further remobilised mineralisation, with deposition in shear and contact zones, and the formation of deposits in the Jackalass Slate (Degeling, 1982).

Ashley (1974) favoured a regional metamorphic dewatering origin for both ultramafic-associated and felsic volcanic-associated gold mineralisation on the basis of the similarity in vein mineralogy. Other processes as listed above may have operated locally (Ashley, 1974).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Gundagai (D)

PRINCIPAL SOURCES: Degeling (1977), Basden & others (1978), Basden (1982), Degeling (1982), Markham (1982), Suppel & others (1986).

SUMMARY

Gundagai lies in the Gocup Block in the southern part of the Tumut Synclinorial Zone. A large number of mostly small reef and alluvial deposits occurred in two main contrasting host rock settings:-
i) in or marginal to Silurian felsic volcanic rocks and associated metasediments (Frampton Volcanics, Jackalass Slate), and
ii) in or marginal to Silurian and Cambro-Ordovician mafic-ultramafic rocks (Long Tunnel Metabasic Igneous Complex, Gundagai Serpentinite, Jackalass Slate adjacent to contact with ultramafic). Mineralisation was strongly associated with shear zones or zones of chloritic alteration.

REGIONAL SETTING: TUMUT SYNCLINORIAL ZONE

PRINCIPAL SOURCES: Degeling (1977), Basden & others (1978), Basden (1982), Degeling (1982), Suppel & others (1986).

The Tumut Synclinorial Zone (formerly Bogan Gate Synclinorial Zone, Markham & Basden, 1974) contains remnants of a marine sedimentary trough sequence which unconformably overlies Cambro-Ordovician and Ordovician basement rocks represented by the Jindalee Group (Basden, 1982). The trough was partly floored by oceanic crustal material represented by the Coolac Ophiolite Suite (Basden, 1982; Degeling, 1982).

In the Scheibner (1976) model, a volcanic arc, the Molong Volcanic Arc, developed eastwards of the Australian plate and Wagga Marginal Basin in the Early Ordovician, possibly on crustal basement of a rifted continental block, the Molong Microcontinent. Crustal rifting in the Early-Middle Silurian, influenced by the pre-existing Gilmore Fault Zone (Suppel & others, 1986), resulted in splitting of the western edge of the arc and opening of the Tumut Trough. The Frampton Volcanics may represent a localised silicic phase of volcanism associated with the initiation of rifting (Basden, 1982).
NOTE: The Tumut Trough is the southern part of the Cowra Trough of Scheibner (1976); Degeling (1982).

During the Silurian, thick sequences of shallow to deep water flysch sediments, represented by the Wyangle and Bumbolee Creek Formations, plus andesitic to dacitic volcanics and associated sediments, represented by the Jackalass Slate and Blowering Group, accumulated in the trough (Basden & others, 1978; Basden, 1982).

The Bowning Orogeny in the latest Silurian-earliest Devonian closed the trough and deformed and metamorphosed the fill (Suppel & others, 1986). Oceanic lithospheric and mantle material was emplaced along major thrust systems (e.g. Coolac Ophiolite Suite) (Basden & others, 1978; Degeling, 1982). The trough sequence was intruded by I-type granites and overlain by associated felsic volcanics and shallow marine sediments during the Early Devonian (Degeling, 1982; Suppel & others, 1986).

REGIONAL SUCCESSION & ASSOCIATED MINERALISATION: TUMUT SYNCLIN ZONE (S)
PRINCIPAL SOURCES: Degeling (1977), Basden & others (1978), Basden (1982), Degeling (1982).

The host formations are part of the Silurian Tumut Trough sequence and basement serpentinite.
The oldest rocks in the deposit region are blocks of Cambro-Ordovician basement Girilambone Slope and Basin (Jindalee Group - D6K1 on Wagga Wagga metallogenic map; epsilon j on Cootamundra 1:100 000 geological map), which includes the Gundagai Serpentinite (epsilon jg).
Gold mineralisation at Jones Creek (in association with asbestos), Mount Parnassus, Jackalass Flat, Jackalass lead and smaller unnamed deposits occurred in the serpentinite or in adjacent Jackalass Slate marginal to ultramafic rock.

The overlying Tumut Trough sequence, with associated gold mineralisation comprises, from the base:-
1./ Frampton Volcanics (Early or Middle-Late Silurian) (B2L1 on Wagga Wagga metallogenic map; Sf on Cootamundra 1:100 000 geological map) - steeply-dipping series of lavas, some tuffs - rhyolite, rhyodacitic tuff, andesite, volcaniclastic and polymictic conglomerate.
The silicic volcanics may be associated with initiation of rifting at the opening of the Tumut Trough in the Early Silurian (Basden, 1982).
The volcanics are host to gold mineralisation at Prince of Wales, Mount Potter, Princess Marina, Clarke & Wesley-Big Reef-Morning Star, Kangaroo, Bushmans Daughter, and Gunning Star.

2./ Jackalass Slate (B3L4 on Wagga Wagga metallogenic map; Sbv on Cootamundra 1:100 000 geological map) (Middle-Late Silurian) - strongly foliated andesitic to dacitic volcaniclastic slate and sandstone, phyllite, conglomerate, lithic tuff, minor andesitic lava.
Contacts with the underlying volcanics are probably both unconformable and faulted (Basden, 1982).
The Jackalass Slate is host to gold mineralisation not directly associated with igneous rocks at Lady Milburn, Big Ben-Stoney Creek, and Stony Creek.
The formation contains slivers of serpentinite, metagabbro, and metabasalt, including:-

3./ Long Tunnel Metabasic Igneous Complex (Basden, 1982) - tholeiitic metabasalt, including pillow basalt, meta-andesite, diorite, and minor keratophyre, serpentinite and sediments. Boundaries are apparently faulted (Basden, 1982).
The mafic-ultramafic rocks host gold mineralisation at Robinson & Rices and Long Tunnel.

4./ Bumbolee Creek Formation (beta3L12 on Wagga Wagga metallogenic map) (Middle-Late Silurian) - quartz-rich flysch. Not significant for gold mineralisation. Conformably overlain by:-
5./ Blowering Group (beta3L1-3 on Wagga Wagga metallogenic map; Sb on Cootamundra 1:100 000 geological map) - porphyritic rhyodacitic volcanics, associated metasediments, mafic volcanics. Not significant for gold mineralisation.

GELOGICAL SETTING: GUNDAGAI
PRINCIPAL SOURCES: Degeling (1977), Basden (1982), Degeling (1982).

The southern part of the Tumut Synclinorial Zone is largely bounded by major NNW-trending thrust faults - the Gilmore Fault Zone to the W, and the Mooney Mooney Thrust System to the E - against which the trough sequence is in contact with dominantly granitic terrain of the Wagga and Young Anticlinorial Zones.
The trough succession is folded into a series of mainly NNW-trending anticlinoria and synclinoria with complex subsidiary folds and complicated by faulting and igneous intrusion (Basden, 1982).
In the Gundagai region, Jackalass Slate and Bumbolee Creek Formation are exposed in a major synclinorium trending SE in the western part of the synclinorial zone. Frampton Volcanics are exposed in anticlinorial cores in the central part of the zone. Mafic and ultramafic rocks are abundant in the eastern part of the zone, E of Gundagai.
Major faults and shear zones transect the trough sequence. In the Gundagai area, gold mineralisation is particularly associated with the Cootamundra Fault and the Gundagai Shear.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Degeling (1982), Markham (1982).

Gold mineralisation in the Gundagai area is found in two main contrasting host rock settings (Degeling, 1982):-
i) in or marginal to felsic volcanics and associated metasediments, and
ii) in or marginal to ultramafic rocks.

Orebodies of type i) typically occur in veins in chloritic shear zones within or at the contacts of Frampton Volcanics or Jackalass Slate. Deposits associated with the Frampton Volcanics include Prince of Wales, Mount Potter, Clarke & Wesley-Big Reef-Morning Star, Bushmans Daughter, and Princess Marina.
Deposits associated with Jackalass Slate include Milburn, St Patricks, and Big Ben-Stony Creek.

Orebodies of type ii) include a) vein deposits associated with Silurian serpentinite in fault blocks within Jackalass Slate (Long Tunnel Metabasic Igneous Complex) at Robinson & Rices and Long Tunnel; and b) vein deposits associated with Cambrian-Ordovician serpentinite in contact with Jackalass Slate, e.g. Mount Parnassus.

OREBODY: Big Ben-Stoney Creek
Both primary and alluvial gold were worked. Primary mineralisation was hosted by slaty shale and quartz-rich siltstone (Jackalass Slate).
The Stoney Creek lead was worked at 13 m (false bottom) and 28 m (main lead).

OREBODY: Clarke & Wesley-Big Reef-Morning Star
Mineralisation was localised in a quartz vein in interbedded slate, quartzite(?) and porphyritic felsic volcanics of the Frampton Volcanics. Arsenopyrite was disseminated in slate.

OREBODY: Jackalass Lead
The Jackalass lead formed in a northerly-flowing Cainozoic channel which drained into the Murrumbidgee River. The auriferous gravel averaged 0.5 m in thickness and contained numerous waterworn quartz cobbles. The lead derived its gold from vein deposits in serpentinite near the head of the lead.

OREBODY: Kangaroo
Host rock is quartzofelspathic lithic sandstone within Frampton Volcanics. Mineralisation was apparently similar to Prince of Wales.

OREBODY: Lady Milburn
Host sequence is Jackalass Slate. Mineralisation took the form of multiple or stockwork calcite-quartz veinlets localised within talc-chlorite schist ?=altered mafic-intermediate tuff.

OREBODY: Long Tunnel
PRINCIPAL SOURCES: Degeling (1972), Markham (1982).

Host rock is a mafic unit, Long Tunnel Metabasic Igneous Complex, emplaced in a NW-striking fault zone in Jackalass Slate. Mafic lithologies are metabasalt, meta-andesite, diorite, and minor keratophyre, serpentinite and sediments.

Mineralisation was associated with a narrow body of serpentinite along its southwestern contact with diorite, metabasalt and meta-andesite. The serpentinite is in contact with deformed felsic volcanics and quartz-rich metasediments of the Jackalass Slate on its northern margin. Gold occurred in talc-rich sheared and altered zones along the contact between serpentinite/diorite and metabasalt and within the serpentinite. Diorite is also altered along the contact zone.

Lode channels were irregular and variable in width, in places occupied by sheared talcose serpentinite, elsewhere defined by a narrow fissure. Footwall (serpentinite) contact was faulted and sharp; hanging wall (diorite) contact was less well defined. Gold was apparently concentrated at intersections of minor faults with the serpentinite/diorite contact, the orebodies arranged as steeply-dipping lenses within the lode channels.

OREBODY: Mount Parnassus
Gold occurred in a large quartz vein and sparsely disseminated in clay slates adjacent to a contact with serpentinite.

OREBODY: Mount Potter
Host rock is slate of Jackalass Slate, close to contact with Frampton Volcanics.

OREBODY: Prince Of Wales

PRINCIPAL SOURCES: Degeling (1982), Markham (1982).

Host rocks are porphyritic felsic volcanics and conglomerate of the Frampton Volcanics. In the vicinity of the deposit the formation is represented by a steeply NE-dipping sequence of conglomerate, conglomeratic mudstone, siltstone and crystal tuff.
Mineralisation consisted of a major conformable quartz vein or zone of subparallel veins in 'slate' at the ?faulted contact between conglomeratic and volcanic units (Degeling, 1982) or mudstone units (Markham, 1982).
The narrower parallel veins occurred in mudstone higher in the sequence.
Total width of line of lode = 6.1 m.

OREBODY: Princess Marina
PRINCIPAL SOURCES: Degeling (1982), Markham (1982).

Mineralisation occurred in a major fault zone up to 3 m wide in Frampton Volcanics. Rocks in the zone are chloritic schist, crushed and brecciated slate, grey and blue chert, and bodies of feldspar porphyry.

The quartz vein system was composed of large lenticular blocks of barren white quartz surrounded by a zone of silicified, quartz- and calcite-veined chloritic schist carrying sulphide mineralisation.
The quartz in the silicified zone was chalcedonic, and in areas of intense silicification imparted the appearance of chert.

The highest gold concentrations were apparently associated with the most intensely silicified zones. The lode may have been a zoned structure comprising:-
(i) central zone of barren white quartz,
(ii) zone of chalcendonic quartz with small quartz and calcite veins,
(iii) calcite zone with a marginal sulphide rich zone, and
(iv) zone of sheared chloritic schist with disseminated gold and sulphides on foliation planes.
Total length of line of lode = 60 m.

OREBODY: Robinson & Rices
Northern extension of Long Tunnel; same geological setting.

OREBODY: St Patricks
Host rocks are slate, schist, quartzite of Jackalass Slate, close to contact with Frampton Volcanics.

OREBODY: Stony Creek
Host is Jackalass Slate.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Ashley P.M., Ambler E.P., 1981
Cobaltite-gersdorffite with gold inclusions at the Long Tunnel mine, near Gundagai, New South Wales.
Australian Mineralogist
34 P171-174

Basden H., Adrian J., Clift D.S.L., Winchester R.E., 1978
Geology of the Cootamundra 1:100 000 sheet 8528.
Geological Survey of New South Wales
1v

Basden H., 1982
Preliminary report on the geology of the Tumut 1:100 000 sheet area, southern New South Wales.
Geological Survey of New South Wales. Quarterly Notes
46 P1-18

Degeling P.R., 1977
Wagga Wagga, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-15 (plus parts of SI 55-14, SJ 55-02, SJ 55-03), 1st edition.
Geological Survey of New South Wales
1v

Degeling P.R., 1982
Mine data sheets and metallogenic study of the Wagga Wagga 1:250 000 metallogenic series map, Sheet SI 55-15.
Geological Survey of New South Wales
1v

Gilligan L.B., 1980
An inspection of the Prince of Wales mine, Gundagai.
Geological Survey of New South Wales. Report

Kenny E.J., 1938
Notes on certain mines at Adelong and Gundagai.
New South Wales. Department of Mines. Annual Report
1937 P111-112

Kenny E.J., 1950
Long Tunnel gold mine, Gundagai.
New South Wales. Department of Mines. Geological Report
1939-1945 P9

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Pittman E.F., 1901
Report on the Robinson and Rice's goldmine, near Gundagai.
New South Wales. Department of Mines. Annual Report
1900 P179

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

Suppel D.W., Warren A.Y.E., Watkins J.J., Chapman J., Tenison Woods K.L., Barron L., 1986
A reconnaissance study of the geology and gold deposits of the West Wyalong - Temora - Adelong district.
Geological Survey of New South Wales. Quarterly Notes
64 P1-23

Winward K., 1972
The geology of the Gundagai district. B.Sc. (Hons) thesis.
University of Sydney. Unpublished
1v

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 24 CULLINGA

DEPOSIT IDENTIFICATION:

SYNONYMS: Cootamundra, Christmas Gift

COMMODITIES: Au

DISTRIBUTION:
Record covers three main separate reefs along 5 km length of NNE contact between Jindalee and Blowering Groups. Nos. 96–98 on Cootamundra metallogenic map.

OREBODIES:
Cullinga (D), Christmas Gift, Democrat, McLeods Shaft

MINES:
Baulderstones, Christmas Gift, Christmas Gift Extended (Boxsells), Cullinga Extended, Dawn Of Hope, Democrat, McLeods Shaft, Middletons, Old Christmas Gift, Old Federal, Venables

GROUP: -

COMMENTS:
See Deposit No.23 GUNDAGAI for regional setting of Tumut Synclinorial Zone.

LOCATION:

LATITUDE: 34 36 — LONGITUDE: 148 10
250K SHEET: SI55 11 — 100K SHEET: 8528

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Wagga Wagga
LOCAL GOVERNMENT AREA (LGA): Cootamundra

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1892	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Christmas Gift	Christmas Gift	Possible	Open-Cut
Christmas Gift	Christmas Gift Extended (Boxsells)	Historical	Underground
Christmas Gift	Old Christmas Gift	Historical	Underground
Christmas Gift	Old Federal	Historical	Underground
Christmas Gift	Baulderstones	Historical	Underground
Christmas Gift	Venables	Historical	Underground
Christmas Gift	Dawn Of Hope	Historical	Underground
Christmas Gift	Middletons	Historical	Underground
Christmas Gift	Cullinga Extended	Historical	Underground
Democrat	Democrat	Historical	Underground
Democrat	Democrat	Historical	Open-Cut
McLeods Shaft	McLeods Shaft	Historical	Underground

COMPANIES:

OREBODY: Cullinga (D)

PRESENT OWNERS:	EQUITY%
Freeport Of Australia Inc.	51.00
Nicron Resources Ltd.	12.25
Petrocarb Exploration N L.	12.25
Range Resources Ltd.	24.50

OREBODY: Christmas Gift

PRESENT OPERATORS:
Freeport Of Australia Inc.

PRESENT OWNERS:	EQUITY%
Freeport Of Australia Inc.	51.00
Nicron Resources Ltd.	12.25
Petrocarb Exploration N L.	12.25
Range Resources Ltd.	24.50

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 1,242
Average recovered grade 18 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: 1892-1941,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION			
Sept 1988	150	4.5	675	Subeconomic Inferred	In-Situ	o/c	Christmas Gift

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Tumut Synclinorial Zone
SUB-PROVINCE: Jindalee Block

HOST ROCKS:

FORMATION NAME & AGE: Jindalee Group - Cambrian-Early Ordovician
LITHOLOGY: Schistose serpentinite, greenschist, amphibolite schist, quartzite, quartz-magnetite rock, chert, quartz-mica schist.
RELATIONSHIP TO MINERALISATION: Vein mineralisation occurred in metasedimentary units associated with serpentinite in contact with porphyry intrusive phase of Blowering Group.

FORMATION NAME & AGE: Blowering Group - Middle-Late Silurian
LITHOLOGY: Altered dacitic volcanics: porphyroid dacite tuff, porphyroid dacite, trachyandesite crystal tuff, quartz trachyandesite, associated sediments.
RELATIONSHIP TO MINERALISATION: Mineralisation occurred in contact zone with felsic porphyries assumed to be intrusive phase of Blowering Group volcanics; probably genetically related to mineralisation.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Felsic Porphyry, Metasedimentary,
SIGNIFICANT: Mafic Igneous

STRUCTURAL FEATURES:

MAJOR: Faulting,
SIGNIFICANT: Jointing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

MAJOR: Intrusive Contact

IGNEOUS ACTIVITY:

MAJOR: Sub-Volcanism (Felsic Porphyry)

METAMORPHISM:
Regional metamorphic grade is greenschist facies. Mineralisation occurs within contact aureole of ?intrusive porphyries.

ALTERATION:

OREBODY: Cullinga (D)
Mineralisation was associated with strong silicification of host rock.

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Auriferous quartz veins/stockwork in metasediments and mafic volcanics associated with ultramafic intrusive adjacent to felsic porphyry intrusive.

STYLE:

SIGNIFICANT: Conformable, Stratabound

MORPHOLOGY: Irregular

AGE OF MINERALISATION: Palaeozoic Late Silurian

DIMENSIONS/ORIENTATION:

OREBODY: Cullinga (D)

		ANGLE (deg.)	DIRECTION
DIP		75-90	E
STRIKE		010	

OREBODY: Christmas Gift

		MIN	AVE	MAX
STRIKE LENGTH	(m)			120.0
TRUE WIDTH	(cm)			200.0
VERTIC'L DEPTH	(m)			91.0
		ANGLE (deg.)		DIRECTION
DIP		70		E
STRIKE		010		

OREBODY: Democrat

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			25.0

OREBODY: McLeods Shaft

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			18.0

ORE TEXTURE:

NATURE OF MINERALISATION:
PRIMARY ORE: Bed, Dissemination, Lode (Alteration Zone), Multiple Veins, Vein (Reef)

MINERALOGY:

OREBODY: Cullinga (D)
Sulphide ore: gold, galena, pyrite, sphalerite, chalcopyrite, silver.
Gold was contained within sulphides.
Fine-grained free gold occurred only in the oxidised zone.
Gangue: minor carbonate.

CONTROLS OF MINERALISATION:
PRINCIPAL SOURCES: Fitzpatrick (1979), Markham (1982).

Local structural control: cleavage, shearing, jointing.
Mineralisation occurs in sheared, deformed, siliceous alteration zone adjacent to ?intrusive contact.

GENETIC MODELS:
PRINCIPAL SOURCES: Markham (1982).

Contact-type mineralisation occurring in crushed and shattered zone of metasomatic replacement induced by intrusion of nearby porphyry (Harper, 1915, reported by Markham, 1982).
Sulphides may have been introduced by siliceous solutions derived from the felsic volcanism which formed the Blowering Group.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Cullinga (D)
PRINCIPAL SOURCES: Markham & Basden (1974), Fitzpatrick (1976), Basden & others (1978), Fitzpatrick (1979), Markham (1982).

SUMMARY

Cullinga lies in the Jindalee Block in the southeastern part of the Tumut Synclinorial Zone. Mineralisation occurred in metamorphosed and silicified claystone (slate) and limestone, and associated amphibolite and serpentinite of the Cambro-Ordovician Jindalee Group, along a contact with massive felsic volcanics of the Silurian Blowering Group.

GEOLOGICAL SETTING: CULLINGA
PRINCIPAL SOURCES: Fitzpatrick (1976), Basden & others (1978), Fitzpatrick (1979).

The Tumut Synclinorial Zone contains remnants of a marine sedimentary sequence deposited during the Silurian in the Tumut Trough. According to the Scheibner (1976) model, the trough opened in the Early Silurian as a result of crustal rifting and splitting of the Ordovician Molong Volcanic Arc. The Jindalee Block is a N-S trending belt of metamorphosed sediments, mafic volcanics and serpentinite that represents basement to at least part of the trough sequence (Basden, 1982).

REGIONAL SUCCESSION: CULLINGA
PRINCIPAL SOURCES: Fitzpatrick (1976), Basden & others (1978), Fitzpatrick (1979).

1./ Jindalee Group (D6K on Cootamundra metallogenic map; epsilon j on Cootamundra 1:100 000 geological map) (Cambrian-Early Ordovician) - mafic volcanics, greenschist, quartzite, quartz-magnetite rocks, sandstone, black chert, quartz-mica schist, and intrusive bodies of serpentinite and talc-carbonate rocks.
The sequence represents a Cambrian-Early Ordovician trench complex or deep-water flysch wedge deposited on oceanic crust of the Girilambone Slope and Basin (Fitzpatrick, 1979). The complex was deformed during the Middle Cambrian-Early Ordovician Delamerian Orogeny, at which time mantle material and oceanic crust were upthrust along fault or shear zones (Basden & others, 1978).
Lenses of ultramafic rocks are prominent in the deposit region.
The Jindalee Group has been affected by several periods of deformation and is characterised by isoclinal folding and strong N-S foliation (Fitzpatrick, 1979).
The Jindalee Group is overlain unconformably by:-

2./ Blowering Group (B3L on Cootamundra metallogenic map; Sb on Cootamundra 1:100 000 geological map) (Middle-Late Silurian) - porphyritic felsic volcanics. The Blowering Group is the main formation of the Tumut Trough sequence.
In the deposit region the Blowering Group comprises variably foliated porphyroid dacite tuff, porphyroid dacite, trachyandesite crystal tuff and quartz trachyandesite and interbedded slaty siltstone. Numerous lenses of porphyroid dacite elongate parallel to the regional N-S structural trend occur in the siltstone. Lenses are up to 200 m x 100 m. Quartz veins are most abundant near the sediment/volcanic contact.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Markham & Basden (1974), Basden & others (1978), Fitzpatrick (1979), Markham (1982).

Gold mineralisation in the Cullinga field occurred in slate and associated amphibolite and serpentinite adjacent to coarse-grained felsic porphyries which may be intrusive phases of the Blowering Group (Markham & Basden, 1974).
Some ore shoots extended across the Jindalee Group/Blowering Group contact, occurring in both slate and dacite (Basden & others, 1978). The ore shoots have a preferred orientation parallel to the regional cleavage and a steep dip, occurring in places as 'pressure lenses' where a change in strike of cleavage occurs. However, cross-cutting mineralised veins also occur. (Basden & others, 1978).
Ore occurred as disseminations or irregularly-shaped shoots within structural ?replacement zones in the host rock. Comparatively minor mineralisation was associated with narrow quartz-pyrite veins which traversed dense masses of silicified and indurated claystone. In places within the ore zone the host rock was markedly brecciated.

OREBODY: Christmas Gift
Christmas Gift accounted for about 90% of production from the field. Mineralisation occurred in amphibolite, indurated and silicified claystone, calcareous claystone, mudstone and slate, adjacent to felsic porphyry and serpentinite intrusives.

OREBODY: Democrat
Mineralisation occurred in fractured and silicified slates (Jindalee Group) adjacent to an irregular contact with porphyritic felsic

volcanics (Blowering Group).

ORBODY: McLeods Shaft
Host rocks are Jindalee Group and porphyry (?Blowering Group).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Basden H., Adrian J., Clift D.S.L., Winchester R.E., 1978
Geology of the Cootamundra 1:100 000 sheet 8528.
Geological Survey of New South Wales
1v

Basden H., 1982
Preliminary report on the geology of the Tumut 1:100 000 sheet area, southern New South Wales.
Geological Survey of New South Wales. Quarterly Notes
46 P1-18

Clift D.S.L., 1970
The Cullinga gold field.
Geological Survey of New South Wales. Report
GS1970/679

Clift D.S.L., 1973
Mining history of the Cootamundra 1:100 000 sheet.
Geological Survey of New South Wales. Report
GS1973/479

Cooney P.M., 1966
Cullinga gold mine.
Geological Survey of New South Wales
GS1966/090

Fitzpatrick K.R., 1976
Cootamundra, New South Wales, 1:250 000 metallogenic series map, Sheet SI 55-11, 1st edition.
Geological Survey of New South Wales
1v

Fitzpatrick K.R., 1979
Cootamundra, New South Wales, 1:250 000 metallogenic series map, Sheet SI 55-11: mine data sheets and metallogenic study.
Geological Survey of New South Wales
1v

Harper L.F., 1915
Report on the Cullinga goldfield, near Wallenbeen.
New South Wales. Department of Mines. Annual Report
1914 P200-207

Harper L.F., 1925
Christmas Gift gold mine, Cullinga.
New South Wales. Department of Mines. Annual Report
1924 P86

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 25 YOUNG-WOMBAT

DEPOSIT IDENTIFICATION:

SYNONYMS: Lambing Flat

COMMODITIES: Au

DISTRIBUTION:
Record covers complex lead system with multiple tributaries in two NNW-trending zones: one 10 km x 7 km centred on Young, one 15 km long centred on Wombat 15 km to S. Reefs lay 6 km S of Young. Nos. 51-67 on Cootamundra metallogenic map.

OREBODIES:
Young-Wombat (D), Archdeacon, Barnes, Burrangong-Possum Flat, Davidsons, Garibaldi, Marys Dream, New Chum, Quartz Reef Hill, Sawpit Gully, Spring Creek, Stoney Creek, Tipperary Gully, Victoria Hill (Victoria Gully), Whybrows-Rocky Hill, Wombat Creek-Demondrille Creek

MINES:
Archdeacon, Barnes, Burrangong Creek, Davidsons, Demondrille Creek, Garibaldi, Heffernan, Hidden Star, Lambing Flat, Marys Dream, New Burrangong, New Chum, North Burrangong, Possum Flat, Quartz Reef Hill, Rocky Hill, Sawpit Gully, South Burrangong, Spring Creek, Stoney Creek, Three Mile, Tipperary Gully, Victoria Hill (Victoria Gully), Whybrows, Wombat Creek

GROUP: Young Group

COMMENTS:
Record includes regional setting of Young Anticlinorial Zone and Young group.

LOCATION:

LATITUDE: 34 19	LONGITUDE: 148 18
250K SHEET: SI55 11	100K SHEET: 8529

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Goulburn
LOCAL GOVERNMENT AREA (LGA): Young

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1860	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Archdeacon	Barnes	Historical	Underground
Archdeacon	Archdeacon	Historical	Underground
Archdeacon	Archdeacon	Historical	Open-Cut
Archdeacon	Archdeacon	Historical	Dredging &/Or Sluicing
Archdeacon	Archdeacon	Historical	Surface
Barnes	Barnes	Historical	Underground
Burrangong-Possum Flat	Burrangong Creek	Historical	Underground
Burrangong-Possum Flat	Possum Flat	Historical	Underground
Burrangong-Possum Flat	Hidden Star	Historical	Underground
Burrangong-Possum Flat	New Burrangong	Historical	Underground
Burrangong-Possum Flat	New Burrangong	Historical	Dredging &/Or Sluicing
Burrangong-Possum Flat	North Burrangong	Historical	Underground
Burrangong-Possum Flat	North Burrangong	Historical	Dredging &/Or Sluicing
Burrangong-Possum Flat	Lambing Flat	Historical	Underground
Burrangong-Possum Flat	Lambing Flat	Historical	Dredging &/Or Sluicing
Burrangong-Possum Flat	Three Mile	Historical	Underground
Burrangong-Possum Flat	Three Mile	Historical	Dredging &/Or Sluicing
Burrangong-Possum Flat	Heffernan	Historical	Underground
Burrangong-Possum Flat	Heffernan	Historical	Dredging &/Or Sluicing
Burrangong-Possum Flat	South Burrangong	Historical	Underground
Burrangong-Possum Flat	South Burrangong	Historical	Dredging &/Or Sluicing

Davidsons	Davidsons	Historical	Underground
Garibaldi	Garibaldi	Historical	Underground
Marys Dream	Marys Dream	Historical	Underground
New Chum	New Chum	Historical	Underground
Quartz Reef Hill	Quartz Reef Hill	Historical	Underground
Sawpit Gully	Sawpit Gully	Historical	Underground
Sawpit Gully	Sawpit Gully	Historical	Dredging &/Or Sluicing
Spring Creek	Spring Creek	Historical	Underground
Stoney Creek	Stoney Creek	Historical	Underground
Stoney Creek	Stoney Creek	Historical	Surface
Tipperary Gully	Tipperary Gully	Historical	Underground
Tipperary Gully	Tipperary Gully	Historical	Surface
Victoria Hill (Victoria Gully)	Victoria Hill (Victoria Gully)	Historical	Unknown
Whybrows-Rocky Hill	Whybrows	Historical	Underground
Whybrows-Rocky Hill	Whybrows	Historical	Surface
Whybrows-Rocky Hill	Rocky Hill	Historical	Underground
Whybrows-Rocky Hill	Rocky Hill	Historical	Surface
Wombat Creek-Demondrille Creek	Wombat Creek	Historical	Dredging &/Or Sluicing
Wombat Creek-Demondrille Creek	Wombat Creek	Historical	Underground
Wombat Creek-Demondrille Creek	Demondrille Creek	Historical	Dredging &/Or Sluicing
Wombat Creek-Demondrille Creek	Demondrille Creek	Historical	Underground

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 10,000
Average recovered grade (reef ore) approximately 30 g/t Au; alluvial ore up to 125 g/cubic m Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1876-1912), 1860-1875,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Young Anticlinorial Zone
SUB-PROVINCE: Young Anticlinorial Zone (S)

HOST ROCKS:

FORMATION NAME & AGE: Young Granodiorite - Late Silurian?-Early Devonian
LITHOLOGY: Biotite granodiorite.
RELATIONSHIP TO MINERALISATION: Host to primary mineralisation in veins and source of secondary alluvial deposits.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to alluvial deposits.

GEOCHRONOLOGY:

Young Granodiorite has been dated at:-
397+-16 my (K-Ar) i.e Early Devonian (Patrick, 1973, reported by Basden & others, 1978), although this is probably an alteration age; 417+-6 my (K-Ar) i.e Late Silurian (J.R.Richards, reported by Basden & others, 1978), also probably an alteration age. However, petrological and field evidence indicate that deformation occurred during the final stages of crystallisation (Basden & others, 1978).

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Alluvium,
SIGNIFICANT: Granitic

STRUCTURAL FEATURES:

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Granodiorite),
SIGNIFICANT: Plutonism (Diorite)

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Alluvial.
SIGNIFICANT: Auriferous quartz veins in granitoid.

STYLE:

MAJOR: Discordant

MORPHOLOGY: Lenticular

AGE OF MINERALISATION: Cainozoic Tertiary, Palaeozoic Late Silurian

DIMENSIONS/ORIENTATION:

OREBODY: Young-Wombat (D)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			4800.0
VERTICAL DEPTH	(m)			34.0

OREBODY: Archdeacon

		MIN	AVE	MAX
STRIKE LENGTH	(m)			91.0
TRUE WIDTH	(m)			61.0
VERTICAL DEPTH	(m)	3.0		5.0

OREBODY: Barnes

		MIN	AVE	MAX
TRUE WIDTH	(cm)			30.0
VERTICAL DEPTH	(m)			37.0
		ANGLE (deg.)		DIRECTION
STRIKE		90		

OREBODY: Burrangong-Possum Flat

		MIN	AVE	MAX
STRIKE LENGTH	(m)			4800.0
TRUE WIDTH	(m)			6.3
VERTICAL DEPTH	(m)			34.0

OREBODY: Davidsons

	ANGLE (deg.)	DIRECTION
DIP		N
STRIKE	90	

OREBODY: Garibaldi

		MIN	AVE	MAX
STRIKE LENGTH	(m)			15.0
VERTICAL DEPTH	(m)			91.0

OREBODY: Marys Dream

		MIN	AVE	MAX
STRIKE LENGTH	(m)			46.0
VERTICAL DEPTH	(m)			21.0
		ANGLE (deg.)		DIRECTION
STRIKE		180		

OREBODY: New Chum

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			30.0

OREBODY: Quartz Reef Hill

		MIN	AVE	MAX
STRIKE LENGTH	(m)			34.0
TRUE WIDTH	(cm)			10.0
VERTICAL DEPTH	(m)			35.0
		ANGLE (deg.)		DIRECTION
DIP				N
STRIKE		90		

OREBODY: Sawpit Gully

		MIN	AVE	MAX
STRIKE LENGTH	(m)			1500.0
TRUE WIDTH	(m)			61.0

OREBODY: Spring Creek

		MIN	AVE	MAX
STRIKE LENGTH	(m)	3200.0		4800.0
VERTICAL DEPTH	(m)			1.0

OREBODY: Stoney Creek

		MIN	AVE	MAX
STRIKE LENGTH	(m)	3200.0		
TRUE WIDTH	(m)	30.0		61.0

OREBODY: Tipperary Gully

		MIN	AVE	MAX
STRIKE LENGTH	(m)			3050.0
TRUE WIDTH	(m)			91.0
VERTICAL DEPTH	(m)			18.0

OREBODY: Victoria Hill (Victoria Gully)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			2100.0
TRUE WIDTH	(m)			61.0

OREBODY: Whybrows-Rocky Hill

		MIN	AVE	MAX
STRIKE LENGTH	(m)			21.0
TRUE WIDTH	(cm)			40.0
VERTICAL DEPTH	(m)			22.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		N
STRIKE		075		

OREBODY: Wombat Creek-Demondrille Creek

		MIN	AVE	MAX
STRIKE LENGTH	(m)			1600.0
TRUE WIDTH	(m)			100.0

ORE TEXTURE:

NATURE OF MINERALISATION:
PRIMARY ORE: Vein (Reef),
SECONDARY ORE: Detrital (Alluvial)

MINERALOGY:

GENETIC MODELS:
Magmatic hydrothermal, related to late-stage granite intrusion (Markham & Basden, 1974).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Young-Wombat (D)
PRINCIPAL SOURCES: Markham & Basden (1974), Fitzpatrick (1976), Basden & others (1978), Fitzpatrick (1979), Markham (1982).
SUMMARY

The Young group of deposits - Young-Wombat, HARDEN-MURRUMBURRAH (Deposit No.26), and McMAHONS REEF (Deposit No.27) - comprised both reef and derived alluvial deposits hosted by a Late Silurian granite batholith, the Young Granodiorite, which forms the core of the southern part of the Young Anticlinorial Zone.

REGIONAL SETTING: YOUNG ANTICLINORIAL ZONE
PRINCIPAL SOURCES: Fitzpatrick (1976), Basden & others (1978)

Fitzpatrick (1979).

The Young Anticlinorial Zone contains mainly calc-alkaline volcanic arch volcanics and associated orogenic granites of Middle-Late Silurian age, overlain unconformably by Devonian shelf sediments and volcanics.

According to the Scheibner (1976) model, the volcanic arch developed in the Middle-Late Silurian over basement of Jindalee Group or Ordovician metamorphics or both. Crustal rifting in the Early Silurian had resulted in splitting of the Ordovician Molong Volcanic Arc and the opening of the Tumut Trough.
(Ordovician intermediate volcanics of the Molong Volcanic Arc and Silurian sedimentary-volcanic trough sequences are now preserved in the Tumut Sy.clinorial Zone to the W of the Young Anticlinorial Zone).

During the Middle-Late Silurian, calc-alkaline volcanism and shallow marine and terrestrial sedimentation occurred on a volcanic arch - the Yass-Canberra Rise - on the eastern margin of the trough (Basden & others, 1978; Fitzpatrick, 1979).
Volcanic activity is represented by the Illunie Rhyolite in the northern part of the zone and the Goobarragandra Volcanics (Basden, 1982) in the southern part of the zone.
The Goobarragandra Volcanics are shown as Duoro Group on the Cootamundra 1:250 000 metallogenic map - B5L - and Cootamundra 1:100 000 geological map - Sd.
Orogenic granites were subsequently emplaced in the Late Silurian-Early Devonian - the Grenfell and Eugowra Granites and smaller plutons in the N and the Young Granodiorite in the S. The Young Granodiorite is considered to be comagmatic with the Goobarragandra Volcanics, which it intrudes at a high level (Basden & others, 1978).

ASSOCIATED MINERALISATION: YOUNG ANTICLINORIAL ZONE
PRINCIPAL SOURCES: Markham & Basden (1974), Fitzpatrick (1979).

The principal gold mineralisation is associated with orogenic granitoid intrusives - with Devonian quartz-feldspar porphyry intrusives into slates near the western margin of the Anticlinorial Zone at GRENFELL (Deposit No.13) and with the Late Silurian Young Granodiorite at Young-Wombat, HARDEN-MURRUMBURRAH, McMAHONS REEF (Deposit Nos.26, 27) and smaller fields.

REGIONAL SETTING: YOUNG GROUP
PRINCIPAL SOURCES: Fitzpatrick (1976), Basden & others (1978), Fitzpatrick (1979), Basden (1982).

The Young Granodiorite (gamma3-4L7 on Cootamundra metallogenic map; S-Dgy on Cootamundra 1:100 000 geological map) (Late Silurian) is a meridionally elongate, compositionally uniform, late kinematic Murrumbidgee-type, S-type batholith (Basden & others, 1978).
Lithology is mainly massive to foliated biotite granodiorite grading locally to adamellite, and including several small bodies of hornblende diorite; granodiorite porphyry is a marginal phase (Basden & others, 1978). The granodiorite intrudes probably comagmatic dacitic and rhyodacitic pyroclastic volcanics (Goobarragandra Volcanics) on its eastern margin. The western margin is a faulted contact with mafic/ultramafic rocks of the Coolac Serpentinite, Honeysuckle Metabasic Igneous Complex and Jindalee Group along the Mooney Mooney Thrust System (Basden & others, 1978). The thrust system may be a high angle thrust along which oceanic crust and upper mantle material were upthrust along the boundary between the Yass-Canberra Rise and the Tumut Trough (Basden & others, 1978).

The granodiorite is traversed by several regional N-S trending shear zones in which granodiorite is strongly stressed and brecciated.
The two largest of these are a zone near the western margin related to the Mooney Mooney Thrust System, and the Jugiong Shear Zone.
Late magmatic aplitic dykes and quartz veins are common but are most abundant E of the Jugiong Shear Zone.
The Jugiong Shear Zone is considered to be a large-scale fault zone which divides the batholith into an eastern, relatively downthrown block and a western, relatively uplifted block (Basden & others, 1978).

The granodiorite has been intruded by lamprophyric (monchiquite) dykes of Early Jurassic age, which occur close to some deposits.

Gold mineralisation is associated with quartz veining and is virtually restricted to the eastern downthrown part of the batholith, and is considered to have been localised near the batholith roof.
Reefs strike ESE or NE.

GEOLOGICAL SETTING: YOUNG-WOMBAT
PRINCIPAL SOURCES: Markham & Basden (1974), Fitzpatrick (1979)

Markham (1982).

Production was mainly from alluvial deposits formed by reworking of older leads derived from auriferous quartz veins within granodiorite, and also directly by erosion of granodiorite.
The granodiorite hosting the source reefs of the alluvial mineralisation must have been extensively eroded as remaining primary mineralisation was relatively small (Fitzpatrick, 1979).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Basden H., Adrian J., Clift D.S.L., Winchester R.E., 1978
Geology of the Cootamundra 1:100 000 sheet 8528.
Geological Survey of New South Wales
1v

Basden H., 1982
Preliminary report on the geology of the Tumut 1:100 000 sheet area, southern New South Wales.
Geological Survey of New South Wales. Quarterly Notes
46 P1-18

Clift D.S.L., 1975
Gold dredging in New South Wales.
Geological Survey of New South Wales. Mineral Resources
41

Fitzpatrick K.R., 1976
Cootamundra, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-11, 1st edition.
Geological Survey of New South Wales
1v

Fitzpatrick K.R., 1979
Cootamundra, New South Wales, 1:250 000 metallogenic series map, Sheet SI 55-11: mine data sheets and metallogenic study.
Geological Survey of New South Wales
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 26 HARDEN-MURRUMBURRAH

DEPOSIT IDENTIFICATION:

SYNONYMS: Murrumburrah

COMMODITIES: Au

DISTRIBUTION:
Nos. 99-101 on Cootamundra metallogenic map.

OREBODIES:
Harden-Murrumburrah (D)

MINES:
Blind Creek, Harden Central, Harden Future, Harden West, Metcalfs

GROUP: Young Group

COMMENTS:
See Deposit No.25 YOUNG-WOMBAT for regional setting of Young Anticlinorial Zone and Young group.

LOCATION:

LATITUDE: 34 34 LONGITUDE: 148 22
250K SHEET: SI55 11 100K SHEET: 8528

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Goulburn
LOCAL GOVERNMENT AREA (LGA): Harden

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD	COMMENTS
1883	Prospecting	
1896		Extension To Known Mineralisation

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Harden-Murrumburrah (D)	Harden West	Historical	Underground
Harden-Murrumburrah (D)	Harden Central	Historical	Underground
Harden-Murrumburrah (D)	Harden Future	Historical	Underground
Harden-Murrumburrah (D)	Metcalfs	Historical	Underground
Harden-Murrumburrah (D)	Blind Creek	Historical	Underground

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 1,796
Average recovered grade 15-30 g/t Au, locally up to 90 g/t Au; grade of alluvial ore 4.6-7.6 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: 1883-1913,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Young Anticlinorial Zone
SUB-PROVINCE: Young Anticlinorial Zone (S)

HOST ROCKS:

FORMATION NAME & AGE: Young Granodiorite - Late Silurian-?Early Devonian
LITHOLOGY: Biotite granodiorite.
RELATIONSHIP TO MINERALISATION: Mineralisation occurred in veins in granodiorite, and in minor derived alluvial deposits.

GEOCHRONOLOGY:
As for YOUNG-WOMBAT (Deposit No.25).

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Granitic

STRUCTURAL FEATURES:

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Granodiorite)

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Auriferous quartz veins in granitoid.
MINOR: Alluvial.

STYLE:

MAJOR: Discordant

MORPHOLOGY: Lenticular

AGE OF MINERALISATION: Palaeozoic Late Silurian

DIMENSIONS/ORIENTATION:

OREBODY: Harden-Murrumburrah (D)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			200.0
TRUE WIDTH	(cm)	40.0	100.0	300.0
VERTICAL DEPTH	(m)			233.0
DEPTH OXIDATION	(m)			25.0
		ANGLE (deg.)		DIRECTION
DIP		85-90		N
PITCH				E
STRIKE		80-110		

ORE TEXTURE:

NATURE OF MINERALISATION:
PRIMARY ORE: Vein (Reef),
SECONDARY ORE: Detrital (Alluvial)

MINERALOGY:

OREBODY: Harden-Murrumburrah (D)
Sulphide ore: gold, quartz, pyrite, arsenopyrite, galena, (chalcopyrite, sphalerite), locally scheelite.

GENETIC MODELS:
Magmatic hydrothermal, related to late-stage granite intrusion (Markham & Basden, 1974).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Harden-Murrumburrah (D)

PRINCIPAL SOURCES: Markham & Basden (1974), Basden & others (1978), Fitzpatrick (1979), Markham (1982).
Harden-Murrumburrah comprised mainly reef mineralisation in the Young Granodiorite.
Initial production was from early discovered alluvial sources along Blind Creek, but the bulk of total production from the field was from reef mineralisation discovered subsequently.
Ore occurred in well-defined E-pitching, S-dipping shoots within a vein system of total length 2 km.
Alluvial mineralisation occurred in gravels 7.5 cm to 30 cm thick at an average depth of 9 m.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Basden H., Adrian J., Clift D.S.L., Winchester R.E., 1978
Geology of the Cootamundra 1:100 000 sheet 8528.
Geological Survey of New South Wales
1v

Clift D.S.L., 1970
The Harden-Murrumburrah gold field.
Geological Survey of New South Wales. Report
GS1970/678

Clift D.S.L., 1973
Mining history of the Cootamundra 1:100 000 sheet.
Geological Survey of New South Wales. Report
GS1973/479

Fitzpatrick K.R., 1976
Cootamundra, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-11, 1st edition.
Geological Survey of New South Wales
1v

Fitzpatrick K.R., 1979
Cootamundra, New South Wales, 1:250 000 metallogenic series map, Sheet SI 55-11: mine data sheets and metallogenic study.
Geological Survey of New South Wales
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

McClatchie L., 1960
Gold in the Harden-Murrumburrah area.
Geological Survey of New South Wales. Report
GS1960/052

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 27 McMAHONS REEF

DEPOSIT IDENTIFICATION:

COMMODITIES: Au

DISTRIBUTION:
Nos. 103-104 on Cootamundra metallogenic map.

OREBODIES:
McMahons Reef (D)

MINES:
New McMahons Reef, Old McMahons Reef

GROUP: Young Group

COMMENTS:
See Deposit No.25 YOUNG-WOMBAT for regional setting of Young Anticlinorial Zone and Young group.

LOCATION:

LATITUDE: 34 40	LONGITUDE: 148 26
250K SHEET: SI55 11	100K SHEET: 8528

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Wagga Wagga
LOCAL GOVERNMENT AREA (LGA): Cootamundra

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1876	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
McMahons Reef (D)	Old McMahons Reef	Historical	Underground
McMahons Reef (D)	New McMahons Reef	Historical	Underground

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 630
Average recovered grade 43 g/t Au, locally up to 120 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1934-1938), 1885-1899,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Young Anticlinorial Zone
SUB-PROVINCE: Young Anticlinorial Zone (S)

HOST ROCKS:

FORMATION NAME & AGE: Young Granodiorite - Late Silurian?-Early Devonian
LITHOLOGY: Biotite granodiorite.
RELATIONSHIP TO MINERALISATION: Mineralisation occurred in veins in granodiorite. No alluvial deposits.

GEOCHRONOLOGY:
As for YOUNG-WOMBAT (Deposit No.25).

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Granitic

STRUCTURAL FEATURES:

MAJOR: Fracturing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Granodiorite)

ALTERATION:

OREBODY: McMahons Reef (D)
Mineralisation was associated with ?argillic alteration zone of granodiorite = 30 cm wide zone of soft red ferruginous clay on the hanging wall. The clay may represent weathered crushed altered host rock (Fitzpatrick, 1979).

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Auriferous quartz veins in granitoid.

MORPHOLOGY: Lenticular

AGE OF MINERALISATION: Palaeozoic Late Silurian

DIMENSIONS/ORIENTATION:

OREBODY: McMahons Reef (D)

		MIN	AVE	MAX
STRIKE LENGTH	(m)	150.0		400.0
TRUE WIDTH	(cm)	50.0	100.0	300.0
VERTICAL DEPTH	(m)			60.0
DEPTH OXIDATION	(m)			60.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		S
STRIKE		110-130		

ORE TEXTURE:

NATURE OF MINERALISATION:
PRIMARY ORE: Vein (Reef)

MINERALOGY:

OREBODY: McMahons Reef (D)
Sulphide ore: complex, with no free gold. Gold was held in solid solution in chalcopyrite, pyrite, arsenopyrite, galena.
Silver occurred in minor amounts.
Oxide ore: free gold, oxides, chalcedonic quartz, (pyrite).

GENETIC MODELS:
Magmatic hydrothermal, related to late-stage granite intrusion (Markham & Basden, 1974).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: McMahons Reef (D)
PRINCIPAL SOURCES: Markham & Basden (1974), Fitzpatrick (1979), Basden & others (1978), Markham (1982).

Mineralisation occurred in a well defined fissure lode in an argillic alteration zone within the Young Granodiorite.

At the surface the reef was 60 cm wide and rimmed by a clay ?alteration zone 30 cm wide on the hanging wall. At 20 m and 30 m depth the reef comprised two parallel lodes, the 'quartz' lode (50 cm wide), and the 'pyrite' lode (100 cm wide), separated by 15 m of barren country rock.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Basden H., Adrian J., Clift D.S.L., Winchester R.E., 1978
Geology of the Cootamundra 1:100 000 sheet 8528.
Geological Survey of New South Wales
1v

Clift D.S.L., 1970
The McMahons Reef gold mines - a compilation.
Geological Survey of New South Wales. Report
GS1970/676

Clift D.S.L., 1973
Mining history of the Cootamundra 1:100 000 sheet.
Geological Survey of New South Wales. Report
GS1973/479

Fitzpatrick K.R., 1976
Cootamundra, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-11, 1st edition.
Geological Survey of New South Wales
1v

Fitzpatrick K.R., 1979
Cootamundra, New South Wales, 1:250 000 metallogenic series map, Sheet SI 55-11: mine data sheets and metallogenic study.
Geological Survey of New South Wales
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 28 LUCKNOW

DEPOSIT IDENTIFICATION:

SYNONYMS: Wentworth

COMMODITIES: Au, Ag

DISTRIBUTION:
Record covers the main Lucknow deposit, including its N and S extensions (North Lucknow, South Lucknow), which are distributed along a strike length of 1 km; plus 2 minor deposits 3-4 km to the NW. Nos. 136-140 on Bathurst metallogenic map.

OREBODIES:
Lucknow (D), Lucknow, North Lucknow, South Lucknow, Surprise, Wellwood

MINES:
Aladdins Lamp, Amana, Bismarck Range, Lucknow 66, Lucknow Pups, South Lucknow, St Aigans, Surprise, Wellwood, Wentworth

GROUP: Orange Group

COMMENTS:
See Deposit No.30 BROWNS CREEK for regional setting of Molong-South Coast Anticlinorial Zone (N) and Orange group.

LOCATION:

LATITUDE: 33 21 LONGITUDE: 149 10
250K SHEET: SI55 8 100K SHEET: 8731

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Orange
LOCAL GOVERNMENT AREA (LGA): Orange

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD	COMMENTS
1851	Prospecting	
1863		Extension To Known Mineralisation

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Lucknow	Wentworth	Historical	Underground
Lucknow	Wentworth	Historical	Surface
Lucknow	Amana	Historical	Underground
Lucknow	Amana	Historical	Surface
Lucknow	Aladdins Lamp	Historical	Underground
Lucknow	Aladdins Lamp	Historical	Surface
North Lucknow	Bismarck Range	Historical	Unknown
North Lucknow	St Aigans	Historical	Unknown
South Lucknow	Lucknow Pups	Historical	Unknown
South Lucknow	South Lucknow	Historical	Unknown
South Lucknow	Lucknow 66	Historical	Unknown
Surprise	Surprise	Historical	Underground
Wellwood	Wellwood	Historical	Underground

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 16,189
Recorded grades during period of major reef production were 70 g/t Au

(Wentworth mine), 100 g/t Au (Aladdins Lamp mine).

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: 1890-1913, 1933-1987,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Molong-South Coast Anticlinorial Zone(N)
SUB-PROVINCE: Molong Anticlinorium

HOST ROCKS:

FORMATION NAME & AGE: Angullong Tuff (?Oakdale Formation) - Late Ordovician
LITHOLOGY: Andesite, conglomerate, greywacke, limestone.
RELATIONSHIP TO MINERALISATION: Host to primary mineralisation in faulted contact zone with ultramafic intrusive.

FORMATION NAME & AGE: Unnamed Serpentinite - Middle Devonian
LITHOLOGY: Serpentinite.
RELATIONSHIP TO MINERALISATION: Adjacent to vein mineralisation; ?genetically related to source of gold.

FORMATION NAME & AGE: Unnamed Intermediate Intrusion - Middle Devonian
LITHOLOGY: Syenite, monzonite.
RELATIONSHIP TO MINERALISATION: Adjacent to minor vein mineralisation north of Lucknow.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to deep lead and alluvial mineralisation.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Intermediate Extrusive, Ultramafic,
SIGNIFICANT: Alluvium

STRUCTURAL FEATURES:

MAJOR: Faulting,
SIGNIFICANT: Folding

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

MAJOR: Fault/Stratigraphic Boundary, Intrusive Contact

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Ultramafic), Volcanism (Intermediate)

METAMORPHISM:

Regional metamorphic grade is zeolite facies.

ALTERATION:

OREBODY: Lucknow (D)
Host andesites are hydrothermally altered.

DEPOSIT CHARACTERISTICS:

TYPES:

MAJOR: Auriferous quartz veins in intermediate volcanics adjacent to mafic/ultramafic intrusive.
SIGNIFICANT: Deep lead.
Alluvial.
Auriferous quartz veins in fault/shear zones.

STYLE:

MAJOR: Discordant

MORPHOLOGY: Irregular, Pipe-Like

AGE OF MINERALISATION: Cainozoic Recent Quaternary, Cainozoic Tertiary, Palaeozoic Middle Devonian

DIMENSIONS/ORIENTATION:

OREBODY: Lucknow (D)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			1000.0
VERTICAL DEPTH	(m)			230.0
DEPTH OXIDATION	(m)		40.0	
TRUE WIDTH	(cm)			200.0
		ANGLE (deg.)		DIRECTION
DIP		65-85		NE
PLUNGE		55		
STRIKE		135		

OREBODY: Lucknow

		MIN	AVE	MAX
STRIKE LENGTH	(m)	7.0	13.0	17.0
VERTICAL DEPTH	(m)			230.0
		ANGLE (deg.)		DIRECTION
DIP		60		NE
PLUNGE		55		
STRIKE		130		

OREBODY: North Lucknow

		ANGLE (deg.)	DIRECTION
STRIKE		135	

OREBODY: South Lucknow

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			210.0
		ANGLE (deg.)		DIRECTION
STRIKE		135		

OREBODY: Surprise

		MIN	AVE	MAX
STRIKE LENGTH	(m)			30.0
TRUE WIDTH	(cm)		25.0	
VERTICAL DEPTH	(m)			25.0
		ANGLE (deg.)		DIRECTION
DIP		48		W
STRIKE		040		

OREBODY: Wellwood

		MIN	AVE	MAX
STRIKE LENGTH	(m)			25.0
VERTICAL DEPTH	(m)			25.0

ORE TEXTURE:
Disseminated

NATURE OF MINERALISATION:
PRIMARY ORE: Dissemination, Vein (Reef),
SECONDARY ORE: Deep Lead, Detrital (Alluvial)

MINERALOGY:

OREBODY: Lucknow (D)
PRINCIPAL SOURCES: Stevens (1975), Markham (1982).

Mineralogy is unusual and complex. Gold occurred both as the native metal (slightly argentiferous), and as aurostibite, associated with arsenopyrite.
Sulphide zone: arsenopyrite, gold, (pyrite, chalcopyrite, pyrrhotite, sphalerite, galena, stibarsenic (AsSb), native arsenic, native antimony, nickeliferous aurostibite ($AuSb_2$)).
Gold was closely associated with arsenopyrite (the most abundant mineral), occurring as large adjacent grains and as small exsolution blebs and fracture fillings (Stevens, 1975).
Aurostibite occurred adjacent to and within gold grains and may have

accounted for a high proportion of the gold present (Markham, 1982). Textures indicate deformation of arsenopyrite and plastic flow of gold to fill fractures, during deformation (Stevens, 1975).

Gangue: arsenopyrite-gold (-stibarsenic-arsenic-antimony-aurostibite) occurred almost exclusively in carbonate (calcite) gangue; base metal sulphides (chalcopyrite-pyrite-sphalerite-galena) were associated with quartz (-calcite) gangue.
Grades appeared to continue at depth.
Serpentinite: CPX phenocrysts (0-40%), plus smaller pyroxene grains in serpentinite matrix ?after OPX, accessory magnetite-+bastite (pseudomorphous after OPX).

OREBODY: Lucknow
Sulphide zone: auriferous arsenopyrite, pyrite, (gold, antimony, stibnite, chalcopyrite, sphalerite).
Gangue: quartz, calcite.

OREBODY: North Lucknow
Gangue: calcite.

OREBODY: South Lucknow
Sulphide zone: auriferous arsenopyrite, pyrite, (gold, chalcopyrite, sphalerite, galena, pyrrhotite).
Gangue: quartz, calcite.

OREBODY: Surprise
Sulphide zone: gold, pyrite, sphalerite, galena, chalcopyrite, (?tetrahedrite, magnetite, hematite).
Pyrite and sphalerite are coarse-grained.
Sphalerite carries inclusions of pyrite, chalcopyrite, galena, hematite.
Pyrite contains inclusions of chalcopyrite, (sphalerite, ?galena, ?tetrahedrite, gold).
Oxide zone: hematite.
Gangue: quartz, calcite.
Ore was medium- to coarse-grained.

OREBODY: Wellwood
Sulphide zone: pyrite, (galena). Gangue: quartz, calcite.

CONTROLS OF MINERALISATION:
Mineralisation is strongly structurally controlled: i) localisation was in faulted contact zone, ii) ore development was related to intersections of quartz vein system with contact zone.

GENETIC MODELS:
PRINCIPAL SOURCES: Harper (1920), Stevens (1975).

Hydrothermal. Stevens (1975): association of the gold with ultramafic rock suggests a deep-seated ?mantle origin for the mineralisation, the nickel content of the ore possibly indicating derivation from (or contamination by) ultramafic material.

Harper (1920) suggested the sequence:-
i) Deformation of volcanics, associated quartz veining, straining/ faulting.
ii) Emplacement of peridotite in fault and widening of fissure.
iii) Cooling, and serpentinisation of ultramafic by hydrothermal fluids.
iv) Hydrothermal precipitation of gold and alteration of andesite.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Lucknow (D)
PRINCIPAL SOURCES: Harper (1920), Stevens (1972a,b), Markham & Basden (1974), Stevens (1975), Markham (1982).
SUMMARY

Lucknow lies in the Molong Anticlinorium near the eastern margin of the Molong-South Coast Anticlinorial Zone (N). Mineralisation was contained in a faulted contact between altered andesitic volcanics and serpentinised ultramafic intrusive emplaced along the fault. Reef, deep lead and alluvial sources all contributed significantly to production.

GEOLOGICAL SETTING: LUCKNOW
PRINCIPAL SOURCES: Stevens (1972a, 1975), Markham (1982).

1./ Lucknow is hosted by a NW-trending belt of Late Ordovician volcanics of intermediate composition. The volcanics are shown as Angullong Tuff (Oat) on the Bathurst metallogenic map, but are distinguished as Oakdale Formation by Pogson (1972, reported by Markham & Basden, 1974). Lithologies are andesitic lavas and tuffs, conglomerate and feldspatholithic greywacke, plus interbedded limestone lenses.

The volcanics are broadly to tightly folded and faulting is pronounced at all scales.
2./ The andesites are intruded in the vicinity of Lucknow by two intermediate stocks of Middle(?) Devonian age, one syenitic, one monzonitic; minor gold mineralisation at the northern end of the Lucknow field (Surprise, Wellwood) is close to the syenitic body.
3./ The volcanics are intruded along NW-trending faults by serpentinised ultramafic bodies, which are abundant between Lucknow and the eastern boundary of the Anticlinorial Zone with the Hill End Synclinorial Zone. The serpentinised peridotites could be remobilised fragments of depleted oceanic mantle material formed by upwelling and differentiation of mantle material during crustal rifting of the Molong Volcanic Arc in the Middle Silurian to form the Hill End Trough (Stevens, 1975). (Copper mineralisation is associated with the andesites and ultramafics E of Lucknow.)
4./ To the SW of Lucknow the Ordovician rocks are largely concealed by an extensive mantle of Tertiary basalt and trachyte flows of the Canobolas Complex (Middlemost, 1981, reported by Creelman & others, 1988 - see Deposit No.30 (BROWNS CREEK)).
Deep lead mineralisation at Lucknow is associated with basalt cover in the western part of the field.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Stevens (1972b, 1975), Markham (1982).

Gold mineralisation occurred along a major contact between altered andesitic volcanics on the footwall (western) side and serpentinite on the hanging wall side. The contact zone is a significant tectonic boundary along which fault movement has occurred and the ultramafic body emplaced (Markham, 1982).
The fault strikes 300 deg at Lucknow but swings to 320-340 deg NW of Lucknow. The localisation of ultramafic intrusion and of gold mineralisation may have been related to the change in strike of the fault (Fitzgerald, 1953, reported by Stevens, 1975).
The fault and serpentinite probably extend SE from Lucknow beneath basalt and alluvium (Stevens, 1975).

The Lucknow serpentinite is 800 m x up to 90 m and foliated parallel to the regional axial plane cleavage of the andesites.
Original composition may have been olivine-rich peridotite with some CPX and occasional OPX (Fitzgerald, 1953, reported by Stevens, 1975). Ultramafic bodies intruding volcanics to the E of Lucknow are of similar composition but are not foliated and are essentially devoid of gold mineralisation. The stronger foliation of the Lucknow serpentinite may indicate greater deformation at Lucknow, i.e the Lucknow body was either emplaced earlier than the other bodies or later deformation was more pronounced at Lucknow (Stevens, 1975).
The andesite was described by Harper (1920) as augite andesite.

Mineralisation occurred in about eighteen short but rich calcite veins trending 80-90 deg within andesite across the footwall contact zone. The veins extended as lower grade auriferous quartz veins into the andesite beyond the contact zone, and rarely, into the serpentinite for a short distance. Ore zones represented the intersections of quartz veins with the main contact (fault/fissure) zone, forming pipe-like bodies plunging steeply down the fault. Shoots lay along or near the veins within the contact zone, extended horizontally from a vein along the contact, or occurred as downward extensions from the footwall of the fault. Calcite replaced quartz gangue in the mineralised sections of veins. Shoots were cut by post-ore faulting.

OREBODY: South Lucknow
Some mineralisation (Lucknow 66) was hosted by ?limburgite, sedimentary breccias, quartzite.

OREBODY: Surprise
Deposit occurred in a fault zone in crushed andesite adjacent to a syenite intrusion. Mineralisation may have been pyrometasomatic in origin (Stevens, 1975).

OREBODY: Wellwood
Mineralisation occurred in the northern extension of the Lucknow fault zone in andesite close to a syenite intrusion.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Cross S.J., 1973
The Lucknow-Orange ultramafic belt and associated gold deposits. B.Sc. (Hons) thesis.
Macquarie University. Unpublished

1v

Fitzgerald J.K., 1953
The geology of the Lucknow-Byng district. B.Sc. (Hons) thesis.
University of Sydney. Unpublished
1v

Harper L.F., 1920
The Lucknow goldfield.
Geological Survey of New South Wales. Mineral Resources
30

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Stevens B., 1972
Bathurst, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-08, 1st edition.
Geological Survey of New South Wales
1v

Stevens B.P.J., 1972
Mine data sheets to accompany Bathurst, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-08.
Geological Survey of New South Wales
1v

Stevens B.P.J., 1975
A metallogenic study of the Bathurst 1:250 000 sheet. Sheet SI 55-08.
Geological Survey of New South Wales
1v

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 29 FOREST REEFS

DEPOSIT IDENTIFICATION:

COMMODITIES: Au

DISTRIBUTION:
Record covers primary mineralisation in Finnerans Hill area and deep leads of limited areal extent immediately to SE. Nos. 127-132 on Bathurst metallogenic map.

OREBODIES:
Forest Reefs (D), Finnerans Hill, Great Extended, Little Emma, Lumpy, Panuara, The Blacksmiths, Tigeroo

MINES:
Austral, Great Extended, Ironclad, Little Emma (Beneree), Lumpy, Stewarts, The Blacksmiths, Tigeroo, Timmins, Williams

GROUP: Orange Group

COMMENTS:
See Deposit No.30 BROWNS CREEK for regional setting of Molong-South Coast Anticlinorial Zone (N) and of Orange group.

LOCATION:

LATITUDE: 33 27 — LONGITUDE: 149 5
250K SHEET: SI55 8 — 100K SHEET: 8731

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Orange
LOCAL GOVERNMENT AREA (LGA): Cabonne

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1870	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Finnerans Hill	Williams	Historical	Underground
Finnerans Hill	Ironclad	Historical	Underground
Finnerans Hill	Stewarts	Historical	Underground
Finnerans Hill	Timmins	Historical	Underground
Finnerans Hill	Austral	Historical	Underground
Great Extended	Great Extended	Historical	Underground
Little Emma	Little Emma (Beneree)	Historical	Underground
Little Emma	Little Emma (Beneree)	Historical	Open-Cut
Lumpy	Lumpy	Historical	Unknown
The Blacksmiths	The Blacksmiths	Historical	Underground
Tigeroo	Tigeroo	Historical	Underground

COMPANIES:

OREBODY: Forest Reefs (D)

PRESENT OPERATORS:
B H P Gold Mines Ltd

PRESENT OWNERS:	EQUITY%
Broken Hill Metals N L	45.00
B H P Gold Mines Ltd	55.00

OREBODY: Panuara

PRESENT OPERATORS:
Cyprus Minerals Australia Co.

PRESENT OWNERS:	EQUITY%
Arimco N L	20.00
Climax Mining Limited	40.00
C S R Ltd	20.00
Cyprus Minerals Australia Co.	20.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 74

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: 1876-1884, 1880-1916,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION		
Dec 1947	100	7.7	770	Subeconomic Inferred	In-Situ	u/g

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Molong-South Coast Anticlinorial Zone(N)
SUB-PROVINCE: Molong Anticlinorium

HOST ROCKS:

FORMATION NAME & AGE: Angullong Tuff - Late Ordovician
LITHOLOGY: Andesite, tuff, conglomerate, greywacke, limestone.
RELATIONSHIP TO MINERALISATION: Host to primary mineralisation in shear zones.

FORMATION NAME & AGE: Canobolas Complex - Tertiary
LITHOLOGY: Basalt, trachyte.
RELATIONSHIP TO MINERALISATION: Overlies deep lead deposits.

FORMATION NAME & AGE: Panuara Group - Early or Middle Silurian
LITHOLOGY: Shale, quartzofeldspathic sandstone, limestone.
RELATIONSHIP TO MINERALISATION: Overlies host andesites (Angullong Tuff) in deposit region.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to deep lead and alluvial mineralisation.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Alluvium, Intermediate Extrusive

STRUCTURAL FEATURES:

MAJOR: Shearing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

MAJOR: Volcanism (Intermediate),
MINOR: Plutonism (Intermediate)

METAMORPHISM:

Regional metamorphic grade is zeolite facies.

DEPOSIT CHARACTERISTICS:

TYPES:

MAJOR: Deep lead.
SIGNIFICANT: Lode in intermediate volcanics adjacent to felsic/intermediate porphyry intrusive.
Alluvial.

STYLE:

MAJOR: Conformable, SIGNIFICANT: Discordant, Stratabound

AGE OF MINERALISATION: Cainozoic Tertiary

DIMENSIONS/ORIENTATION:

OREBODY: Forest Reefs (D)

		MIN	AVE	MAX
TRUE WIDTH	(cm)	100.0	300.0	800.0
DEPTH OXIDATION	(m)		3C.0	
STRIKE LENGTH	(m)			245.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		
STRIKE		120		

OREBODY: Finnerans Hill

		MIN	AVE	MAX
TRUE WIDTH	(m)			9.0
		ANGLE (deg.)		DIRECTION
DIP		80		
STRIKE		277;300		

OREBODY: Great Extended

		MIN	AVE	MAX
STRIKE LENGTH	(m)			1350.0
VERTICAL DEPTH	(m)			69.0
DEPTH OF COVER	(m)		76.0	

OREBODY: Little Emma

	ANGLE (deg.)	DIRECTION
STRIKE	180	

OREBODY: The Blacksmiths

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			26.0

OREBODY: Tigeroo

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			29.0

ORE TEXTURE:
Disseminated, Massive

NATURE OF MINERALISATION:
PRIMARY ORE: Dissemination, Lode (Alteration Zone), Vein (Reef),
SECONDARY ORE: Deep Lead, Detrital (Alluvial)

MINERALOGY:

OREBODY: Forest Reefs (D)
Sulphide zone: pyrite, (chalcopyrite, sphalerite). Pyrite occurrence varies from massive-semi-massive to coarsely disseminated.
Gold occurs in pyrite in solid solution or as inclusions up to 20 microns.
Oxide zone, quartz, hematite, free gold.
Gangue: milky quartz.

OREBODY: Finnerans Hill
Sulphide zone: pyrite, FeAu sulphide, (arsenopyrite, chalcopyrite, sphalerite).
Oxide zone: hematite, gold, (limonite).

OREBODY: Little Emma
Sulphide zone: auriferous arsenopyrite.
Oxide zone: Fe oxide.

CONTROLS OF MINERALISATION:
Main control is structural, provided by shear zone.

GENETIC MODELS:

PRINCIPAL SOURCES: Stevens (1975), Paterson & Bowman (1977).

Hills (1937, reported by Stevens, 1975): metasomatic replacement of andesite along zones of pronounced shearing.
Paterson & Bowman (1977): 'If the alteration at Forest Reefs is shown to be associated with the reefs it would suggest that the deposits were derived from diorite-monzonite intrusives. On the other hand the apparent stratabound nature of the Finnerans Hill and Austral deposits and the nature of the host rocks, suggest that a volcanogenic origin is also possible.'

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Forest Reefs (D)
PRINCIPAL SOURCES: Stevens (1972a,b, 1975), Paterson & Bowman (1977).
SUMMARY

Forest Reefs lies in the Molong Anticlinorium, Molong-South Coast Anticlinorial Zone (N). The gold field included primary disseminated and vein gold deposits in andesitic host rocks, and secondary deep lead and alluvial deposits beneath Tertiary basalt.

REGIONAL SUCCESSION: FOREST REEFS
As for JUNCTION REEFS (SHEAHAN-GRANTS) (Deposit No.32).

GEOLOGICAL SETTING: FOREST REEFS
PRINCIPAL SOURCES: Stevens (1972a, 1975), Paterson & Bowman (1977).

1./ The Forest Reefs goldfield is hosted by andesitic rocks of the Late Ordovician Angullong Tuff (Oat on Bathurst metallogenic map).
In the deposit region the formation comprises E-striking altered andesite and trachyandesite tuffs and agglomerates (Wadley, 1975, reported by Paterson & Bowman, 1977).
Elsewhere Angullong Tuff also includes conglomerate, feldspatholithic greywake, and interbedded limestone lenses.
Minor andesite lavas crop out in the vicinity of Forest Reefs, and quartz-tourmaline rock which may be an altered intermediate intrusive (Wadley, 1975, reported by Paterson & Bowman, 1977) crops out close to the Austral mine.
2./ To the W of Forest Reefs the Ordovician rocks are overlain by shale, quartzofeldspathic sandstone, and limestone of the Middle Silurian Panuara Group (Sp on Bathurst metallogenic map).
3./ Numerous small bodies of generally intermediate composition have intruded the Ordovician rocks. Lithologies include monzonite and syenite (shoshonitic suite), and dacite and diorite (calc-alkaline suite).
(Paterson & Bowman, 1977). Probable ages are Late Silurian (calc-alkaline suite), and Late Silurian-Early Devonian (shoshonitic suite) (Paterson & Bowman, 1977).
4./ The Palaeozoic rocks are overlain by an extensive largely flat-lying plateau of Tertiary basalt (Canobolas Complex) which caps a large area between Forest Reefs and Orange to the NE (Middlemost, 1981, reported by Creelman & others, 1988 - see Deposit No.30 (BROWNS CREEK)).
(LUCKNOW (Deposit No.28) occurs on the northern margin of the plateau.)

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Stevens (1972b, 1975), Paterson & Bowman (1977).

The reef deposits comprise a series of steeply-dipping, mostly apparently conformable zones of altered fractured andesitic lapilli tuffs infilled with quartz-calcite-sulphide veins.
The lodes are localised along zones of pronounced shearing and do not have well defined walls, rather they grade into barren andesite (Paterson & Bowman, 1977).

OREBODY: Great Extended
Host alluvium = diagenetically metamorphosed clay, gravel, minor sand.

OREBODY: Little Emma
Mineralisation was disseminated in a shear zone in andesite.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report

Unpublished

Paterson I.B.L., Bowman H.N., 1977
Mineralization in the Carcoar-Junction Reefs-Forest Rocks area.
Geological Survey of New South Wales. Report
GS1977/271

Stevens B., 1972
Bathurst, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-08, 1st edition.
Geological Survey of New South Wales
1v

Stevens B.P.J., 1972
Mine data sheets to accompany Bathurst, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-08.
Geological Survey of New South Wales
1v

Stevens B.P.J., 1975
A metallogenic study of the Bathurst 1:250 000 sheet. Sheet SI 55-08.
Geological Survey of New South Wales
1v

ooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 30 BROWNS CREEK

DEPOSIT IDENTIFICATION:

COMMODITIES: Au, Ag, Cu, Fe

DISTRIBUTION:
No. 285 on Bathurst metallogenic map.

OREBODIES:
Browns Creek (D), Bergalia, Browns Creek (Historical), No. 6 Orebody, No. 8 Orebody

MINES:
Browns Creek

GROUP: Orange Group

COMMENTS:
Includes regional geological description of Molong-South Coast Anticlinorial Zone (N) and Orange group.

LOCATION:

LATITUDE: 33 32 LONGITUDE: 149 10
250K SHEET: SI55 8 100K SHEET: 8730

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Orange
LOCAL GOVERNMENT AREA (LGA): Blayney

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD	COMMENTS
1871	Prospecting	
1982		Extension To Known Mineralisation

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Browns Creek (D)	Browns Creek	Operating	Open-Cut
Browns Creek (Historical)	Browns Creek	Historical	Open-Cut
Browns Creek (Historical)	Browns Creek	Historical	Underground

COMPANIES:

OREBODY: Browns Creek (D)

PRESENT OPERATORS:
B H P Gold Mines Ltd

PRESENT OWNERS:	EQUITY%
B H P Gold Mines Ltd	100.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 1,517
Average recovered grade to 1964 5.2 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

YEAR	PRODUCTION
1987	470
1988	660

MAIN PRODUCTION PERIODS: (1904-1911), 1876-1896, 1987-,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION	
May 1988	410	4.8	1,968	Economic Demonstrated	Recoverable o/c

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Molong-South Coast Anticlincrial Zone(N)
SUB-PROVINCE: Molong Anticlinorium

HOST ROCKS:

FORMATION NAME & AGE: Angullong Tuff - Late Ordovician
LITHOLOGY: Andesite, tuff, conglomerate, greywacke, limestone.
RELATIONSHIP TO MINERALISATION: Host to mineralisation in calc-silicate skarns in limestone units interbedded within andesitic volcanics.

FORMATION NAME & AGE: Carcoar Granite (Long Hill Diorite) - ?Late Sil Or Farly Dev
LITHOLOGY: Granite, granodiorite.
RELATIONSHIP TO MINERALISATION: Adjacent to mineralised sediments; possible source of metals and hydrothermal fluids.

GEOCHRONOLOGY:
Long Hill Diorite dated at 415 +- 8 my (Late Silurian) (Markham, 1982). Similar intrusions at Cadia are dated at 408 +- 4 my (Early Devonian) (Taylor, 1983).

STRATIGRAPHIC ENVIRONMENT:

SIGNIFICANT: Carbonate, Intermediate Extrusive, Volcanogenic Sedimentary

STRUCTURAL FEATURES:

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

MAJOR: Intrusive Contact, Stratigraphic Boundary

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Granodiorite), Volcanism (Intermediate)

METAMORPHISM:
Angullong Tuff is regionally metamorphosed to low grade - prehnite-pumpellyite - facies (Creelman & others, 1988). Host sequence is thermally metamorphosed to pyroxene hornfels facies in granodiorite contact zone.

ALTERATION:

OREBODY: Browns Creek (D)
PRINCIPAL SOURCES: Taylor (1983), Creelman & others (1988).

Au-Cu mineralisation is associated with a skarn alteration sequence produced by prograde and retrograde (including weathering) alteration of limestone and andesitic volcanics and associated sediments. The mineralisation appears to post-date most of the original skarn formation and may be associated with either retrograde alteration or a later hydrothermal event (Creelman & others, 1988).

Taylor (1983) identified a three-stage sequence of metamorphism and/or metasomatic replacement based on mineral assemblages of the limestone, skarn, and mudstone:-
In Assemblage I representing the lowest intensity of alteration, limestone is generally fine-grained, thinly-bedded calcite. Thin beds of goethite-magnetite sandstone within the limestone are interpreted as products of minor volcanic exhalative activity. Mudstone is fine-grained hornfelsic quartz-calcite, with bedding defined by microcrystalline chlorite and amorphous oxides and/or sulphides. Larger clasts of epidote or calcite occur within the chloritic laminations. A tuffaceous component is suggested by pyroxene fragments, partly replaced by

fibrous actinolite. Skarn minerals are restricted to within a few centimetres of the mudstone/limestone contact. Colloform pyrite occurs closest to the carbonate host, chalcopyrite is disseminated within clinozoisite skarn. (Taylor, 1983).

In Assemblage II, calcite in limestone is recrystallised, and as skarn contacts are approached, the marble contains secondary quartz and xenoblastic phlogopite. Mudstones are composed of tremolite, quartz, calcite, wollastonite. (Taylor, 1983).

In Assemblage III, representing the greatest intensity of alteration, carbonate rock is marble showing contorted bedding, and composed of recrystallised calcite, epidote, and quartz porphyryblasts. Mudstone is composed of wollastonite and clinozoisite, with porphyryblasts of biotite and diopside. Both fine and coarse-grained skarn occur. Fine-grained skarn shows contorted banding; sulphides are small disseminated grains or arsenopyrite porphyryblasts. Coarse-grained skarn occurs as lenses of massive sulphide up to 50 cm thick with idiomorphic garnet. Textures indicate attainment of stable high-grade metamorphic conditions. (Taylor, 1983).

The vein skarns show a two-stage alteration sequence:-
Vein-skarn Assemblage I is found around isolated minor fractures.
Vein-skarn Assemblage II is zoned from an outer zone of garnet retrogressive to chlorite-idocrase passing into a thin zone of diopside which passes into the unzoned central part of the vein = wollastonite-epidote-banded garnet. Bands of chalcopyrite-bornite are normal to radiating sheaves of wollastonite and parallel to the vein walls. (Taylor, 1983).

Supergene alteration is associated with post-skarn faulting and the formation of fracture zones characterised by reticulate quartz veins, silicification, and the formation of pervasive chlorite and clay fault-gouge. (Taylor, 1983).
Creelman & others (1988) distinguished three types of clay lodes:-
i) nontronite zones, interpreted to have been formed by clay replacement of retrograde amphibole or chlorite after wollastonite.
ii) massive clay zones in the upper levels of the deposit probably formed by in situ weathering.
iii) clay breccias, in which wollastonite has been replaced by xonolite. The breccias may have formed partly by repeated collapse during weathering and partly by explosion brecciation in zones of forceful fluid injection (Creelman & others, 1988).

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Calc-silicate skarn adjacent to granitoid.

STYLE:

MAJOR: Stratabound, MINOR: Discordant

MORPHOLOGY: Tabular

AGE OF MINERALISATION: Palaeozoic Early Devonian

DIMENSIONS/ORIENTATION:

OREBODY: Browns Creek (D)

		MIN	AVE	MAX
TRUE WIDTH	(m)	1.0	2.0	10.0
		ANGLE (deg.)		DIRECTION
DIP		40-50		

OREBODY: Browns Creek (Historical)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			230.0
VERTICAL DEPTH	(m)	21.0		110.0
		ANGLE (deg.)		DIRECTION
DIP		75-80		NE
STRIKE		290		

ORE TEXTURE:
Banded/Laminated, Zoned

NATURE OF MINERALISATION:
PRIMARY ORE: Breccia, Dissemination, Skarn,
SECONDARY ORE: Supergene Enrichment

MINERALOGY:

OREBODY: Browns Creek (D)

PRINCIPAL SOURCES: Taylor (1983), Creelman & others (1988).

Several discrete mineral assemblages represent stages of prograde and retrograde replacement (Taylor, 1983; Creelman & others, 1988).
Taylor (1993) identified a three-stage replacement sequence for the stratabound skarn:-
Assemblage I: sulphides: pyrite, chalcopyrite; skarn: wollastonite, quartz, calcite, clinozoisite.
Assemblage II: sulphides: coarsely banded pyrrhotite, pyrite, chalcopyrite, (retrograde marcasite); skarn: quartz, calcite, actinolite, (wollastonite, phlogopite, biotite).
Assemblage III: sulphides: arsenopyrite, chalcopyrite, pyrrhotite, (tennantite, gold); skarn: quartz, calcite, idocrase alternate with darker bands of epidote, chlorite, (garnet, wollastonite, diopside, siderite). Assemblage III represents maximum replacement and is restricted to the thickest sections of the skarn. (Taylor, 1983).

Creelman & others (1988) distinguished three stages of alteration in the andesite-derived skarn:-
i) bleached porphyritic andesite composed of diopside, (garnet, vesuvianite).
ii) massive garnet-hedenbergite skarn; sulphides: copper sulphides.
iii) massive wollastonite skarn, accessory diopside, hedenbergite, vesuvianite, epidote, quartz, garnet; sulphides: sulphur-rich bornite, chalcopyrite; telluride: hessite.
Limestone-derived skarn: calcite, garnet, wollastonite, (quartz, epidote, hedenbergite). (Creelman & others, 1988).

In the vein skarns, Taylor (1983) identified two calc-silicate-sulphide associations:-
Vein-skarn Assemblage I: sulphides: bornite, chalcopyrite, pyrite, chalcocite, covellite; skarn: wollastonite, (epidote, garnet), retrograde chlorite, clay. Bornite contains inclusions of gold.
Vein-skarn Assemblage II: sulphides: chalcopyrite, bornite, chalcocite, pyrite, gold; skarn: garnet, diopside, idocrase, wollastonite, retrograde chlorite, clay. (Taylor, 1983).

According to Creelman & others (1988), the vein skarns are mineralogically similar to the stratabound skarns.

Clay lodes: i) nontronite; ii) unidentified clay mineral; iii) xonolite.
Sulphides: pyrrhotite, arsenopyrite, chalcopyrite. Telluride: hedleyite.
Nontronite zones are enriched in gold. (Creelman & others, 1988).
Supergene ore: pyrite, chalcocite, chalcopyrite, bornite, covellite, copper oxides, copper, gold (Taylor, 1983).

Gold occurs in native form in fracture-filling veins associated with bornite, copper sulphides, chalcopyrite, and hessite and in small fractures without associated sulphides (Creelman & others, 1988).

CONTROLS OF MINERALISATION:

PRINCIPAL SOURCES: Taylor (1983), Creelman & others (1988).

Primary control is chemical, provided by the reaction of favourable lithology with hydrothermal solutions.
Skarn formation appears to have been controlled both by structural features and by lithological contacts, and in detail is not controlled by the margin of the granodiorite (Creelman & others, 1988).
Wollastonite in Assemblage I suggests a minimum temperature in the range 500-650 deg (Taylor, 1983), 600 deg (Creelman & others, 1988).
Actinolite-phlogopite in Assemblage II indicates higher metamorphic grade and high oxygen fugacity. (Taylor, 1983).
Assemblage III represents hydrous, volatile-rich, oxidising environment.
Banding in Assemblage III may be due to diffusion process (Taylor, 1983).

Sulphur-rich bornite is indicative of low temperature sulphide generation by either direct precipitation or supergene reactions (Creelman & others, 1988).
The presence of hessite in association with gold indicates relatively low temperature of formation of approximately 200 deg C, indicating the gold to be a lower temperature overprint on the original skarn, possibly related to retrograde metamorphism, or to a later hydrothermal event (Creelman & others, op.cit).

The lack of conspicuous veining within the limestone and the occurrence of mineralisation at both the upper and lower contacts of the mudstone beds are compatible with a derivation of skarn metal sulphides from either the mudstones themselves, or by lateral diffusion along the mudstone bed, from a more distant source (Taylor, 1983).

GENETIC MODELS:

PRINCIPAL SOURCES: Stevens (1975), Bowman & others (1977), Taylor (1983), Creelman & others (1988).

Stevens (1975): pyrometasomatic deposit developed as a result of intrusion of Long Hill Diorite.
Bowman & others (1977): stratiform mineralisation, preferentially localised in tuff/calcareous mud horizon immediately overlying andesitic lavas.
Taylor (1983): metasomatic replacement by hydrothermal infiltration and diffusion. Base and precious metals may have been derived from either a volcanic source i.e. Angullong Tuff, (fluids from granite intrusion), or a magmatic source, i.e. both metals and fluids derived from late-stage differentiates of the intruding granodiorite magma.
Creelman & others (1988): gold and copper mineralisation post-dates skarn formation and may be associated with retrograde alteration or a later hydrothermal event.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Browns Creek (D)

PRINCIPAL SOURCES: Stevens (1972a,b, 1975), Markham (1982), Paterson & Bowman (1977), Taylor (1983), BHP Gold Mines Ltd (1987), Creelman & others (1988).

SUMMARY

Browns Creek lies in the Molong Anticlinorium, E of the axis of the Molong-South Coast Anticlinorial Zone (N). Mineralisation occurs in stratabound and vein calc-silicate skarns in limestone units interbedded within andesitic volcanics of the Late Ordovician Angullong Tuff adjacent to a contact with a granodiorite phase of the Early Devonian Carcoar Granite.

REGIONAL SETTING: MOLONG-SOUTH COAST ANTICLINORIAL ZONE (N)
PRINCIPAL SOURCES: Markham & Basden (1974), Matson (1975), Stevens (1975), Paterson & Bowman (1977), Felton (1977).

The northern part of the Molong-South Coast Anticlinorial Zone consists of two subparallel belts separated by the Hill End Synclinorial Zone (Markham & Basden, 1974). The principal structural elements of the Capertee Block, which makes up the eastern belt, are the Sofala and Rockley Anticlinoria (see Deposit No.44 SOFALA-WATTLE FLAT). The major part of the western belt is the Molong Anticlinorium, which passes southwards into the Cullarin Anticlinorium (Stevens, 1975).

The Molong Anticlinorium contains an andesite-limestone association of Early or Middle to Late Ordovician age, locally overlain disconformably (Stevens, 1975) by Silurian shallow water detrital sediments and biochemical limestones (Panuara Group). The Ordovician andesitic rocks or associated sediments are host to several major gold deposits.
The Ordovician rocks are intruded by numerous small intermediate plutons of ?Late Silurian-Early Devonian age, and by Devonian and Carboniferous granite plutons (Paterson & Bowman, 1977). The intermediate plutons and the Devonian Carcoar Granite are spatially related to some gold deposits (Paterson & Bowman, 1977).
Serpentinised ultramafic bodies emplaced along faults, probably also during the Middle Devonian (Markham & Basden, 1974), are host to gold mineralisation at LUCKNOW (Deposit No. 28).

The Ordovician volcanic province contracts southwards to a narrow belt along the western margin of the Cullarin Anticlinorium (Stevens, 1975). In the Molong-South Coast Anticlinorial Zone (S), Ordovician andesitic volcanics are restricted to the Nine Mile Volcanics (Markham & Basden, 1974), which are host to gold mineralisation at KIANDRA (Deposit No.22).

In the Scheibner (1976) model, the volcanic rocks were formed in a meridionally trending island arc - Molong Volcanic Arc - which developed in the Early Ordovician at the leading edge of a rifted microcontinent composed of a Cambro-Ordovician Girilambone flysch wedge (Stevens, 1975; Paterson & Bowman, 1977).
The volcanics were derived from partial melting of oceanic crust in a subduction zone to the E (Stevens, 1975).
E of the arc a new flysch wedge formed on the Monaro Slope and Basin (Paterson & Bowman, 1977). The arc was split during the Late Ordovician, resulting in separation of a westerly microcontinent, the Parkes Terrace (Felton, 1977), and was deformed and metamorphosed to zeolite to greenschist facies grade during the Benambran Orogeny at the end of the Ordovician (Paterson & Bowman, 1977).
Further orogenesis in the Early Silurian (Quidongan Orogeny) marked the

onset of arch and rift felsic volcanism and the emplacement of syn-kinematic granite batholiths, mainly in the southern part of the Molong-South Coast Anticlinorial Zone (Stevens, 1975). The Wyangala Batholith, which is spatially associated with gold deposits at MOUNT McDONALD (Deposit No.33) could be related to the Benambran or the Quidongan Orogeny (Stevens, 1975).
Rifting of the eastern part of the arc in the Middle Silurian resulted in separation of the Capertee Rise, composed partly of the Sofala and Rockley Volcanics, which was separated from the remnant arc by a new marginal sea (Hill End Trough) (Stevens, 1975; Felton, 1977).
The arc succession was deformed by the Middle Devonian Tabberabberan Orogeny (Stevens, 1975), and intruded by Devonian and Carboniferous intermediate and granitic plutons.

REGIONAL SUCCESSION AND ASSOCIATED MINERALISATION: MOLONG SYNCLINORIUM (ORANGE GROUP)
PRINCIPAL SOURCES: Markham & Basden (1974), Stevens (1975), Paterson & Bowman, 1977).

Gold mineralisation occurs in a variety of styles in the central part of the Molong Anticlinorium. Disseminated, vein, and stratiform (copper-) gold(-iron) deposits are associated predominantly with Ordovician andesitic sequences, and are commonly spatially related to intermediate intrusives (Stevens, 1975). Disseminated copper-gold deposits are concentrated in the axial region of the Molong-South Coast Anticlinorial Zone (N) (Stevens, 1975).

Metamorphosed flysch sequences of the Monaro Slope and Basin are represented in the Molong Anticlinorium by:-
1./ Abercrombie Beds (Oab on Bathurst metallogenic map) (Early-Late Ordovician) - greywacke/slate sequence. The formation is host to vein gold adjacent to Wyangala Batholith at MOUNT McDONALD (Deposit No.33).
The Abercrombie Beds both underlie and pass laterally into andesitic formations of the Molong Volcanic Arc (Paterson & Bowman, 1977).

The Ordovician volcanics comprise a calc-alkaline island arc suite of flows and tuffs ranging in composition from possible basalts (spilite, keratophyre) through pyroxene andesite to hornblende andesite; plus shallow marine sediments derived from the volcanic rocks, including conglomerate, volcanic sandstone, siltstone, shale and chert; and interbedded limestone and calcareous shale (Markham & Basden, 1974; Stevens, 1975).
The principal formations in the central part of the anticlinorium, and associated mineralisation (Stevens, 1975; Paterson & Bowman, 1977) are:-
2./ Walli Andesite (including Mount Pleasant Andesite) (Owa on Bathurst metallogenic map) (Early Ordovician) - andesitic volcanics, minor intercalated sediments.
3./ Malongulli Formation (Omf) (Middle Ordovician) - volcanically derived sediments. Host to stratiform Au-Ag-Cu adjacent to intermediate intrusive at JUNCTION REEFS (SHEAHAN-GRANTS) (Deposit No.32).
4./ Angullong Tuff (Oat) (Late Ordovician) - andesitic lavas and tuffs, limestone lenses. Host to stratiform Fe-Cu-Au at CADIA (Deposit No.31) and to vein and disseminated Cu-Au at FOREST REEFS (Deposit No.29). Fault-controlled Au-Ag mineralisation at LUCKNOW (Deposit No.28) is localised at a contact between volcanics of the Angullong Tuff and serpentinite.
The Angullong Tuff has been subdivided in the southeastern part of the Molong Anticlinorium (Paterson & Bowman, 1977):-
i) Blayney Andesite (Oatb in Paterson & Bowman, 1977) - andesitic lavas, minor tuffs.
ii) Quigleys Hill Tuff (Oatq) - andesitic tuffs, minor lavas.
iii) Cowriga Limestone (Oatc) - limestone, minor volcanics.
The limestone is host to Au-Cu-Fe skarn mineralisation adjacent to the Long Hill Diorite (Carcoar Granite) at BROWNS CREEK (Deposit No.30).

5./ Panuara Group (Sp) (Early or Middle Silurian) - shale, quartzo-feldspathic arenite, limestone.
6./ Wyangala Batholith (gw) (?Early Silurian or Late Silurian-Early Devonian) - gneissic, concordant, poly-phase granite.
Vein gold at MOUNT McDONALD (Deposit No.33) occurs adjacent to northern contact of batholith.
7./ Intermediate intrusives (?Late Silurian-Early Devonian) - syenite, monzonite, diorite. Abundant in central part of anticlinorium.
Stocks and dykes occur in vicinity of CADIA and JUNCTION REEFS (SHEAHAN-GRANTS (Deposit Nos.31, 32).
8./ Granite plutons (Early or ?Middle Devonian) - discordant, massive granites, including Carcoar Granite (gca), Barry Granite (gba), Pine Mountain Granodiorite (gp) which intrude central part of anticlinorium.
Browns Creek occurs adjacent to granodiorite phase - Long Hill Diorite - of Carcoar Granite.
9./ Canobolas Complex (Tb, Tt) (Tertiary) - basalt, hawaiite, trachyte (Middlemost, 1981, reported by Creelman & others, 1988).

GEOLOGICAL SETTING: BROWNS CREEK
PRINCIPAL SOURCES: Bowman & others (1977), Paterson & Bowman (1977), Taylor (1983), Creelman & others (1988).

Browns Creek occurs within Cowriga Limestone close to a contact with Long Hill Diorite at the northern margin of the Carcoar Granite.

Angullong Tuff forms the bulk of the central area of the anticlinorium. The formation is represented mainly by Blayney Andesite, which is extensive to the N and E of Browns Creek (Paterson & Bowman, 1977). Lithologies in the vicinity of Browns Creek are pyroxene-porphyritic andesitic lavas and tuffs with chloritic groundmass, and minor volcanic breccias (Creelman & others, 1988).
A thick limestone lens - Cowriga Limestone - is exposed in a triangular inlier within the volcanics (Paterson & Bowman, 1977). The limestone is generally pure, massive, coarsely recrystallised calcite rock (Creelman & others, 1988), with thin interbedded tuffaceous mudstones and lavas (Bowman & others, 1977; Taylor, 1983).
The limestone block is interpreted by Bowman & others (1977) to be a downfaulted block, but is considered by Taylor (1983) and Creelman & others (1988) to be a conformable unit near the base of the Blayney Andesite. In the latter interpretation, the limestone unit is exposed at the crest of a broad NE-plunging anticline. The limbs of the anticline dip approximately 45 deg N and NE and are cut by several N-trending faults (Creelman & others, 1988). The limestone is truncated to the S and at depth by faults and by the Long Hill Diorite (Taylor, 1983; Creelman & others, 1988).

The andesite-limestone sequence is intruded to the S and E of Browns Creek by the Carcoar Granite and the Long Hill Diorite.
The latter occurs at the northern margin of the Carcoar Granite and is in immediate contact with the host andesite-limestone at Browns Creek.
The Carcoar Granite is a massive, discordant, I-type (Creelman & others, 1988) intrusive body with a narrow contact metamorphic aureole.
Lithologies given by Paterson & Bowman (1977) are granodiorite, quartz diorite. The Long Hill Diorite was described as quartz diorite by Paterson & Bowman (1977), and as a somewhat variable, granodiorite phase of the Carcoar Granite by Taylor (1983) and Creelman & others (1988).
The granodiorite contact trends irregularly WNW and dips N @ 55-70 deg (Stevens, 1975). Numerous dykes and sills of granodiorite intrude the andesite-limestone sequence, and all rock types are cut by a series of N-trending aplitic dykes (Creelman & others, 1988).
The limestone is either in direct contact with diorite or is separated from it by underlying andesite. Bowman & others (1977) and Taylor (1983) refer to tuffaceous and calcareous mudstones which occur at the basal contact between limestone and andesite; Creelman & others (1988) refer to a direct limestone/andesite contact.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Stevens (1975), Bowman & others (1977), Markham (1982), Taylor (1983), Creelman & others (1988).

Mineralisation occurs in stratabound skarn, vein skarn, and clay lodes (Taylor, 1983; Creelman & others, 1988) developed along the base of the Cowriga Limestone. Gold and copper mineralisation appears to post-date most of the skarn formation and occurs preferentially in wollastonite-rich skarns (Creelman & others, 1988).

According to Bowman & others (1977) and Taylor (1983), stratabound skarn is preferentially developed at the contacts between carbonate rocks and thin tuffaceous mudstones immediately overlying the Blayney Andesite and underlying the Cowriga Limestone.
Creelman & others (1988) describe the skarn mineralisation as occurring on both sides of the limestone/andesite contact.

The vein skarns occur as N-trending subvertical zones of alteration in carbonate rocks higher upsequence adjacent to fractures or andesite dykes (Taylor, 1983; Creelman & others, 1988). The vein skarns have short strike length, great vertical extent, and widths up to 15 m (Creelman & others, 1988).

Clay lodes are associated with i) zones of retrograde skarn alteration to nontronite, ii) weathered ore in the upper levels of the deposit, and iii) clay breccias (Creelman & others, 1988).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

BHP Gold Mines Limited., 1987
BHP Gold Mines Limited - Prospectus.

BHP Gold Mines Limited
1v

Bowman H.N., Richardson S.J., Hobbs J.J., 1977
Browns Creek disseminated gold-copper mine - a volcanogenic deposit.
Geological Survey of New South Wales. Report
GS1977/086

Creelman R.A., Lipton I.T., Stagg R.N., 1988
Skarn hosted gold copper mineralisation at Browns Creek, New South Wales.
IN Bicentennial Gold 88, Extended Abstracts.
Geological Society of Australia. Abstracts
23 P258-261

Felton E.A., 1977
Part 2. A metallogenic study of the Goulburn 1:250 000 sheet.
Geological Survey of New South Wales
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Matson C.R., 1975
Part 2. A metallogenic study of the Dubbo 1:250 000 shee Sheet SI 55-04.
Geological Survey of New South Wales
1v

Paterson I.B.L., Bowman H.N., 1977
Mineralization in the Carcoar-Junction Reefs-Forest Rocks area.
Geological Survey of New South Wales. Report
GS1977/271

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

Stevens B., 1972
Bathurst, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-08, 1st edition.
Geological Survey of New South Wales
1v

Stevens B.P.J., 1972
Mine data sheets to accompany Bathurst, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-08.
Geological Survey of New South Wales
1v

Stevens B.P.J., 1975
A metallogenic study of the Bathurst 1:250 000 sheet. Sheet SI 55-08.
Geological Survey of New South Wales
1v

Taylor G.R., 1983
Copper and gold in skarn at Brown's Creek, Blayney, N.S.W.
Geological Society of Australia. Journal
30(4) P431-442

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 31 CADIA

DEPOSIT IDENTIFICATION:

COMMODITIES: Fe, Cu, Au, Ag, Mo

DISTRIBUTION:
Record covers the main Cadia orebody (Iron Duke plus New Cadia and probably East Cadia), Chilcott 750 m to the SE, West Cadia 800 m SSW, White Engine 1 km to the S, & Little Cadia 3 km to the SE. Nos. 120-126 on Bathurst metallogenic map.

OREBODIES:
Cadia (D), Chilcott, Iron Duke, Little Cadia, West Cadia, White Engine

MINES:
Chilcott, East Cadia, Iron Duke, Little Cadia (Cadia Extended), New Cadia, Old Cadia (White Engine), West Cadia

GROUP: Orange Group

COMMENTS:
See Deposit No.30 BROWNS CREEK for regional setting of Molong-South Coast Anticlinorial Zone (N) and Orange group.

LOCATION:

LATITUDE: 33 27 LONGITUDE: 149 1
250K SHEET: SI55 8 100K SHEET: 8731

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Orange
LOCAL GOVERNMENT AREA (LGA): Blayney

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD	COMMENTS
1851		Date approximate

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Chilcott	Chilcott	Historical	Underground
Chilcott	Chilcott	Historical	Open-Cut
Iron Duke	Iron Duke	Historical	Underground
Iron Duke	Iron Duke	Historical	Open-Cut
Iron Duke	New Cadia	Historical	Unknown
Iron Duke	East Cadia	Historical	Unknown
Little Cadia	Little Cadia (Cadia Extended)	Historical	Underground
West Cadia	West Cadia	Historical	Underground
White Engine	Old Cadia (White Engine)	Historical	Underground

COMPANIES:

OREBODY: Cadia (D)

PRESENT OPERATORS:
Endeavour Resources Ltd

PRESENT OWNERS:	EQUITY%
Bond Corporation Holdings Ltd	100.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 54
Average recovered grade 6 g/t Au (Iron Duke)

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1851-1881), 1882-1898, 1905-1917, 1918-1929, 1941-1943,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION			
Dec 1975	29,400	0.6	16,758	Subeconomic Demonstrated	In-Situ	o/c	Copper grade 0.72% Cu

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Molong-South Coast Anticlinorial Zone(N)
SUB-PROVINCE: Molong Anticlinorium

HOST ROCKS:

FORMATION NAME & AGE: Angullong Tuff - Late Ordovician
LITHOLOGY: Andesite, tuff, conglomerate, greywacke, limestone.
RELATIONSHIP TO MINERALISATION: Host to principal mineralisation in stratiform magnetite-sulphide bodies in pyroclastic sedimentary units. Possibly genetically related to mineralisation.

FORMATION NAME & AGE: Panuara Formation - Early or Middle Silurian
LITHOLOGY: Shale, quartzofeldspathic sandstone, limestone.
RELATIONSHIP TO MINERALISATION: Overlies host formation close to deposits.

FORMATION NAME & AGE: Unnamed Intermediate Intrusive - Middle Devonian
LITHOLOGY: Diorite-monzonite.
RELATIONSHIP TO MINERALISATION: Host to minor Cu-Au-Mo vein mineralisation. Also possibly genetically related to stratiform bodies.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Intermediate Extrusive,
SIGNIFICANT: Volcanogenic Sedimentary,
MINOR: Intermediate Intrusive

STRUCTURAL FEATURES:

SIGNIFICANT: Faulting, Fracturing, Shearing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Diorite), Volcanism (Intermediate)

METAMORPHISM:

Minor recrystallisation is attributable to burial metamorphism. The Ordovician sediments and volcanics have been recrystallised adjacent to the monzonite-diorite intrusive. Metamorphic mineral assemblage of the host shale/tuff sequence sediments is chlorite-epidote-quartz. (Welsh, 1975).

ALTERATION:

OREBODY: Cadia (D)
PRINCIPAL SOURCES: Welsh (1975).

Intense hydrothermal alteration (?propylitic) is associated with the ore bands in the lower portion of the Angullong Tuff, where the tuffs and shales are replaced by chlorite-epidote-quartz-calcite-fibrous amphibole. Less intense alteration extends away from the zone into the upper portion of Angullong Tuff and downwards into the lavas. Proportion of quartz and calcite decrease with decreasing alteration intensity. Alteration may be deuteric, related to proximal volcanic centre (Welsh, 1975).
Basal sections of Panuara Group consisting of quartz-sericite-tourmaline-pyrite may be altered sediments or an intrusion.

Widespread alteration of andesitic rocks to ?albite-chlorite-epidote-carbonate-fibrous amphibole may be a deuteric or a combined deuteric /burial metamorphic effect. (Welsh, 1975).
Deuteric alteration of the western phase of the intrusive stock has produced the assemblage sericite-epidote-chlorite-fibrous amphibole; the more intense alteration of the eastern phase has resulted in the formation of ?biotite-alkali feldspar-albite-sericite-chlorite-quartz -carbonate-fibrous amphibole-epidote.

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Gold in massive stratiform magnetite-sulphide bodies in intermediate volcanics adjacent to intermediate intrusives.
MINOR: Auriferous quartz veins in intermediate intrusive.

STYLE:

MAJOR: Conformable, Stratabound, Stratiform, MINOR: Discordant

MORPHOLOGY: Lenticular, Tabular

AGE OF MINERALISATION: Palaeozoic Middle Devonian, Palaeozoic Late Ordovician

DIMENSIONS/ORIENTATION:

OREBODY: Cadia (D)

		MIN	AVE	MAX
VERTICAL DEPTH	(m)	30.0		40.0
DEPTH OXIDATION	(m)		40.0	

OREBODY: Chilcott

		MIN	AVE	MAX
TRUE WIDTH	(m)			4.0
		ANGLE (deg.)		DIRECTION
DIP		90		
STRIKE		045		

OREBODY: Iron Duke

		MIN	AVE	MAX
STRIKE LENGTH	(m)			1000.0
TRUE WIDTH	(m)			250.0
VERTICAL DEPTH	(m)	40.0		70.0

OREBODY: Little Cadia

	ANGLE (deg.)	DIRECTION
DIP	10-20	

OREBODY: White Engine

	ANGLE (deg.)	DIRECTION
DIP	70-80;90	SE
STRIKE	045;080	

ORE TEXTURE:
Banded/Laminated, Disseminated, Massive

NATURE OF MINERALISATION:
PRIMARY ORE: Bed, Multiple Veins, Vein (Reef),
SECONDARY ORE: Supergene Enrichment

MINERALOGY:

OREBODY: Cadia (D)
PRINCIPAL SOURCES: Stevens (1972b), Markham & Basden (1974), Welsh (1975), Markham (1982).

Sulphide zone: magnetite (up to 70%, average 40%), chalcopyrite (<5%), pyrite (5-15%, average 7%), (gold). Magnetite occurs in coarse massive bladed form; some carries small hematite inclusions. Bornite and digenite are alteration products of pyrite and chalcopyrite.
The chalcopyrite-gold mineralisation is concentrated in the upper portion of the magnetite-rich unit but also extends into the overlying tuffs at the main orebody Iron Duke. Gold distribution is erratic, the highest concentrations occurring in cross-cutting veins and fractures.
The trace amounts of gold present were apparently included within

chalcopyrite (Markham, 1982).

Supergene effects have produced a copper-rich zone at the base of the orebody, containing secondary sulphides chalcocite, digenite, and covellite, and oxidation products cuprite and tenorite. Other minerals in the oxide zone are goethite and delafossite.
Gangue: calcite (average 20% of orebody), chlorite (20%), quartz (5%), (epidote 5%).
Banding is defined by alternation of Fe-oxide bands (1-5 cm) with silicate bands.
Disseminated pyrite-chalcopyrite also occurs in the monzonite stock.

OREBODY: Iron Duke
PRINCIPAL SOURCES: Stevens (1972b), Welsh (1975).

Sulphide zone: magnetite, pyrite, chalcopyrite, (galena, molybdenite, native copper, silver, electrum). Magnetite (and hematite) occur as interlocking blades, random to radiating aggregates, or equant grains. Blades pseudomorph specularite, and show evidence of stress deformation. Pyrite, chalcopyrite, silicates are largely interstitial; chalcopyrite also occupies veinlets. The greater proportion of the gold, along with galena, electrum, rutile and molybdenite, is associated with chalcopyrite-rich areas. (Welsh, 1975).
Paragenesis: specularite, calcite, quartz: magnetite: pyrite: chalcopyrite (Welsh, 1975).
Oxide zone: hematite, limonite.

OREBODY: West Cadia
Sulphide zone: chalcopyrite, pyrite, (gold, molybdenite).
Gangue: quartz, calcite.

OREBODY: White Engine
Sulphide zone: pyrite, chalcopyrite, (gold, molybdenite).
Gangue: quartz, calcite, chlorite.

CONTROLS OF MINERALISATION:
Main orebodies are stratigraphically controlled. Minor vein mineralisation is structurally controlled. Proximity to intrusive complex of intermediate composition is also considered a controlling feature (Welsh, 1975 - see 'GENETIC MODELS').

GENETIC MODELS:
PRINCIPAL SOURCES: Stevens (1975), Welsh (1975).

Stevens (1975) cites features supporting each of two possible models:-
1./ Metasomatic replacement of carbonate-rich sediments by material derived from the intrusives.
2./ Deposition as chemical sediments by magnetite flows, associated with andesitic volcanism.

1./ is favoured by the proximity of intrusives, the calcium-rich gangue, the presence of disseminated copper in the altered monzonite, the occurrence of copper in fractures within and outside the intrusives, the high magnetite content of unaltered intrusive, the deviation from strict stratigraphic conformability, the lack of banding continuity, the similarity of mineralogy to that of typical metasomatic deposits, and the occurrence of magnetite-rich contact deposits on a regional scale.
2./ is favoured by the stratigraphic control of the orebodies, their tabular form and overall conformability, textures suggesting hematite replacement by magnetite, banding which could be sedimentary, and the local clay-phyllite host rock association within volcanic sequences, indicating a suitable environment for chemical deposition during intervening periods of quiet sedimentation.

Welsh (1975) cites the following features in support of a replacement model:- the occurrence of fault-related magnetite replacement, the close spatial association and stratabound nature of intense alteration, sulphide mineralisation, and the magnetite body.
Welsh postulated that the orebodies were developed by selective hydrothermal replacement and fracture filling of a sedimentary unit composed largely of calcareous tuff, calcareous shale, and chemically precipitated or replacement iron oxide bands.
Hydrothermal fluids emanating from the adjacent intermediate intrusive stock deposited pyrite, copper, and gold in those portions of the sedimentary unit that were both relatively permeable and reactive.
The process was accompanied by hydrothermal alteration and chemical reduction of the iron oxide bands to magnetite.
The intrusive complex was at least indirectly a source of metals.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Cadia (D)

PRINCIPAL SOURCES: Stevens (1972a,b), Markham & Basden (1974), Stevens (1975), Welsh (1975), Paterson & Bowman (1977), Markham (1982).

SUMMARY

Cadia lies in the central part of the Molong Anticlinorium near the axis of the Molong-South Coast Anticlinorial Zone. Gold is associated with iron and copper in massive, stratiform magnetite-sulphide bodies interbedded with calcareous andesitic pyroclastic sediments which form the upper portion of the predominantly andesitic Late Ordovician Angullong Tuff. Minor copper-gold-molybdenum vein mineralisation occurs in younger diorite intrusives.

REGIONAL SUCCESSION: CADIA

PRINCIPAL SOURCES: Stevens (1972a, 1975), Welsh (1975).

1./ Malongulli Formation (Omf on Bathurst metallogenic map) (Late Ordovician) (thickness 2000 m) - siltstone interbedded with black shale, calcareous siltstone, andesitic tuffs and lavas, greywacke and limestone breccia. Near Cadia the unit is represented by quartzose sediments and andesitic lava. The unit is overlain with probable disconformity by:-

2./ Angullong Tuff (Oat) (Late Ordovician) (9000 m thick) - andesitic and basaltic lava, tuff, breccia, agglomerate and minor lahar, with greywacke, feldspathic sandstone, siltstone, minor limestone, and conglomerate. The formation is host to stratiform Cu-Fe-Au mineralisation at Iron Duke and Little Cadia and to minor vein sulphides at Chilcott. Uncomformably overlain by:-

3./ Panuara Group (Sp) (Middle Silurian on Bathurst metallogenic map; Early Silurian in Paterson & Bowman, 1977) (600 m thick) - interbedded shale, siltstone, and quartzose sandstone with minor limestone, conglomerate, feldspathic and calcareous sandstone near base.

4./ Intermediate intrusives (Late Ordovician or ?Middle Devonian) - a complex diorite-monzonite stock intrudes the Angullong Tuff and possibly also Panuara Group in the deposit area. The western phase comprises orthoclase diorite, grading northwards to pyroxene diorite, which has undergone minor alteration. The eastern phase comprises monzonite porphyry and quartz monzonite porphyry and is brecciated and extensively altered. The eastern phase probably represents a fault brecciated and deuterically altered margin (Welsh, 1975).
The diorite contains about 5% magnetite and the altered monzonite has considerable sulphide content and a low magnetite content. The diorite is host to vein Cu-Au-Mo deposits at White Engine and West Cadia. A variety of monzonitic-syenitic dykes, probably related to the intrusive stock, mainly occupy E-W shears.

5./ Tertiary olivine basalt and trachyte of the Canobolas Complex (Middlemost, 1981, reported by Creelman & others, 1988 - see Deposit No.30 BROWNS CREEK) occupy extensive areas to the N of Cadia.

The Angullong Tuff and Panuara Group are gently folded; the former generally dips S @ 15-25 deg, the unconformable Panuara Group dips WSW @ 20-30 deg. There is some evidence of a NE-trending syncline on which are superimposed extensive block faulting and warping (Welsh, 1975).

LOCAL SETTING: MINERALISATION

PRINCIPAL SOURCES: Welsh (1975), Paterson & Bowman (1977).

The Angullong Tuff is subdivided into three units (Paterson & Bowman, 1977):-

i) Blayney Andesite (Oatb in Paterson & Bowman, 1977) - porphyritic augite andesite lava, minor tuffs, some agglomerate, basal shallow water sediments.

ii) Quigleys Hill Tuff (Oatq) - crystal and crystal-lithic andesitic and dacitic tuffs and minor lavas (Paterson & Bowman, 1977). Lithologies at Cadia are tuffs, reworked tuffs, calcareous shales and calcareous tuffs (50-100 m) grading upwards into massive andesitic tuffs breccias, agglomerates, and possible lavas (150 m) (Welsh, 1975).

iii) Cowriga Limestone (Oatc) - limestone, minor lavas and tuffs.

The lower shaly section of Quigleys Hill Tuff contains the Cu-Au-Fe mineralisation in shallowly-dipping, for the most part conformable, tabular orebodies 30-40 m thick. The upper tuffaceous section commonly contains low-grade copper mineralisation.

Local faulting has offset parts of the orebodies and enclosing sequence.

OREBODY: Chilcott

Chilcott is representative of a number of small copper-gold deposits that occur in ill-defined quartz veins localised within the Angullong Tuff. Mineralisation was hosted by andesitic volcanics and occupied a fault zone that forms the eastern termination of the Iron Duke orebody (Welsh, 1975).
The gold was apparently concentrated as a result of remobilisation of metals originally present as stratiform mineralisation (Markham, 1982).

OREBODY: Iron Duke
PRINCIPAL SOURCES: Welsh (1975).

The orebody approximates a rectangular prism concordantly occupying 30-40 m of the lower shaly section of the Angullong Tuff. The major chalcopyrite-gold association is coincident with the upper portions of the magnetite and continues into the overlying andesitic section.
Locally the magnetite may be split by up to three discontinuous silicate bands, generally andesitic tuffs or lavas. These bands are commonly up to several metres thick but may reach 30 m with consequent reduction in the development of magnetite. Narrow bands are frequently barren of chalcopyrite. (Welsh, 1975).
The deposit is bisected by the NE-trending PC 40 fault along which the southern block was downthrown by 50 to 100 m. Younger faulting and fracturing, though extensive, produced relatively minor displacements.
Local deformation has folded the western end of the orebody into a shallow syncline plunging NE @ 20-25 deg, and the NE portion of the orebody into an anticline plunging SE @ 20-25 deg.
The downfaulted section has an open basinal or synclinal structure plunging S. The Iron Duke is terminated by the Chilcott shear to the E, reduced grade and thickness to the N, and by outcrop to the W and NW. The southern margin has not been located. (Welsh, 1975).

OREBODY: Little Cadia
Structure is overall similar to that of Iron Duke. However, distribution of magnetite and copper are more irregular at Little Cadia, and the magnetite bands have been displaced by the intrusion of monzonite dykes and sills. The southern side of the deposit is downthrown by 20-40 m by E-W fault. (Welsh, 1975).

OREBODY: West Cadia
Host rock is the diorite phase of the intermediate intrusive.

OREBODY: White Engine
Host rock is the diorite phase of the intermediate intrusive.
Mineralisation occupies discontinuous sub-parallel faults and fractures.
Mineralisation is partly disseminated in the monzonite, partly occurs in veins composed of cryptocrystalline grey siliceous material.
(Welsh, 1975).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Newton J.P., 1971
The geological environment of the iron and copper deposits at Cadia, N.S.W. B.Sc. (Appl.) (Hons) thesis.
University of New South Wales. Unpublished
1v

Paterson I.B.L., Bowman H.N., 1977
Mineralization in the Carcoar-Junction Reefs-Forest Rocks area.
Geological Survey of New South Wales. Report
GS1977/271

Sadler D.R., 1972
Geology of Cadia, N.S.W. B.Sc. (Hons) thesis.
Australian National University. Unpublished
1v

Savage E.N., 1971
The geology of the Iron Duke iron and copper ores, Cadia, N.S.W. B.Sc. (Appl.) (Hons) thesis.
University of New South Wales. Unpublished
1v

Schaffer F.M., 1971
The geology of the Little Cadia iron and copper ores, Cadia, N.S.W. B.Sc. (Appl.) (Hons) thesis.
University of New South Wales. Unpublished
1v

Stevens B., 1972
Bathurst, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-08, 1st edition.
Geological Survey of New South Wales
1v

Stevens B.P.J., 1972
Mine data sheets to accompany Bathurst, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-08.
Geological Survey of New South Wales
1v

Stevens B.P.J., 1975
A metallogenic study of the Bathurst 1:250 000 sheet. Sheet SI 55-08.
Geological Survey of New South Wales
1v

Welsh T.C., 1975
Cadia copper-gold deposits. IN Knight C.L.(ed) - Economic geology of Australia and Papua New Guinea - 1. Metals.
AusIMM. Monograph Series
5 P711-716

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 32 JUNCTION REEFS (SHEAHAN-GRANTS)

DEPOSIT IDENTIFICATION:

SYNONYMS: Sheahan-Grants

COMMODITIES: Au, Cu, Ag

DISTRIBUTION:
Frenchmans-Cornishmens (Sulphide) ore series trends WNW for about 2 km in the northern part of the field (N of the Belubula River); Sheahan-Grants lies 1 km to the S. No. 259 on Bathurst metallogenic map.

OREBODIES:
Junction Reefs (Sheahan-Grants) (D), Frenchmans-Cornishmans, Glendale, Prince Of Wales, Sheahan-Grants

MINES:
Frenchmans, Frenchmans-Cornishmens, Glendale-Glendale North, Grants, Sheahan, Sheahan-Grants, Sulphide (Cornishmens)

GROUP: Orange Group

COMMENTS:
See Deposit No.30 BROWNS CREEK for regional setting of Molong-South Coast Anticlinorial Zone (N) and Orange group.

LOCATION:

LATITUDE: 33 38 LONGITUDE: 148 59
250K SHEET: SI55 8 100K SHEET: 8630

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Orange
LOCAL GOVERNMENT AREA (LGA): Blayney

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD	COMMENTS
1871		Date approximate
1980		Extension To Known Mineralisation
1980	Drilling	
1980	Geochemistry	

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Frenchmans-Cornishmans	Frenchmans	Historical	Underground
Frenchmans-Cornishmans	Frenchmans	Historical	Open-Cut
Frenchmans-Cornishmans	Sulphide (Cornishmens)	Historical	Underground
Frenchmans-Cornishmans	Sulphide (Cornishmens)	Historical	Open-Cut
Frenchmans-Cornishmans	Frenchmans-Cornishmens	Possible	Open-Cut
Glendale	Glendale-Glendale North	Possible	Open-Cut
Sheahan-Grants	Sheahan	Historical	Underground
Sheahan-Grants	Sheahan	Historical	Open-Cut
Sheahan-Grants	Grants	Historical	Underground
Sheahan-Grants	Grants	Historical	Open-Cut
Sheahan-Grants	Sheahan-Grants	Operating	Open-Cut

COMPANIES:

OREBODY: Frenchmans-Cornishmans

PRESENT OPERATORS:
Climax Mining Limited

PRESENT OWNERS:	EQUITY%
Climax Mining Limited	50.00

Cyprus Minerals Australia Co.	50.00

OREBODY: Glendale

PRESENT OPERATORS:
Cyprus Minerals Australia Co.

PRESENT OWNERS:	EQUITY%
Climax Mining Limited	50.00
Cyprus Minerals Australia Co.	50.00

OREBODY: Sheahan-Grants

PRESENT OPERATORS:
Climax Mining Limited

PRESENT OWNERS:	EQUITY%
Cyprus Gold Australia Corporation	50.00
Climax Mining Limited	50.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 1,680
Average recovered grade (to 1964) 12.2 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

YEAR	PRODUCTION
1988	1,079

MAIN PRODUCTION PERIODS: (1886-1902), 1903-1938, 1988-,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION			
Sept 1988	328	2.4	787	Economic Demonstrated (Measured)	Recoverable	o/c	Sheahan-Grants, oxide ore
Sept 1988	876	3.2	2,803	Economic Demonstrated (Measured)	Recoverable	u/g	Sheahan-Grants, sulphide ore
Mar 1989	460	3.7	1,702	Subeconomic Demonstrated	In-Situ	o/c	Frenchmans, Cornishmens
Sept 1988	1,300	2.0	2,600	Subeconomic Demonstrated	In-Situ	o/c	Glendale, Glendale North
Sept 1988	300	2.0	600	Subeconomic Inferred	In-Situ	o/c	Glendale East, Prince of Wales

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Molong-South Coast Anticlinorial Zone(N)
SUB-PROVINCE: Molong Anticlinorium

HOST ROCKS:

FORMATION NAME & AGE: Malongulli Formation - Middle Ordovician
LITHOLOGY: Tuffaceous siltstone, sandstone, shale, chert, minor andesite, agglomerate, calcareous beds.
RELATIONSHIP TO MINERALISATION: Mineralisation occurs in stratiform calc-silicate sulphide interbeds in laminated siliceous sediments.

FORMATION NAME & AGE: Unnamed - Middle Devonian
LITHOLOGY: Andesitic intrusives and/or extrusives.
RELATIONSHIP TO MINERALISATION: Dykes, sills and/or flows occupy network of fractures and joints in host sequence.

FORMATION NAME & AGE: Unnamed - Middle Devonian
LITHOLOGY: Diorite.
RELATIONSHIP TO MINERALISATION: Intrudes host formation adjacent to deposit.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Clastic Sedimentary, Volcanogenic Sedimentary

STRUCTURAL FEATURES:

MAJOR: Faulting, Fracturing,
SIGNIFICANT: Fold Axis

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

SIGNIFICANT: Fault/Fault, Stratigraphic Boundary

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Diorite), Volcanism (Intermediate)

METAMORPHISM:

Regional metamorphic grade is albite-epidote hornfels.
Locally, metamorphic grade increases towards the diorite intrusive along the Marungulla Fault.

ALTERATION:

OREBODY: Junction Reefs (Sheahan-Grants) (D)
PRINCIPAL SOURCES: Wilson (1965), Stevens (1972b, 1975), Overton (1986).

Wilson (1965) distinguished a low-grade regional metamorphic effect from an alteration effect associated with the diorite intrusion.
He stated: 'the metamorphism was essentially thermal and the fine-grained sediments have been converted to .. quartz-plagioclase-mica -amphibole hornfels', and that the mineralised beds were highly altered rocks comprised of varying amounts of actinolite, quartz, calcite, chlorite, epidote, diopside, plagioclase and colourless ?mica.
The alteration extended beyond the mineralised zone, and was identifiable by a a progressive darkening of the rock and textural changes.
Stevens (1972b) recorded wall rock alteration as propylitic, but seemed to imply (Stevens, 1975) that Wilson's (1965) alteration assemblage was a product of low-grade regional metamorphism.
Overton (1986) stated that no alteration assemblage had been recognised.

DEPOSIT CHARACTERISTICS:

TYPES:

MAJOR: Gold in stratiform calc-silicate sulphides in intermediate volcanogenic sediments adjacent to intermediate intrusives.

STYLE:

MAJOR: Conformable, Stratabound, Stratiform

MORPHOLOGY: Tabular

AGE OF MINERALISATION: Palaeozoic Middle Devonian, Palaeozoic Middle Ordovician

DIMENSIONS/ORIENTATION:

OREBODY: Junction Reefs (Sheahan-Grants) (D)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			400.0
TRUE WIDTH	(m)			150.0
DEPTH OXIDATION	(m)		10.0	
		ANGLE (deg.)		DIRECTION
DIP		16-20		NW
STRIKE		045		

ORE TEXTURE:

Disseminated, Free Milling, Massive

NATURE OF MINERALISATION:

PRIMARY ORE: Bed

MINERALOGY:

OREBODY: Junction Reefs (Sheahan-Grants) (D)
PRINCIPAL SOURCES: Wilson (1965), Stevens (1972b), Markham (1982), Overton (1986).

Sulphide ore: pyrrhotite, pyrite, arsenopyrite, (chalcopyrite

bismuthinite, marcasite, cubanite, covellite, gold, silver).
Sulphides make up 10-20% of the ore beds in the ore zone. Pyrrhotite predominates; other sulphides total 0.5-1.5% (Overton, 1986).
The following assemblages have been identified (Wilson, 1965):-
i) arsenopyrite-pyrite-chalcopyrite-gold,
ii) pyrrhotite-arsenopyrite-chalcopyrite-bismuthinite-gold,
iii) pyrrhotite-marcasite-gold.

Gold occurs as free fine grains (not within the lattice) averaging 10-20 (-55 historical) microns in diameter. Some gold is included in pyrrhotite, and in association with arsenopyrite and bismuthinite (Wilson, 1965). Silver content is variable up to 5 g/t Ag.

Oxide ore: calc-silicates destroyed; copper oxides abundant; sulphide cores are rimmed by goethite (Overton, 1986).

Gangue: largely quartz-calcite, also stilpnomelane, variable clinopyroxene (hedenbergite), amphibole (actinolite), wollastonite, epidote, plagioclase. The zeolite thompsonite has also been recorded.

Gold grades are lognormally distributed, falling off from high grade cores of ore zones to lower grade fringes (Overton, 1986).
Gold grades are the same in sulphide and oxide zones (Overton, 1986).

CONTROLS OF MINERALISATION:

PRINCIPAL SOURCES: Henderson (1953), Wilson (1965), Stevens (1975).

In the epigenetic model (see 'GENETIC MODELS'), controls are i) structural, provided by faulting and fault intersections, which controlled diorite intrusion; and ii) chemical, provided by tuffaceous, calcareous and carbonaceous lithologies which were susceptible to hydrothermal alteration and replacement by sulphide minerals.

In the syngenetic model, chemical control, provided by lateral and vertical facies changes, would have been most important; faulting and intrusion may have only been modifying factors.

GENETIC MODELS:

PRINCIPAL SOURCES: Henderson (1953), Wilson (1965), Stevens (1975).

Henderson (1953) and Wilson (1965) postulated an epigenetic replacement origin in which gold was derived from intermediate intrusives and localised in faulted areas by reaction with carbonate-rich host rocks.
Stevens (1975) however points to the occurrence of mineralisation within certain sedimentary layers with intervening barren layers and the lack of apparent disconformable mineralisation (except for thin veneers in faults) and suggests that a syngenetic origin should not be ruled out: sulphides and gold derived from andesitic volcanism could have been deposited into sediments of the sea floor, changes in physical and chemical conditions resulting in alternating deposition and non-deposition.
The volcanics may be related to the intermediate intrusives (Stevens, 1975).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Junction Reefs (Sheahan-Grants) (D)

PRINCIPAL SOURCES: Henderson (1953), Wilson (1965), Stevens (1972a,b), Markham & Basden (1974), Stevens (1975), Paterson & Bowman (1977), Markham (1982), Climax Mining Ltd (1986), Overton (1986), Macdonald (1987).
SUMMARY

The Junction Reefs field lies in the central part of the Molong Anticlinorium near the axis of the Molong-South Coast Anticlinorial Zone (N). Mineralisation occurs in stratiform sulphide-rich calc-silicate interbeds within a laminated sequence of altered volcanogenic shale-siltstone-sandstone of the Middle Ordovician Malongulli Formation.

REGIONAL SUCCESSION: JUNCTION REEFS (SHEAHAN-GRANTS)
PRINCIPAL SOURCES: Stevens (1972a), Paterson & Bowman (1977).

1./ Abercrombie Beds (Oab on Bathurst metallogenic map) (Early-Late Ordovician) - grey and black slate, quartz greywacke, siltstone.
The Abercrombie Beds are part of a flysch wedge complex which was deposited to the E of the Molong Volcanic Arc on the Monaro Slope and Basin, contemporaneously with the andesitic volcanism of the arc (Paterson & Bowman, 1977).
In the Junction Reefs area the Abercrombie Beds are overlain by volcanics of the Walli Andesite; elsewhere they pass laterally into Malongulli Formation and Angullong Tuff (Paterson & Bowman, 1977).

2./ Walli Andesite (Owa, also Omp (Paterson & Bowman, 1977)) (Early Ordovician) (600 m thick) - porphyritic andesite and tuff, minor interbedded volcanically derived sediments.
3./ Malongulli Formation (Omf) (Middle Ordovician) (2000 m) - siltstone, sandstone, shale, and chert, mostly tuffaceous, with minor intercalated andesitic flows, tuffs, agglomerate and calcareous beds. The high feldspathic component of the sediments is taken to indicate an andesitic volcanic source (Stevens, 1975). Malongulli Formation is host to the gold mineralisation at Junction Reefs. Conformably overlain by:-
4./ Angullong Tuff (Oat) (Late Ordovician) (9000 m) - andesitic lavas, tuffs and interbedded volcanically derived sediments.
The volcanics have shoshonitic affinities (Overton, 1986) and represent island arc volcanism of the Molong Volcanic Arc (Stevens, 1975).
5./ Panuara Group (Sp) (Middle Silurian on Bathurst metallogenic map; Early Silurian in Paterson & Bowman, 1977) (600 m thick) - shale, quartzofeldspathic sandstone, limestone.
6./ Intrusive and extrusive intermediate rocks (Middle Devonian) -
i) numerous small bodies of generally intermediate composition have intruded the Ordovician and Silurian rocks. Compositions are mainly diorite/quartz diorite, microdiorite, monzonite, and syenite.
Chivas (1975, reported by Paterson & Bowman, 1977) grouped the intrusions into three associations: a shoshonitic suite of mainly monzonites and syenites, a calc-alkaline suite represented by dacites and diorites, and a mafic suite including gabbros and dolerites.
Emplacement of the stock-like intrusions was apparently structurally controlled (Paterson & Bowman, 1977).
The intermediate stocks show an apparent compositional distribution: in the Junction Reefs area calc-alkaline intrusives predominate, whereas shoshonitic intrusives are dominant E of a NW-trending line 4 km to the E of Junction Reefs (Chivas, 1975, reported by Paterson & Bowman, 1977). The distribution pattern may reflect eastwards migration of volcanic activity (Paterson & Bowman, 1977).
Large diorite stocks occur immediately N, NE, and S (S of the Marungulla Fault) of the Junction Reefs deposit. The northerly body was described by Wilson (1965) as hornblende granodiorite.
ii) a suite of andesite dykes, sills (Wilson, 1965), and/or flows (Stevens, 1975) is well developed across the centre of the field, the intrusive bodies occupying a network of fractures and joints. Wilson (1965) identified three phases of intrusion. The more-or-less conformable bodies may include flows and sills (Stevens, 1975), and vary in thickness from a few centimetres to 100 m (Henderson, 1953). The dioritic bodies have similar chemistry to the Ordovician volcanics and are probably related to andesitic lavas within the Angullong Tuff (Overton, 1986).

GEOLOGICAL SETTING: JUNCTION REEFS (SHEAHAN-GRANTS)
PRINCIPAL SOURCES: Henderson (1953), Wilson (1965), Stevens (1975), Markham (1982), Overton (1986).

The field lies on the nose and towards the eastern limb of a shallowly N-pitching syncline. Strata dip @ 10-25 deg NW.
The rocks are extensively fractured and faulted. The layered sequence including the ore beds is terminated to the W by a major N-S fault, the Marungulla Fault; movement on the fault was apparently W block down by either 170 or 230 m (Henderson, 1953), bringing a complex of microdiorite intrusive rocks into contact with the ore bed series (Wilson, 1965).
The Belubula Fault strikes WNW across the centre of the field; displacement was apparently S block down 180 m (Henderson, 1953).
The Sulphide-Frenchmans ore beds may be a fault repetition of the Sheahan-Grants series (Wilson, 1965).
The ore horizons are disrupted by subvertical NE-trending faults, several of which have associated diorite intrusives, with displacements of up to 20 m (Overton, 1986).

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Henderson (1953), Wilson (1965), Stevens (1975), Markham (1982), Overton (1986).

Mineralisation occurs in a number of discrete sedimentary horizons near the top of the Malongulli Formaton. Eighteen separate horizons - termed 'ore beds' - with an aggregate thickness of 17 m occur within a stratigraphic interval of 40 m (Henderson, 1953).
The mine sequence consists of a series of finely laminated siliceous sediments - siltstone, carbonaceous shale, fine sandstone, and chert - with intercalated calc-silicate horizons, the ore beds. The ore beds range from 0.5-6.0 m thick, and show lateral thickness variations.
The eight main ore bed horizons are individually named and have been correlated across the field. In current terminology the M,N,O,Q,R, and S subdivisions correspond in part with the historical units 'basal 4-foot bed'; '11-foot bed'; etc. (Overton, 1986).

Ore occurs in forms ranging from coarse-grained massive sulphide aggregates associated with varying amounts of carbonate-quartz gangue in areas of most intense mineralisation, through to irregular bands and rounded aggregates of medium to coarse-grained sulphides, and to sparse disseminations and fine-grained fracture-fillings (Markham, 1982).

Current mining operations are based on the relatively low-grade gold halo around and down dip of the extensively worked old high-grade Grants open-cut and Sheahan scraping (Overton, 1986).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Climax Mining Ltd, 1986
The Sheahan-Grants gold deposit, Junction Reefs.
New South Wales. Department of Mineral Resources. Minfo
14 P1-4

Henderson Q.J., 1953
The Junction Reef goldfield, Mandurama. IN Edwards A.B.(ed) - Geology of Australian ore deposits. 5th Empire Mining & Metallurgical Congress, Australia & New Zealand, 1953, Melbourne.
AusIMM
1 P935-940

Macdonald D., 1987
The Sheahan Grants mine.
Gold Gazette
2(18) P17-22

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Overton R., 1986
The Sheahan-Grants gold deposit at Junction Reefs. IN Geological setting of precious metals in New South Wales. One-day symposium, Sydney, October 1986. Abstracts.
Geological Society of Australia
18

Paterson I.B.L., Bowman H.N., 1977
Mineralization in the Carcoar-Junction Reefs-Forest Rocks area.
Geological Survey of New South Wales. Report
GS1977/271

Stevens B., 1972
Bathurst, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-08, 1st edition.
Geological Survey of New South Wales
1v

Stevens B.P.J., 1972
Mine data sheets to accompany Bathurst, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-08.
Geological Survey of New South Wales
1v

Stevens B.P.J., 1975
A metallogenic study of the Bathurst 1:250 000 sheet. Sheet SI 55-08.
Geological Survey of New South Wales
1v

Wilson G.I., 1965
Gold deposits of Junction Reefs, Mandurama. IN McAndrew J.(ed) - Geology of Australian ore deposits. 8th Commonwealth Mining & Metallurgical Congress, Australia & New Zealand, 1965, Melbourne.
AusIMM
1 P420-422

oooooooooooooooooooooooooooooooooooooo

DEPOSIT: 33 MOUNT McDONALD

DEPOSIT IDENTIFICATION:

COMMODITIES: Au

DISTRIBUTION:
Record covers a series of vein deposits along 3 km N-S line of lode. Nos. 389-393 on Bathurst metallogenic map.

OREBODIES:
Mount McDonald (D), Balmoral, Caledonian, Eureka, Grants Amalgamated, Olivers Freehold

MINES:
Balmoral, Balmoral West, Bobby Burns, Caledonia Reform, Caledonian, Cash & Party, Domimish & Frazer, Eureka, Fergussons, Fifield & Mullen, Franklin & Party, Frazer, Grants Amalgamated, Great Eastern, Kennedy & Cash, Long & Party, Olivers Freehold, Queen Of The Mount, Shamrock, Webb & Party, Woolston & Co, Zulu

GROUP: Orange Group

COMMENTS:
See Deposit No.30 BROWNS CREEK for regional setting of Molong-South Coast Anticlinorial Zone (N) and Orange group.

LOCATION:

LATITUDE: 33 55 LONGITUDE: 148 57
250K SHEET: SI55 8 100K SHEET: 8630

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Orange
LOCAL GOVERNMENT AREA (LGA): Blayney

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1880	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Balmoral	Balmoral	Historical	Underground
Balmoral	Balmoral West	Historical	Open-Cut
Balmoral	Bobby Burns	Historical	Open-Cut
Balmoral	Webb & Party	Historical	Open-Cut
Caledonian	Great Eastern	Historical	Underground
Caledonian	Great Eastern	Historical	Open-Cut
Caledonian	Shamrock	Historical	Underground
Caledonian	Shamrock	Historical	Open-Cut
Caledonian	Caledonian	Historical	Underground
Caledonian	Caledonian	Historical	Open-Cut
Caledonian	Caledonia Reform	Historical	Underground
Caledonian	Caledonia Reform	Historical	Open-Cut
Caledonian	Woolston & Co	Historical	Underground
Caledonian	Woolston & Co	Historical	Open-Cut
Caledonian	Fergussons	Historical	Underground
Caledonian	Fergussons	Historical	Open-Cut
Caledonian	Long & Party	Historical	Underground
Caledonian	Long & Party	Historical	Open-Cut
Caledonian	Zulu	Historical	Underground
Caledonian	Zulu	Historical	Open-Cut
Eureka	Eureka	Historical	Underground
Eureka	Eureka	Historical	Open-Cut
Eureka	Cash & Party	Historical	Underground
Eureka	Cash & Party	Historical	Open-Cut
Eureka	Frazer	Historical	Underground
Eureka	Frazer	Historical	Open-Cut
Eureka	Domimish & Frazer	Historical	Underground
Eureka	Domimish & Frazer	Historical	Open-Cut

Eureka	Fifield & Mullen	Historical	Underground
Eureka	Fifield & Mullen	Historical	Open-Cut
Grants Amalgamated	Grants Amalgamated	Historical	Underground
Grants Amalgamated	Queen Of The Mount	Historical	Underground
Grants Amalgamated	Kennedy & Cash	Historical	Underground
Grants Amalgamated	Franklin & Party	Historical	Underground
Olivers Freehold	Olivers Freehold	Historical	Underground
Olivers Freehold	Olivers Freehold	Historical	Surface

COMPANIES:

OREBODY: Mount McDonald (D)

PRESENT OWNERS:	EQUITY%
Barrier Shelf (65) Pty Ltd	100.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 1,698
Average recovered grade 22g/t Au, locally 56 g/t Au. 1,698
Average recovered grade 22 g/t Au, locally 56 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: 1881-1916,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Molong-South Coast Anticlinorial Zone(N)
SUB-PROVINCE: Molong Anticlinorium

HOST ROCKS:

FORMATION NAME & AGE: Abercrombie Beds - Early Ordovician
LITHOLOGY: Grey and black slate, shale, quartz greywacke.
RELATIONSHIP TO MINERALISATION: Mineralisation occurred in apparently stratabound veins in siliceous sediments.

FORMATION NAME & AGE: Wyangala Batholith -?Early Silurian-Early Devonian
LITHOLOGY: Granite.
RELATIONSHIP TO MINERALISATION: Intrudes host sediments adjacent to deposit.

FORMATION NAME & AGE: Walli Andesite (Rothery Tuff) - Early Ordovician
LITHOLOGY: Andesitic tuff, minor lavas, sediments.
RELATIONSHIP TO MINERALISATION: Overlies host formation; ?genetically related to mineralisation.

GEOCHRONOLOGY:

Wyangala Batholith dated at 390 my i.e Early Devonian, in Goulburn sheet area to the S (Evernden & Richards, 1962, reported by Stevens, 1975). However Stevens (1975) notes that the age relates to a massive phase which most likely post-dated the foliated phases in the deposit region, which on the basis of intrusive relationships could be Early Silurian.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Clastic Sedimentary, Intrusive Contact

STRUCTURAL FEATURES:

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Granite),
SIGNIFICANT: Volcanism (Intermediate)

METAMORPHISM:
Sediments are contact metamorphosed to albite-epidote hornfels.

ALTERATION:

OREBODY: Mount McDonald (D)
Host slates are silicified; sandy sediments are altered to quartz-sericite rock (Stevens, 1972b).

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Auriferous quartz veins in metasediments adjacent to granitoid.

STYLE:

MAJOR: Stratabound

DIMENSIONS/ORIENTATION:

OREBODY: Mount McDonald (D)

		ANGLE (deg.)		DIRECTION
STRIKE		180		

OREBODY: Balmoral

		MIN	AVE	MAX
STRIKE LENGTH	(m)			66.0
VERTICAL DEPTH	(m)			33.0
		ANGLE (deg.)		DIRECTION
STRIKE		180		

OREBODY: Caledonian

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			46.0
		ANGLE (deg.)		DIRECTION
DIP		70-80		W
STRIKE		184		

OREBODY: Eureka

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			152.0
		ANGLE (deg.)		DIRECTION
DIP		85		W
PITCH				S
STRIKE		187		

OREBODY: Grants Amalgamated

		MIN	AVE	MAX
VERTICAL DEPTH	(m)	123.0		
		ANGLE (deg.)		DIRECTION
DIP		75-90		E,W
STRIKE		180		

ORE TEXTURE:
Disseminated

NATURE OF MINERALISATION:
PRIMARY ORE: Dissemination, Multiple Veins, Vein (Reef)

MINERALOGY:

OREBODY: Mount McDonald (D)
Sulphide zone: arsenopyrite, pyrite.
Gangue: quartz.

OREBODY: Balmoral
Sulphide zone: arsenopyrite, (pyrite). Arsenopyrite occurred as disseminated subhedral to euhedral grains (some interpenetrating grains) (Stevens, 1972b).
Gangue: quartz.

OREBODY: Grants Amalgamated
Sulphide zone: pyrite.

CONTROLS OF MINERALISATION:
Stratigraphic, and granite intrusion.

GENETIC MODELS:
PRINCIPAL SOURCES: Stevens (1975), Markham (1982).

Stevens (1975): 'the close spatial association suggests a genetic relationship between granite and mineralisation.'
Markham (1982) suggested that mineralisation may have been related to granite intrusion or alternatively was originally stratabound and related to early stage andesitic volcanism.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Mount McDonald (D)
PRINCIPAL SOURCES: Stevens (1972a,b), Markham & Basden (1974), Stevens (1975), Markham (1982).
SUMMARY

Mount McDonald lies in the southwestern part of the Molong Anticlinorium which forms the western branch of the Molong-South Coast Anticlinorial Zone (N). Mineralisation comprised a N-S trending line of apparently stratabound quartz vein deposits within Early Ordovician siliceous slate (Abercrombie Beds) adjacent to an intrusive contact with granite of the late-kinematic ?Early Silurian or Late Silurian-Early Devonian Wyangala Batholith.

GEOLOGICAL SETTING: MOUNT McDONALD
PRINCIPAL SOURCES: Stevens (1972a, 1975), Markham (1982).

The southern part of the Molong Anticlinorium (passing into the Cullarin Anticlinorium) consists of extensive belts of low grade metamorphosed flysch sediments - originally deposits of the Monaro Slope and Basin - intruded by concordant orogenic granite batholiths.

REGIONAL SUCCESSION: MOUNT McDONALD
PRINCIPAL SOURCES: Stevens (1972a), Markham (1982).

1./ Abercrombie Beds (Oab on Bathurst metallogenic map) (Ordovician) - folded and indurated black and grey slate, shale, and quartz greywacke. The Abercrombie Beds are host to gold mineralisation at Mount McDonald.
2./ Rothery Tuff (Early Ordovician) (maximum thickness 600 m) - dominantly andesitic tuffs with minor lavas and interbedded sediments. The unit forms the basal part of the Walli Andesite (Owa).
3./ Wyangala Batholith (gw) (?Early Silurian or Late Silurian-Early Devonian) - gneissic, concordant, poly-phase granite.
4./ Pine Mountain Granodiorite (gp) (Middle? Devonian) - intrudes the Abercrombie Beds N of Mount McDonald.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Stevens (1972b), Markham & Basden (1974), Stevens (1975), Markham (1982).

The gold deposits occurred in a narrow N-S belt of metasediments in an embayment in the northern boundary of the Wyangala Batholith.
Gold occurred in veins, veinlets and disseminations in siliceous slate.
Veins were apparently stratabound in form (Bowman & others, 1976, reported by Markham, 1982). No gold has been mined from the granite.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Bowman H.N., Richardson S.J., Hobbs J.J., 1976
The Walli-Woodstock disseminated copper district.
Geological Survey of New South Wales. Report
GS1976/330

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Stevens B., 1972

Bathurst, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-08, 1st edition.
Geological Survey of New South Wales
1v

Stevens B.P.J., 1972
Mine data sheets to accompany Bathurst, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-08.
Geological Survey of New South Wales
1v

Stevens B.P.J., 1975
A metallogenic study of the Bathurst 1:250 000 sheet. Sheet SI 55-08.
Geological Survey of New South Wales
1v

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 34 TRUNKEY CREEK

DEPOSIT IDENTIFICATION:

SYNONYMS: Trunkey

COMMODITIES: Au

DISTRIBUTION:
Record covers N-S belt of primary deposits 20 km x 5 km, N of the Abercrombie River, and alluvial/deep lead deposits associated with the Abercrombie River. Nos. 309, 400, 402, 404-425, 427-428 on Bathurst metallogenic map.

OREBODIES:
Trunkey Creek (D), Abercrombie River, American Star, Barratts, Betsys Flat, Chard & Arthurs, Colossal, Craiglea, Davies, Golden Point, Golden Wattle, Mastodon, Mount Dudley, Mount Nicholls, Mountain Run, Number Seven (Alma), Oakey Creek, Patience (Womans), Pine Ridge, Rob Roys, Rocky Bridge, Rose Of Australia, Scabben Flat, South Vanderbilt, Trunkey (Deep Lead), Wilsons, Wrights, Yellow Streak-Podgers, Young Australia

MINES:
Abercrombie River, Alexander, American Star, Bells, Benjamins, Bennetts, Black, Boltons, British Lion, Caledonian, Cartwrights, Cashs, Chard & Arthurs, City Of Sydney, Crouchers, Ducksburys (Jewellers Shop), Easdowns, East Pioneer, Electric Spark, Evans, Golden Wattle (Balmers), Gunnas Blow, Headricks, McKenzies, Mosquito, Mount Dudley, Mountain Run, Murphys, Murrays, Nobles, Number Five, Number Seven (Alma), Number Six, Oakey Creek, Pine Ridge (Hells Hole Or Omrah), Pioneer, Pioneer Whip, Prima Donna, Ranekies, Rocky Bridge, Schultzs, Tanners, The German Band, Thompsons, Trunkey, Turners, Wilsons, Wrenchs, Wrights, Yellow Streak, Young Australian (Queen Of Australia)

GROUP: Copperhania Thrust Group

COMMENTS:
Record includes regional setting of Trunkey Synclinorium and of Copperhania Thrust group. See Deposit No.42 HILL END-TAMBAROORA for regional setting and associated mineralisation of Hill End Synclinorial Zone.

LOCATION:

LATIDUDE: 33 49 LONGITUDE: 149 19
250K SHEET: SI55 8 100K SHEET: 8730

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Orange
LOCAL GOVERNMENT AREA (LGA): Blayney

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD	COMMENTS
1851	Prospecting	
1868		Reef

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Abercrombie River	Abercrombie River	Historical	Underground
American Star	Caledonian	Historical	Underground
American Star	Pioneer	Historical	Underground
American Star	Turners	Historical	Underground
American Star	City Of Sydney	Historical	Underground
American Star	Black	Historical	Underground
American Star	Crouchers	Historical	Underground
American Star	Easdowns	Historical	Underground
American Star	Electric Spark	Historical	Underground
American Star	American Star	Historical	Underground

American Star	Pioneer Whip	Historical	Underground
American Star	East Pioneer	Historical	Underground
Chard & Arthurs	The German Band	Historical	Underground
Chard & Arthurs	Cashs	Historical	Underground
Chard & Arthurs	British Lion	Historical	Underground
Chard & Arthurs	Chard & Arthurs	Historical	Underground
Chard & Arthurs	Bells	Historical	Underground
Chard & Arthurs	Bennetts	Historical	Underground
Golden Point	Thompsons	Historical	Underground
Golden Point	Evans	Historical	Underground
Golden Point	Nobles	Historical	Underground
Golden Point	Gunnas Blow	Historical	Underground
Golden Point	Mosquito	Historical	Underground
Golden Wattle	Golden Wattle (Balmers)	Historical	Underground
Mount Dudley	Mount Dudley	Historical	Underground
Mount Dudley	Mount Dudley	Historical	Open-Cut
Mountain Run	Mountain Run	..storical	Underground
Number Seven (Alma)	Alexander	Historical	Underground
Number Seven (Alma)	Number Seven (Alma)	Historical	Underground
Number Seven (Alma)	Boltons	Historical	Underground
Number Seven (Alma)	Ducksburys (Jewellers Shop)	Historical	Underground
Number Seven (Alma)	Ranekies	Historical	Underground
Number Seven (Alma)	Number Six	Historical	Underground
Number Seven (Alma)	Number Five	Historical	Underground
Number Seven (Alma)	Cartwrights	Historical	Underground
Number Seven (Alma)	Murphys	Historical	Underground
Oakey Creek	Oakey Creek	Historical	Underground
Pine Ridge	Pine Ridge (Hells Hole or Omrah)	Historical	Underground
Pine Ridge	Pine Ridge (Hells Hole or Omrah)	Historical	Open-Cut
Pine Ridge	Pine Ridge (Hells Hole or Omrah)	Historical	Surface
Rocky Bridge	Rocky Bridge	Historical	Underground
Trunkey (Deep Lead)	Trunkey	Historical	Underground
Wilsons	Wilsons	Historical	Underground
Wilsons	Prima Donna	Historical	Underground
Wilsons	Benjamins	Historical	Underground
Wilsons	Schultzs	Historical	Underground
Wilsons	Wrenchs	Historical	Underground
Wilsons	Murrays	Historical	Underground
Wrights	Wrights	Historical	Underground
Wrights	McKenzies	Historical	Underground
Yellow Streak-Podgers	Yellow Streak	Historical	Unknown
Young Australia	Young Australian (Queen Of Australia)	Historical	Underground
Young Australia	Headricks	Historical	Underground
Young Australia	Tanners	Historical	Underground

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 1,630
Average recovered grade 19 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1851-1874), 1875-1880, 1887-1908,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Hill End Synclinorial Zone
SUB-PROVINCE: Trunkey Synclinorium

HOST ROCKS:

FORMATION NAME & AGE: Campbells Group - ?Ordovician or Early Silurian
LITHOLOGY: Quartz greywacke, shale, slate.
RELATIONSHIP TO MINERALISATION: Host to major mineralisation of field in structurally controlled quartz veins in slates.

FORMATION NAME & AGE: Kildrummie Group - Middle-Late Silurian
LITHOLOGY: Felsic volcanics, limestone, conglomerate, shale, slate, greywacke.
RELATIONSHIP TO MINERALISATION: Host to some mineralisation of field in structurally controlled quartz veins in slates.

FORMATION NAME & AGE: Box Ridge Formation - Early Devonian
LITHOLOGY: Spilite, mudstone, tuff, slate.
RELATIONSHIP TO MINERALISATION: Two deposits (Mountain Run, Mount Dudley) occur in fault zones adjacent to mafic volcanics.

FORMATION NAME & AGE: Unnamed - Middle Devonian
LITHOLOGY: Intermediate porphyry.
RELATIONSHIP TO MINERALISATION: Occurs adjacent or proximal to many deposits.

FORMATION NAME & AGE: Unnamed -Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to deep lead and alluvial mineralisation.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Alluvium, Clastic Sedimentary

STRUCTURAL FEATURES:

MAJOR: Faulting,
SIGNIFICANT: Shearing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

SIGNIFICANT: Intrusive Contact

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Diorite),
SIGNIFICANT: Sub-Volcanism (Felsic Porphyry), Volcanism (Mafic)

METAMORPHISM:
Regional metamorphic grade is greenschist facies.

ALTERATION:

OREBODY: Trunkey Creek (D)
Diorite sill and spilitic volcanics are highly altered.

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Metamorphic auriferous quartz veins in flysch-type metasediments (slate/greywacke sequences); no granitoid rocks in proximity.
Alluvial.
SIGNIFICANT: Deep lead.
Auriferous quartz veins in metasediments adjacent to mafic volcanics.
Auriferous quartz veins in fault/shear zones.

STYLE:

MAJOR: Conformable, MINOR: Discordant

MORPHOLOGY: Irregular, Lenticular

AGE OF MINERALISATION: Palaeozoic Devonian

DIMENSIONS/ORIENTATION:

OREBODY: Trunkey Creek (D)

		MIN	AVE	MAX
TRUE WIDTH	(cm)	10.0	30.0	
VERTICAL DEPTH	(m)			185.0
DEPTH OXIDATION	(m)		25.0	
		ANGLE (deg.)		DIRECTION
DIP		75-90		W,E
STRIKE		345-010		

OREBODY: American Star

		MIN	AVE	MAX
STRIKE LENGTH	(m)			8.0
VERTICAL DEPTH	(m)			90.0

OREBODY: Chard & Arthurs

		MIN	AVE	MAX
STRIKE LENGTH	(m)			150.0
VERTICAL DEPTH	(m)			73.0
		ANGLE (deg.)		DIRECTION
DIP				W

OREBODY: Golden Point

		MIN	AVE	MAX
STRIKE LENGTH	(m)			60.0
VERTICAL DEPTH	(m)			20.0
		ANGLE (deg.)		DIRECTION
DIP		60		W
STRIKE		005		

OREBODY: Golden Wattle

		MIN	AVE	MAX
STRIKE LENGTH	(m)			8.0
VERTICAL DEPTH	(m)			18.0

OREBODY: Mount Dudley

		MIN	AVE	MAX
STRIKE LENGTH	(m)			100.0
VERTICAL DEPTH	(m)			90.0
		ANGLE (deg.)		DIRECTION
DIP		55		W
STRIKE		350		

OREBODY: Mountain Run

		MIN	AVE	MAX
TRUE WIDTH	(m)	6.0		18.0

OREBODY: Number Seven (Alma)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			54.0
VERTICAL DEPTH	(m)			98.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		W
STRIKE		015		

OREBODY: Pine Ridge

		MIN	AVE	MAX
TRUE WIDTH	(cm)			75.0
VERTICAL DEPTH	(m)			18.0
		ANGLE (deg.)		DIRECTION
DIP		30-45		S

OREBODY: Rocky Bridge

	ANGLE (deg.)	DIRECTION
STRIKE	060	

OREBODY: Wilsons

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			183.0
		ANGLE (deg.)		DIRECTION
DIP		80		E
STRIKE		010		

OREBODY: Wrights

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			43.0

OREBODY: Yellow Streak-Podgers

	ANGLE (deg.)	DIRECTION
DIP		W

ORE TEXTURE:

Disseminated

NATURE OF MINERALISATION:
PRIMARY ORE: Dissemination, Fault/Shear Filling, Stockwork, Vein (Reef)

SECONDARY ORE: Deep Lead, Detrital (Alluvial)

MINERALOGY:

OREBODY: Trunkey Creek (D)
Sulphide zone: gold, pyrite, (galena).
Gangue: white quartz. Slickensiding and shattered quartz indicates movement after vein emplacement (Stevens, 1975).

OREBODY: Chard & Arthurs
Sulphide zone: pyrite.

OREBODY: Mount Dudley
Some magnetite in quartz.

OREBODY: Pine Ridge
Sulphide zone: pyrite.

CONTROLS OF MINERALISATION:
Controls are largely structural, provided by bedding, cleavage and fault planes. Some control by proximity to mafic volcanics or intermediate porphyries. (Raggatt, 1934).

GENETIC MODELS:
1./ See 'GENETIC MODELS', Deposit No.42 HILL END-TAMBAROORA for discussion of structurally controlled auriferous quartz veins that are remote from any apparent igneous rocks.
2./ Association of some orebodies with mafic volcanics and mafic/intermediate dykes/sills suggests introduction of gold with the mafic/intermediate rocks (Stevens, 1975).
Volcanics and dykes may be related to formation of oceanic crust in the trough floor. (Stevens, op.cit; see also 'GENETIC MODELS', TUENA, Deposit No.35).
3./ Orebodies localised directly in major fault zones show no consistent host rock association. The faults are interpreted as deep-seated breaks extending down into the mantle, so that gold-bearing solutions from mantle regions could have access along them (Stevens, 1975).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Trunkey Creek (D)
PRINCIPAL SOURCES: Stevens (1972a,b), Felton (1974), Markham & Basden (1974), Stevens (1975), Felton (1977), Markham (1982).
SUMMARY

The Copperhania group of deposits comprises a long narrow belt of gold mineralisation that extends over 50 km in a faulted block - the Copperhania Thrust - along the western boundary of the southern section of the Hill End Synclinorial Zone. Trunkey Creek and TUENA (Deposit No. 35) were the principal centres of production.
Mineralisation at Trunkey Creek comprised both alluvial deposits which were associated with the Abercrombie River drainage system, accounting for 60-70% of production, and primary deposits, which were predominantly of the quartz vein-in-slate type. Some slate-hosted veins were close to spilitic volcanics; some primary deposits were in shear zones.

REGIONAL SETTING: TRUNKEY SYNCLINORIUM
PRINCIPAL SOURCES: Stevens (1972a), Felton (1974), Markham & Basden (1974), Stevens (1975).

The southern part of the Hill End Synclinorial Zone (S of the Bathurst Granite) consists of a complex series of narrow synclinoria separated by anticlinorial structures of the Molong-South Coast Anticlinorial Zone (N). The Copperhania group of deposits occurs in the Trunkey Synclinorium, which is the largest of the synclinorial structures.
In the Scheibner (1976) model, the Copperhania Thrust which bounds the synclinorial zone on the W, and the corresponding Wiagdon Fault (?Thrust) on the eastern margin, are considered to represent the sites of initial rifting of the Molong Volcanic Arc to form the Hill End Trough (Stevens, 1975). The thrust system was a zone of localised tension in the Silurian (Matson, 1975), resulting in the development of rift/graben structures peripheral to the opening marginal sea (Matson, op.cit). The thrust system was reactivated during the Tabberabberan Orogeny (Middle Devonian) when the trough sequence was folded and deformed (Stevens, 1975).

REGIONAL SUCCESSION AND ASSOCIATED MINERALISATION: TRUNKEY SYNCLINORIUM

PRINCIPAL SOURCES: Stevens (1972a), Felton (1974), Stevens (1975).

1./ Triangle Group (Q8L2 on Goulburn metallogenic map) (Middle-Late Ordovician) - shale, greywacke, subgreywacke, chert, minor tuff. Identical to rocks in adjacent Rockley Anticlinorium (which host disseminated gold mineralisation at LUCKY DRAW (Deposit No.36)).
2./ Campbells Group (Q8L1) (Early Silurian on Goulburn, Bathurst metallogenic maps, but possibly Ordovician (Stevens, 1975)) - quartz greywacke, shale, slate.
The Triangle and Campbells Groups represent flysch deposits of the Monaro Slope and Basin which were deformed in the Quidongan Orogeny (to Early Silurian) and form basement to the Siluro-Devonian trough sequences (Felton, 1974; Stevens, 1975).
The Campbells Group is uncomformably overlain by:-
3./ Kildrummie Group (B6L1) (Middle-Late Silurian) - dacitic and rhyolitic volcanics, tuff, limestone, conglomerate, shale, slate, greywacke.
The Campbells and Kildrummie Groups are the principal hosts to primary mineralisation in the Trunkey Creek and Tuena fields.
4./ Kangaloolah Volcanics (B6L2)(Middle-Late Silurian) - quartz-feldspar porphyry, rhyolite, dacite, minor feldspathic greywacke, shale, slate.
The basal portion of the Kildrummie Group and the Kangaloolah Volcanics may represent rift volcanism associated with early splitting in the southern part of the trough (Felton, 1974).
The volcanic units are overlain in most areas by sediments of:-
5./ Burraga Group (T6L1) (Early Devonian) - feldspathic greywacke, slate, dacite, spilite, tuff, mudstone.
In the Trunkey Synclinorium, rocks which may be lateral equivalents of the Burraga Group (Felton, 1974; Stevens, 1975) include considerable amounts of spilitic volcanics (Stevens, 1975) and are known as:-
6./ Box Ridge Formation (T6L2) (Early Devonian) - spilite, mudstone, tuff, slate.
The Box Ridge Formation is overlain by:-
7./ Unnamed sediments (probably Early-Middle Devonian) - slate, greywacke, minor conglomerate (Stevens, 1975).
8./ The gold belt region is distinctive in the abundance of elongate N-S trending unfoliated porphyries. At least one of the major bodies is an intrusive diorite sill (Chin, 1972, reported by Stevens, 1975) of probable Middle Devonian age (Felton, 1977), but some of the smaller bodies have been identified as greywacke bands within the Campbells and Kildrummie Groups (Chin, op.cit). Alternatively, the porphyries may represent folded and metamorphosed andesite flows (D.Royale & D.Hughes, reported by Markham & Basden, 1974).
The majority of deposits in the Trunkey field were reported to be close to contacts with porphyry bodies (Raggatt, 1934, reported by Markham, 1982).

GEOLOGICAL SETTING: COPPERHANIA GROUP
PRINCIPAL SOURCES: Stevens (1972b, 1975), Felton (1975, 1977).

The gold deposits of the Copperhania group occur in four associations:-
i) quartz veins in slates of the Campbells and Kildrummie Groups (most deposits of the Trunkey Creek field);
ii) quartz veins in slates adjacent to mafic volcanics (spilites) of the Box Ridge Formation (many in TUENA field; Mountain Run and Mount Dudley in Trunkey Creek field);
iii) quartz veins in slates associated with felsic porphyries (Markhams Hill and Peeks in TUENA field);
iv) quartz veins in fault/shear zones (Yellow Streak, Podgers, Craiglea, Patience, Mount Dudley and Mountain Run in Trunkey Creek field).

LOCAL SETTING: MINERALISATION (TRUNKEY CREEK)
PRINCIPAL SOURCES: Raggatt (1934, reported by Markham & Basden, 1974; Stevens, 1975; and Markham, 1982).

The majority of deposits strike parallel to the enclosing host which comprises thinly-bedded carbonaceous slates; most veins dip parallel to bedding (steep W) but some parallel cleavage (steep E) (Raggatt, 1934). Where the veins widened occasionally to form reefs or blows, gold values were concentrated in the wall rocks (Stevens, 1975).
The main line of workings - comprising Number Seven (Alma), American Star, Chard & Arthurs, and Golden Point - extended discontinuously over a strike length of 3 km (Stevens, 1975).
According to Raggatt (1934) the veins generally occurred within about 1 km of and parallel to western margins of the porphyries; the main line of workings follows the western contact of the diorite sill which is thought to overlie host slates uncomformably (Markham & Basden, 1974). However, the main line also includes deposits remote from porphyry (Markham & Basden, 1974).
At Yellow Streak veins passed downwards into porphyrite where they branched into narrow veinlets (Raggatt, 1934).
Mountain Run and Mount Dudley were adjacent to mafic or intermediate

volcanics (Markham & Basden, 1974).
Pine Ridge was hosted by altered spilitic basalt and deformed kaolinised slate (Stevens, 1975).
Reefs of type iv) above were lenticular, irregular bodies localised in shear zones (Stevens, 1975).

OREBODY: Abercrombie River
Alluvial gold was recovered from the Abercrombie River and from a number of tributaries which enter the river both from the N and the S.
The most productive section of the river itself was from downstream of Coolah to S of Pine Ridge, a distance of 5 km. The most productive tributary was Oakey Creek together with its tributaries (see OREBODY: Oakey Creek). (Raggatt, 1934, reported by Markham, 1982).
Creeks which traversed slate/phyllite terrain were more productive than those which traversed schistose felsic volcanic terrain.

OREBODY: Mount Dudley
Mineralisation was localised on a linear feature with occasional ironstone, probably a major strike fault (Stevens, 1975). Host rocks are slate and limestone close to a contact with schistose quartz porphyry and to mafic volcanics. The orebody had poorly defined walls. (Stevens, 1975).

OREBODY: Mountain Run
Mineralisation consisted of sheared and brecciated phyllite traversed by quartz veinlets and unbroken veinlets of ironstone, reputedly barren. Close to mafic volcanics. (Stevens, 1975).

OREBODY: Oakey Creek
The most productive of the tributaries of the Abercrombie River.
Alluvial gold was won from tributaries of Oakey Creek including Trunkey, Mulgunnia, Mountain Run (Copperhania) and Johnsons Creeks. (Markham, 1982).

OREBODY: Pine Ridge
Host lithologies are altered spilitic basalt, kaolinised deformed slate, crumpled phyllite, decomposed porphyrite (Stevens, 1972b, 1975).

OREBODY: Rocky Bridge
Yielded gold all the way upstream from the Abercrombie River, but was most productive between its junction with Black Hill Creek and along Colo Creek (Markham, 1982).

OREBODY: Yellow Streak-Podgers
Mineralisation consisted of irregular lenticular veins with small rich shoots localised in slate in a crush/shear zone related to a major fault (Stevens, 1975).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Felton E.A., 1974
Goulburn, New South Wales, 1:250 000 metallogenic map. Sheet SI/55-12, 1st edition.
Geological Survey of New South Wales
1v

Felton E.A., 1975
Part 1. Mine data sheets to accompany metallogenic map, Goulburn 1:250 000 sheet.
Geological Survey of New South Wales
1v

Felton E.A., 1977
Part 2. A metallogenic study of the Goulburn 1:250 000 sheet.
Geological Survey of New South Wales
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Matson C.R., 1975
Part 2. A metallogenic study of the Dubbo 1:250 000 sheet. Sheet SI 55-04.

Geological Survey of New South Wales
1v

Raggatt H.G., 1934
Trunkey-Tuena goldfield.
Geological Survey of New South Wales. Report
GS1934/004

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

Stevens B., 1972
Bathurst, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-08, 1st edition.
Geological Survey of New South Wales
1v

Stevens B.P.J., 1972
Mine data sheets to accompany Bathurst, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-08.
Geological Survey of New South Wales
1v

Stevens B.P.J., 1975
A metallogenic study of the Bathurst 1:250 000 sheet. Sheet SI 55-08.
Geological Survey of New South Wales
1v

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 35 TUENA

DEPOSIT IDENTIFICATION:

COMMODITIES: Au, Ag

DISTRIBUTION:
Record covers deposits grouped in 2 areas: a NNW belt 5 km long S of Tuena, and a NNW belt 5 km long 15 km further S. Nos. 29, 32-44, 47-61, 63-65 on Goulburn metallogenic map.

OREBODIES:
Tuena (D), Advance, Alexandria (Bald Ridge), City Of Sydney, Cooper & McKenzie, Garnet, Golden Dyke/Dyke, Hit or Miss, Lucky Hit (Amos), Markhams Hill-Peeks Reef, Nuggetty Gully, Phantom-Carlton-White, Red Flag, Royal George-Victoria, Royal Standard, Stockyard-Hidden Secret, Tuena Creek-Kangaloolah Creek, Washington

MINES:
Advance, Caledonian, Carlton, City Of Sydney, Cooper & McKenzie, Garnet, Hidden Secret (Johnsons), Kangaloolah Creek, Markhams Hill, Peeks Reef, Phantom, Royal George, Stockyard, Tuena Creek, Victoria, Washington, White

GROUP: Copperhania Thrust Group

COMMENTS:
See Deposit No.34 TRUNKEY CREEK for regional setting of Trunkey Synclinorium and of Copperhania group; Deposit No.42 HILL END-TAMBAROORA for regional setting and associated mineralisation of Hill End Synclinorial Zone.

LOCATION:

LATITUDE: 34 1	LONGITUDE: 149 20
250K SHEET: SI55 12	100K SHEET: 8729

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Orange
LOCAL GOVERNMENT AREA (LGA): Evans

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1851	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
City Of Sydney	City Of Sydney	Historical	Underground
Cooper & McKenzie	Cooper & McKenzie	Historical	Underground
Garnet	Garnet	Historical	Underground
Garnet	Advance	Historical	Underground
Markhams Hill-Peeks Reef	Markhams Hill	Historical	Underground
Markhams Hill-Peeks Reef	Markhams Hill	Historical	Surface
Markhams Hill-Peeks Reef	Peeks Reef	Historical	Underground
Markhams Hill-Peeks Reef	Peeks Reef	Historical	Surface
Phantom-Carlton-White	Caledonian	Historical	Underground
Phantom-Carlton-White	Caledonian	Historical	Surface
Phantom-Carlton-White	Carlton	Historical	Underground
Phantom-Carlton-White	Phantom	Historical	Underground
Phantom-Carlton-White	White	Historical	Underground
Royal George-Victoria	Victoria	Historical	Underground
Royal George-Victoria	Victoria	Historical	Open-Cut
Royal George-Victoria	Royal George	Historical	Underground
Stockyard-Hidden Secret	Stockyard	Historical	Underground
Stockyard-Hidden Secret	Hidden Secret (Johnsons)	Historical	Underground
Stockyard-Hidden Secret	Hidden Secret (Johnsons)	Historical	Surface
Tuena Creek-Kangaloolah Creek	Tuena Creek	Historical	Unknown
Tuena Creek-Kangaloolah Creek	Kangaloolah Creek	Historical	Unknown
Washington	Washington	Historical	Underground

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 1,383
Recovered grades highly variable, most within range 4-37 g/t Au, locally up to 183 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1851-1874), 1875-1909,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Hill End Synclinorial Zone
SUB-PROVINCE: Trunkey Synclinorium

HOST ROCKS:

FORMATION NAME & AGE: Campbells Group - ?Ordovician or Early Silurian
LITHOLOGY: Quartz greywacke, shale, slate.
RELATIONSHIP TO MINERALISATION: Host to some mineralisation of field in structurally controlled quartz veins in slates.

FORMATION NAME & AGE: Kildrummie Group - Middle-Late Silurian
LITHOLOGY: Felsic volcanics, limestone, conglomerate, shale, slate, greywacke.
RELATIONSHIP TO MINERALISATION: Host to major mineralisation of field in structurally controlled quartz veins in slates.

FORMATION NAME & AGE: Box Ridge Formation - Early Devonian
LITHOLOGY: Spilite, mudstone, tuff, slate.
RELATIONSHIP TO MINERALISATION: Adjacent to most slate-hosted vein deposits; host to some.

FORMATION NAME & AGE: Unnamed - Early Devonian
LITHOLOGY: Intermediate porphyry.
RELATIONSHIP TO MINERALISATION: Several deposits (Markhams Hill, Peeks, and others) are associated with felsic porphyries.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to alluvial deposits (Tuena Creek-Kangaloolah Creek).

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Alluvium, Clastic Sedimentary

STRUCTURAL FEATURES:

SIGNIFICANT: Faulting

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

MAJOR: Volcanism (Mafic),
SIGNIFICANT: Sub-Volcanism (Felsic Porphyry)

METAMORPHISM:

Regional metamorphic grade is greenschist facies.

ALTERATION:

OREBODY: Stockyard-Hidden Secret
Silicification of slate; chlorite developed in mafic tuff (Felton,1975).

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Metamorphic auriferous quartz veins in flysch-type metasediments (slate/greywacke sequences); no granitoid rocks in proximity.
Alluvial.
Auriferous quartz veins in metasediments adjacent to mafic volcanics.

STYLE:

SIGNIFICANT: Conformable

MORPHOLOGY: Lenticular

AGE OF MINERALISATION: Palaeozoic Devonian

DIMENSIONS/ORIENTATION:

OREBODY: Tuena (D)

		ANGLE (deg.)	DIRECTION
DIP			NE,SW
STRIKE		350	

OREBODY: Advance

		MIN	AVE	MAX
VERTICAL DEPTH	(m)	20.0		

OREBODY: City Of Sydney

		MIN	AVE	MAX
STRIKE LENGTH	(m)			89.0
TRUE WIDTH	(cm)	70.0		600.0
VERTICAL DEPTH	(m)			58.0
		ANGLE (deg.)		DIRECTION
STRIKE		180		W

OREBODY: Garnet

		MIN	AVE	MAX
STRIKE LENGTH	(m)			26.0
TRUE WIDTH	(cm)			40.0
VERTICAL DEPTH	(m)			45.0
		ANGLE (deg.)		DIRECTION
DIP				NE
STRIKE		135		

OREBODY: Markhams Hill-Peeks Reef

		MIN	AVE	MAX
STRIKE LENGTH	(m)			19.0
TRUE WIDTH	(cm)	30.0		200.0
VERTICAL DEPTH	(m)			6.0
		ANGLE (deg.)		DIRECTION
DIP		60-85		SW
STRIKE		330-345		

OREBODY: Phantom-Carlton-White

		MIN	AVE	MAX
STRIKE LENGTH	(m)	8.0	90.0	130.0
TRUE WIDTH	(cm)	30.0		600.0
VERTICAL DEPTH	(m)	5.0		76.0
		ANGLE (deg.)		DIRECTION
DIP		54,90;-		W;E
STRIKE		350-010		

OREBODY: Royal George-Victoria

		MIN	AVE	MAX
STRIKE LENGTH	(m)	26.0		66.0
VERTICAL DEPTH	(m)	26.0		33.0
		ANGLE (deg.)		DIRECTION
DIP		45		
STRIKE		330		

OREBODY: Stockyard-Hidden Secret

		MIN	AVE	MAX
STRIKE LENGTH	(m)			97.0
TRUE WIDTH	(cm)	10.0		30.0
VERTICAL DEPTH	(m)	19.0		97.0
		ANGLE (deg.)		DIRECTION
DIP		30		W-SW
STRIKE		320-360		

OREBODY: Washington

		MIN	AVE	MAX
STRIKE LENGTH	(m)			200.0
TRUE WIDTH	(cm)			100.0
VERTICAL DEPTH	(m)			63.0
		ANGLE (deg.)		DIRECTION
DIP		30		ENE
STRIKE		340		

ORE TEXTURE:
Disseminated

NATURE OF MINERALISATION:
PRIMARY ORE: Stockwork, Vein (Reef),
SECONDARY ORE: Deep Lead, Detrital (Alluvial)

MINERALOGY:

OREBODY: Tuena (D)
Sulphide zone: disseminated native gold, auriferous pyrite, (galena, stibnite, arsenopyrite) (Felton, 1975, 1977).
Felsic volcanic-associated veins: gold, pyrite, quartz, galena.
Mafic volcanic-associated veins: gold, pyrite, quartz, calcite.
(Felton, 1977).

OREBODY: City Of Sydney
Sulphide zone: pyrite, gold.
Gangue: quartz, calcite.
Pyrite occurs as euhedral crystals up to 5 mm diameter disseminated in the country rock, in crystalline form in cleavage-filling veinlets, and disseminated in quartz-calcite veinlets (Felton, 1977).

OREBODY: Markhams Hill-Peeks Reef
Sulphide zone: gold, pyrite, galena.
Gangue: quartz.

CONTROLS OF MINERALISATION:
Controls are i) structural, provided by cleavage and bedding planes;
ii) proximity to mafic volcanics; and to a lesser extent
iii) proximity to intermediate porphyries.

GENETIC MODELS:
Gold was probably introduced with the Box Ridge Formation spilitic volcanics and subsequently remobilised by porphyrite intrusion during Middle Devonian folding (Felton, 1977).
The volcanic rift environment and disseminated nature of some mineralisation associated with felsic volcanics suggests that a hot spring or fumarolic origin may be possible (Markham & Basden, 1974).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Tuena (D)
PRINCIPAL SOURCES: Felton (1974), Markham & Basden (1974), Felton (1975), Felton (1977).
SUMMARY

The Tuena field lies near the southern end of a belt of gold mineralisation which parallels the western margin of the Hill End Synclinorial Zone. A major thrust fault system - the Copperhania Thrust - coincides with the boundary in the deposit region.

See Deposit No.34 TRUNKEY CREEK, 'GEOLOGICAL SETTING OF MINERALISATION' for REGIONAL SETTING, REGIONAL SUCCESSION AND ASSOCIATED MINERALISATION: TRUNKEY SYNCLINORIUM and GEOLOGICAL SETTING: COPPERHANIA GROUP.

LOCAL SETTING: MINERALISATION (TUENA)
PRINCIPAL SOURCES: Felton (1974, 1977).

Both primary and Recent alluvial deposits were extensive in the field.

Primary mineralisation (Felton, 1977) comprised:-
i) gold-pyrite-quartz-galena veins in slate intruded by felsic

porphyries or interbedded with felsic volcanics (Markhams Hill, Peeks, and other orebodies).
ii) gold-pyrite-quartz-calcite veins in slate intruded by mafic rocks or interbedded with mafic volcanics (Box Ridge Formation) (City of Sydney, Lucky Hit, Red Flag, Stockyard, Hidden Secret and others).

Host lithologies are slate and phyllite, locally metasandstone, mafic tuff and andesitic tuff of the Campbells and Kildrummie Groups (Felton, 1974). Veins were narrow and discontinuous (Felton, 1977). Veins commonly parallelled slaty cleavage (strike 350 deg, dip vertical); others parallelled bedding and dipped moderately NE or SW (Felton, 1977).

OREBODY: City Of Sydney
Orebody was in chloritic slates and phyllites (?Campbells Group - Felton, 1974) adjacent to a contact with sheared mafic volcanics, probably tuffs, of the Box Ridge Formation (Felton, 1975).
Slates probably also contain fine mafic tuffaceous material (Felton, 1977).

OREBODY: Markhams Hill-Peeks Reef
Host lithologies are slate, phyllite (?Kildrummie Group - Felton, 1974), either intruded by felsic porphyries or interbedded with porphyritic felsic volcanics (Felton, 1977).

OREBODY: Phantom-Carlton-White
Host lithologies are andesitic tuff and slate (?Kildrummie Group).
Vein orientation is conformable with bedding. Ore occurred in localised bulges, i.e. reef is a true fissure-filling. (Felton, 1975).
Deep lead deposits occupied a channel 300-400m wide, 50 m deep (Felton, 1975).

OREBODY: Stockyard-Hidden Secret
Host lithologies are slate, claystone (Kildrummie Group) and mafic tuff (Box Ridge Formation) (Felton, 1974, 1975).
Mineralisation was localised in a fault zone at the contact between slate and mafic tuff (Felton, 1975).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Felton E.A., 1974
Goulburn, New South Wales, 1:250 000 metallogenic map. Sheet SI/55-12, 1st edition.
Geological Survey of New South Wales
1v

Felton E.A., 1975
Part 1. Mine data sheets to accompany metallogenic map, Goulburn 1:250 000 sheet.
Geological Survey of New South Wales
1v

Felton E.A., 1977
Part 2. A metallogenic study of the Goulburn 1:250 000 sheet.
Geological Survey of New South Wales
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Raggatt H.G., 1934
Trunkey-Tuena goldfield.
Geological Survey of New South Wales. Report
GS1934/004

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 36 LUCKY DRAW

DEPOSIT IDENTIFICATION:

SYNONYMS: Burraga

COMMODITIES: Au

DISTRIBUTION:

OREBODIES:
Lucky Draw (D), Northern, Southern, Western

MINES:
Lucky Draw

GROUP: -

COMMENTS:
See Deposit No.30 BROWNS CREEK for regional setting of Molong-South Coast Anticlinorial Zone (N),

LOCATION:

LATITUDE: 33 55	LONGITUDE: 149 34
250K SHEET: SI55 8	100K SHEET: 8830

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Orange
LOCAL GOVERNMENT AREA (LGA): Evans

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1985	Geology
1985	Geochemistry

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Lucky Draw (D)	Lucky Draw	Operating	Open-Cut

COMPANIES:

OREBODY: Lucky Draw (D)

PRESENT OPERATORS:
Renison Goldfields Consolidated Ltd

PRESENT OWNERS:	EQUITY%
Renison Goldfields Consolidated Ltd	100.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 0

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: 1989-,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION	
June 1988	140	3.5	490	Economic Inferred	Recoverable o/c

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Molong-South Coast Anticlinorial Zone(N)
SUB-PROVINCE: Rockley Anticlinorium

HOST ROCKS:

FORMATION NAME & AGE: Triangle Group - Middle-Late Ordovician
LITHOLOGY: Slate, greywacke.
RELATIONSHIP TO MINERALISATION: Mineralisation occurs in a tabular orebody comprising several pods of mineralised lenses in schistose rocks.

FORMATION NAME & AGE: Rockley Volcanics - Ordovician
LITHOLOGY: Andesite, basalt, sediments.
RELATIONSHIP TO MINERALISATION: Overlies mineralised schists immediately W of deposit.

FORMATION NAME & AGE: Thompsons Creek Granite - Middle-Late Carboniferous
LITHOLOGY: Granite.
RELATIONSHIP TO MINERALISATION: Intrudes mineralised schists immediately E of deposit.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Clastic Sedimentary

STRUCTURAL FEATURES:

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

SIGNIFICANT: Plutonism (Granite), Volcanism (Intermediate)

METAMORPHISM:
Regional metamorphic grade is greenschist facies.

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Disseminated gold in metasediments.

STYLE:

MAJOR: Stratabound

MORPHOLOGY: Tabular

DIMENSIONS/ORIENTATION:

OREBODY: Lucky Draw (D)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			250.0
TRUE WIDTH	(m)			150.0
VERTICAL DEPTH	(m)	40.0		80.0
DEPTH OXIDATION	(m)	30.0		40.0

ORE TEXTURE:

NATURE OF MINERALISATION:
PRIMARY ORE: Dissemination

MINERALOGY:

OREBODY: Lucky Draw (D)
Gold occurs as finely disseminated particles of native gold up to 0.1 mm diameter (Renison Goldfields Consolidated Ltd, 1988).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Lucky Draw (D)
PRINCIPAL SOURCES: Stevens (1972a, 1975), Renison Goldfields Consolidated Ltd (1988).
SUMMARY

Lucky Draw lies in the Rockley Anticlinorium in the eastern branch of the Molong-South Coast Anticlinorial Zone (N). Mineralisation is disseminated in lenses in finely laminated schistose sediments of the Ordovician Triangle Group.

GEOLOGICAL SETTING: LUCKY DRAW
PRINCIPAL SOURCES: Stevens (1972a, 1975).

In the deposit region, anticlinoria of the Molong-South Coast Anticlinorial Zone (N) interfinger with synclinoria of the Hill End Synclinorial Zone. Lucky Draw lies near the western margin of the Rockley Anticlinorium, adjacent to an unconformable boundary with the Trunkey Synclinorium, which makes up the major part of the southern section of Hill End Synclinorial Zone (the section of the zone S of the Bathurst Granite).

REGIONAL SUCCESSION: ROCKLEY ANTICLINORIUM
PRINCIPAL SOURCES: Stevens (1972a, 1975), Renison Goldfields Consolidated Ltd (1988).

1./ Triangle Group (Ot on Bathurst metallogenic map) (Middle-Late Ordovician) - finely laminated grey slate, quartz-rich and feldspathic greywacke. The formation is similar to and of equivalent age to the Abercrombie Beds in the Cullarin Anticlinorium in the western branch of the Molong-South Coast Anticlinorial Zone (N) to the W; and may represent a lateral extension of the deep water Monaro Slope and Basin environment of the Abercrombie Beds (Stevens, 1975).
The Triangle Group is host to the Lucky Draw gold deposit.
The Triangle Group is overlain by or grades laterally into:-
2./ Rockley Volcanics (Or) (Late Ordovician) - pyroxene and hornblende andesites, minor basalt, tuffs, pyroclastics, minor black slate, quartz greywacke.
The Rockley Volcanics represent submarine volcanism of the Molong Volcanic Arc, perhaps forming local highs at the margin of the Monaro Basin (Stevens, 1975). The unit crops out immediately W of Lucky Draw.

Both the Triangle Group and Rockley Volcanics are strongly folded.

The Rockley Volcanics or, where these are not present, the Triangle Group, are overlain ?conformably by:-
3./ Campbells Group (Skc) (Ordovician in Renison Goldfields Consolidated Ltd (1988); Early Silurian on Bathurst metallogenic map) - metamorphosed flysch sediments comprising finely laminated slate, and quartz-rich and feldspathic greywacke. The Campbells Group represents metamorphosed flysch complex of the Monaro Slope and Basin (Felton, 1974).
The Campbells Group overlies Rockley Volcanics W of Lucky Draw.
4./ Thompsons Creek Granite (g) (Middle-Late Carboniferous) - intrudes Triangle Group immediately E of the deposit.

Regional strike is N-S, dip 20-25 deg NW (Renison Goldfields Consolidated Ltd, 1988).

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Renison Goldfields Consolidated Ltd (1988).

The deposit is hosted by schistose rocks of the Triangle Group.
Mineralisation occurs in a tabular orebody comprising two main pods - Southern, Northern - built up of numerous mineralised lenses.
A smaller pod, Western, is separated from the main pods by a fault.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Felton E.A., 1974
Goulburn, New South Wales, 1:250 000 metallogenic map. Sheet SI/55-12, 1st edition.
Geological Survey of New South Wales
1v

Renison Goldfields Consolidate, 1988
Lucky Draw gold deposit, Burraga.
New South Wales. Department of Mineral Resources. Minfo
21

Stevens B., 1972
Bathurst, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-08, 1st edition.

Geological Survey of New South Wales
1v

Stevens B.P.J., 1975
A metallogenic study of the Bathurst 1:250 000 sheet. Sheet SI 55-08.
Geological Survey of New South Wales
1v

oooooooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 37 BODANGORA (MITCHELLS CREEK)

DEPOSIT IDENTIFICATION:

SYNONYMS: Mitchells Creek

COMMODITIES: Au

DISTRIBUTION:
No. 29 on Dubbo metallogenic map.

OREBODIES:
Bodangora (Mitchells Creek) (D), Mitchells Creek (Cluff Resources), Mitchells Creek (Kaiser)

MINES:
Kaiser, Mitchells Creek

GROUP: -

COMMENTS:
See Deposit No.30 BROWNS CREEK for regional setting of Molong-South Coast Anticlinorial Zone (N).

LOCATION:

LATITUDE: 32 27 LONGITUDE: 148 58
250K SHEET: SI55 4 100K SHEET: 8733

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Dubbo
LOCAL GOVERNMENT AREA (LGA): Wellington

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD	COMMENTS
1840		Possible

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Mitchells Creek (Cluff Resources)	Mitchells Creek	Operating	Tailings Re-Treatment
Mitchells Creek (Kaiser)	Kaiser	Possible	Open-Cut

COMPANIES:

OREBODY: Mitchells Creek (Cluff Resources)

PRESENT OPERATORS:
Cluff Resources Pacific Ltd.

PRESENT OWNERS:	EQUITY%
Cluff Resources Pacific Ltd.	100.00

OREBODY: Mitchells Creek (Kaiser)

PRESENT OPERATORS:
Compass Resources Nl

PRESENT OWNERS:	EQUITY%
Ajax Joinery Pty Ltd	8.00
Compass Resources NL	92.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 5,972

Average recovered grade (to 1964) approx. 19.9 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

YEAR	PRODUCTION	
1987	77	
1988	34	tailings re-treatment

MAIN PRODUCTION PERIODS: (1840-1868), 1869-1881, 1891-1917, 1986-,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION			
Dec 1988	270	1.5	405	Subeconomic Demonstrated	In-Situ	o/c	Mitchells Creek (Kaiser)

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Molong-South Coast Anticlinorial Zone(N)
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Mumbil Formation - Middle-Late Silurian
LITHOLOGY: Shale, limestone, chert, tuff.
RELATIONSHIP TO MINERALISATION: Shown as host formation on Dubbo metallogenic map. Mineralisation occurs in a transgressive quartz vein occupying a fault in thermally metamorphosed andesites and greywackes.

FORMATION NAME & AGE: Oakdale Formation - Ordovician?-Silurian
LITHOLOGY: Keratophyre, spilite, andesite, siltstone, limestone.
RELATIONSHIP TO MINERALISATION: Host formation according to Shackleton (1970).

FORMATION NAME $ AGE: Wuuluman Granite - ?Carboniferous
LITHOLOGY: Hornblende granite.
RELATIONSHIP TO MINERALISATION: Intrudes host sequence close to deposit. Possibly genetically related to mineralisation.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Intermediate Extrusive,
SIGNIFICANT: Volcanogenic Sedimentary

STRUCTURAL FEATURES:

MAJOR: Faulting

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Granite), Volcanism (Intermediate)

METAMORPHISM:

Sequence has been metamorphosed by granite intrusion to albite-epidote facies. Hornfels assemblage is pyroxene-amphibole-epidote-albite; hornblende hornfels also occurs. (Shackleton, 1970).

ALTERATION:

OREBODY: Bodangora (Mitchells Creek) (D)

Reef emplacement was accompanied by extensive alteration. Wall rock assemblages include quartz-sericite-carbonate (hanging wall), and pyritised calc-silicate rock containing quartz, sericite, carbonate, chlorite, diopside and disseminated pyrite (footwall) (Shackleton, 1970).

Altered andesite N of the deposit consists of albite phenocrysts in a groundmass of white mica and iron oxides (Shackleton, 1970). Silicification and late carbonate alteration are also indicated (Shackleton, 1970).

DEPOSIT CHARACTERISTICS:

TYPES:

MAJOR: Auriferous quartz veins in fault/shear zones.
Auriferous quartz veins in metasediments/intermediate metavolcanics adjacent to granitoid.

STYLE:

MAJOR: Discordant

AGE OF MINERALISATION: Palaeozoic Carboniferous

DIMENSIONS/ORIENTATION:

OREBODY: Bodangora (Mitchells Creek) (D)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			1067.0
TRUE WIDTH	(cm)	13.0		120.0
VERTICAL DEPTH	(m)			305.0
		ANGLE (deg.)		DIRECTION
DIP		45		E
PITCH		55		S
STRIKE		334-350		

ORE TEXTURE:

Disseminated, Refractory

NATURE OF MINERALISATION:

PRIMARY ORE: Fault/Shear Filling, Vein (Reef)

MINERALOGY:

OREBODY: Bodangora (Mitchells Creek) (D)

PRINCIPAL SOURCES: Sackleton (1970), Matson (1975a).

Sulphide zone: pyrite, chalcopyrite, sphalerite, galena, bornite, (tetrahedrite, tennantite, magnetite, ?telluride) (Matson, 1975a).
Oxide zone: hematite, limonite, chalcocite, covellite (Matson, 1975a).

Pyrite is subhedral to anhedral, disseminated, mostly brecciated and healed by quartz, calcite, and galena. Chalcopyrite is disseminated throughout quartz as grains and aggregates, and fills interstices and fractures in pyrite. Sphalerite is abundant and contains blebs of chalcopyrite. Galena occurs throughout quartz, replaces and heals pyrite and fills interstices in pyrite. Folded cleavage planes indicate post-depositional deformation. Bornite replaces chalcopyrite and sphalerite. Covellite forms reaction rims on chalcocite/bornite and chalcocite/chalcopyrite boundaries giving impression of forming before chalcocite. Tetrahedrite is not common but replaces pyrite, chalcopyrite and sphalerite as veins.
(Shackleton, 1970, summarised by Matson, 1975a).

Paragenesis:- i) introduction of barren quartz, ii) slight fracturing and possible deformation of quartz, iii) introduction of pyrite, iv) further deformation of quartz and pyrite, v) introduction of main ore minerals, vi) introduction of further gangue (quartz and minor calcite), vii) alteration of copper sulphides to chalcocite and covellite, viii) late-stage introduction of a little quartz.
(Shackleton, 1970, summarised by Matson, 1975a).

CONTROLS OF MINERALISATION:

Controls are i) strong structural, provided by major fault, and ii) proximity of granite intrusion.

GENETIC MODELS:

Shackleton (1970) considered the deposit to be a fissure vein of pyrometasomatic origin, deposited from fluids emanating from the Wuuluman Granite.
Shackleton (op.cit) determined the following paragenetic sequence:- i) introduction of barren quartz along plane of structural weakness - possibly an axial plane fault, ii) fracturing, iii) introduction of pyrite, iv) deformation, v) introduction of other sulphides ?accompanied by gold, vi) second stage introduction of quartz, vii) alteration, viii) late stage quartz. (Shackleton, 1970).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Bodangora (Mitchells Creek) (D)

PRINCIPAL SOURCES: Shackleton (1970), Matson (1973, 1975a,b), Markham (1982).

SUMMARY

Bodangora lies near the northern tip of the Molong Anticlinorium, which forms the main, western branch of the Molong-South Coast Anticlinorial Zone (N). Mineralisation comprises auriferous quartz veins occupying a major fault plane in altered and metamorphosed Ordovician-Silurian andesites and greywackes close to an intrusive contact with ?Carboniferous granite (Wuuluman Granite).

REGIONAL SUCCESSION: BODANGORA (MITCHELLS CREEK)

PRINCIPAL SOURCES: Matson (1973, 1975b).

The regional succession is a volcanic-greywacke(-limestone) association of the Ordovician-Silurian Molong Volcanic Arc (Matson, 1975b).
As shown on the Dubbo metallogenic map, the succession includes:-
1./ Ov (on Dubbo metallogenic map) (Ordovician) - andesitic flows, tuffs, conglomerate, agglomerate, siltstone, limestone.
2./ Oakdale Formation (Oo) (Ordovician) - keratophyre lava and tuff, spilite, andesite, siltstone, limestone.
3./ Mumbil Formation (Sm) (Middle-Late Silurian) - shale, limestone, chert, tuff.
4./ Gleneski Formation (Sg) (Middle-Late Silurian) - rhyolite and dacite tuffs and flows, shales, tuffaceous sandstone, limestone, quartz feldspar porphyry.
5./ Cuga Burga Volcanics (Dcb) (Early Devonian) - keratophyre and quartz keratophyre, lavas and tuffs, sediments and limestone.
The volcanic-sedimentary sequence is intruded by:-
6./ Wuuluman Granite (Cgw) (?Carboniferous) - Bathurst-type hornblende granite; pluton transgresses boundary between Hill End Synclinorial Zone and Molong-South Coast Anticlinorial Zone (N); occurs 5 km E of Bodangora (Mitchells Creek).

GEOLOGICAL SETTING: BODANGORA (MITCHELLS CREEK)

PRINCIPAL SOURCES: Shackleton (1970), Matson (1973).

Shackleton (1970) assigned the host sequence at Bodangora to the Ordovician?-Silurian Oakdale Formation; on the Dubbo metallogenic map the host formation is shown as Silurian Mumbil Formation.

Rock types in the deposit area are altered porphyritic andesite, amphibole hornfels, feldspathic arenite (greywacke), lithic andesite tuff, interbedded limestone (Shackleton, 1970).
The rocks are tightly folded with axial planes trending N-S, and extensively faulted (Shackleton, op.cit).

LOCAL SETTING: MINERALISATION

PRINCIPAL SOURCES: Shackleton (1970), Matson (1975a), Markham (1982).

Mineralisation consists of quartz vein fault-filling, plus secondary reefs in associated, probably splinter faults (eg. Dick's reef) (Shackleton, 1970).
There is also clear evidence of post-vein faulting (Markham, 1982).
The reefs occur within a zone of country rocks in which amphibole porphyryblasts have been developed, probably as a result of intrusion of the Wuuluman Granite, indicating close proximity of the batholith at depth (Shackleton, 1970).
Much of the quartz has slickensided surfaces; pitch of slickensides parallels reef axis, indicating that reef configuration is related to the direction of movement of the fault plane (Shackleton, 1970).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Matson C.R., 1973
Dubbo 1:250 000 metallogenic series map. Sheet SI 55-04, 1st edition.
Geological Survey of New South Wales
1v

Matson C.R., 1975

Part 1. Mine data sheets to accompany metallogenic map, Dubbo 1:250 000 sheet. Sheet SI 55-04.
Geological Survey of New South Wales
1v

Matson C.R., 1975
Part 2. A metallogenic study of the Dubbo 1:250 000 sheet. Sheet SI 55-04.
Geological Survey of New South Wales
1v

Shackleton W.G., 1967
The geology of the Bodangora area, central New South Wales. M.Sc. thesis.
University of Sydney. Unpublished
1v

Shackleton W.G., 1968
Minor pyrometasomatic mineralization in the Wuuluman Granite, central western New South Wales.
AusIMM. Proceedings
225 P11-14

Shackleton W.G., 1970
The geology and mineralization of the Mitchell's Creek or Bodangora gold mine, central western New South Wales.
AusIMM. Proceedings
235 P93-100

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 38 WELLINGTON

DEPOSIT IDENTIFICATION:

SYNONYMS: Macquarie River

COMMODITIES: Cu, Ag, Au, Pb, Zn, Ba

DISTRIBUTION:
Record covers 6 primary deposits 11-16km ESE Wellington, 3 deposits along SE margin of Wuuluman Granite 15-22km ENE Wellington, alluvial deposits along Macquarie R. mainly SE Wellington.Nos.100,111,112,116-18,122-24,126,8,9 on Dubbo metal.

OREBODIES:
Wellington (D), Bennetts, Commonwealth, Federal, Geenobby, Golden Note, Kellys Perseverance, King Dick, Lady Macquarie, Scotchmans, Stringers, Welcome Jack, Wellington Alluvials

MINES:
Bennetts (Welcome Irish), Commonwealth, Federal, Kellys Perseverance (Welcome Mick), King Dick, Lady Macquarie, Scotchmans, Stringers (Independent), Victoria. Welcome Jack, Wellington

GROUP: Wellington Group

COMMENTS:
Record includes regional setting of Nindethana Thrust System and Wellington group; see Deposit No.30 BROWNS CREEK for regional setting of Molong-South Coast Anticlinorial Zone (N).

LOCATION:

LATITUDE: 32 35 LONGITUDE: 149 4
250K SHEET: SI55 4 100K SHEET: 8732

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Dubbo
LOCAL GOVERNMENT AREA (LGA): Wellington

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD	COMMENTS
1892	Prospecting	
1901		Extension To Known Mineralisation

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Bennetts	Bennetts (Welcome Irish)	Historical	Underground
Bennetts	Bennetts (Welcome Irish)	Historical	Surface
Commonwealth	Commonwealth	Historical	Underground
Commonwealth	Commonwealth	Possible	Underground
Federal	Federal	Historical	Underground
Kellys Perseverance	Kellys Perseverance (Welcome Mick)	Historical	Underground
King Dick	King Dick	Historical	Underground
King Dick	King Dick	Historical	Surface
Lady Macquarie	Lady Macquarie	Historical	Dredging &/Or Sluicing
Scotchmans	Scotchmans	Historical	Underground
Scotchmans	Scotchmans	Historical	Surface
Stringers	Stringers (Independent)	Historical	Underground
Welcome Jack	Welcome Jack	Historical	Underground
Wellington Alluvials	Wellington	Historical	Dredging &/Or Sluicing
Wellington Alluvials	Wellington	Possible	Dredging &/Or Sluicing

COMPANIES:

OREBODY: Commonwealth

PRESENT OPERATORS:
Cluff Resources Pacific Ltd.

PRESENT OWNERS:	EQUITY%
Cluff Resources Pacific Ltd.	50.00
Jones Mining Ltd	50.00

OREBODY: Wellington Alluvials

PRESENT OPERATORS:
Cluff Resources Pacific Ltd.

PRESENT OWNERS:	EQUITY%
Cluff Resources Pacific Ltd.	50.00
Jones Mining Ltd	50.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 7,134
Recorded grade (primary ore) 21 g/t Au, individual orebodies: 61 g/t Au (Federal), 30 g/t Au (Kellys Perseverance), 9 g/t Au (Commonwealth); alluvial ore 0.26 g/cubic m Au, 0.35 g/cubic m Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1935-1937), 1901-1912, 1920-1930, 1938-1958, 1990-,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION			
Dec 1988	82	5.9	484	Subeconomic Demonstrated	In-Situ	u/g	Commonwealth
Dec 1988	10			Subeconomic Inferred	In-Situ	u/g	Commonwealth
Dec 1988	10,600	0.2	2,120	Subeconomic Inferred	In-Situ	all	Wellington alluvial; units: '000 cubic metres, g/cubic m

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Molong-South Coast Anticlinorial Zone(N)
SUB-PROVINCE: Nindethana Thrust System

HOST ROCKS:

FORMATION NAME & AGE: Gleneski Formation - Late Silurian
LITHOLOGY: Calc-alkaline volcanics, shale, tuffaceous sandstone, limestone, quartz feldspar porphyry.
RELATIONSHIP TO MINERALISATION: Host to stratabound volcanogenic massive sulphides at Commonwealth and Stringes, auriferous fault-filling at Welcome Jack, and quartz vein deposits at Scotchmans and possibly Kellys Perseverance.

FORMATION NAME & AGE: Mumbil Formation - Late Silurian
LITHOLOGY: Shale, limestone, chert, tuff.
RELATIONSHIP TO MINERALISATION: Host to quartz vein mineralisation at Bennetts; most other deposits of field are adjacent to contact with Mumbil Formation.

FORMATION NAME & AGE: Wuuluman Granite - ?Carboniferous
LITHOLOGY: Hornblende granite.
RELATIONSHIP TO MINERALISATION: Intrudes host Gleneski and Mumbil Formations and Merrions Tuff; spatially and ?genetically related to vein deposits at Kellys Perseverance, Federal and King Dick.

FORMATION NAME & AGE: Merrions Tuff - Early Devonian
LITHOLOGY: Tuff, dacite, slate.
RELATIONSHIP TO MINERALISATION: Host to vein mineralisation at King Dick.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to deep lead and alluvial

mineralisation.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Clastic Sedimentary, Felsic Extrusive,
SIGNIFICANT: Alluvium, Volcanogenic Sedimentary

STRUCTURAL FEATURES:

MAJOR: Faulting, Shearing,
SIGNIFICANT: Fold Axis

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

MAJOR: Stratigraphic Boundary

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Granite), Volcanism (Felsic),
SIGNIFICANT: Sub-Volcanism (Felsic Porphyry)

METAMORPHISM:
Regional metamorphic grade is greenschist facies.

ALTERATION:

OREBODY: Commonwealth
Silicification.

OREBODY: Welcome Jack
Silicification.

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Alluvial.
Auriferous quartz veins in fault/shear zones.
Auriferous stratabound volcanogenic massive base metal sulphides in felsic-intermediate volcanics.
SIGNIFICANT: Deep lead.
Auriferous quartz veins in felsic volcanics/volcanogenic sediments adjacent to granitoid.

STYLE:

MAJOR: Stratiform, SIGNIFICANT: Discordant

AGE OF MINERALISATION: Palaeozoic Carboniferous, Palaeozoic Late Silurian

DIMENSIONS/ORIENTATION:

OREBODY: Bennetts

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			16.0
		ANGLE (deg.)		DIRECTION
STRIKE		140		

OREBODY: Commonwealth

		MIN	AVE	MAX
STRIKE LENGTH	(m)			95.0
TRUE WIDTH	(m)			6.0
VERTICAL DEPTH	(m)			30.0
DEPTH OXIDATION	(m)	6.0		9.0

OREBODY: Federal

		MIN	AVE	MAX
STRIKE LENGTH	(m)			49.0
TRUE WIDTH	(cm)	30.0		90.0
VERTICAL DEPTH	(m)			52.0
DEPTH OXIDATION	(m)		15.0	
		ANGLE (deg.)		DIRECTION
DIP		75-90		E
STRIKE		180		

OREBODY: Kellys Perseverance

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			30.0
		ANGLE (deg.)		DIRECTION
DIP		50		NE,SW
STRIKE		315		

OREBODY: King Dick

		MIN	AVE	MAX
STRIKE LENGTH	(m)			183.0
VERTICAL DEPTH	(m)			27.0
		ANGLE (deg.)		DIRECTION
DIP		75		SE
STRIKE		330-360		

OREBODY: Scotchmans

		MIN	AVE	MAX
STRIKE LENGTH	(m)			61.0
TRUE WIDTH	(cm)			90.0
		ANGLE (deg.)		DIRECTION
DIP		60,80		W
STRIKE		150,160		

OREBODY: Stringers

	ANGLE (deg.)	DIRECTION
DIP	40	E
STRIKE	220	

OREBODY: Welcome Jack

		MIN	AVE	MAX
STRIKE LENGTH	(m)			91.0
VERTICAL DEPTH	(m)			43.0
		ANGLE (deg.)		DIRECTION
STRIKE		200		

OREBODY: Wellington Alluvials

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			26.0
DEPTH OF COVER	(m)	9.0		15.0
TRUE WIDTH	(m)	100.0		300.0
		ANGLE (deg.)		DIRECTION
STRIKE		135		

ORE TEXTURE:

Banded/Laminated, Massive

NATURE OF MINERALISATION:

PRIMARY ORE: Fault/Shear Filling, Vein (Reef),
SECONDARY ORE: Deep Lead, Detrital (Alluvial)

MINERALOGY:

OREBODY: Commonwealth
Sulphide zone, in order of abundance: pyrite, sphalerite, galena, chalcopyrite, (tetrahedrite, bournonite, gold).
Pyrite is the earliest formed sulphide (Matson, 1975a).
Later sulphides partially replace pyrite (Matson, 1975a).
Oxide zone: covellite.

OREBODY: Federal
Sulphide zone: pyrite, galena, chalcopyrite, sphalerite, (arsenopyrite).
Molybdenite occurs near granite N of the deposit (Matson, 1975a).

OREBODY: Kellys Perseverance
Sulphide zone: pyrite.
Gangue: quartz.

OREBODY: King Dick
Sulphide zone: gold, arsenopyrite.
Oxide zone: iron staining, ochre, clay.

OREBODY: Scotchmans
Sulphide zone: arsenopyrite.

OREBODY: Stringers
Sulphide zone: pyrite, galena, chalcopyrite, (sphalerite).
Oxide zone: malachite, azurite, (covellite).

CONTROLS OF MINERALISATION:
Controls are i) structural, provided by major faults of thrust system, ii) stratigraphic, provided by volcanic/sediment contact, and iii) proximity of granite intrusion.

GENETIC MODELS:
PRINCIPAL SOURCES: Bunny (1962), Jones (1962), and Shackleton (1968); all reported by Matson (1975b); Markham & Basden (1974), Matson (1975a,b).

'From the nature of the deposits and considering the geological history of the area, it would seem that there is more than one source of mineralisation' (Matson, 1975b).

Vein deposits at Kellys Perseverance, Federal, King Dick and possibly also Bennetts may have been either emplaced or remobilised by intrusion of the Wuuluman Granite (Matson, 1975b), as a result of permeation of granite-derived hydrothermal fluids along fracture systems.
Metals may have been derived from the andesite (Gleneski Formation), the granite acting as a source of heat or hydrothermal fluids (Markam & Basden, 1974).

Jones (1962) also favoured a granitic origin for the fault-filling at Welcome Jack, and for the stratabound massive sulphides at Stringers, the ?volcanic/sediment contact at both orebodies providing a locus for the precipitation of ?sulphides from mineralising solutions derived from the Wuuluman Granite (Matson, 1975a).

Shackleton (1968) proposed a granitic origin for the stratabound base metal sulphides at Commonwealth, which Bunny (1962) considered to be an epigenetic 'shear zone' deposit related to the Nindethana Thrust System (Matson, 1975a).

In the case of Scotchmans, Jones (1962) postulated that mineralisation was probably associated with regional metamorphism and differentiation rather than with granite intrusion. Alternatively, an origin associated with the quartz-feldspar porphyry and associated hydrothermal fluids may be postulated for Scotchmans (Matson, 1975b).

Matson (1975b) suggested a volcanogenic origin for the stratabound massive base metal sulphides at Commonwealth and Stringers.
In reviewing earlier theories of granitic origins (Jones, 1962; Bunny, 1962; Shackleton, 1968), Matson (op.cit) cited the following features of the deposits - tectonic setting (rifting, felsic volcanism), relative remoteness from the granite, nature of host rock, mineral assemblage, and banded nature of mineralisation - as being characteristic of the Kuroko volcanic exhalative zone of volcanogenic deposits (Matson, 1975b).

Tertiary deep leads and Recent alluvials were derived from both older deep leads and reef deposits (Matson, 1975a).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Wellington (D)
PRINCIPAL SOURCES: Matson (1973), Markham & Basden (1974), Matson (1975a,b), Markham (1982).
SUMMARY

Wellington lies in the northern part of the Molong Anticlinorium, near the eastern margin of the Molong-South Coast Anticlinorial Zone(N). The deposit region is a structurally complex region where a narrow belt of Silurian rocks of the anticlinorial zone - the Nindethana Thrust System - interfingers with Devonian sedimentary sequences of the adjacent Hill End Synclinorial Zone (Matson, 1973).
Gold deposits near Wellington include stratabound auriferous base metal sulphides, quartz veins in fault zones, quartz veins near stratigraphic contacts close to granite, and secondary alluvial deposits.
Host rocks are mainly calc-alkaline volcanics and to a lesser extent associated sediments of the Late Silurian Gleneski and Mumbil Formations.

GEOLOGICAL SETTING: NINDETHANA THRUST SYSTEM
PRINCIPAL SOURCES: Matson (1973, 1975b).

The Nindethana Thrust System is part of a major regional N-S zone of rifting and graben-like structures produced by tension in the Silurian along the boundary between the Molong Volcanic Arc and marginal seas of the Hill End Trough (Matson, 1975b).
The zone extends from E of Wellington southwards to Captains Flat, corresponding in part to the boundary between the Molong-South Coast Anticlinorial Zone (N) and Hill End Synclinorial Zone (Matson, 1975b).

The thrust system contains Silurian and Devonian sedimentary-volcanic associations in rift/graben structures in a geological environment comparable with that of the adjacent part of the Hill End Synclinorial Zone (Markham & Basden, 1974; Matson, 1975b).

REGIONAL SUCCESSION: NINDETHANA THRUST SYSTEM
PRINCIPAL SOURCES: Matson (1973, 1975b).

1./ Gleneski Formation (Sg on Dubbo metallogenic map) (Late Silurian) - rhyolite and dacite tuffs and flows, shale, tuffaceous sandstone, limestone, quartz-feldspar porphyry.
2./ Mumbil Formation (Sm) (Late Silurian) - shale, limestone, chert, tuff; sedimentary equivalent of Gleneski Formation.
3./ Cuga Burga Volcanics (Dcb) (Early Devonian)- keratophyre and quartz keratophyre, lavas and tuffs, sediments and limestone.
4./ Wuuluman Granite (Cgw) (?Carboniferous) - post-kinematic Bathurst-type hornblende granite.

ASSOCIATED MINERALISATION: NINDETHANA THRUST SYSTEM (WELLINGTON GROUP)
PRINCIPAL SOURCES: Matson (1973), Markham & Basden (1974), Matson (1975a,b), Markham (1982).

A diversity of styles of gold mineralisation occurs within the thrust system and spatially associated with the Wuuluman Granite.
1) Gold occurs in stratabound volcanogenic massive base metal sulphide deposits associated with altered andesitic volcanics of the Gleneski Formation at GALWADGERE (Deposit No. 39), and with faulted contact zones between quartz-feldspar porphyries (?volcanics) of the Gleneski Formation and sediments of the Mumbil Formation at Commonwealth and Stringers (Wellington).
2) Fault-filling deposits in which gold is the major metal and base metals are less significant occur in Cuga Burga Volcanics at Christies and McDowells (Deposit No.39 GALWADGERE), and in Gleneski Formation ?at a contact with Mumbil Formation at Welcome Jack (Wellington).
3) Quartz vein deposits occur in Gleneski/Mumbil contact zones at Kellys Perseverance, Scotchmans and Bennetts, in Cuga Burga Volcanics at Federal, and in Merrions Tuff at King Dick (all Wellington). Kellys Perseverance, Federal and King Dick are close to the southern contact of the Wuuluman Granite.
4) Extensive alluvial deposits were worked along the Macquarie River for many kilometres both to the E and W of Wellington.

OREBODY: Bennetts
Orebody occurred in slate of the Mumbil Formation close to a contact with ?andesite of the Gleneski Formation. Mineralisation may have been localised along the contact. (Matson, 1975a,b).

OREBODY: Commonwealth
Mineralisation is of the stratiform massive sulphide type (Matson, 1975b) (similar to CAPTAINS FLAT, Deposit No.45, and Woodlawn). Commonwealth is localised in a fault (Matson, 1975a) within Gleneski Formation (Matson, 1975b) at the contact between underlying quartz-feldspar porphyry (?tuff) and overlying cleaved highly sheared fine-grained tuffaceous slate (Markham, 1982).
A band of barite-rich material up to 1.2 m wide occurs on the stratigraphic hanging wall (Markham, 1982).

OREBODY: Federal
Orebody comprised a series of at least five parallel reefs within the Cuga Burga Volcanics close to a contact with the Wuuluman Granite (Matson, 1975b; Markham, 1982). Host lithologies are hornfelsed andesitic volcanics, including tuff and agglomerate; slate and mafic hornfels (Markham & Basden, 1974; Matson, 1975a).
Origin of mineralisation may have involved a granitic source, possibly with some remobilistation from the volcanics (Matson, 1975b).

OREBODY: Kellys Perseverance
Host rocks were slaty sediments (siltstone, slate or schist) of the Mumbil Formation (Markham, 1982) or the Gleneski Formation, close to a contact with Mumbil Formation (Matson, 1975b).
Host sediments are conformably overlain by quartz-feldspar porphyry (?volcanics) to the W and in contact with andesite (dyke) to the E. Host sediments strike N, dip 40 deg E (Matson, 1975a).

OREBODY: King Dick
Mineralisation was hosted by andesite, siltstone, shale, probably in a shear zone in Early Devonian Merrions Tuff (Matson, 1975a).

OREBODY: Scotchmans
Host rock is quartz-feldspar porphyry within Gleneski Formation close to a contact with sandstone and slate of the Mumbil Formation (Matson, 1975a,b).

Two types of veining occurred (Matson, 1975a):– i) narrow veining along joint planes, orientations as given above for orebody orientation, and ii) a larger vein (0.9 m wide) parallel to regional strike.

OREBODY: Stringers

Geological setting and style of mineralisation as for OREBODY: Commonwealth (Matson, 1975b; Markham, 1982).
Ore occurred in irregular bunches in (tuffaceous) slate at the faulted contact with ?andesitic feldspar porphyry (either an intrusive or a tuff) (Matson, 1975a,b).
The host fault zone strikes 220 deg, dips 40 E, parallel to orebody (Matson, 1975a). Barite band as at Commonwealth (Markham, 1982).

OREBODY: Welcome Jack

Orebody occurs in Gleneski Formation possibly close to boundary with sediments of Mumbil Formation (Matson, 1975b). Mineralisation is localised along a sheared contact between altered porphyritic ?andesite and shale-slate (Matson, 1975b).
Gold is associated mainly with sediments (Matson, 1975b) or with zones of silicification in altered volcanics (Markham, 1982).
Although geological setting is similar to that at the nearby Stringers and Commonwealth orebodies, no significant base metal mineralisation is present at Welcome Jack (Markham, 1982), and the latter may have a different origin (see 'GENETIC MODELS').

OREBODY: Wellington Alluvials

Basement is weathered andesite.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Bunny M.R., 1962
The geology of the Parishes of Nanima, Wellington and Galwadgere, Wellington, N.S.W. B.Sc. (Hons) thesis.
University of Sydney. Unpublished
1v

Clift D.S.L., 1975
Gold dredging in New South Wales.
Geological Survey of New South Wales. Mineral Resources
41

Jones J.G., 1962
The geology of the Parishes of Wuuluman and Yarragal. B.Sc. (Hons) thesis.
University of Sydney. Unpublished
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Matson C.R., 1973
Dubbo 1:250 000 metallogenic series map. Sheet SI 55-04, 1st edition.
Geological Survey of New South Wales
1v

Matson C.R., 1975
Part 1. Mine data sheets to accompany metallogenic map, Dubbo 1:250 000 sheet. Sheet SI 55-04.
Geological Survey of New South Wales
1v

Matson C.R., 1975
Part 2. A metallogenic study of the Dubbo 1:250 000 sheet. Sheet SI 55-04.
Geological Survey of New South Wales
1v

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

Shackleton W.G., 1968

Minor pyrometasomatic mineralization in the Wuuluman Granite, central western New South Wales.
AusIMM. Proceedings
225 P11-14

Urquhart D.F., 1956
The investigation of deep leads by the seismic refraction method.
Bureau Mineral Resources, Australia. Bulletin
35

oooooooooooooooooooooooooooooooooooooooc

DEPOSIT: 39 GALWADGERE

DEPOSIT IDENTIFICATION:

SYNONYMS: Dawn Of Galwadgere

COMMODITIES: Cu, Au, Ag

DISTRIBUTION:
Nos.119-121 on Dubbo metallogenic map.

OREBODIES:
Galwadgere (D), Christies, McDowells

MINES:
Christies, Galwadgere (Dawn Of Galwadgere), McDowells (Old Paint)

GROUP: Wellington Group

COMMENTS:
See Deposit No.30 BROWNS CREEK for regional setting of Molong-South Coast Anticlinorial Zone (N); Deposit No. 38 WELLINGTON for regional setting of Nindethana Thrust System and Wellington group.

LOCATION:

LATITUDE: 32 40	LONGITUDE: 149 4
250K SHEET: SI55 4	100K SHEET: 8732

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Dubbo
LOCAL GOVERNMENT AREA (LGA): Wellington

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1935	Geophysics
1935	Geochemistry

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Galwadgere (D)	Galwadgere (Dawn Of Galwadgere)	Historical	Underground
Galwadgere (D)	Galwadgere (Dawn Of Galwadgere)	Historical	Surface
Christies	Christies	Historical	Underground
Christies	Christies	Historical	Surface
McDowells	McDowells (Old Paint)	Historical	Underground
McDowells	McDowells (Old Paint)	Historical	Surface

COMPANIES:

OREBODY: Galwadgere (D)

PRESENT OWNERS:	EQUITY%
Compass Resources NL	65.00
Mineral Commodities Ltd	20.00
Noel Adam	15.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 31
Average recovered grade 61.2 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: 1908-1909, 1936-1948,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION		
Dec 1972	2,960			Subeconomic Demonstrated	In-Situ	Dawn of Galwadgere, 1.4% Cu, cut-off grade 1.0% Cu

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Molong-South Coast Anticlinorial Zone(N)
SUB-PROVINCE: Nindethana Thrust System

HOST ROCKS:

FORMATION NAME & AGE: Gleneski Formation - Late Silurian
LITHOLOGY: Calc-alkaline volcanics, shale, tuffaceous sandstone, limestone, quartz-feldspar porphyry.
RELATIONSHIP TO MINERALISATION: Mineralisation occurs in stratabound massive sulphide bodies associated with tuffaceous beds in schistose altered felsic volcanics.

FORMATION NAME & AGE: Cuga Burga Volcanics - Early Devonian
LITHOLOGY: Keratophyre, volcanics, sediments, limestone.
RELATIONSHIP TO MINERALISATION: Host to minor vein mineralisation at Christies and McDowells.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Felsic Extrusive

STRUCTURAL FEATURES:

MAJOR: Faulting

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

MAJOR: Volcanism (Felsic)

METAMORPHISM:
Regional metamorphic grade is greenschist facies.

ALTERATION:

OREBODY: Galwadgere (D)
Host volcanics are altered to quartz-pyrite-sericite and/or chlorite, possibly as a result of pre-metamorphic or plutonically-associated hydrothermal activity (Matson, 1975a).

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Auriferous stratabound volcanogenic massive base metal sulphides in felsic-intermediate volcanics.
MINOR: Auriferous quartz veins in fault/shear zones.

STYLE:

MAJOR: Conformable, Stratabound

MORPHOLOGY: Lenticular

AGE OF MINERALISATION: Palaeozoic Late Silurian

DIMENSIONS/ORIENTATION:

OREBODY: Galwadgere (D)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			500.0
TRUE WIDTH	(m)			30.0
VERTICAL DEPTH	(m)			200.0
		ANGLE (deg.)		DIRECTION
DIP		60		E
PITCH		70-80		E
STRIKE		340-350		

OREBODY: Christies

		MIN	AVE	MAX
STRIKE LENGTH	(m)			7.5
TRUE WIDTH	(m)			0.9
VERTICAL DEPTH	(m)			9.0
		ANGLE (deg.)		DIRECTION
DIP		80		W
STRIKE		170-190		

OREBODY: McDowells

		MIN	AVE	MAX
STRIKE LENGTH	(m)			15.0
TRUE WIDTH	(cm)	60.0		90.0
VERTICAL DEPTH	(m)			21.0
		ANGLE (deg.)		DIRECTION
STRIKE		350-360		

ORE TEXTURE:

NATURE OF MINERALISATION:
PRIMARY ORE: Bed, Fault/Shear Filling, Vein (Reef),
SECONDARY ORE: Supergene Enrichment

MINERALOGY:

OREBODY: Galwadgere (D)
PRINCIPAL SOURCES: Matson (1975a).

Sulphide zone: pyrite, chalcopyrite, in the ratio 3:2, (sphalerite, galena). Pyrite occurs as discrete disseminated anhedral to subhedral grains from 0.025 to 3.1 mm, many of which are fractured. Chalcopyrite occurs as anhedral disseminated grains and fracture-fillings, generally intergrown with gangue (?quartz), commonly controlled by schistosity and associated with pyrite. (Matson, 1975a).
Secondary minerals are bornite, chalcocite/digenite, covellite.
Oxide zone: iron oxide (hematitic and limonitic), copper carbonate.
Gold concentration in sulphide zone is very low; payable concentration was known only from the supegene enriched oxide zone. (Matson, 1975a).

OREBODY: Christies
Oxide zone: Fe oxide, malachite, azurite.

OREBODY: McDowells
Sulphide zone: pyrite, galena, ?chalcopyrite.
Oxides zone: Fe, Pb, Cu oxides.

CONTROLS OF MINERALISATION:
Controls are i) stratigraphic, provided by volcanic host rock lithologies, and by volcanic/sediment contacts, and ii) structural, provided by major fault.

GENETIC MODELS:
PRINCIPAL SOURCES: Markham & Basden (1974), Matson (1975b).

Bunny (1962, reported by Matson, 1975b) suggested a hydrothermal origin related to the Wuuluman Granite. However, in view of the distance from outcropping granite, a hydrothermal granitic origin seems unlikely (Markham & Basden, 1974).
Matson (1975b) compared the tectonic setting (felsic volcanism in a rift environment), nature of host rock, and nature and type of mineralisation, with the Kuroko-type volcanogenic deposits and suggested that features of Galwadgere are characteristic of this class of deposit. In particular, Galwadgere fitted the volcanic hydrothermal zone of the Kuroko model. Matson (op.cit) proposed an origin associated with a syngenetic hydrothermal phase of volcanic exhalative deposition (D.P. Crawford, 1972, reported by Matson, 1975b).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Galwadgere (D)
PRINCIPAL SOURCES: Matson (1973), Markham & Basden (1974)

Matson (1975a,b), Markham (1982).

SUMMARY

Galwadgere lies in the southern part of the Nindethana Thrust System. Mineralisation consists of steeply-pitching stratabound massive sulphide bodies in schistose, highly altered felsic volcanics of the Late Silurian Gleneski Formation.

GEOLOGICAL SETTING: GALWADGERE
PRINCIPAL SOURCES: Matson (1973), Markham & Basden (1974).

In the southern part of the Nindethana Thrust System Gleneski and Mumbil Formations occur in narrow N-S fault blocks flanked by Devonian sediments of the Hill End Synclinorial Zone (Matson, 1973).
The geological and tectonic environment of Galwadgere is comparable with that of the adjacent areas of the synclinorial zone (Markham & Basden, 1974).

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Markham & Basden (1974), Matson (1975a,b).

Cu-Au sulphide mineralisation at Galwadgere occurs in a broad lenticular conformable zone which parallels a tuffaceous marker bed of limited lateral extent within schistose, altered felsic volcanics of Gleneski Formation. The tuff marker forms footwall to the ore zone, and lies between the mineralisation and a major thrust fault to the W. The ore zone approximately parallels the thrust system, which strikes NNW and dips 60-70 deg E. Within the mineralised zone ore occurs in steeply-pitching shoots within the schistosity planes, which strike parallel to the thrust faults, and dip 70-80 deg E. Remobilisation was apparently a factor in localisation. The orebody is cut by numerous small faults, shears and mylonite zones. (Markham & Basden, 1974; Matson, 1975a,b).
Minor discordant gold mineralisation occurs in fault-fillings within andesitic Cuga Burga Volcanics N of Galwadgere at Christies and McDowells (Matson, 1975b).

OREBODY: Christies

Orebody was localised in a regional fault, occurring in a shear zone in a siltstone unit (36 m wide) surrounded by sheared andesite of the Cuga Burga Volcanics (Matson, 1975b). Fault zone strikes 179-190 deg, dips 80 deg W (Matson, 1975a).

OREBODY: McDowells

Orebody was localised in a regional fault, hosted by strained, chlorite-rich schist at or near a contact with andesite of the Cuga Burga Volcanics (Matson, 1975b).
Lode comprised ferruginous material on a shear within schist. (Matson, 1975a).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Bunny M.R., 1962
The geology of the Parishes of Nanima, Wellington and Galwadgere, Wellington, N.S.W. B.Sc. (Hons) thesis.
University of Sydney. Unpublished
1v

Crawford D.P., 1976
Geology and genesis of mineralization in the Galwadgere prospect, Wellington. N.S.W. M.Sc. (qual.) thesis.
University of Sydney. Unpublished
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Matson C.R., 1973
Dubbo 1:250 000 metallogenic series map. Sheet SI 55-04, 1st edition.
Geological Survey of New South Wales
1v

Matson C.R., 1975
Part 1. Mine data sheets to accompany metallogenic map, Dubbo 1:250 000

sheet. Sheet SI 55–04.
Geological Survey of New South Wales
1v

Matson C.R., 1975
Part 2. A metallogenic study of the Dubbo 1:250 000 sheet. Sheet SI 55–04.
Geological Survey of New South Wales
1v

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 40 STUART TOWN

DEPOSIT IDENTIFICATION:

COMMODITIES: Au

DISTRIBUTION:
Record covers large number of primary deposits clustered around Stuart Town in a N-S zone 10 km x 5 km, plus alluvial deposits along Macquarie River 5 km to the E. Nos. 180-214 on Dubbo metallogenic map.

OREBODIES:
Stuart Town (D), Farnham, Muckerawa Creek, Stuart Town, Stuart Town (Alluvial)

MINES:
Bald Hill, Beehive, Bells, Burthundra, Caledonian, Canadian, Chump, Company (Mookerawa), Cornish Point, Daisy, Elslie, Fitzsimmons, German Hill, German Jack, Great Britain, Great Northern, Gum Flat, Hanlon, Horseshoe, Hughes, Iron Duke, Junction Point, Kaiser Wilhelme, Knockout, Lady Carrington, Lower Mookcrawa, Macatanamys, Macquarie Hills, Madmans, Manna Hill, Mascotte, Monks, Perseverance, Poormans, Post Office, Princess Alexandra, Princess Alexandra Extended, Quartz Hill, Redfern, Rockdale, Sailors Gully, Specimen Hill, Splitters Gully, Stringy Bark, Swallows Nest, Trianbil Basalt Hill, Tricketts, Water Lilly, Widows Mite, Ya Hoo Hills

GROUP: Hill End Group

COMMENTS:
See Deposit No.42 HILL END-TAMBAROORA for regional setting of Hill End Synclinorial Zone, Hill End Synclinorium, and Hill End group.

LOCATION:

LATITUDE: 32 48 — LONGITUDE: 149 5
250K SHEET: SI55 4 — 100K SHEET: 8732

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Dubbo
LOCAL GOVERNMENT AREA (LGA): Wellington

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1851	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Farnham	Daisy	Historical	Underground
Farnham	Great Northern	Historical	Underground
Farnham	Iron Duke	Historical	Underground
Farnham	Great Britain	Historical	Underground
Farnham	Sailors Gully	Historical	Underground
Farnham	Stringy Bark	Historical	Surface
Farnham	Stringy Bark	Historical	Underground
Farnham	Elslie	Historical	Underground
Farnham	Mascotte	Historical	Underground
Farnham	Beehive	Historical	Underground
Farnham	Swallows Nest	Historical	Surface
Farnham	Swallows Nest	Historical	Underground
Farnham	Fitzsimmons	Historical	Surface
Farnham	Fitzsimmons	Historical	Underground
Farnham	Splitters Gully	Historical	Surface
Farnham	Splitters Gully	Historical	Underground
Farnham	Lady Carrington	Historical	Underground
Farnham	Monks	Historical	Underground
Farnham	Chump	Historical	Underground
Farnham	Hughes	Historical	Underground
Farnham	Burthundra	Historical	Unknown
Farnham	Kaiser Wilhelme	Historical	Surface

Farnham	Kaiser Wilhelme	Historical	Underground
Farnham	Redfern	Historical	Underground
Muckerawa Creek	Rockdale	Historical	Underground
Muckerawa Creek	Bells	Historical	Open-Cut
Muckerawa Creek	Bells	Historical	Underground
Muckerawa Creek	Manna Hill	Historical	Underground
Muckerawa Creek	Quartz Hill	Historical	Unknown
Muckerawa Creek	Hanlon	Historical	Underground
Muckerawa Creek	Specimen Hill	Historical	Surface
Muckerawa Creek	Specimen Hill	Historical	Underground
Muckerawa Creek	Company (Mookerawa)	Historical	Surface
Muckerawa Creek	Company (Mookerawa)	Historical	Underground
Stuart Town	Perseverance	Historical	Underground
Stuart Town	Horseshoe	Historical	Underground
Stuart Town	Caledonian	Historical	Underground
Stuart Town	Caledonian	Historical	Surface
Stuart Town	Madmans	Historical	Surface
Stuart Town	Madmans	Historical	Underground
Stuart Town	Canadian	Historical	Surface
Stuart Town	Canadian	Historical	Underground
Stuart Town	Tricketts	Historical	Underground
Stuart Town	Poormans	Historical	Open-Cut
Stuart Town	Poormans	Historical	Underground
Stuart Town	Post Office	Historical	Underground
Stuart Town	German Jack	Historical	Underground
Stuart Town	Princess Alexandra	Historical	Open-Cut
Stuart Town	Princess Alexandra	Historical	Underground
Stuart Town	Princess Alexandra Extended	Historical	Open-Cut
Stuart Town	Princess Alexandra Extended	Historical	Underground
Stuart Town	Water Lilly	Historical	Underground
Stuart Town	Knockout	Historical	Underground
Stuart Town	Macatanamys	Historical	Surface
Stuart Town	Macatanamys	Historical	Underground
Stuart Town (Alluvial)	Bald Hill	Historical	Underground
Stuart Town (Alluvial)	Trianbil Basalt Hill	Historical	Underground
Stuart Town (Alluvial)	Lower Mookerawa	Historical	Dredging &/Or Sluicing
Stuart Town (Alluvial)	Junction Point	Historical	Dredging &/Or Sluicing
Stuart Town (Alluvial)	Junction Point	Historical	Surface
Stuart Town (Alluvial)	German Hill	Historical	Underground
Stuart Town (Alluvial)	Widows Mite	Historical	Underground
Stuart Town (Alluvial)	Ya Hoo Hills	Historical	Underground
Stuart Town (Alluvial)	Cornish Point	Historical	Surface
Stuart Town (Alluvial)	Cornish Point	Historical	Dredging &/Or Sluicing
Stuart Town (Alluvial)	Gum Flat	Historical	Placer (Dredging)
Stuart Town (Alluvial)	Gum Flat	Historical	Dredging &/Or Sluicing
Stuart Town (Alluvial)	Gum Flat	Historical	Surface
Stuart Town (Alluvial)	Macquarie Hills	Historical	Underground

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 5,365
Average recovered grade (reef ore) 15-30 g/t Au, locally up to >400 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: 1851-1899, 1900-1920, 1931-1945,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Hill End Synclinorial Zone
SUB-PROVINCE: Hill End Synclinorium

HOST ROCKS:

FORMATION NAME & AGE: Cunningham Formation - Early-Middle Devonian

LITHOLOGY: Slate, siltstone, greywacke.
RELATIONSHIP TO MINERALISATION: Host (as shown on Dubbo metallogenic map) to mineralisation in conformable veins in bedded sediments and volcanics.

FORMATION NAME & AGE: Nubrigyn Formation - Early-Middle Devonian
LITHOLOGY: Limestone, shale, sandstone, conglomerate, andesite.
RELATIONSHIP TO MINERALISATION: Probable host formation, instead of Cunningham Formation.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to alluvial and deep lead deposits.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Alluvium, Clastic Sedimentary,
SIGNIFICANT: Intermediate Extrusive, Volcanogenic Sedimentary

STRUCTURAL FEATURES:

MAJOR: Fold Axis, Folding,
SIGNIFICANT: Faulting, Shearing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

SIGNIFICANT: Stratigraphic Boundary

IGNEOUS ACTIVITY:

MAJOR: Volcanism (Intermediate),
SIGNIFICANT: Volcanism (Mafic)

METAMORPHISM:
Regional metamorphic grade is greenschist facies.

ALTERATION:

OREBODY: Stuart Town (D)
The Quartz Hill reef was associated with alteration of the host volcanics to silicified and pyritised porphyritic rhyolite (Matson, 1975a).

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Metamorphic auriferous quartz veins in flysch-type metasediments (slate/greywacke sequences); no granitoid rocks in proximity.
SIGNIFICANT: Deep lead.
Alluvial.
Stratabound conformable auriferous quartz veins (saddle reefs) in flysch-type metasediments (slate/greywacke sequences).

STYLE:

SIGNIFICANT: Conformable

AGE OF MINERALISATION: Palaeozoic Middle Devonian

DIMENSIONS/ORIENTATION:

OREBODY: Stuart Town (D)

	ANGLE (deg.)	DIRECTION
DIP	60-80;(65)	E,W;(NW)
STRIKE	315-360;(240)	

OREBODY: Farnham

		MIN	AVE	MAX
STRIKE LENGTH	(m)		91.0	
TRUE WIDTH	(cm)	15.0	30.0	120.0
VERTICAL DEPTH	(m)	15.0	30.0	228.0
DOWN-DIP DEPTH	(m)		60.0	

	ANGLE (deg.)	DIRECTION
DIP	65-80,30	E;W;S
STRIKE	290-360	

OREBODY: Muckerawa Creek

MIN	AVE	MAX

		MIN	AVE	MAX
STRIKE LENGTH	(m)			152.0
TRUE WIDTH	(cm)	12.0	45.0	60.0
VERTICAL DEPTH	(m)	20.0		73.0
		ANGLE (deg.)		DIRECTION
DIP		65;-;-		NW;-;-
STRIKE		240,300,360		

OREBODY: Stuart Town

		MIN	AVE	MAX
STRIKE LENGTH	(m)			400.0
TRUE WIDTH	(cm)	22.0	30.0	76.0
VERTICAL DEPTH	(m)	12.0	30.0	122.0
DEPTH OXIDATION	(m)		21.0	
		ANGLE (deg.)		DIRECTION
DIP		40-45,65		E-NE
STRIKE		295-330		

OREBODY: Stuart Town (Alluvial)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			200.0
TRUE WIDTH	(m)			12.0

ORE TEXTURE:
Disseminated

NATURE OF MINERALISATION:
PRIMARY ORE: Fault/Shear-Filling, Saddle Reef, Vein (Reef),
SECONDARY ORE: Deep Lead, Detrital (Alluvial), Supergene Enrichment

MINERALOGY:

OREBODY: Stuart Town (D)
Sulphide zone: gold, pyrite, arsenopyrite, (chalcopyrite, galena, sphalerite). Sulphides comprised up to 5% by volume.
Gangue: quartz.
Gold generally occurred free; grainsize varied from very fine to coarse, including some very coarse reef specimens. Coarse alluvial gold included nuggets up to 4.5 kg.

CONTROLS OF MINERALISATION:
Major controls are structural, provided by large-scale regional thrust fault system (to N and S of Stuart Town) and by an E-W transverse fold across dominant N-S fold trend. Association with andesitic volcanics was apparently also a significant control (see 'GENETIC MODELS'). Major structures controlled localisation and orientation of reefs. (Matson, 1972, 1975b).

GENETIC MODELS:
PRINCIPAL SOURCES: Matson (1972, 1975b).

The exact nature and origin of the gold are unknown (Matson, 1975b). A granitic origin is considered unlikely in veiw of the remoteness from granite (Matson, 1975b).
Mineralisation may have been associated with andesitic volcanism accompanying granites and the Tabberabberan or Kanimblan Orogenies (Middle Devonian, Carboniferous respectively) or it may have been related to rifting on the western margin of the Hill End Trough during the Bowning Orogeny (Silurian) (Matson, 1975b).

A contemporaneous origin of gold and andesite is considered unlikely (Matson, 1975b). However, reef formation during late-stage hydrothermal activity associated with andesitic volcanism is supported by the strong structural control, provided by the fold downwarp and the thrust system (see 'GENETIC CONTROLS'), and by the association with andesitic volcanics.

Matson (1975b) proposed the following model:-
i) Auriferous reefs were emplaced as a result of late-stage hydrothermal activity associated with earlier andesitic volcanism and N-S rifting, possibly during Middle Devonian Tabberabberan Orogeny.
ii) Rifts allowed the upward movement of hydrothermal fluids and, in conjunction with the N-S anticline, controlled the general NNW regional trend of reefs of the field.
iii) Downwarping (transverse fold) of the N-S anticline and associated fracturing allowed formation of E-W reefs. Downwarp was probably also influential in limiting N, S extensions of hydrothermal activity and associated gold mineralisation.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Stuart Town (D)

PRINCIPAL SOURCES: Matson (1972, 1973), Markham & Basden (1974), Matson (1975a,b), Hilyard (1979a,b), Markham (1982).

SUMMARY

Stuart Town lies near the western margin of the Hill End Synclinorial Zone, S along strike from the Nindethana Thrust System. The thrust system is a structurally complex area in which fault blocks of Silurian felsic volcanics and sediments of the Molong-South Coast Anticlinorial Zone (N) are enclosed by folded Devonian slate/greywacke/andesite sequences of the Hill End Synclinorial Zone (Markham & Basden, 1974; Matson, 1975b).

Both primary and secondary deposits occurred at Stuart Town. Primary mineralisation comprised a series of thin quartz veins, subparallel to regional strike, in siltstones and slates, and to a lesser extent tuffs and andesites, of the Early-Middle Devonian Cunningham Formation (?Nubrigyn Formation). Alluvial deposits included gullies, river drifts, gravels and deep leads related to the Macquarie River stream system.

REGIONAL SUCCESSION: STUART TOWN

PRINCIPAL SOURCES: Matson (1973, 1975b), Markham & Basden (1974).

1./ Nubrigyn Formation (Dnf on Dubbo metallogenic map) (Early Devonian) - limestone, shale, sandstone, conglomerate, andesite.

2./ Cunningham Formation (Dcf) (Early-Middle Devonian) - slate, siltstone, lithic and calcareous greywacke, greywacke.

The Nubrigyn Formation is a marginal volcanic/shallow water sedimentary sequence near the base of the Cunningham Formation, cropping out along the boundary of the Hill End Synclinorial Zone with the Molong-South Coast Anticlinorial Zone (N). The host formation for Stuart Town is shown as Cunningham Formation on the Dubbo metallogenic map; however the presence of considerable quantities of andesite and andesitic tuff in the sequence suggests that the Nubrigyn Formation may be more widely represented in the area. (Matson, 1975b).

To the W, the Devonian trough sequences overlie Ordovician spilitic volcanics (Oakdale Formation), Silurian felsic volcanics and sediments (Mullions Range Volcanics, Mumbil Formation) and Devonian keratophyres (Cuga Burga Volcanics) of the Molong-South Coast Anticlinorial Zone(N) and zone boundary region.

GEOLOGICAL SETTING: STUART TOWN

PRINCIPAL SOURCES: Matson (1972, 1975b).

The Cunningham Formation rocks (as mapped) strike 340 deg and have been folded into a series of symmetrical anticlines and synclines whose fold axes trend 350 deg. The Stuart Town goldfield occurs in rocks which apparently overlie a regional downwarp (or transverse fold) in a major N-S anticlinal structure (Matson, 1972, 1975b).

To the N the anticlinal structure, which plunges S, contains the Nindethana Thrust System; to the S, a large anticline plunges N. Stuart Town lies S along strike from the Nindethana Thrust System, and N along strike from the northern extension of its possible southerly continuation, the Copperhania Thrust (Matson, 1972, 1975b).

The Nindethana Thrust System and Copperhania Thrust are part of a major N-S rift zone which marked the boundary between the northern part of the Molong Volcanic Arc and the Hill End Trough (Matson, 1975b).

At Stuart Town, faulting is locally pronounced and a prominent shear zone trending NNW across the field, which may have influenced the localisation of some of the quartz reefs (Jones, 1935, reported by Matson, 1972) may be linked with the two thrust systems (Matson, 1972).

LOCAL SETTING: MINERALISATION

PRINCIPAL SOURCES: Matson (1972, 1975a,b), Hilyard (1979a), Markham (1982).

. Reefs were worked in three main areas:- i) around Stuart Town itself; ii) 4 km SSE at Farnham; and iii) 3 km ENE around Muckerawa Creek.

. Host lithologies, in order of importance, were:- i) siltstone, slate; ii) andesite, andesitic tuff; iii) greywacke, sandstone, quartzite; iv) tuffaceous conglomerate.

. Some reefs were localised in shear/fault zones (e.g. Manna Hill, Specimen Hill) and at least one, Quartz Hill, was reported to be accompanied by alteration of the host rock: the host was silicified, pyritised rhyolite porphyry (Matson, 1975a).

. The veins mostly parallelled or approximately parallelled regional NNW strike and dipped steeply E,W; some transected the major direction (e.g. Manna Hill, on a fault, strike 240 deg, dip 65 NW), and some reefs

were curved. The curved reefs were most strongly developed in the Farnham area. The Company mine (Muckarawa Creek) was on a saddle reef.
. Richest ore zones were commonly at intersections of small E-W cross veins with the main N-S vein; high grades may also have been associated with a slate/andesitic contact (Matson, 1972; Markham, 1982).
. Veins narrowed at depth and grades decreased concomitantly.

OREBODY: Farnham
Several reefs were curved. The Beehive reef curved from strike 300 deg, dip 60 deg E to strike 225 deg, dip 30 deg S.

OREBODY: Muckerawa Creek
Andesite and andesitic tuffs were more common as host rocks than at Stuart Town and Farnham (Matson, 1975b).
The Company mine was based on a saddle reef on a S-plunging N-S fold (Matson, 1975a). The ore zone thinned at depth and was payable only on the fold limbs (Matson, 1975a).

OREBODY: Stuart Town (Alluvial)
PRINCIPAL SOURCES: Matson (1972), Markham (1982).

Matson (1972, summarised by Markham, 1982) distinguished four types of alluvial workings:-
rich gullies, river drifts, basement gravels, and deep leads.
The rich gullies were essentially alluvial deposits of Recent age which developed in close proximity to the source reef deposits.
Productive watercourses included those flowing both E and W from the region of Stuart Town and Farnham (Matson, 1972; Markham, 1982).

River drifts comprised gold-bearing alluvials occurring along the present channel of the Macquarie River and on flats adjacent to the river. The older gravels occurred at elevations up to 18 m above the level of the present Macquarie River. However, the greatest quantity of gold occurred in basement gravels below river level. Thickness of wash was on average up to 3.5 m; 21 m at Lower Mookerawa.
The basement gravel deposits formed the basis of sluicing operations along the Macquarie River in the 1880s and subsequently of dredging operations in the early 1900s. (Matson, 1972; Markham, 1982).
River flats near the junction of Mookerawa Creek and the Macquarie River, now flooded by the Burrendong Dam, are said to have contained some of the richest ground (Matson, 1972; Markham, 1982).

Tertiary deep lead deposits, comprising beds of sand and quartz gravels overlain by Tertiary basalt, occurred at elevations approximately 150-180 m above the present level of the Macquarie River (Matson, 1972; Markham, 1982).
The deep leads are covered, at least in part, by the products of two episodes of basaltic volcanism, one in the Late Eocene-Early Oligocene and a second in the Middle Miocene (Matson, 1972).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Clift D.S.L., 1975
Gold dredging in New South Wales.
Geological Survey of New South Wales. Mineral Resources
41

Hilyard D., 1979
Stuart Town gold deposits map, 1:50 000 scale.
Geological Survey of New South Wales
1v

Hilyard D., 1979
Sofala-Hill End-Stuart Town gold deposits map, 1:250 000 scale.
Geological Survey of New South Wales
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Matson C.R., 1972
The Stuart Town goldfield.
Geological Survey of New South Wales. Report

GS1972/220

Matson C.R., 1973
Dubbo 1:250 000 metallogenic series map. Sheet SI 55-04, 1st edition.
Geological Survey of New South Wales
1v

Matson C.R., 1975
Part 1. Mine data sheets to accompany metallogenic map, Dubbo 1:250 000 sheet. Sheet SI 55-04.
Geological Survey of New South Wales
1v

Matson C.R., 1975
Part 2. A metallogenic study of the Dubbo 1:250 000 sheet. Sheet SI 55-04.
Geological Survey of New South Wales
1v

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 41 HARGRAVES-WINDEYER

DEPOSIT IDENTIFICATION:

SYNONYMS: Windeyer

COMMODITIES: Au

DISTRIBUTION:
Record covers primary deposits distributed over wide area from 7 km N to 10 km S of Hargraves, & from Hargraves 8 km E to Windeyer & to 12 km S of Windeyer, plus alluvial deposits along 30km of Meroo Creek system. Nos. 221-235 on Dubbo map.

OREBODIES:
Hargraves-Windeyer (D), Blue Spec, Campbells Creek, Clarkes Creek, Crystal Palace, Dalys Creek, Ding Dong, Dog Trap, Dun Dun, Eaglehawk Gully, Eldorado Hill, Golden, Hampden Hill, Hargraves, Long Creek, Longmores Reward, Louisa Creek, Maitland Bar, Meroo Creek, Oakey Creek, Stockyard Creek, Tuckers Hill

MINES:
Alma, Band Of Hope, Big Nugget, Blackfellows, Blue Spec, Brown Eagle, Campbells Creek, Catherine, Clarkes Creek, Coronation, Cross Gully, Crystal Palace, Dalys Creek, Ding Dong, Dog Trap, Dun Dun, Eaglehawk, Eaglehawk Broken Hill, Eaglehawk Gully, Eldorado Hill, Eureka, Florence, Foleys, Frenchmans, Golden Gate, Golden Lily, Great Western Pioneer, Gully, Hampden Hill, Happy Dicks, Henrietta, Hit or Miss, Hogans, Homeward Bound, Ida, Jubilee, Jumping Frog, Little Wonder, Lizzie Watson, Long Creek, Long Gully, Longmores Reward, Louisa Creek, Lucks All, Main Axis, Maitland Bar, Meroo Creek, Mudgee, Oakey Creek, Queen Of Shebah, Reef Hill, Sailors Gully, Sawyers, Scotch Hill, South Hill, St George, Stockyard Creek, Tuckers Hill, Turn On The Tide

GROUP: Hill End Group

COMMENTS:
See Record No. 42 HILL END-TAMBAROORA for regional setting of Hill End Synclinorial Zone, Hill End Synclinorium, and Hill End group.

LOCATION:

LATITUDE: 32 48 LONGITUDE: 149 28
250K SHEET: SI55 4 100K SHEET: 8732

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Dubbo
LOCAL GOVERNMENT AREA (LGA): Mudgee

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1851	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Blue Spec	Blue Spec	Historical	Underground
Campbells Creek	Campbells Creek	Historical	Unknown
Clarkes Creek	Clarkes Creek	Historical	Unknown
Crystal Palace	Crystal Palace	Historical	Underground
Crystal Palace	Crystal Palace	Historical	Surface
Dalys Creek	Dalys Creek	Historical	Unknown
Ding Dong	Ding Dong	Historical	Underground
Ding Dong	Ding Dong	Historical	Surface
Dog Trap	Dog Trap	Historical	Underground
Dun Dun	Dun Dun	Historical	Underground
Eaglehawk Gully	Jubilee	Historical	Underground
Eaglehawk Gully	Eaglehawk Broken Hill	Historical	Underground
Eaglehawk Gully	Gully	Historical	Underground
Eaglehawk Gully	South Hill	Historical	Underground

Eaglehawk Gully	Eaglehawk Gully	Historical	Underground
Eaglehawk Gully	Henrietta	Historical	Underground
Eaglehawk Gully	Eaglehawk	Historical	Underground
Eaglehawk Gully	Catherine	Historical	Underground
Eldorado Hill	Eldorado Hill	Historical	Underground
Golden	Golden Lily	Historical	Underground
Golden	Golden Lily	Historical	Open-Cut
Golden	Long Gully	Historical	Underground
Golden	Long Gully	Historical	Open-Cut
Golden	Jumping Frog	Historical	Underground
Golden	Jumping Frog	Historical	Open-Cut
Golden	Coronation	Historical	Underground
Golden	Coronation	Historical	Open-Cut
Golden	Golden Gate	Historical	Underground
Golden	Golden Gate	Historical	Open-Cut
Golden	Cross Gully	Historical	Underground
Golden	Cross Gully	Historical	Open-Cut
Hampden Hill	Homeward Bound	Historical	Surface
Hampden Hill	Hampden Hill	Historical	Underground
Hargraves	Eureka	Historical	Underground
Hargraves	Frenchmans	Historical	Underground
Hargraves	Blackfellows	Historical	Underground
Hargraves	Main Axis	Historical	Underground
Hargraves	Florence	Historical	Underground
Hargraves	Big Nugget	Historical	Underground
Hargraves	Alma	Historical	Underground
Hargraves	Lizzie Watson	Historical	Underground
Hargraves	Mudgee	Historical	Underground
Hargraves	Happy Dicks	Historical	Underground
Hargraves	Brown Eagle	Historical	Underground
Hargraves	Scotch Hill	Historical	Underground
Long Creek	Long Creek	Historical	Unknown
Longmores Reward	St George	Historical	Underground
Longmores Reward	Longmores Reward	Historical	Underground
Longmores Reward	Longmores Reward	Historical	Surface
Louisa Creek	Louisa Creek	Historical	Unknown
Maitland Bar	Little Wonder	Historical	Underground
Maitland Bar	Little Wonder	Historical	Surface
Maitland Bar	Maitland Bar	Historical	Underground
Maitland Bar	Maitland Bar	Historical	Surface
Maitland Bar	Queen Of Shebah	Historical	Underground
Maitland Bar	Queen Of Shebah	Historical	Surface
Maitland Bar	Great Western Pioneer	Historical	Underground
Maitland Bar	Great Western Pioneer	Historical	Surface
Maitland Bar	Sailors Gully	Historical	Underground
Maitland Bar	Sailors Gully	Historical	Surface
Meroo Creek	Meroo Creek	Historical	Unknown
Oakey Creek	Oakey Creek	Historical	Unknown
Stockyard Creek	Stockyard Creek	Historical	Unknown
Tuckers Hill	Band Of Hope	Historical	Underground
Tuckers Hill	Sawyers	Historical	Underground
Tuckers Hill	Foleys	Historical	Underground
Tuckers Hill	Turn On The Tide	Historical	Underground
Tuckers Hill	Hogans	Historical	Underground
Tuckers Hill	Ida	Historical	Underground
Tuckers Hill	Lucks All	Historical	Underground
Tuckers Hill	Hit or Miss	Historical	Underground
Tuckers Hill	Reef Hill	Historical	Underground

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 878
Recorded production only; actual production estimated at 25 000 kg. Reported grades ranged from 3-1000 g/t Au, although most were <100 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1929-1939), 1850-1874,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Hill End Synclinorial Zone
SUB-PROVINCE: Hill End Synclinorium

HOST ROCKS:

FORMATION NAME & AGE: Chesleigh Formation - Middle-Late Silurian
LITHOLOGY: Tuffaceous and quartz-rich greywacke, slate, felsic tuff, mafic sills.
RELATIONSHIP TO MINERALISATION: Minor host to vein mineralisation at Ding Dong.

FORMATION NAME & AGE: Cookman Formation - Late Silurian
LITHOLOGY: Quartzite like quartz, greywacke, slate.
RELATIONSHIP TO MINERALISATION: Minor host to vein mineralisation at Dog Trap.

FORMATION NAME & AGE: Crudine Group - Early Devonian
LITHOLOGY: Slate, siltstone, feldspathic and lithic greywacke and tuff, conglomerate.
RELATIONSHIP TO MINERALISATION: Host to major reef mineralisation at Crystal Palace, Eaglehawk Gully, Golden, and Tuckers Hill.

FORMATION NAME & AGE: Merrions Tuff - Early Devonian
LITHOLOGY: Tuff, dacite, slate.
RELATIONSHIP TO MINERALISATION: Host to major reef mineralisation at Dun Dun, Longmores Reward, and Tuckers Hill.

FORMATION NAME & AGE: Cunningham Formation - Early-Middle Devonian
LITHOLOGY: Slate, siltstone, lithic and calcareous greywacke, greywacke conglomerate.
RELATIONSHIP TO MINERALISATION: Host to major reef mineralisation at Hampden Hill, Maitland Bar, Hargraves, Eldorado Hill, and Blue Spec.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to alluvial deposits.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Alluvium Clastic Sedimentary,
SIGNIFICANT: Felsic Extrusive, Volcanogenic Sedimentary,
MINOR: Felsic Porphyry

STRUCTURAL FEATURES:

MAJOR: Fold Axis, Folding

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

SIGNIFICANT: Fault/Stratigraphic Unit

IGNEOUS ACTIVITY:

MAJOR: Volcanism (Felsic),
MINOR: Sub-Volcanism (Felsic Porphyry)

METAMORPHISM:

Reginal metamorphic grade is greenschist facies.

ALTERATION:

OREBODY: Hargraves-Windeyer (D)
Nil associated with mineralisation. Watt (1899) recorded evidence of alteration along the contact of the granitic dyke; however the dyke may be a volcanic interbed (Matson, 1975b).

DEPOSIT CHARACTERISTICS:

TYPES:

MAJOR: Metamorphic auriferous quartz veins in flysch-type metasediments (slate/greywacke sequences); no granitoid rocks in proximity.
SIGNIFICANT: Alluvial.
Stratabound conformable auriferous quartz veins (saddle reefs) in

flysch-type metasediments (slate/greywacke sequences).

STYLE:

MAJOR: Conformable, Discordant

AGE OF MINERALISATION: Palaeozoic Carboniferous, Palaeozoic Middle Devonian

DIMENSIONS/ORIENTATION:

OREBODY: Hargraves-Windeyer (D)

		MIN	AVE	MAX
VERTICAL DEPTH	(m)		20.0	
		ANGLE (deg.)		DIRECTION
STRIKE		160		

OREBODY: Blue Spec

		MIN	AVE	MAX
DOWN-DIP DEPTH	(m)			67.0
		ANGLE (deg.)		DIRECTION
DIP				E
STRIKE		180		

OREBODY: Crystal Palace

		ANGLE (deg.)		DIRECTION
DIP		75-90		NW
STRIKE		040-050		

OREBODY: Ding Dong

		MIN	AVE	MAX
STRIKE LENGTH	(m)			91.0
TRUE WIDTH	(cm)			25.0

OREBODY: Dog Trap

		MIN	AVE	MAX
TRUE WIDTH	(cm)			40.0

OREBODY: Dun Dun

		MIN	AVE	MAX
STRIKE LENGTH	(m)			1200.0
TRUE WIDTH	(cm)	20.0		23.0
VERTICAL DEPTH	(m)			21.0
		ANGLE (deg.)		DIRECTION
DIP				NE
STRIKE		300		

OREBODY: Eaglehawk Gully

		MIN	AVE	MAX
STRIKE LENGTH	(m)		152.0	3200.0
VERTICAL DEPTH	(m)			61.0
		ANGLE (deg.)		DIRECTION
DIP		-;80		E,N
PITCH		33		N,S
STRIKE		330;90		

OREBODY: Eldorado Hill

		MIN	AVE	MAX
STRIKE LENGTH	(m)			152.0
VERTICAL DEPTH	(m)			30.0
		ANGLE (deg.)		DIRECTION
STRIKE		330-340		

OREBODY: Golden

		MIN	AVE	MAX
STRIKE LENGTH	(m)			305.0
TRUE WIDTH	(cm)	15.0		68.0
DOWN-DIP DEPTH	(m)			244.0
		ANGLE (deg.)		DIRECTION
DIP		32-63		W
STRIKE		330		

OREBODY: Hampden Hill

		MIN	AVE	MAX
STRIKE LENGTH	(m)			122.0
VERTICAL DEPTH	(m)			27.0
		ANGLE (deg.)		DIRECTION
STRIKE		160		

OREBODY: Hargraves

		MIN	AVE	MAX
STRIKE LENGTH	(m)			305.0
TRUE WIDTH	(m)			9.0
VERTICAL DEPTH	(m)			91.0
		ANGLE (deg.)		DIRECTION
DIP		20;55		E,W;W;S
STRIKE		340;335;010		

OREBODY: Longmores Reward

		MIN	AVE	MAX
TRUE WIDTH	(cm)	7.5		10.0
VERTICAL DEPTH	(m)			21.0
		ANGLE (deg.)		DIRECTION
DIP				NE
STRIKE		300		

OREBODY: Maitland Bar

		MIN	AVE	MAX
STRIKE LENGTH	(m)			15.0
TRUE WIDTH	(cm)		20.0	25.0
VERTICAL DEPTH	(m)			28.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		
STRIKE		180		

OREBODY: Tuckers Hill

		MIN	AVE	MAX
STRIKE LENGTH	(m)			142.0
TRUE WIDTH	(cm)	15.0		150.0
VERTICAL DEPTH	(m)			41.0
		ANGLE (deg.)		DIRECTION
DIP		50;55;60-75		W;E
STRIKE		330-360		

ORE TEXTURE:

NATURE OF MINERALISATION:
PRIMARY ORE: Saddle Reef, Vein (Reef),
SECONDARY ORE: Detrital (Alluvial), Supergene Enrichment

MINERALOGY:

OREBODY: Hargraves-Windeyer (D)
Sulphide zone: gold-quartz only in most reefs; some reefs were rich in pyrite and/or arsenopyrite. Minor galena has also been recorded. Gold occurred mainly in a free state with quartz gangue, but also occurred associated with sulphides. (Matson, 1975a,b).
Grainsize ranged from very fine to very coarse.
Grades decreased sharply below about 20 m. (Matson, 1975a,b).

OREBODY: Golden
Sulphide ore: arsenopyrite, pyrite.

OREBODY: Hargraves
Sulphide zone: arsenopyrite. Grainsize varied from fine to very coarse.

CONTROLS OF MINERALISATION:
Occurrence of mineralisation in rocks ranging widely in age, lithology, and host formation indicates absence of stratigraphic control.
Localisation of saddle reefs controlled by folding; localisation of some transgressive reefs related to cleavage, others may be infillings in tension cracks in folds. Significant proportion of mineralisation associated with volcanics. (Matson, 1975b).

GENETIC MODELS:
PRINCIPAL SOURCES: Matson (1975b).

Matson (1975b) notes absence of granitic intrusives in deposit region, but favours an origin related to hydrothermal fluids indirectly associated with felsic intrusive activity.
The non-preferential distribution of gold through the stratigraphic

sequence makes unlikely an origin by remobilisation from 'gold-rich' stratigraphic units. Matson (1975b) cites Carboniferous igneous activity associated with the Kanimblan Orogeny as a probable gold source.

Matson (op.cit) postulated:- i) the auriferous reefs were post-orogenic and were deposited from hydrothermal fluids in zones of low stress, including fold hinge zones; ii) the hydrothermal fluids were derived from granitic (?granodioritic phase) source; iii) the stress variation resulted from folding during the Kanimblan Orogeny (Carboniferous).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Hargraves-Windeyer (D)

PRINCIPAL SOURCES: Matson (1973), Markham & Basden (1974), Matson (1975a,b), Thompson (1981), Markham (1982).

SUMMARY

The Hargraves-Windeyer field lies in the eastern part of the Hill End Synclinorium, which forms the major portion of the synclinorial zone N of the Bathurst Granite. Both primary and alluvial deposits were distributed over a wide area to the E, SE and NW of Hargraves. Primary mineralisation comprised both conformable saddle reefs and transgressive 'non-saddle' reefs in predominantly slaty and tuffaceous sediments in sedimentary-volcanic sequences ranging in age from Middle Silurian to Middle Devonian.
Secondary mineralisation was extensive along more than 30 km of the Meroo Creek and its system of tributaries entering from the S.

REGIONAL SUCCESSION: HARGRAVES-WINDEYER
PRINCIPAL SOURCES: Matson (1973, 1975b).

1./ Bells Creek Volcanics (Sbv on Dubbo metallogenic map) (Middle Silurian) - rhyolite and tuff.
2./ Chesleigh Formation (Sch) (Middle-Late Silurian) - see HOST ROCKS.
3./ Nulling Formation (Snf) (Late Silurian) - rhyolite tuffs and flows. Volcanic unit within sediments of Chesleigh Formation.
4./ Cookman Formation (Scf) (Late Silurian) - see HOST ROCKS.
5./ Crudine Group (Dc) (Early Devonian) - see HOST ROCKS.
6./ Merrions Tuff (Dm) (Early Devonian) - see HOST ROCKS.
7./ Cunningham Formation (Dcf) (Early-Middle Devonian) - see HOST ROCKS.
A large quartz-feldspar porphyry dyke of granitic composition recorded by Watt (1899) may in fact be a Devonian volcanic (Matson, 1975b).

GEOLOGICAL SETTING: HARGRAVES-WINDEYER
PRINCIPAL SOURCES: Matson (1973, 1975b), Thompson (1981).

The Silurian-Devonian sequence is tightly folded along NNW axes.
Well developed slaty axial plane cleavage dips E.
The NNW folds have also been broadly folded on transverse axes.
The saddle reef mineralisation in particular is associated with fold hinge zones.
A regional NNW fault passes through the field E of Hargraves.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Watt (1898, 1899; reported by Markham & Basden, 1974; and Matson, 1975b).

All known primary deposits were quartz reefs localised mainly in slaty and tuffaceous sediments, to a lesser extent in sandstone, andesite, and quartz-feldspar porphyry. Mineralisation was distributed through a wide stratigraphic range, occurring throughout the Silurian and Devonian sequences. Reefs occur in the Silurian Chesleigh and Cookman Formations and in the Devonian Crudine Group, Merrions Tuff, and Cunningham Formation. (Matson, 1975a,b).
Several types of reefs occurred: saddle reefs, which parallelled folded bedding, and planar reefs, which were both parallel to and transverse to bedding (Markham & Basden, 197 ; Matson, 1975b).

'Normal' and inverted saddle reefs occurred in the anticlinal and synclinal hinges respectively of tight folds with well-develped axial plane cleavage; strike of axial planes is 330-350 deg. Thick cap or core quartz occurred in many places. The reefs thinned sharply on fold limbs. Richest ore was confined to S-pitching shoots within the reefs. (Watt, 1898, 1899; reported by Matson, 1975b).

Transgressive reefs were corrugated in nature and had a strike ranging from oblique to near parallel to the anticlinal structures, and dipped at a low angle transgressive to bedding (Watt, 1899, reported by Matson, 1975b). Some reefs intersected regional bedding and structures at a high angle; these may be infillings of tension cracks in the folds (Matson, 1975b).

Rich ore was localised at intersections of quartz veins with thin beds of dark brownish green slate (Watt, 1899, reported by Matson, 1975b).

OREBODY: Blue Spec
Orebody comprised a large low-grade reef in shale and slate, probably of the Cunningham Formation (Matson, 1975a), near a contact with Merrions Tuff (Matson, 1973).

OREBODY: Crystal Palace
Host is ?porphyry within Crudine Group (Matson, 1975a).

OREBODY: Ding Dong
Host rock is clay slate, Chesleigh Formation (Matson, 1975a).

OREBODY: Dog Trap
Host is ?schist, Cookman Formation, possibly related to a shear zone (Matson, 1975a).

OREBODY: Dun Dun
Host rock is slate within Merrions Tuff (Matson, 1975a).

OREBODY: Eaglehawk Gully
Host rocks are slate, tuff, sandstone and quartz-feldspar porphyry of the Crudine Group (Matson, 1975a).

OREBODY: Eldorado Hill
Host rock is Cunningham Formation (Matson, 1975a).
Rich ore was in 'leaders' to main reef (Matson, 1975b).

OREBODY: Golden
Host rock is slate within Crudine Group. Ore was in rich shoots; reef split in places. Veins continued to depth with thickness variation. (Matson, 1975a).

OREBODY: Hampden Hill
Host rock is sandstone (Matson, 1975a) of the Cunningham Formation (Matson, 1973).

OREBODY: Hargraves
Host rocks are shale and slate of the Cunningham Formation.
Five parallel reef-bearing anticlinal folds occur within a distance of 200 m across strike. Thirteen saddles have been intersected by drilling.
Veins parallel axial plane cleavage. (Matson, 1975a,b).
Eureka is a transgressive reef; strikes 010 deg and dips shallowly S.

OREBODY: Longmores Reward
Host is Merrions Tuff. Vein is parallel to and NE of Dun Dun Reef. (Matson, 1975a).

OREBODY: Maitland Bar
Host rocks are slate of the Cunningham Formation (Matson, 1975a).

OREBODY: Tuckers Hill
Hosts are tuff and andesite, Merrions Tuff, and slate, sandstone, shale, and tuffaceous sandstone, Crudine Group (Matson 1973, 1975a).
Ore occurred in the cap of an anticlinal arch.
Rich ore occurred in 'leaders' to main reef. (Matson, 1975b).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Matson C.R., 1973
Dubbo 1:250 000 metallogenic series map. Sheet SI 55-04, 1st edition.
Geological Survey of New South Wales
1v

Matson C.R., 1975
Part 1. Mine data sheets to accompany metallogenic map, Dubbo 1:250 000 sheet. Sheet SI 55-04.
Geological Survey of New South Wales
1v

Matson C.R., 1975
Part 2. A metallogenic study of the Dubbo 1:250 000 sheet. Sheet SI 55-04.
Geological Survey of New South Wales
1v

Thompson D.M., 1981
Hargraves gold deposits map, 1:50 000 scale.
Geological Survey of New South Wales
1v

Watt J.A., 1898
Saddle reefs at Hargraves.
Geological Survey of New South Wales. Records
5(4) P153-160

Watt J.A., 1899
Further remarks on the saddle reefs of the Hargraves goldfield.
Geological Survey of New South Wales. Records
6(2) P83-107

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 42 HILL END-TAMBAROORA

DEPOSIT IDENTIFICATION:

SYNONYMS: Tambaroora

COMMODITIES: Au

DISTRIBUTION:
Record covers narrow N-S zone 10 km long between Hill End and Tambaroora, minor deposits 5 km S, 8 km E and 12 km E of H E; plus alluvials along Turon R. Nos. 44-51, 53-56 on Bathurst and Nos.219-220 on Dubbo metallogenic maps.

OREBODIES:
Hill End (D), Box Ridge, Brand & Fletchers (Amalgamated) (HH), Chambers Creek, Daddys/Rowleys (HH), Dirt Hole, East (HH), Frenchmans (HH), Golden Gully, Hawkins Hill, Hermans (HH), Kings (HH), Lady Belmore (HH), Marshalls (HH), Middle Workings (HH), Mountain Maid (HH), Moustakas (HH), Oakey Creek, Paxtons (HH), Phillipsons (HH), Prince Alfred (HH), Quartz Ridge, Red Hill, Sargents Hill, Star Of Peace (HH), Turon River, Valentine, West Workings (HH)

MINES:
Britannia, Dirt Hole, Golden Crown & Cross, Halpins Secret, Hans, Homeward Bound, Numerous Mines, Oakey Creek, Quartz Ridge, Randwick, Shakespeare, Sir John Moore, Turon River, Valentine

GROUP: Hill End Group

COMMENTS:
Record includes regional setting of Hill End Synclinorial Zone, Hill End Synclinorium, and Hill End group.

LOCATION:

LATITUDE: 33 2　　LONGITUDE: 149 25
250K SHEET: SI55 8　　100K SHEET: 8731

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Orange
LOCAL GOVERNMENT AREA (LGA): Evans

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1851	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Box Ridge	Homeward Bound	Historical	Underground
Box Ridge	Britannia	Historical	Underground
Box Ridge	Shakespeare	Historical	Underground
Box Ridge	Hans	Historical	Underground
Box Ridge	Halpins Secret	Historical	Underground
Chambers Creek	Golden Crown & Cross	Historical	Unknown
Chambers Creek	Randwick	Historical	Unknown
Chambers Creek	Sir John Moore	Historical	Unknown
Dirt Hole	Dirt Hole	Historical	Underground
Golden Gully	Numerous Mines	Historical	Unknown
Hawkins Hill	Numerous Mines	Historical	Underground
Oakey Creek	Oakey Creek	Historical	Unknown
Quartz Ridge	Quartz Ridge	Historical	Unknown
Red Hill	Numerous Mines	Historical	Unknown
Sargents Hill	Numerous Mines	Historical	Underground
Turon River	Turon River	Historical	Unknown
Valentine	Valentine	Historical	Underground

COMPANIES:

OREBODY: Hill End (D)

PRESENT OPERATORS:
Silver Orchid Pty Ltd.

PRESENT OWNERS:	EQUITY%
B H P Gold Mines Ltd	50.00
Silver Orchid Pty Ltd.	50.00

OREBODY: Red Hill

PRESENT OWNERS:	EQUITY%
Silver Orchid Pty Ltd.	50.00
Unknown or Private Interests	50.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 22,000

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1887-1950), 1851-1869, 1870-1886,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Hill End Synclinorial Zone
SUB-PROVINCE: Hill End Synclinorium

HOST ROCKS:

FORMATION NAME & AGE: Chesleigh Formation - Late Silurian
LITHOLOGY: Quartz-rich greywacke and slate, tuffaceous at top, felsic tuff, metamorphosed mafic sills.
RELATIONSHIP TO MINERALISATION: Host to the principal orebodies, viz. Hawkins Hill, Sargents Hill, Red Hill, and Golden Gully; host to minor mineralisation at Chambers Creek 5 km S of Hill End.

FORMATION NAME & AGE: Cookman Formation - Late Silurian
LITHOLOGY: Quartzite like quartz, greywacke and slate.
RELATIONSHIP TO MINERALISATION: Host to minor mineralisation at Valentine and Dirt Hole at northern end of field.

FORMATION NAME & AGE: Crudine Group - Late Silurian-Early Devonain
LITHOLOGY: Slate, siltstone, feldspathic and lithic greywacke and tuff, conglomerate.
RELATIONSHIP TO MINERALISATION: Host to minor mineralisation at Box Ridge, 12 km E of Hill End.

FORMATION NAME & AGE: Cunningham Formation - Early-Middle Devonian
LITHOLOGY: Slate, siltstone, lithic and calcareous greywacke, greywacke, conglomerate.
RELATIONSHIP TO MINERALISATION: Host to minor mineralisation at Quartz Ridge 8 km E of Hill End.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to alluvial and deep lead mineralisation.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Clastic Sedimentary,
SIGNIFICANT: Alluvium, Carbonate, Volcanogenic Sedimentary

STRUCTURAL FEATURES:

MAJOR: Fold Axis, Folding,
SIGNIFICANT: Faulting

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

MAJOR: Stratigraphic Boundary

IGNEOUS ACTIVITY:

METAMORPHISM:
Regional metamorphic grade is greenschist facies.

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Metamorphic auriferous quartz veins in flysch-type metasediments (slate/greywacke sequences); no granitoid rocks in proximity.
Stratabound conformable auriferous quartz veins (saddle reefs) in flysch-type metasediments (slate/greywacke sequences).
SIGNIFICANT: Deep lead.
Alluvial.

STYLE:

MAJOR: Conformable, MINOR: Discordant

AGE OF MINERALISATION: Palaeozoic Early Carboniferous , Palaeozoic Late Devonian, Palaeozoic Late Silurian

DIMENSIONS/ORIENTATION:

OREBODY: Box Ridge

		ANGLE (deg.)		DIRECTION
DIP		63;90		E;-
STRIKE		350-360		

OREBODY: Dirt Hole

		MIN	AVE	MAX
TRUE WIDTH	(cm)			40.0
		ANGLE (deg.)		DIRECTION
DIP		10		N
STRIKE		90		

OREBODY: Hawkins Hill

		MIN	AVE	MAX
STRIKE LENGTH	(m)			600.0
TRUE WIDTH	(cm)		15.0	40.0
VERTICAL DEPTH	(m)			250.0
		ANGLE (deg.)		DIRECTION
DIP		60-70		E
PITCH		20		N,S
STRIKE		180		

OREBODY: Quartz Ridge

		ANGLE (deg.)		DIRECTION
DIP		60;67		W;W
STRIKE		345;350		

OREBODY: Red Hill

		MIN	AVE	MAX
TRUE WIDTH	(cm)			10.0
VERTICAL DEPTH	(m)	6.0		12.0
		ANGLE (deg.)		DIRECTION
PITCH				N
STRIKE		180		

OREBODY: Sargents Hill

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			90.0

OREBODY: Valentine

		MIN	AVE	MAX
STRIKE LENGTH	(m)			122.0

TRUE WIDTH	(cm)	15.0	30.0
VERTICAL DEPTH	(m)		66.0
		ANGLE (deg.)	DIRECTION
PITCH			N

ORE TEXTURE:
Banded/Laminated, Disseminated, Free Milling

NATURE OF MINERALISATION:
PRIMARY ORE: Multiple Veins, Saddle Reef, Vein (Reef),
SECONDARY ORE: Detrital (Alluvial), Supergene Enrichment

MINERALOGY:

OREBODY: Hill End (D)
Sulphide zone: gold, pyrite, (pyrrhotite, magnetite, arsenopyrite, sphalerite, galena), the latter four occurring mainly in the saddle reefs (Harper, 1918, reported by Stevens, 1975).
Gangue: quartz, (calcite), locally muscovite.
In places calcite was aligned parallel to the vein walls, giving a banded texture; gold content was apparently similarly aligned.
Pyrite occurred as thin films on joint faces; other metallic minerals occurred as discrete grains in quartz.
Gold occurred as coarse granules (grainsize varied from very fine to very coarse); little or no gold was contained in the sulphide grains. (Harper, 1918, reported by Stevens, 1975).

OREBODY: Hawkins Hill
Sulphide zone: Gold, pyrite, (pyrrhotite, galena, sphalerite, arsenopyrite). Pyrite occurred as thin veneers in joints of quartz, indicating late formation (Stevens, 1972b).
Highest gold grades were mainly above 120 m (Stevens, 1972a).
Gangue: quartz, (calcite, muscovite).
Sulphides were commonly associated with calcite. (Stevens, 1972b).

OREBODY: Quartz Ridge
Sulphide zone: arsenopyrite, galena, pyrite, ?sphalerite.

OREBODY: Red Hill
Sulphide zone: arsenopyrite.

CONTROLS OF MINERALISATION:
Controls are mainly structural, provided on a regional scale by the Hill End Anticline and on a local scale by smaller folds and cross-faults (Stevens, 1975).
The occurrence of auriferous veins in cross-faults suggests that deposition occurred after cross-faulting, which post-dates the regional Tabberabberan (late Middle Devonian) folding. However many of the veins, including the saddle reefs, parallel bedding rather than cleavage, and could have formed prior to folding, with the cross-veins resulting from remobilisation. (Markham & Basden, 1974).
Stratigraphic control is lacking on a regional scale, but exists on a local scale, where gold concentration was associated with carbonaceous slate (Stevens, 1975).

GENETIC MODELS:
PRINCIPAL SOURCES: Markham & Basden (1974), Stevens (1975).

Harper (1918, reported by Stevens, 1975) favoured a granitic origin in which mineral-charged vapours and hydrothermal solutions were given off by a presumed underlying (Kanimblan) granitic mass. A granitic origin is considered unlikely by Stevens (1975) as most deposits of the district have no direct spatial association with felsic intrusives, and the possibility of distant granitic bodies merging at depth is remote.

Stevens (1975) proposed a metamorphic origin: taking into account the wide age range of host formations and the strong structural control of mineralisation, Stevens (op.cit) concluded that emplacement of the gold was probably associated with the Kanimblan Orogeny (Early Carboniferous) but the vein material may not have been derived directly from the granitic intrusions.

According to Stevens (1975), possible sources of the gold include:-
i) expulsion of gold and aqueous fluids at depth during regional metamorphism, prior to granite magma generation;
ii) leaching of trace gold content from carbonaceous slate, possibly during metamorphism;
iii) remobilisation of gold from basaltic oceanic crust and oceanic mantle below the Hill End Trough (if this represents a marginal sea).

Deposition of gold in its final positions was most likely effected by chemical action of carbonaceous material from the slate on the gold-

bearing ions in the hydrothermal solution - probably gold chloride complexes (Stevens, 1975).
At Hill End the path of the gold-bearing fluids appears to have been controlled by the major anticlinal structure, and small fold structures may have had controlling effects in other parts of the district (Stevens, 1975).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Hill End (D)

PRINCIPAL SOURCES: Harper (1918), Stevens (1972a,b), Matson (1973), Markham & Basden (1974), Matson (1975a,b), Stevens (1975), Hilyard (1979a,b), (Markham (1982).
SUMMARY

The Hill End-Tambaroora field lies in the central part of the Hill End Synclinorium, which forms the major part of the synclinorial zone N of the Bathurst Granite. The field included reef deposits between Tambaroora and Hill End, at Chambers Creek 5 km S and at Quartz Ridge and Box Ridge 8 km and 12 km E of Hill End respectively; plus extensive alluvial deposits along the Turon River from W of Hill End to E of SOFALA-WATTLE FLAT (Deposit No.44).
Primary mineralisation comprised a N-S line of multiple vein orebodies, localised mainly in slate units within slate/greywacke sequences of the Silurian Chesleigh and Cookman Formations, Siluro-Devonian Crudine Formation, and the Devonian Cuningham Formation (Stevens, 1972a).
Orebodies consisted of sets of multiple narrow veins, which occurred for the most part as conformable planar or saddle reefs, also as transgressive 'blows' and fissures associated with fault zones or stratigraphic contacts.

REGIONAL SETTING: HILL END SYNCLINORIAL ZONE
PRINCIPAL SOURCES: Markham & Basden (1974), Stevens (1975).

The Hill End Synclinorial Zone contains inliers of Ordovician flysch sequences deposited on the Monaro Slope and Basin, and volcanics of the Molong Volcanic Arc, overlain by Silurian volcanic rift/arch felsic volcanics and flysch sequences which were deposited in the Hill End Trough (Markham & Basden, 1974; Stevens, 1975).

According the the Scheibner (1976) model, the Monaro Slope and Basin was a plate margin continental slope/oceanic basin which accumulated flysch deposits E of a volcanic arc - the Molong Volcanic Arc - during the Ordovician (Markham & Basden, 1974; Stevens, 1975).

In the Middle Silurian continued eastward travel of the locus of subduction resulted in strong extension and splitting of the Molong Volcanic Arc (Stevens, 1975). The Hill End Trough opened initially as a volcanic rift along a zone bounded by the Copperhania and Wiagdon Thrusts, which now bound part of the synclinorial zone to the W and E respectively (Markham & Basden, 1974).
The eastern segment of the arc became part of the Capertee Rise (now represented by the Capertee Block) (Stevens, 1975). The rift widened in the Late Silurian to form a marginal sea in the N (Markham & Basden, 1974), in which were deposited thick sequences of felsic volcanics and interbedded sediments in the Middle Silurian, and deep water flysch sediments in the Late Silurian-Middle Devonian (Stevens, 1975).
Basement rocks to the Siluro-Devonian trough sequence include deformed andesitic volcanics of the Molong Volcanic Arc, which are represented by the Rockley and Sofala Volcanics, and deformed flysch sediments of the Monaro Slope and Basin, represented by the Triangle and Campbells Groups (Markham & Basden, 1974; Stevens, 1972a, 1975).

The Hill End Trough was folded by the Middle Devonian Tabberabberan Orogeny. Tight N-S folds with axial plane cleavage were formed, and regional metamorphism produced biotite-grade greenschist facies assemblages. Cratonisation was completed with intrusion of granitic plutons in association with the Kanimblan Orogeny (Carboniferous).
The Bathurst Granite was emplaced along a major E-W zone of structural weakness, possibly related to differential movements of the northern and southern blocks of the Hill End Trough. (Stevens, 1975).

ASSOCIATED MINERALISATION: HILL END SYNCLINORIAL ZONE (HILL END GROUP AND COPPERHANIA GROUP)
PRINCIPAL SOURCES: Markham & Basden (1974), Stevens (1975).

The principal gold association in the synclinorial zone is gold-quartz veins in predominantly slaty metasediments within slate/greywacke sequences (Markham & Basden, 1974). The association is represented by the Hill End and Copperhania groups of deposits:- STUART TOWN, HARGRAVES -WINDEYER and HILL END-TAMBAROORA (Deposit Nos.40-42) (Hill End group), and TRUNKEY CREEK and TUENA (Deposit Nos.34,35) (Copperhania group).

Deposits have the following general characteristics:-
i) Mineralisation is distributed through a wide stratigraphic and age range.
ii) Mineralisation most commonly occurs in narrow veins that are overall conformable with bedding in planar or folded (saddle) reefs. Some ore was localised in wider reefs or blows, commonly associated with fault zones, in places along stratigraphic contacts (e.g HILL END-TAMBAROORA, STUART TOWN, TRUNKEY CREEK).
iii) Mineralis... also occurs in structurally controlled transgressive ?fissure veins (HILL END-TAMBAROORA, HARGRAVES-WINDEYER), cleavage planes (TRUNKEY CREEK, TUENA), and fault planes (STUART TOWN, TRUNKEY CREEK).
iv) Mineralisation is commonly associated with folding, on a regional and/or a local scale. STUART TOWN lies on a cross-fold on a regional anticlinal axis; HILL END-TAMBAROORA lies on the axis of a major regional anticline. Saddle reefs at HILL END-TAMBAROORA and HARGRAVES-WINDEYER occur in fold hinge zones.
v) All deposits are remote from outcropping granite.
vi) HILL END-TAMBAROORA, HARGRAVES-WINDEYER, and some orebodies at TRUNKEY CREEK are not directly associated with igneous rocks; some orebodies at TUENA are spatially associated with felsic volcanics, and some orebodies at TRUNKEY CREEK, STUART TOWN, and TUENA are close to mafic-intermediate volcanics. (Markham & Basden, 1974; Stevens, 1975).

REGIONAL SETTING: HILL END SYNCLINORIUM
PRINCIPAL SOURCES: Markham & Basden (1974), Stevens (1975).

The Hill End Synclinorium is a broad, northward-narrowing synclinorium which represents the maximum development of the Hill End Trough (Markham & Basden, 1974; Stevens, 1975).
Extensive rhyolitic to dacitic volcanics which were associated with early rifting are exposed at the base of the trough succession along the eastern and western margins of the synclinorium (Bells Creek and Mullions Range Volcanics respectively) (Markham & Basden, 1974).
The volcanics are overlain by a thick succession of graptolite-bearing slate, greywacke, conglomerate (Chesleigh and Cookman Formations and Crudine Group), and largely reworked dacitic tuff (Merrions Tuff) (Stevens, 1972a, 1975).
The Silurian and Early Devonian rocks are closely to tightly folded with a well developed axial plane cleavage; folds are near isoclinal in restricted areas (Stevens, 1975). Excluding the bounding thrust faults, regional faulting is apparently not a prominent feature of the synclinorium (Markham & Basden, 1974).

REGIONAL SUCCESSION: HILL END SYNCLINORIUM
PRINCIPAL REFERENCES: Matson (1973), Stevens (1972a).

1./ Mullions Range Volcanics and Bells Creek Volcanics (Smv and Sbc on Bathurst metallogenic map) (Middle Silurian) - rhyolite, dacite, tuff.
2./ Chesleigh Formation (Sch) (Late Silurian) - quartz-rich greywacke and slate, tuffaceous at top, felsic tuff, metamorphosed mafic sills. Unit is host to the major orebodies at Hill End, including Hawkins Hill, Sargents Hill, Red Hill, and Golden Gully; to minor orebodies at Chambers Creek; and to minor reefs at HARGRAVES-WINDEYER(Deposit No.41).
3./ Cookman Formation (Scf) (Late Silurian) - quartzite like quartz, greywacke, and slate. Host to minor veins at northern end of Hill End-Tambaroora field, and minor reefs at HARGRAVES-WINDEYER.
4./ Crudine Group (S-Dc) (Late Silurian-Early Devonian) - slate, siltstone, feldspathic and lithic greywacke and tuff, conglomerate. Host to major orebodies at HARGRAVES-WINDEYER; and to minor orebodies at Box Ridge (Hill End-Tambaroora).
5./ Merrions Tuff (Dm) (Early Devonian) - tuff, dacite, slate. Host to major orebodies at HARGRAVES-WINDEYER; and to minor orebodies N of the Hill End-Tambaroora field.
6./ Cunningham Formation (Dcf) (Early-Middle Devonian) - slate, silts... ...ic and calcareous greywacke, greywacke, conglomerate.
Ho... ...mineralisation at HARGRAVES-WINDEYER and at STUART TOWN (D... (as shown on Dubbo metallogenic map); and to minor o... ...artz Ridge (Hill End-Tambaroora).
7./ ...gyn Formation (Dnf on Dubbo metallogenic map) (Early Devonian) - limestone, shale, sandstone, comglomerate.
Sedimentary facies equivalent of Cunningham Formation.
Possible host (instead of Cunningham Formation) to STUART TOWN (Matson, 1975b).

GEOLOGICAL SETTING: HILL END-TAMBAROORA
PRINCIPAL SOURCES: Harper (1918), Stevens (1972a), Markham & Basden (1974), Stevens (1975), Markham (1982).

The Hill End-Tambaroora field is situated in the core of a major regional anticline. The Silurian Chesleigh Formation is exposed along

the fold axis, flanked by Devonian rocks folded on a smaller scale (Stevens, 1972a; Markham & Basden, 1974).
The closest granitic intrusive is a stock of Carboniferous Bruinbun Granite 12 km S of Hill End, 6 km S of Chambers Creek.

Harper (1918) distinguished two rock units in the Hill End area - a lower unit consisting of Ordovician highly cleaved and crushed black slates with interbedded mica schist and fine-grained sandstone, unconformably overlain by an upper unit of coarsely bedded tuff and arkose of 'Devonian' age. The entire sequence was assigned to the Late Silurian Chesleigh Formation by Packham (1958, reported by Stevens, 1975), and the 'unconformity' may represent a structural break produced by strong folding of an interface between competent sandy rocks and incompetent slaty beds (Stevens, 1975). Host lithologies are predominantly slate, also tuffaceous rocks, quartzite, arkose, greywacke, feldspathic arenite.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Harper (1918), Stevens (1975), Markham (1982).

Harper distinguished four main types of quartz veins:-
(1) Bedded (conformable) veins in lower, slaty unit ('older rocks').
(2) Normal and inverted saddle reefs in upper, greywacke unit ('younger rocks').
(3) Reefs and blows along slate/greywacke contact ('older'/'younger' strata contact).
(4) Small fissure veins, commonly found as offshoots of types (1)-(3).

Veins of type (1) were the most productive, the main centre of production being Hawkins Hill.
Veins of type (2) were more commonly saddle reefs, thick at the crests, but thinning sharply on the limbs. Generally not productive; most of the gold from the greywacke unit came from shoots on E-dipping limbs associated with carbonaceous rocks.
Reefs or blows (type (3)) were locally productive, the best values occurring at intersections of bedded veins in the underlying rocks with the contact. The blows were irregular, with sharp hanging wall and gradational footwall.
Fissure veins (type (4)) were not significant for production except near intersections with bedded veins. They may represent remobilised quartz or a later stage of quartz introduction than the bedded veins (Markham, 1982).

OREBODY: Box Ridge
Host rocks are feldspathic arenite and slate of the Crudine Group (Stevens, 1972b).

OREBODY: Chambers Creek
Host rock is greywacke or slate of the Chesleigh Formation (Stevens, 1972a,b).

OREBODY: Dirt Hole
Mineralisation was localised at contact of sandstone and slate within Cookman Formation (Matson, 1975a).

OREBODY: Golden Gully
Reefs were probably limbs of saddle reefs; veins decreased in thickness and grade with depth (Stevens, 1975).
Host rocks are tuff, arkose, and slate (Stevens, 1972b) of the Chesleigh Formation (Stevens, 1972a).
The alluvial deposit was the discovery site of the field (Markham,1982).

OREBODY: Hawkins Hill
PRINCIPAL SOURCES: Harper (1918, summarised by Markham & Basden, 1974; Stevens, 1975; and Markham, 1982), Stevens (1972a,b).

Hawkins Hill was the source of most of the recorded production from the Hill End-Tambaroora field (Markham & Basden, 1974).
Host rocks are tuff, arkose, slate, and quartzite of the Chesleigh Formation (Stevens, 1972a,b). The principal reefs at Hawkins Hill are listed separately in this datafile, suffixed by '(HH)'.

Gold was concentrated in a large number of subparallel veins. Most of the principal veins, some of which were actually closely spaced groups of veins, parallelled bedding within the lower slaty unit (Harper,1918). The veins followed carbonaceous slate beds. Frenchmans was located at the contact between the lower slaty unit and the upper sandy unit. Several veins - Prince Alfred, Daddys, Rowleys, Mountain Maid - were described by Harper (1918) as inverted saddle reefs in the sandy unit. Small fissure veins occurred as local offshoots from the bedded veins, but significant gold values rarely extended more than a metre from the bedded vein. (Harper, 1918, summarised by Markham & Basden, 1974;

Stevens, 1975; and Markham, 1982).

OREBODY: Quartz Ridge
Host rocks are black slate and metagreywacke of the Cunningham Formation (Stevens, 1972b; Markham, 1982).

OREBODY: Red Hill
Host rocks are tuff, quartzite, and slate (Stevens, 1972b) of the Chesleigh Formation (Stevens, 1972a). Ore shoot had extended length, but restricted depth (Stevens, 1972b).

OREBODY: Sargents Hill
Host rocks are slate and quartzite (Stevens, 1972b) of the Chesleigh Formation (Stevens, 1972a).

OREBODY: Valentine
Host rocks are quartzite and slate of the Cookman Formation (Matson, 1975a).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Harper L.F., 1918
The Hill End-Tambaroora goldfield.
Geological Survey of New South Wales. Mineral Resources
27

Hilyard D., 1979
Sofala-Hill End-Stuart Town gold deposits map, 1:250 000 scale.
Geological Survey of New South Wales
1v

Hilyard D., 1979
Hill End gold maps. 4 maps, including Hill End gold deposits map, 1:50 000 scale.
Geological Survey of New South Wales
1v

Hobbs J.J., 1977
Geochemical survey of the Hill End-Sofala districts.
Geological Survey of New South Wales. Report
GS1977/153

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Matson C.R., 1973
Dubbo 1:250 000 metallogenic series map. Sheet SI 55-04, 1st edition.
Geological Survey of New South Wales
1v

Matson C.R., 1975
Part 1. Mine data sheets to accompany metallogenic map, Dubbo 1:250 000 sheet. Sheet SI 55-04.
Geological Survey of New South Wales
1v

Matson C.R., 1975
Part 2. A metallogenic study of the Dubbo 1:250 000 sheet. Sheet SI 55-04.
Geological Survey of New South Wales
1v

Moffitt R.S., 1974
Arsenopyrite at the Sir John Moore prospect, Chambers Creek, south of the Hill End goldfield.
Geological Survey of New South Wales. Report
GS1974/192

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

Stevens B., 1972
Bathurst, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-08, 1st edition.
Geological Survey of New South Wales
1v

Stevens B.P.J., 1972
Mine data sheets to accompany Bathurst, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-08.
Geological Survey of New South Wales
1v

Stevens B.P.J., 1975
A metallogenic study of the Bathurst 1:250 000 sheet. Sheet SI 55-08.
Geological Survey of New South Wales
1v

oooooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 43 GULGONG

DEPOSIT IDENTIFICATION:

COMMODITIES: Au

DISTRIBUTION:
Record covers reefs along 5 km length of a ridge running SSE from Gulgong township, and at Royal George 16 km S; plus deep leads in area 20 km x 16 km centred on ridge. Nos. 46, 49-51, 53-57, 59-66, 68-82, 84 on Dubbo metallogenic map.

OREBODIES:
(Old) Gulgong, Gulgong (D), Cudgegong, East -- Eureka/Scandinavian, East -- Helvetia/Brown Snake, Louisianna, Northeast -- Black/Happy Valley, Parramatta/Happy Valley, Red Hill, Royal George, Salvation Hill, Scabby Gully, South -- Magpie/Rapps Gully, Southeast -- Canadian/Home Rule, Southeast -- Cumbandry/Britannia, Southeast -- Little Cumbandry, Southwest -- Caledonian, Southwest -- Moonlight, Tallawang, Two Mile Flat, Welcome, West -- Adams, West -- Perseverance/Frasers

MINES:
Adams, Beryl (Diamond Fields), Black, Black Hill, Black Swan, Brilliant, Britannia, Brown Snake, Caledonian, Canadian, Christmas, Coming Event, Cosmopolitan, Cudgegong, Cumbandry, Digger Prince, Dog & Cat, Eureka, Fletchers, Fords Creek, Frasers, Grecian Bend, Gulgong, Happy Valley, Helvetia, Home Rule, Lily May, Little Caledonian, Little Cumbandry, Louisa, Louisianna, Magpie (Eldorado), Mariners, Moonlight, Never-Say-Die, Nil Desperandum, Old 44, Parramatta, Periwinkle, Perseverance, Rapps Gully, Red, Red Hill, Red Streak, Redgate, Rose Of England, Royal George, Salvation Hill, Scandinavian, Shallow Rush, Sovereign, Springfield, Standard, Star, Star Of The South, Three Mile, Victorian, Welcome

GROUP: -

COMMENTS:
See Deposit No.44 SOFALA-WATTLE FLAT for regional setting of Molong-South Coast Anticlinorial Zone (Capertee Block). The deep leads are grouped into six tributary systems according to location relative to Gulgong, viz: W, SW, S, SE, E, NE.

LOCATION:

LATITUDE: 32 22   LONGITUDE: 149 32
250K SHEET: SI55 4   100K SHEET: 8833

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Dubbo
LOCAL GOVERNMENT AREA (LGA): Mudgee

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1852	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
(Old) Gulgong	Gulgong	Historical	Underground
(Old) Gulgong	Mariners	Historical	Underground
Cudgegong	Cudgegong	Possible	Placer (Dredging)
East -- Eureka/Scandinavian	Eureka	Historical	Underground
East -- Eureka/Scandinavian	Star	Historical	Underground
East -- Eureka/Scandinavian	Star	Historical	Surface
East -- Eureka/Scandinavian	Scandinavian	Historical	Underground
East -- Eureka/Scandinavian	Star Of The South	Historical	Underground
East -- Eureka/Scandinavian	Star Of The South	Historical	Surface
East -- Helvetia/Brown Snake	Helvetia	Historical	Underground
East -- Helvetia/Brown Snake	Brown Snake	Historical	Underground

Louisianna	Louisianna	Historical	Underground
Northeast -- Black/Happy Valley	Fletchers	Historical	Underground
Northeast -- Black/Happy Valley	Happy Valley	Historical	Underground
Northeast -- Black/Happy Valley	Black	Historical	Surface
Northeast -- Black/Happy Valley	Black	Historical	Underground
Northeast -- Black/Happy Valley	Standard	Historical	Underground
Northeast -- Black/Happy Valley	Parramatta	Historical	Surface
Northeast -- Black/Happy Valley	Parramatta	Historical	Underground
Northeast -- Black/Happy Valley	Black Swan	Historical	Surface
Northeast -- Black/Happy Valley	Black Swan	Historical	Underground
Northeast -- Black/Happy Valley	Black Hill	Historical	Surface
Northeast -- Black/Happy Valley	Black Hill	Historical	Underground
Northeast -- Black/Happy Valley	Cosmopolitan	Historical	Underground
Northeast -- Black/Happy Valley	Coming Event	Historical	Underground
Northeast -- Black/Happy Valley	Old 44	Historical	Underground
Parramatta/Happy Valley	Brilliant	Historical	Underground
Parramatta/Happy Valley	Happy Valley	Historical	Underground
Parramatta/Happy Valley	Standard	Historical	Underground
Parramatta/Happy Valley	Parramatta	Historical	Underground
Parramatta/Happy Valley	Never-Say-Die	Historical	Underground
Red Hill	Red Hill	Historical	Underground
Royal George	Royal George	Historical	Underground
Salvation Hill	Salvation Hill	Historical	Underground
South -- Magpie/Rapps Gully	Three Mile	Historical	Underground
South -- Magpie/Rapps Gully	Three Mile	Historical	Surface
South -- Magpie/Rapps Gully	Magpie (Eldorado)	Historical	Underground
South -- Magpie/Rapps Gully	Magpie (Eldorado)	Historical	Surface
South -- Magpie/Rapps Gully	Springfield	Historical	Underground
South -- Magpie/Rapps Gully	Springfield	Historical	Surface
South -- Magpie/Rapps Gully	Rapps Gully	Historical	Underground
South -- Magpie/Rapps Gully	Rapps Gully	Historical	Surface
South -- Magpie/Rapps Gully	Fords Creek	Historical	Underground
South -- Magpie/Rapps Gully	Fords Creek	Historical	Surface
South -- Magpie/Rapps Gully	Sovereign	Historical	Underground
South -- Magpie/Rapps Gully	Sovereign	Historical	Surface
Southeast -- Canadian/Home Rule	Nil Desperandum	Historical	Underground
Southeast -- Canadian/Home Rule	Shallow Rush	Historical	Underground
Southeast -- Canadian/Home Rule	Canadian	Historical	Underground
Southeast -- Canadian/Home Rule	Home Rule	Historical	Underground
Southeast -- Canadian/Home Rule	Christmas	Historical	Underground
Southeast -- Canadian/Home Rule	Rose Of England	Historical	Underground
Southeast -- Cumbandry/Britannia	Britannia	Historical	Underground
Southeast -- Cumbandry/Britannia	Britannia	Historical	Surface
Southeast -- Cumbandry/Britannia	Cumbandry	Historical	Underground
Southeast -- Cumbandry/Britannia	Cumbandry	Historical	Surface
Southeast -- Cumbandry/Britannia	Dog & Cat	Historical	Underground
Southeast -- Cumbandry/Britannia	Dog & Cat	Historical	Surface
Southeast -- Cumbandry/Britannia	Lily May	Historical	Underground
Southeast -- Cumbandry/Britannia	Lily May	Historical	Surface
Southeast -- Little Cumbandry	Red	Historical	Underground
Southeast -- Little Cumbandry	Red Streak	Historical	Underground
Southeast -- Little Cumbandry	Little Cumbandry	Historical	Underground
Southeast -- Little Cumbandry	Periwinkle	Historical	Underground
Southwest -- Caledonian	Caledonian	Historical	Underground
Southwest -- Caledonian	Caledonian	Historical	Surface
Southwest -- Caledonian	Victorian	Historical	Underground
Southwest -- Caledonian	Victorian	Historical	Surface
Southwest -- Caledonian	Grecian Bend	Historical	Underground
Southwest -- Caledonian	Grecian Bend	Historical	Surface
Southwest -- Caledonian	Redgate	Historical	Underground
Southwest -- Caledonian	Redgate	Historical	Surface
Southwest -- Caledonian	Little Caledonian	Historical	Underground
Southwest -- Caledonian	Little Caledonian	Historical	Surface
Southwest -- Moonlight	Moonlight	Historical	Underground
Southwest -- Moonlight	Moonlight	Historical	Surface
Welcome	Welcome	Historical	Underground
West -- Adams	Eureka	Historical	Underground
West -- Adams	Adams	Historical	Underground
West -- Adams	Adams	Historical	Surface
West -- Perseverance/Frasers	Frasers	Historical	Surface
West -- Perseverance/Frasers	Frasers	Historical	Underground
West -- Perseverance/Frasers	Louisa	Historical	Underground
West -- Perseverance/Frasers	Beryl (Diamond Fields)	Historical	Underground
West -- Perseverance/Frasers	Digger Prince	Historical	Underground

COMPANIES:

OREBODY: Cudgegong

PRESENT OPERATORS:
Cluff Resources Pacific Ltd.

PRESENT OWNERS:	EQUITY%
Cluff Resources Pacific Ltd.	50.00
Unknown Or Private Interests	50.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 17,606

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1885-1894), (1901-1910), (1931-1945), 1870-1884, 1895-1900,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION			
Dec 1988	2,200	0.3	550	Subeconomic Demonstrated	In-Situ	all	Cudgegong alluvial; units: '000 cubic metres, g/cubic m

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Molong-S C Anticlin Zone(Capertee Block)
SUB-PROVINCE: Sofala Anticlinorium

HOST ROCKS:

FORMATION NAME & AGE: Burranah Formation - Early Devonian
LITHOLOGY: Andesite, tuff, siltstone, tuffaceous sandstone, limestone.
RELATIONSHIP TO MINERALISATION: Host to Red Hill reef.

FORMATION NAME & AGE: Tinja Formation - Early Devonian
LITHOLOGY: Shale, siltstone, chert, limestone, arkose.
RELATIONSHIP TO MINERALISATION: Host to Royal George reef.

FORMATION NAME & AGE: Gulgong Granite - Early-Middle Carboniferous
LITHOLOGY: Granite, adamellite, granodiorite, ?diorite.
RELATIONSHIP TO MINERALISATION: Host to (Old) Gulgong and Louisianna reefs.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to alluvial mineralisation.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Alluvium,
MINOR: Clastic Sedimentary, Granitic, Intermediate Extrusive , Volcanogenic Sedimentary

STRUCTURAL FEATURES:

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

MAJOR: Intrusive Contact

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Granodiorite)

METAMORPHISM:

Regional metamorphic grade is greenschist facies.

ALTERATION:

OREBODY: Red Hill

Host claystones are highly altered.

DEPOSIT CHARACTERISTICS:

TYPES:

MAJOR: Deep lead.
MINOR: Auriferous quartz veins in metasediments adjacent to granitoid.
Gold-bearing quartz veins/stockwork in granitoid.

STYLE:

MAJOR: Discordant

AGE OF MINERALISATION: Cainozoic Tertiary, Palaeozoic Early Carboniferous, Palaeozoic Middle Carboniferous

DIMENSIONS/ORIENTATION:

OREBODY: (Old) Gulgong

		MIN	AVE	MAX
TRUE WIDTH	(cm)	15.0	60.0	91.0
VERTICAL DEPTH	(m)			70.0
		ANGLE (deg.)		DIRECTION
DIP		60-70		E
STRIKE		320		

OREBODY: Gulgong (D)

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			76.0

OREBODY: East -- Eureka/Scandinavian

		MIN	AVE	MAX
STRIKE LENGTH	(m)			122,0
VERTICAL DEPTH	(m)	3.0		34.0

OREBODY: East -- Helvetia/Brown Snake

		MIN	AVE	MAX
VERTICAL DEPTH	(m)		24.0	48.0

OREBODY: Louisianna

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			38.0
		ANGLE (deg.)		DIRECTION
STRIKE		320-340		

OREBODY: Northeast -- Black/Happy Valley

		MIN	AVE	MAX
TRUE WIDTH	(m)	4.5	91.0	
VERTICAL DEPTH	(m)	0.0		62.0

OREBODY: Red Hill

		MIN	AVE	MAX
STRIKE LENGTH	(m)			70.0
VERTICAL DEPTH	(m)			65.5
		ANGLE (deg.)		DIRECTION
DIP		75-90		E
STRIKE		180		

OREBODY: Royal George

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			52.0
		ANGLE (deg.)		DIRECTION
STRIKE		160		W

OREBODY: Salvation Hill

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			49.0

OREBODY: South -- Magpie/Rapps Gully

		MIN	AVE	MAX
STRIKE LENGTH	(m)			2400.0

		MIN	AVE	MAX
TRUE WIDTH	(m)	3.0		21.0
VERTICAL DEPTH	(m)	0.0	21.0	40.0

OREBODY: Southeast -- Canadian/Home Rule

		MIN	AVE	MAX
STRIKE LENGTH	(m)	122.0		
TRUE WIDTH	(m)	24.0		170.0
VERTICAL DEPTH	(m)	4.5		72.0
DEPTH OF COVER	(m)	0.3		18.0

OREBODY: Southeast -- Cumbandry/Britannia

		MIN	AVE	MAX
VERTICAL DEPTH	(m)	0.0		62.0

OREBODY: Southeast -- Little Cumbandry

		MIN	AVE	MAX
TRUE WIDTH	(m)			15.0
VERTICAL DEPTH	(m)		43.0	60.0

OREBODY: Southwest -- Caledonian

		MIN	AVE	MAX
STRIKE LENGTH	(m)			3600.0
TRUE WIDTH	(m)	3.0		30.0
VERTICAL DEPTH	(m)	3.0		40.0

OREBODY: Southwest -- Moonlight

		MIN	AVE	MAX
VERTICAL DEPTH	(m)	42.0		60.0

OREBODY: Welcome

		MIN	AVE	MAX
STRIKE LENGTH	(m)			91.0
DEPTH OF COVER	(m)			27.5

OREBODY: West -- Adams

		MIN	AVE	MAX
TRUE WIDTH	(m)			91.0
VERTICAL DEPTH	(m)	0.0		45.0

OREBODY: West -- Perseverance/Frasers

		MIN	AVE	MAX
STRIKE LENGTH	(m)	100.0		1850.0
TRUE WIDTH	(m)	3.0	8.0	15.0
VERTICAL DEPTH	(m)	3.0		41.0

ORE TEXTURE:
Free Milling, Oxidised

NATURE OF MINERALISATION:
PRIMARY ORE: Vein (Reef),
SECONDARY ORE: Deep Lead

MINERALOGY:

OREBODY: (Old) Gulgong
Sulphide zone: minor Cu, Pb, Zn, Fe sulphides.

OREBODY: Gulgong (D)
Gold, rare sulphides.

OREBODY: Salvation Hill
Sulphide zone: gold, pyrite.

CONTROLS OF MINERALISATION:
Main control on primary mineralisation was proximity of Gulgong Granite. Development of deep lead deposits was controlled by climate and geomorphology.

GENETIC MODELS:
Matson (1975b) favoured a granitic origin for the reef gold.

The fossil drainage pattern represented by the tributary leads indicates that the source material of the alluvial mineralisation was the rocks within the ridge trending SSE from Gulgong township (Matson, 1975b).

Decrease in grade and grainsize of alluvial gold downstream indicates short distance of transportation (Matson, 1975b).
Gold-bearing Permiam sediments to the E may also have been a significant source of gold in the leads (Matson, 1975b).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: (Old) Gulgong

Orebody comprised three parallel reefs in hornblende granodiorite (Markham, 1982). Mariners reef lay 550 m to the E (Matson, 1975a).

OREBODY: Gulgong (D)

PRINCIPAL SOURCES: Jones (1940, summarised by Markham, 1982), Matson (1973, 1975a,b).
SUMMARY

The Gulgong gold field occurs in the northern part of the Sofala Anticlinorium within the Capertee Block, which forms the eastern branch of the Molong-South Coast Anticlinorial Zone (N). Mineralisation comprised both reef and deep lead workings of which the deep leads contributed the major proportion of production.
Primary mineralisation consisted of irregular and inconsistent reefs in granodiorite of the Carboniferous Gulgong Granite, and in andesitic volcanics or slate of the Devonian Burranah and Tinja Formations adjacent to intrusive contacts with the granodiorite.
Secondary mineralisation comprised an extensive system of partially basalt-covered deep leads in tributaries which drained both sides of a ridge, which hosted reef deposits, into a Middle Miocene river which meandered between Cooyal and Gulgong.

REGIONAL SETTING: SOFALA ANTICLINORIUM (N)
PRINCIPAL SOURCES: Matson (1973, 1975b).

The Sofala Anticlinorium contains Silurian-Middle Devonian arch/rift volcanics and associated sediments which were developed over rifted Ordovician volcanics (Sofala Volcanics) of the Molong Volcanic Arc.
In the Gulgong region, basement rocks are ?Ordovician-Middle Silurian deformed flysch sediments (Lue Beds) that were attached to the Molong Volcanic Arc (Matson, 1973, 1975b).

REGIONAL SUCCESSION: GULGONG
PRINCIPAL SOURCES: Jones (1940), Matson (1973, 1975b).

The Lue Beds are unconformably overlain by:-
1./ Dungeree Volcanics (Sdu on Dubbo metallogenic map) (Middle Silurian) - rhyolite, dacite, tuff, shale. (Arch/rift volcanics related to rifting of Molong Volcanic Arc; Matson, 1975b).
2./ Tucklan Beds (Dtb) (Late Silurian-Early Devonian) - andesite, tuff, arkose, shale. (Following Late Silurian uplift; Matson, 1975b).
3./ Burranah Formation (Dlh) (Early Devonian) - andesite, tuff, siltstone, tuffaceous sandstone, limestone. (Arch volcanics, shallow water sedimentation; Matson, 1975b).
4./ Tinja Formation (Dlt) (Early Devonian) - shale, siltstone, chert, limestone, arkose. (Shallow water sedimentation; Matson, 1975b).
5./ Boogledie Formation (Dma) (Middle Devonian) - shale, feldspathic arenite, conglomerate, tuff, limestone. (Shallow marine; Matson, 1975b).

The Capertee Rise was deformed by the Tabberabberan Orogeny in the late Middle Devonian (Matson, 1975b).

The Silurian-Middle Devonian succession was intruded during the Kanimblan Orogeny by:-
6./ Gulgong Granite (Cgg) (Early-Middle Carboniferous) - granite, adamellite, granodiorite, ?diorite.

The area is adjacent to the western margin of the Sydney Basin and is believed (Markham, 1982) to have been at one stage covered by:-
7./ Permian sediments (Pu) - remnants of sandstone, conglomerate locally preserved.
8./ Tertiary-Recent terrestrial sequence - thick fluvial sediments in a remnant Miocene river valley were host to gold-bearing alluvial leads.
9./ Miocene olivine basalt - largely covered lower portions of valley systems.

LOCAL SETTING: REEF MINERALISATION
PRINCIPAL SOURCES: Jones (1940), Matson (1975a,b), Markham (1982).

The principal reefs - Red Hill, Louisianna, and (Old) Gulgong - occurred on a NNW-trending ridge SE of Gulgong, composed of Burranah Formation sediments intruded by granodiorite. The ridge is believed to have been the main locus for shedding of gold into the flanking deep leads (Markham, 1982).

In addition, a number of reefs occurred at depth beneath deep lead deposits, viz. Welcome, Parramatta, Happy Valley, Brilliant, Standard, and Never-Say-Die. (Jones, 1940; Markham, 1982).
The host rock for most of the reefs was a granodiorite phase of the Gulgong Granite (Jones, 1940); sedimentary and 'felsite' hosts adjacent to granodiorite were recorded for Red Hill, Royal George and Salvation Hill by Jones (op.cit). The reefs were generally highly variable in grade and not very productive, although they were evidently the source of much of the rich deep lead ore (Jones, 1940; Markham, 1982).

LOCAL SETTING: DEEP LEAD MINERALISATION
PRINCIPAL SOURCES: Jones (1940), Matson (1975a,b), Markham (1982).

The deep leads occurred in Tertiary to Recent sediments in a remnant river valley system in the deeply eroded region around Gulgong. The system dates from at least Middle Miocene. Tributary leads drained from a topographic high trending SSE from Gulgong which shed gold to the E, W and N. The tributaries flowed into a large meander of the main deep lead channel, a river which ran from between Cooyal and Mudgee NW through Home Rule, to N of Gulgong and further W and SW. The course of the main lead channel was similar to that of the present Wyaldra Creek.
The lower portions of the leads were infilled with basalt.
The leads were productive only in the upper portions, i.e. not in the main lead channel. Depth to auriferous gravel and thickness of basalt cover increased and grade decreased downstream.
(Jones, 1940; Markham, 1982).

OREBODY: **East -- Eureka/Scandinavian**
Basement rock was diorite with ?andesite nodules.
Gold grades were generally low. (Matson, 1975a).

OREBODY: **East -- Helvetia/Brown Snake**
Gold grades were generally low (Matson, 1975a).

OREBODY: **Louisianna**
Mineralisation occurred in irregular bodies of quartz close to the contact of granodiorite and ?volcanic 'felsite' (Markham, 1982) of the Burranah Formation (Matson, 1973).
Gold grades were locally high, but generally patchy (Matson, 1975a).

OREBODY: **Northeast -- Black/Happy Valley**
One of the most productive lead systems of the field. The lead rose in the vicinity of reef mineralisation at Red Hill.
The Parramatta and Black Swan tributary leads junctioned with the Black Hill while lower down the Black lead was joined by the Happy Valley lead and subsequently the Cosmopolitan. Standard and Coming Event were tributaries of Happy Valley.
Grades were extremely high in upper portions, decreased downstream with increasing thickness of basalt and width of channel.
Wash thickness = 15-45 cm, average 30 cm.
(Matson, 1975a; Markham, 1982).

OREBODY: **Parramatta/Happy Valley**
These reefs were discovered beneath worked deep leads. Brilliant and Parramatta reefs occurred beneath the Black and tributary Parramatta leads; Brilliant was near the Black/Parramatta junction.
Happy Valley reef (beneath Happy Valley lead) comprised a number of thin quartz veins containing free gold, but not productive.
Standard reef lay near Standard/Happy Valley junction; Never-Say-Die occurred between the Parramatta and Black leads.
(Matson, 1975a; Markham, 1982).

OREBODY: **Red Hill**
Discovery site of the field. Host rocks are highly altered claystones of Devonian age (Burranah Formation) which have been intruded by dykes and irregular masses of granodiorite. Rocks were traversed by a network of irregular and mostly narrow quartz veins, carrying free gold in places. A more persistent vein strikes N-S on the S side of Red Hill.
Gold grades were highly variable. (Matson, 1975a; Markham, 1982).

OREBODY: **Royal George**
Orebody comprised a series of parallel veins within slates of the Tinja Formation. Grades were highly variable. (Matson, 1975a; Markham, 1982).

OREBODY: **Salvation Hill**
Host rocks are shale/slate - undifferentiated Palaeozoic sediments/ volcanics (Pzh on Dubbo metallogenic map) - intruded by granodiorite and 'felsite' dykes. Felsite is heavily impregnated with pyrite.
(Matson, 1973, 1975a; Markham, 1982).

OREBODY: **South -- Magpie/Rapps Gully**
System originated in vicinity of (Old) Gulgong-Louisianna reefs.

Basement was reported to be Carboniferous (?Permian) conglomerate (Matson, 1975a). Basalt cover was up to 15 m thick.
Wash thickness = 15-25 cm, average 24 cm. Grades decreased at depth.
Three Mile lead was distinctive in recovery of numerous nuggets.
(Matson, 1975a; Markham, 1982).

OREBODY: Southeast -- Canadian/Home Rule
System headed on eastern side of main Gulgong range and flowed E before joining main lead channel. Host = ferruginous clay with layers of wash composed of limestone boulders and quartz, plus gravel.
Basement is locally composed of cavernous limestone, and slate.
Wash thickness = 45 cm average. (Matson, 1975a; Markham, 1982).

OREBODY: Southeast -- Cumbandry/Britannia
Britannia was lower continuation of Dog & Cat, (and Cumbandry), and Lily May. System worked in upper portions only, i.e. not in Britannia.
(Matson, 1975a; Markham, 1982).

OREBODY: Southeast -- Little Cumbandry
Red Streak and Little Cumbandry were tributaries of Red lead.
Wash thickness = 25-35 cm. System worked in upper portions only.
(Matson, 1975a; Markham, 1982).

OREBODY: Southwest -- Caledonian
Basalt covers practically whole course of Caledonian lead proper, i.e. below Grecian/Victorian junction. Wash thickness = 15-25 cm.
(Matson, 1975a; Markham, 1982).

OREBODY: Southwest -- Moonlight
Thickness of basalt cover = 12-30 m. Gold grades were relatively low.
(Matson, 1975a; Markham, 1982).

OREBODY: Welcome
Welcome reef was discovered below Three Mile lead. The reef was reportedly not very productive. (Matson, 1975a; Markham, 1982).

OREBODY: West -- Adams
First lead to be worked on the field. Lead originated from reef mineralisation at Red Hill. Lead was partially basalt-filled; thickness = 30 m. Wash thickness = 38 cm. Gold values decreased as thickness of basalt cover increased in lower portions of lead. (Matson, 1975a; Markham, 1982).

OREBODY: West -- Perseverance/Frasers
Perseverance-Digger Prince/Fraser entered main lead channel from the N.
Louisa and Beryl (Diamonds) were small leads further W.
Wash thickness = 22 cm average, 70 cm maximum. (Matson, 1975a; Markham, 1982).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Clift D.S.L., 1975
Gold dredging in New South Wales.
Geological Survey of New South Wales. Mineral Resources
41

Hill H., 1969
The geology of the Cudgegong district. B.Sc. (Hons) thesis.
University of Sydney. Unpublished
1v

Jones L.F., 1940
Part 1. The Gulgong goldfield.
Geological Survey of New South Wales. Mineral Resources
38 P1-134

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Matson C.R., 1973
Dubbo 1:250 000 metallogenic series map. Sheet SI 55-04, 1st edition.
Geological Survey of New South Wales
1v

Matson C.R., 1975
Part 1. Mine data sheets to accompany metallogenic map, Dubbo 1:250 000 sheet. Sheet SI 55-04.
Geological Survey of New South Wales
1v

Matson C.R., 1975
Part 2. A metallogenic study of the Dubbo 1:250 000 sheet. Sheet SI 55-04.
Geological Survey of New South Wales
1v

Rayner J.M., 1940
Part 11. Magnetic prospecting of the Gulgong deep leads.
Geological Survey of New South Wales. Mineral Resources
38 P135-160

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 44 SOFALA-WATTLE FLAT

DEPOSIT IDENTIFICATION:

SYNONYMS: Turon River, Wattle Flat

COMMODITIES: Au

DISTRIBUTION:
Record covers primary deposits clustered in NNW zone 4km x 2km between Sofala & Wattle Flat & smaller deposits 3km S of W F & up to 20km E of W F along Turon R, plus alluvials along Turon R. Nos. 60-81, 94-101 on Bathurst metallogenic map.

OREBODIES:
Sofala-Wattle Flat (D), Bald Hill, Big Oakey, Bullock Flat, Butchers Boy, Cox & McPeaks, Eldorado/Williams, Golden Fleece (Reef Gully), Hill Top, Little Oakey, McCuddens, Mount Wiagdon, Nuggetty Hill, Queenslander (King), Red Hill, Rileys Creek, Sofala, Solitary, Surface Hill, The Caledonian, Turon River, Wattle Flat Hill, Whalans Hill

MINES:
Bald Hill, Big Oakey, Bullock Flat, Butchers Boy, Caledonian, Cox & McPeaks, Eldorado/Williams, Golden Fleece (Reef Gully), Hill Top, Lawsons, Little Oakey, Magenta, McCuddens, Mount Wiagdon, Nuggetty Hill, Queenslander (King), Red Hill, Rileys Creek, Roxburgh, Scott & Clarkes, Sofala, Turon River, Wattle Flat Hill, Whalans Hill

GROUP: -

COMMENTS:
Record includes regional setting of Molong-South Coast Anticlinorial Zone (Capertee Block).

LOCATION:

LATITUDE: 33 9 | LONGITUDE: 149 41
250K SHEET: SI55 8 | 100K SHEET: 8831

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Orange
LOCAL GOVERNMENT AREA (LGA): Evans

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1851	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Bald Hill	Bald Hill	Historical	Underground
Bullock Flat	Bullock Flat	Historical	Unknown
Butchers Boy	Butchers Boy	Historical	Unknown
Cox & McPeaks	Cox & McPeaks	Historical	Unknown
Eldorado/Williams	Eldorado/Williams	Historical	Unknown
Golden Fleece (Reef Gully)	Golden Fleece (Reef Gully)	Historical	Unknown
Hill Top	Hill Top	Historical	Underground
McCuddens	McCuddens	Historical	Unknown
Mount Wiagdon	Mount Wiagdon	Historical	Unknown
Nuggetty Hill	Nuggetty Hill	Historical	Unknown
Queenslander (King)	Queenslander (King)	Historical	Open-Cut
Red Hill	Red Hill	Historical	Unknown
Rileys Creek	Rileys Creek	Historical	Unknown
Sofala	Sofala	Historical	Unknown
Solitary	Lawsons	Historical	Underground
Solitary	Scott & Clarkes	Historical	Underground
Solitary	Magenta	Historical	Underground
Solitary	Roxburgh	Historical	Underground
Surface Hill	Caledonian	Historical	Surface
Surface Hill	Caledonian	Historical	Underground

Surface Hill	Little Oakey	Historical	Underground
Surface Hill	Big Oakey	Historical	Underground
Turon River	Turon River	Possible	Dredging &/Or Sluicing
Wattle Flat Hill	Wattle Flat Hill	Historical	Unknown
Whalans Hill	Whalans Hill	Historical	Underground
Whalans Hill	Whalans Hill	Historical	Open-Cut

COMPANIES:

OREBODY: Turon River

PRESENT OPERATORS:
Compass Resources Nl

PRESENT OWNERS:	EQUITY%
Compass Resources NL	50.00
Unknown Or Private Interests	50.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 4,452
Post-1874 roduction only; estimated total production 31 000 kg Au. Recorded grades 30 g/t Au (Big Oakey), and 18 g/t Au (Queenslander).

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1915-1919), (1932-1937), 1851-1875, 1876-1914,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION			
July 1988	898	0.6	539	Subeconomic Demonstrated	In-Situ	all	Turon River alluvial; units: '000 cubic metres, g/cubic m

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Molong-S C Anticlin Zone(Capertee Block)
SUB-PROVINCE: Sofala Anticlinorium

HOST ROCKS:

FORMATION NAME & AGE: Sofala Volcanics - Early-Late Ordovician
LITHOLOGY: Andesite and tuff, feldspathic greywacke, chert.
RELATIONSHIP TO MINERALISATION: Host to all primary mineralisation in reefs, multiple veins, stockworks, and disseminations in andesite, derived sandy sediments, and slate.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to alluvial deposits.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Alluvium,
SIGNIFICANT: Intermediate Extrusive, Volcanogenic Sedimentary

STRUCTURAL FEATURES:

SIGNIFICANT: Faulting, Folding

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

SIGNIFICANT: Intrusive Contact

IGNEOUS ACTIVITY:

MAJOR: Volcanism (Intermediate)

METAMORPHISM:

Regional metamorphic grade ranges from zeolite to greenschist facies (Stevens, 1975). Some relict ferromagnesian minerals remain, but original pyroxene-amphibole-plagioclase assemblage is largely replaced by a sequence of metamorphic and alteration minerals (Markham, 1982) (see 'MINERALOGY',' ALTERATION'). Mineral assemblages formed under conditions of fairly constant temperature of 415 deg C and relatively constant pressure (B.J. Watts, reported by Stevens, 1975).

ALTERATION:

OREBODY: Sofala-Wattle Flat (D)

Much of the area has been affected by carbonate alteration, particularly in the vicinity of the Queenslander and Surface Hill orebodies. Gold mineralisation is closely spatially related to areas of more intense carbonate alteration (Stevens, 1975). Alteration minerals are Fe, Mg, and Ca carbonates, talc, and chlorite. The various mineral assemblages formed in response to variations in the fluid pressures of water and carbon dioxide (B.J. Watts, reported by Stevens, 1975). Both the carbonate-bearing and water-bearing assemblages are spatially related to major faults (B.J. Watts, op.cit). Intermediate argillic alteration was recorded at Hill Top (Stevens, 1972b).

OREBODY: Queenslander (King)

Host rock is altered andesitic lava. Alteration involved addition of water and CO2, and possibly some removal of silica. (Stevens, 1975).

OREBODY: Surface Hill

Altered host rocks consist of recrystallised carbonate, quartz, white mica, abundant plagioclase (Watts, 1969a, reported by Stevens, 1975).

DEPOSIT CHARACTERISTICS:

TYPES:

MAJOR: Alluvial.
Auriferous quartz veins/stockwork in intermdeiate volcanics/volcanogenic sediments.

STYLE:

MAJOR: Stratabound, SIGNIFICANT: Conformable, Discordant

AGE OF MINERALISATION: Palaeozoic Ordovician

DIMENSIONS/ORIENTATION:

OREBODY: Surface Hill

		MIN	AVE	MAX
TRUE WIDTH	(cm)	3.0		10.0
		ANGLE (deg.)		DIRECTION
DIP		45-70;20-45		S;W
STRIKE		090,180		

ORE TEXTURE:

Refractory

NATURE OF MINERALISATION:

PRIMARY ORE: Dissemination, Stockwork, Vein (Reef),
SECONDARY ORE: Detrital (Alluvial), Supergene Enrichment

MINERALOGY:

OREBODY: Sofala-Wattle Flat (D)

Sulphide zone: pyrite, arsenopyrite, (chalcopyrite, galena).
Gangue (reefs, stockworks): quartz, (calcite). (Stevens, 1972b).
Altered volcanics: quartz, albite, epidote, tremolite, chlorite, dolomite-ankerite, magnesite-siderite, calcite. (Markham, 1982).

OREBODY: Queenslander (King)

Sulphide zone: quartz, calcite, gold, pyrite, arsenopyrite. Free gold was locally abundant. Sulphides were also present in the wall rock.
Host rock: albite, chlorite, carbonate, Fe oxide, (quartz, sericite).
Albite apparently pseudomorphous after original plagioclase. (Stevens, 1975).

CONTROLS OF MINERALISATION:

Controls are mainly structural/alteration: mineralisation is related to carbonate alteration which is spatially related to major faults (Watts, 1974, reported by Stevens, 1975). Lithological control lacking. No close associated plutonic rocks.

GENETIC MODELS:

PRINCIPAL SOURCES: Markham & Basden (1974), Stevens (1975).

The association of gold with alteration suggests that mineralisation was introduced by carbonate-rich hydrothermal solutions, which could have been a) related to the closing stages of andesitic volcanism, b) derived from the surrounding sediments, or c) introduced during regional metamorphism (Markham & Basden, 1974; Stevens, 1975).
Field relationships indicate that carbonate and water-bearing alteration assemblages are spatially related to important faults (B.J. Watts, reported by Stevens, 1975). The faults apparently acted as channelways for the introduction of C02 and H20 (Stevens, 1975); suggesting that alteration occurred during metamorphism.
The association of gold with alteration implies that mineralisation also occurred during metamorphism, after faulting took place (Stevens, 1975).
A hydrothermal origin from plutonic rocks is considered unlikely by Stevens (1975) because of the distance from granite (the nearest granite is also on the opposite side of the Wiagdon Thrust).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Sofala-Wattle Flat (D)

PRINCIPAL SOURCES: Mulholland (1936, reported by Markham, 1982), Stevens (1972a,b), Watts (1974, reported by Stevens, 1975), Stevens (1975), Barron (1976, reported by Markham, 1982), Markham (1982).
SUMMARY

The Sofala-Wattle Flat field occurs near the western margin of the Sofala Anticlinorium, Capertee Block, of the Molong-South Coast Anticlinorial Zone (N). Mineralisation included both reef and alluvial deposits, of which the latter have been economically the most important. Primary deposits occurred as reefs, multiple veins, or stockworks, and to a lesser extent disseminations, in andesite, sandy sediment derived from andesite, and slate of the Ordovician Sofala Volcanics.
The most productive reefs were Big Oakey, Solitary, Queenslander, and Surface Hill, although production from early worked reefs is not known.
Alluvial deposits were extensively distributed along the Turon River and its N-flowing tributaries.

REGIONAL SETTING: CAPERTEE BLOCK
PRINCIPAL SOURCES: Stevens (1975).

The Capertee Rise formed after the Quidongan Orogeny in the Middle Silurian. Basement rocks in the central part of the Sofala Anticlinorium are Ordovician andesitic volcanics and associated sediments (Sofala Volcanics) which in the Scheibner (1976) model are remnants of a rifted section of the Molong Volcanic Arc (Stevens, 1975).
The anticlinorium is bounded on the W by a major thrust fault, the Wiagdon Thrust, which is considered (Stevens, 1975) to represent the site of a volcanic rift along which the arc was split to subsequently open the Hill End Trough. The Capertee Rise was deformed during the late Middle Devonian by the Tabberabberan Orogeny. (Stevens, 1975).

REGIONAL SUCCESSION: SOFALA ANTICLINORIUM (S)
PRINCIPAL SOURCES: Stevens (1972a, 1975).

1./ Sofala Volcanics (Os on Bathurst metallogenic map) (Early-Late Ordovician) (> 2100 m thick) - andesite and tuff, feldspathic greywacke, chert. Host to reef gold mineralisation in Sofala-Wattle Flat region. Overlain conformably or disconformably by:-
2./ Tanwarra Shale (Sts) (Early-Middle Silurian) - cobble conglomerate, mainly andesite-derived, shale, some limestone, partly foliated. Unconformably overlain by:-
3./ Bells Creek Volcanics (Sbc) (Early-Middle Silurian) - rhyolite, felsic tuff, sediments. Rift volcanics, associated with arc splitting.
4./ Chesleigh Formation, 5./ Cookman Formation, 6./ Crudine Group and 7./ Merrions Tuff (Sch, Scf, S-Dc, Dm) (Late Silurian - Early Devonian) - greywacke/slate, felsic tuff. These units are correlated with the adjacent parts of the succession in the Hill End Trough (see Deposit No. 42 HILL END-TAMBAROORA for description), although the sequence is thinner in the Sofala Anticlinorium and was probably deposited in shallower conditions, on a submarine rise (Stevens, 1975).
8./ Limekilns Group (Dlh) (Early-Middle Devonian) - black and grey shale, siltstone, and limestone.
9./ Winburn Tuff (Dwt) (Early-Middle Devonian) - dacitic tuff and slate. Unconformably overlain by:-
10./ Lambie Group (Dlg) (Late Devonian) - sediments.

The Siluro-Devonian sequence was intruded by two granite plutons:- 11./ Wiagdon Granite and Millah Murrah Granite (gwa, gmm) (Carboniferous), which occur some 12 km SSW of Sofala.

Folds are moderate to steep, and mainly concentric in style (Stevens, 1975).

GEOLOGICAL SETTING: SOFALA-WATTLE FLAT
PRINCIPAL SOURCES: Watts (1974, reported by Stevens, 1975; and Markham, 1982), Stevens (1975), Barron (1976, reported by Markham, 1982), Markham (1982).

The Sofala Volcanics comprise a variety of lithologies including andesitic lavas, volcanically-derived sediments (from conglomerates to siltstones) together with radiolarian cherts and some limestone lenses. Chert predominated in the early stages of deposition, under quiet, deep water conditions, followed by submarine volcanism which produced a build-up of material and led to shallower conditions, probably with local emergence of volcanic islands (Stevens, 1975).
The formation is characterised by rapid lateral sedimentary facies changes and inter-tonguing of individual units (Watts, 1974, reported by Markham, 1982). Barron (1976, reported by Markham, 1982) has shown that the original andesitic volcanics have a calc-alkaline chemistry consistent with formation in an island arc environment.

Watts (1974, reported by Stevens, 1975) subdivided the Sofala Volcanics, from the base, as follows:-
i) Folded and foliated chert.
ii) Strongly carbonated andesite, tuff, arenite and conglomerate, minor limestone.
iii) Pyroxene andesite, tuff and some cobble conglomerate, minor chert.
iv) Felspathic andesite, tuff and arenite, some conglomerate, minor chert.
v) Pyroxene andesite intrusive breccia.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURES: Mulholland (1936, reported by Markham, 1982), Stevens (1975), Markham (1982).

Primary deposits comprised well-defined reefs, multiple veins or stockworks and to a lesser extent disseminations, within the Sofala Volcanics. The quartz reefs were simple reefs which trended parallel to the general strike of the altered volcanics and dipped either parallel to or oblique to the upper surface of the andesite flow.
The multiple veins or stockworks comprised a series of narrow quartz veins apparently representing infillings along joints.
Disseminated sulphide mineralisation was widely present within the host rocks themselves. (Mulholland, 1936, reported by Markham, 1982).

Alluvial deposits occurred along the Turon River to the E and W of Sofala and in a number of N-flowing tributaries including Big Oakey Creek, Little Oakey Creek, and Spring Creek, all of which drained areas of known reef mineralisation. Mulholland (1936) recorded that the richest alluvial workings within tributary streams S of Sofala occurred in the vicinity of the contact between altered andesitic volcanics and overlying sediments. (Mulholland, 1936, reported by Markham, 1982).

OREBODY: Queenslander (King)
PRINCIPAL SOURCES: Mulholland (1936), Watts (1974); both as reported by Stevens (1975), and Markham (1982).

Mineralisation comprised a series of narrow quartz veins which traversed a black fine-grained altered igneous rock described by Mulholland (1936) as monzonite, but referred to by Watts (1974) as altered andesite. Disseminated gold has also been noted following bedding (Stevens, 1975). Watts (1974) mapped the workings as occurring (on a broad scale) in andesitic and tuffaceous units close to the faulted contact of an altered intrusive pyroxene andesite breccia, possibly a volcanic neck. (The breccia may be the augite porphyrite of Mulholland (1936)). (Stevens, 1975; Markham, 1982).

OREBODY: Surface Hill
Host rocks are altered slate and mafic andesite (Stevens, 1972b).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Barron B.J., Barron L.M., 1976
A model for greenschist facies equilibria in altered mafic volcanic rocks at Sofala, New South Wales.
American Journal of Science

276(5) P637-669

Clarke I., Raphael N.M., 1982
A resource evaluation of the Razorback gold antimony mine.
Geological Survey of New South Wales. Report
GS1982/437

Clift D.S.L., 1975
Gold dredging in New South Wales.
Geological Survey of New South Wales. Mineral Resources
41

Hilyard D., 1979
Sofala-Hill End-Stuart Town gold deposits map, 1:250 000 scale.
Geological Survey of New South Wales
1v

Hilyard D., 1979
Sofala gold deposits map, 1:50 000 scale.
Geological Survey of New South Wales
1v

Hilyard D., 1980
Mining history of the Sofala-Wattle Flat district.
Geological Survey of New South Wales. Report
GS1980/001

Hobbs J.J., 1977
Geochemical survey of the Hill End-Sofala districts.
Geological Survey of New South Wales. Report
GS1977/153

Hordern M.J., 1973
Structure and gold mineralization near Sofala and Wattle Flat, New South Wales. B.A. (Hons) thesis.
Macquarie University. Unpublished
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Mulholland C. St J., 1936
Geology of the Wattle Flat-Sofala district.
Geological Survey of New South Wales. Report
GS1936/014

Richardson S.J., Lishmund S.R., 1980
Geological resources of the central western region.
Geological Survey of New South Wales. Report
GS1980/406

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

Stevens B., 1972
Bathurst, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-08, 1st edition.
Geological Survey of New South Wales
1v

Stevens B.P.J., 1972
Mine data sheets to accompany Bathurst, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-08.
Geological Survey of New South Wales
1v

Stevens B.P.J., 1975
A metallogenic study of the Bathurst 1:250 000 sheet. Sheet SI 55-08.
Geological Survey of New South Wales
1v

Watts B.J., 1974
Studies on altered mafic igneous rocks and their metamorphism - a

geochemical appraisal of the Sofala Volcanics in central western New South Wales. Ph.D. thesis.
University of Sydney. Unpublished
1v

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 45 CAPTAINS FLAT

DEPOSIT IDENTIFICATION:

SYNONYMS: Lake George

DISTRIBUTION:
No.177 on Canberra metallogenic map.

OREBODIES:
Captains Flat (D), Central, Elliots, Keatings, Vanderbilt

MINES:
Lake George

GROUP: -

COMMENTS:
Record includes regional setting of Captains Flat-Goulburn Synclinorial Zone.

LOCATION:

LATITUDE: 35 35 LONGITUDE: 149 27
250K SHEET: SI55 16 100K SHEET: 8726

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Goulburn
LOCAL GOVERNMENT AREA (LGA): Yarrowlumla

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1874	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Captains Flat (D)	Lake George	Historical	Underground
Captains Flat (D)	Lake George	Historical	Open-Cut

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 7,341
Average recovered grade 1.7 g/t Au. (Grades of other metals 10% Zn, 6% Pb, 0.67% Cu, 56 g/t Ag).

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1900-1928), 1882-1899, 1937-1962,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Captains Flat-Goulburn Synclinorial Zone
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Kohinoor Volcanics - Early Silurian
LITHOLOGY: Porphyritic felsic pyroclastics - rhyodacite-rhyolite tuffs, flows, agglomerates; some tuffaceous shale interbeds.
RELATIONSHIP TO MINERALISATION: Gold was associated with stratabound massive base metal sulphides in shear zone intersections in shale unit within volcanics.

FORMATION NAME & AGE: Keatings Shale Member - Early Silurian
LITHOLOGY: Sheared silicified brown shale.
RELATIONSHIP TO MINERALISATION: Immediate host to massive sulphide mineralisation.

FORMATION NAME & AGE: Hoskinstown Group - Early-Late Silurian
LITHOLOGY: Lower mainly sedimentary section, central felsic volcanic section, upper mainly sedimentary section.
RELATIONSHIP TO MINERALISATION: Includes host formation.

GEOCHRONOLOGY:
Galena dated at 150-310 my, average 300 my (Late Carboniferous), but with wide uncertainty range (Richards, 1962, reported by Oldershaw, 1965).

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Felsic Extrusive, Volcanogenic Sedimentary

STRUCTURAL FEATURES:

MAJOR: Fold Limb

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

MAJOR: Fault/Fault, Fault/Stratigraphic Unit

IGNEOUS ACTIVITY:

MAJOR: Volcanism (Felsic)

METAMORPHISM:
Regional metamorphic grade is greenschist facies.

ALTERATION:

OREBODY: Captains Flat (D)
The volcanics stratigraphically below the orebodies have been strongly altered by pyrite alteration and silicification (Davis, 1975, Gilligan, 1975).
The zone of pyritisation extends beyond the ore zone for 500 m to the N and 1200 m to the S (Davis, 1975).

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Auriferous stratabound volcanogenic massive base metal sulphides in felsic-intermediate volcanics.

STYLE:

MAJOR: Stratabound

MORPHOLOGY: Lenticular, Pipe-Like

AGE OF MINERALISATION: Palaeozoic Early Silurian

DIMENSIONS/ORIENTATION:

OREBODY: Captains Flat (D)

		MIN	AVE	MAX
DEPTH OXIDATION	(m)		30.0	
DOWN-DIP DEPTH	(m)			1000.0
STRIKE LENGTH	(m)			1200.0
TRUE WIDTH	(m)	1.0		20.0
		ANGLE (deg.)		DIRECTION
DIP		80-87		W
PITCH		60-70		N
STRIKE		010		

OREBODY: Elliots

		MIN	AVE	MAX
DOWN-DIP DEPTH	(m)			900.0
STRIKE LENGTH	(m)	120.0	300.0	600.0
TRUE WIDTH	(m)	2.0	3.0	12.0
VERTICAL DEPTH	(m)	600.0		
		ANGLE (deg.)		DIRECTION
DIP		80-87		W
PITCH		60-70		N
STRIKE		010		

OREBODY: Keatings

		MIN	AVE	MAX
DOWN-DIP DEPTH	(m)			600.0
STRIKE LENGTH	(m)	120.0		300.0
TRUE WIDTH	(m)	2.0	6.0	15.0
VERTICAL DEPTH	(m)	500.0		
		ANGLE (deg.)		DIRECTION
DIP		80-87		W
PITCH		60-70		N
STRIKE		010		

OREBODY: Vanderbilt

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			100.0
		ANGLE (deg.)		DIRECTION
PLUNGE				N

ORE TEXTURE:
Banded/Laminated, Massive, Zoned

NATURE OF MINERALISATION:
PRIMARY ORE: Fault/Shear Filling,
SECONDARY ORE: Supergene Enrichment

MINERALOGY:

OREBODY: Captains Flat (D)
PRINCIPAL SOURCES: Edwards & Baker (1953, reported by Gilligan, 1975; and Markham, 1982), Glasson & Paine (1965), Markham & Basden (1974), Davis (1975), Gilligan (1975), Markham (1982).

Stockwork veins in pyritised tuff: quartz, chalcopyrite, sphalerite, arsenopyrite (Markham & Basden 1974).
Massive sulphides: pyrite, sphalerite, galena, pyrite, (chalcopyrite, arsenopyrite, tennantite, bournonite, pyrrhotite, gold, silver, antimony and arsenic contained in tetrahedrite). (Glasson & Paine, 1965; Gilligan, 1975).
Oxide zone: limonite, malachite.
Gangue: quartz, calcite, dolomite, sericite, chlorite, barite. (Gilligan, 1975).

Pyrite occurred as corroded and embayed euhedral crystals, apparently two generations present. Sphalerite enclosed pyrite, replaced pyrite and arsenopyrite, showed exsolution features with chalcopyrite. Galena and chalcopyrite occurred as intergrowths in fracture fillings and veins. (Edwards & Baker, 1953, reported by Gilligan, 1975; Glasson & Paine, 1965).

Layering and banding occurred on a grain-size scale over widths of a fraction of a millimetre to several centimetres. The pyrite-sphalerite zone was segregated into pyrite-rich, sphalerite-rich, (chalcopyrite-rich and galena-rich) layers. (Davis, 1975).

Gold occurred as fine-grained inclusions associated with arsenopyrite, within tennantite. The gold particles may have been exsolved from the tennantite. (Edwards & Baker, 1953, reported by Markham, 1982). Distribution of gold (and other metals) in the orebodies was not uniform, the highest Au values being obtained from the stratigraphic top of the orebodies and from the northern end of Eliots (northernmost body) where Zn:Pb ratio was low (Edwards & Baker, op.cit). Gold was strongly enriched in the gossans and oxidised ore (Markham, 1982).

OREBODY: Vanderbilt
Sulphide zone: pyrite, galena, chalcopyrite.

CONTROLS OF MINERALISATION:

The deposit is stratigraphically controlled in its association with felsic pyroclastics. Orebody zonation and fine banding have been interpreted as sedimentary stratification (Davis, 1975).
In detail, the present form of the orebody is structurally controlled in the localisation of mineralisation at the intersections of shear zones (Glasson & Paine, 1965).

GENETIC MODELS:

PRINCIPAL SOURCES: Glasson & Paine (1965), Oldershaw (1965), Davis (1975).

Kenny & Mulholland (1941), Edwards & Baker (1953), The Staff, Lake George Mines (1953); all reported by Oldershaw (1965); and Glasson & Paine (1965) proposed a hydrothermal replacement origin: structurally controlled replacement of shale beds which may have contained syngenetic pyrite, either by hydrothermal fluids moving along shears or faults, or by lateral accretion of syngenetic sulphides disseminated through the Silurian volcanics and shales (Glasson & Paine, 1965).

Davis (1975) proposed a volcanic exhalative origin: precipitation in a sedimentary environment after being exhaled from fumaroles which were part of a volcanic vent system. Davis (1975) proposed the sequence:-
i) extrusion of dacitic and rhyodacitic tuffs from a volcanic centre located N of the deposit area.
ii) extrusion of rhyolitic tuffs in which silica and pyrite were deposited as sinters. The sinters confirm the fumarolic environment and the shallow depths of water.
iii) exhalation of metal-bearing fluids during a time of waning volcanicity and lagoonal sedimentation in quiet, reducing conditions suitable for metal precipitation. Metal transport was limited and was controlled by basin floor topography.
The iron-bearing chert which occurs at the same stratigrahic level as the orebodies may represent similar volcanic exhalative conditions in a shallow water oxidising environment (Davis, 1975).

Davis (1975) cites the following features in support of the volcanic exhalative model:-
i) Orebody morphology and zonation are consistent with a linear metal source - a fumarolic vent - with a central feeder pipe - now the massive pyrite zone.
ii) Fine-scale banding indicates chemical precipitation rather than selective hydrothermal replacement.
iii) The presence of barite and carbonate at Captains Flat, which are characteristically associated with volcanic exhalative ores.
iv) The presence of chert, formed from contemporaneous emanation of silica. (Davis, 1975).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Captains Flat (D)

PRINCIPAL SOURCES: Glasson & Paine (1965), Oldershaw (1965), Gilligan (1974), Markham & Basden (1974), Davis (1975), Gilligan (1975), Markham (1982).
SUMMARY

Captains Flat lies in a narrow synclinorium that forms a southerly projection of the western section of the Captains Flat-Goulburn Synclinorial Zone. Mineralisation comprises stratabound massive lead-zinc-copper(-silver-gold) sulphides in shear zone intersections in a shale unit within altered and cleaved pyroclastic felsic volcanics of the Late Silurian Kohinoor Volcanics.

REGIONAL SETTING: CAPTAINS FLAT-GOULBURN SYNCLINORIAL ZONE
PRINCIPAL SOURCES: Gilligan (1974), Markham & Basden (1974).

The Captains Flat-Goulburn Synclinorial Zone is a composite structural zone made up of elongate partly fault-bounded synclinoria which interfinger with anticlinoria of the Molong-South Coast Anticlinorial Zone (S) (Gilligan, 1974; Markham & Basden, 1974).
The synclinoria contain Middle-Late Silurian volcanics and sediments, and Early and Late Devonian sediments, which were deposited in a volcanic rift or marginal sea (Captains Flat Trough) (Markham & Basden, 1974).
The zone is intruded by Early Devonian and Carboniferous granitoids.

Silurian volcanics are most abundant in the southern part of the zone, S of Goulburn. This part is divided into an eastern and a western section, separated by the Rocky Pic Anticlinorium (Gilligan, 1974).
The Captains Flat Synclinorium, in which Captains Flat occurs, constitutes the southernmost part of the western section.

ASSOCIATED MINERALISATION: CAPTAINS FLAT-GOULBURN SYNCLINORIAL ZONE

PRINCIPAL SOURCES: Oldershaw (1965), Markham & Basden (1974).

The principal association is stratabound base metal sulphide mineralisation associated with felsic pyroclastic-shale-limestone sequences. Captains Flat and Woodlawn are the main examples; these and about nine similar smaller deposits define a broad N-trending zone of base metal sulphide mineralisation in the western section of the southern part of the synclinorial zone (between Captains Flat and Goulburn) (Oldershaw, 1965).
The larger deposits are considered to be of volcanic exhalative origin, some of the smaller deposits are apparently hydrothermal veins (Markham & Basden, 1974).
Gold in the Captains Flat-Goulburn Synclinorial Zone occurs mainly as a minor constituent of base metal sulphide ores, and in minor hydrothermal vein deposits (Markham & Basden, 1974).

GEOLOGICAL SETTING: CAPTAINS FLAT SYNCLINORIUM
PRINCIPAL SOURCES: Gilligan (1974), Markham & Basden (1974), Davis (1975).

The Captains Flat Synclinorium contains Silurian strata that have been folded into a shallowly N-plunging synclinorium that is closed both to the N and the S (Davis, 1975). The synclinorial sequence is preserved in a N-trending graben 32 km long x 2.8 km wide. The graben is bounded by major regional faults against which the Silurian rocks are in contact with structural highs comprising deformed Ordovician metasediments and Siluro-Devonian granitoids of the Molong-South Coast Anticlinorial Zone (S) (Gilligan, 1974; Davis, 1975).
Folds and major faults trend N-S; bedding dips 70 deg to vertical, with local overturning (Davis, 1975).
The synclinorium developed from rifting associated with deformation of the Ordovician sediments during the Late Ordovician-Early Silurian Benambran Orogeny (Markham & Basden, 1974; Davis, 1975).
Following deposition of the Silurian rocks, a period of intense tectonism during the Early Devonian Bowning Orogeny resulted in folding of the synclinorial sequence about N-S axes, N-S shearing and faulting which produced the horst/graben structures, and the development of axial plane cleavage (Davis, 1975).
The sequence was disrupted by an episode of NW faulting late in the tectonic history of the area (Davis, 1975).

REGIONAL SUCCESSION: CAPTAINS FLAT SYNCLINORIUM
PRINCIPAL SOURCES: Oldershaw (1965), Gilligan (1974), Markham & Basden (1974), Davis (1975).

The Silurian sequence is represented by the Hoskinstown Group, which unconformably overlies Ordovician metamorphosed greywacke/shale sequences (Foxlow Beds).
The Hoskinstown Group comprises, from the base:-
1./ Rutledge Quartzite (included with Copper Creek Shale, B7L9, on Canberra metallogenic map) (Early Silurian) (>90 m thick) - white quartzite, conglomeratic quartzite interbedded with thin siltstone. Conformably overlain by:-
2./ Copper Creek Shale (B7L9 on Canberra metallogenic map) (Early Silurian (60-150 m thick) - grey shale, graphitic shale, argillaceous siltstone, calcareous shale, limestone, thin tuff and reworked tuff units. Contains up to 8% sulphides in lenses and disseminated crystals of pyrite and chalcopyrite. Conformably overlain by:-
3./ Kohinoor Volcanics (B7L8) (Early Silurian) (45-750 m) - foliated porphyritic interbedded flows, tuffs, agglomerates, welded tuffs, and tuffaceous shale beds. The volcanics fall mainly in the compositional range rhyodacite-rhyolite, with some dacites and andesites (Davis, 1975), and were deposited under shallow marine conditions (Markham & Basden, 1974).
The formation contains several lenses of interbedded shale.
The Keatings Shale Member (6-12 m thick) is sheared silicified brown shale occurring near the top of the Volcanics. The Elliots Shale lens is probably stratigraphically equivalent to the Keatings Shale Member (Glasson & Paine, 1965).
The Kohinoor Volcanics are host to the Captains Flat auriferous base metal sulphide mineralisation, which is localised in the Keatings Shale Member (Oldershaw, 1965; Markham & Basden, 1974).
The formation is conformably overlain (elsewhere) by:-
4./ Carwoola Beds (B7L7) (Late Silurian) (>1200 m) - shale, siltstone, argillaceous brown sandstone. Not present in Captains Flat area. Conformably overlain by:-
5./ Captains Flat Formation (B7L6) (Late Silurian) (750-1200 m) - basal section of cleaved grey shale and siltstone; central section of reworked lithic tuff from Kohinoor Volcanics, felsic crystal tuff, dacite, basalt flows; upper section of interbedded shale and reworked lithic tuff. Directly overlies Kohinoor Volcanis in Captains Flat area because of absence of Carwoola Beds (Oldershaw, 1965).

The succession is cut by several dykes and one large lens of dolerite.

GEOLOGICAL SETTING: CAPTAINS FLAT
PRINCIPAL SOURCES: Oldershaw (1965), Davis (1975).

The rocks in the synclinorium were folded twice; because of differences in competence folding was disharmonic (Oldershaw, 1965). Strata above Keatings Shale Member were folded into a simple twin-keel structure whereas strata below the shale were folded into one major asymmetric keel with numerous minor folds and dragfolds. Incompetent shale units and axial planes of folds are marked by a series of N and ENE-trending faults and shears which developed during the later stages of folding.
The Main Lode Shear is a major shear zone within the Keatings Shale Member which may have formed as a result of differential slip along the shale unit during folding (Oldershaw, 1965).
The Narongo Shears are a set of shears trending 020 deg, dipping 70-80 W, which diverge eastwards from the Narongo Fault and are localised in the axial planes of minor folds on the western limb of the synclinorium (Oldershaw, 1965).
Forsters and ?Vanderbilt are the principal Narongo shears.
Mineralisation is associated with the Main Lode Shear at its intersections with Narongo Shears (Oldershaw, 1965).

The western limb of the synclinorium is overturned to the E, and has been thrust upwards and to the E over the eastern limb.
The synclinorium is bounded by high angle reverse faults, the Narongo Fault to the W, and the Ballallaba Fault to the E, along which the Ordovician metasedimentary blocks have been upthrust by hundreds of metres (Oldershaw, 1965).

The host formation to mineralisation is the Kohinoor Volcanics.
The volcanics are characterised by facies changes and lensing of beds interpreted by Davis (1975) to represent interdigitating products of several vents. The predominant rock types are crystal (lithic and lapilli) tuffs (Davis, 1975). The lower part of the formation shows a broad compositional progression upsequence from dacitic tuffs to rhyolitic and alkaline rhyolitic tuffs (Markham & Basden, 1974; Davis, 1975). The rhyolitic tuffs are overlain by a complex zone which includes the orebodies, which is overlain by upper dacitic and andesitic tuff units (Markham & Basden, 1974). Other rock types present are:-
i) agglomerate - volcanic breccias, ii) rhyolitic lavas and associated rocks, iii) tuffaceous sediments, iv) sinters - within the rhyolitic crystal tuffs of the mineralised area, and v) volcanic cherts - exhalites (Davis, 1975).

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Glasson & Paine (1965), Oldershaw (1965), Markham & Basden (1974), Davis (1975), Gilligan (1975), Markham (1982).

The principal ore forms at Captains Flat are large conformable masses of banded sulphide ore within thin tuffaceous shale lenses of the Keatings Shale Member of the Kohinoor Volcanics. The main orebodies are Keatings, Central and Elliots. Minor mineralisation occurs in shear zones in volcanic units of the Kohinoor Volcanics (Vanderbilt), and in shale units of the underlying Copper Creek Shale and the Ordovician metasedimentary sequence.

Keatings, Central and Elliots lie on the overturned western limb of the synclinorium (Glasson & Paine, 1965; Oldershaw, 1965).
The orebodies occur as flattened lenses within the most highly stressed part of the shale bed near its northern limit (Oldershaw, 1965).
Mineralisation is localised along the intersections of two shear systems - the Main Lode Shear, which trends 010 deg, dips 80 deg W, and the Narongo Shears, which trend 020 deg, dip 70-80 deg W (Oldershaw, 1965).

The orebodies are asymmetric, with gradational hanging walls (western contact, stratigraphic base) but sharp footwalls (eastern, upper contact) (Glasson & Paine, 1965; Davis, 1975).
Metal distribution, hence also mineralogy, are strongly zoned:-
Pb, Zn, Au, and Ag values increase upwards, while Cu is more abundant in the lower part of the ore zone (Glasson & Paine, 1965; Davis, 1975).
From W to E (=from stratigraphic base), the mineralised zone comprises:-
1./ pyritised fine rhyolitic crystal tuff (80-100 m thick) - pyrite is disseminated in crystals and veinlets, increases in concentration upwards (towards main ore zone) and occurs in bands, accompanied by minor chalcopyrite. Pyritisation is associated with intense silicification and quartz-sulphide (other than pyrite) stockwork veining. Grades into:-
2./ Massive to semi-massive pyrite (15 m) with minor chalcopyrite, sphalerite, galena. Sulphides occur in narrow lenses and bands from a few cm to several metres thick. Overlain by:-
3./ Massive sulphide lode (up to several metres), comprising banded

pyrite-sphalerite.
The upper level of the lode is marked by:-
4./ Zone of high sphalerite-galena concentration.
5./ Shale with sulphide lenses.
The ore zone is overlain by:-
6./ Fine tuff and lava.
7./ Coarse dacitic crystal tuff.
(Glasson & Paine, 1965; Markham & Basden, 1974; Davis, 1975).
Down dip from the massive sulphides the ore horizon is represented by chert and dolomite (Glasson & Paine, 1965).

OREBODY: Elliots
Orebody consists of three separate sections: a wide persistent northern section, a narrow elongate central section and a small but high-grade southern section (Glasson & Paine, 1965; Oldershaw, 1965).

OREBODY: Keatings
Orebody consists of three closely connected lenses separated by a major dolomitic shear (Glasson & Paine, 1965; Oldershaw, 1965).

OREBODY: Vanderbilt
Orebody occurs at the intersection of the Vanderbilt Shear (trending 020 deg) with the Dam Shear (trending 010 deg) along the axial plane of the Vanderbilt Anticline. The orebody is truncated to the N by the Molonglo Fault. (Oldershaw, 1965).
Vanderbilt is hosted by volcanics, not the Keatings Shale (Oldershaw, op.cit).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Davis L.W., 1975
Captains Flat lead-zinc orebody. IN Knight C.L.(ed) - Economic geology of Australia and Papua New Guinea - 1.Metals.
AusIMM. Monograph Series
5 P694-700

Edwards A.B., 1943
The composition of the lead-zinc ores at Captains Flat, N.S.W.
AusIMM. Proceedings
129 P25-40

Edwards A.B., Baker G., 1953
The composition of the lead-zinc ores at Captain's Flat, N.S.W. II.
AusIMM. Proceedings
170 P103-131

Gilligan L.B., 1974
Canberra, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-16, 1st edition.
Geological Survey of New South Wales
1v

Gilligan L.B., 1975
Part I. Mine data sheets to accompany metallogenic map, Canberra 1:250 000 sheet. Sheet SI55-16.
Geological Survey of New South Wales
1v

Glasson K.R., 1956
The regional geology and structures of an area around Captain's Flat. M.Sc. thesis.
University of Sydney. Unpublished
1v

Glasson K.R., Paine V.R., 1965
Lead-zinc-copper ore deposits of Lake George Mines, Captain's Flat. IN McAndrew J.(ed) - Geology of Australian ore deposits. 8th Commonwealth Mining and Metallurgical Congress, Australia & New Zealand, 1965, Melbourne.
AusIMM
1 P423-431

Kenny E.J., Mulholland C. St J., 1941
The ore deposits at Captain's Flat, N.S.W.
AusIMM. Proceedings
122 P45-64

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales

1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Oldershaw W., 1965
Geological and geochemical survey of the Captains Flat area, New South Wales.
Bureau Mineral Resources, Australia. Report
101

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

The Staff, Lake George Mines, 1953
Lake George Mines at Captain's Flat. IN Edwards A.B.(ed) - Geology of Australian ore deposits. 5th Empire Mining and Metallurgical Congress, Australia & New Zealand, 1953, Melbourne.
AusIMM
1 P910-920

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 46 COWARRA

DEPOSIT IDENTIFICATION:

SYNONYMS: Victoria, Cowra Creek

COMMODITIES: Au

DISTRIBUTION:
Record covers 5 parallel N-S lines of lode in N-S zone 2 km x 500 m. Nos. 29-40 on Bega metallogenic map.

OREBODIES:
Cowarra (D) , Cowarra (Victoria)-The King , Ironclad-Vanderbilt-Ambassador-etc, Never Never, The Princess, The Queen-The Democrat

MINES:
Cowarra, Cowarra (Victoria), Cowra Creek, Ironclad, Never Never, Polar Star, The Ambassador, The Democrat, The King, The Prime Minister, The Princess, The Queen, Vanderbilt

GROUP: -

COMMENTS:
See Deposit No.48 ARALUEN-MAJORS CREEK for regional setting of Molong-South Coast Anticlinorial Zone (S).

LOCATION:

LATITUDE: 36 1 LONGITUDE: 149 18
250K SHEET: SJ55 4 100K SHEET: 8725

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Cooma
LOCAL GOVERNMENT AREA (LGA): Cooma-Monaro

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1887	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Cowarra (D)	Cowarra	Historical	Underground
Cowarra (D)	Cowarra	Maintenance	Underground
Cowarra (D)	Cowra Creek	Historical	Underground
Cowarra (Victoria)-The King	Cowarra (Victoria)	Historical	Underground
Cowarra (Victoria)-The King	The King	Historical	Underground
Cowarra (Victoria)-The King	The King	Historical	Open-Cut
Cowarra (Victoria)-The King	The King	Historical	Surface
Ironclad-Vanderbilt-Ambassador-etc	Ironclad	Historical	Underground
Ironclad-Vanderbilt-Ambassador-etc	Vanderbilt	Historical	Underground
Ironclad-Vanderbilt-Ambassador-etc	The Ambassador	Historical	Underground
Ironclad-Vanderbilt-Ambassador-etc	The Prime Minister	Historical	Underground
Ironclad-Vanderbilt-Ambassador-etc	The Prime Minister	Historical	Surface
Ironclad-Vanderbilt-Ambassador-etc	Polar Star	Historical	Underground
Ironclad-Vanderbilt-Ambassador-etc	Polar Star	Historical	Surface
Never Never	Never Never	Historical	Underground
Never Never	Never Never	Historical	Surface
The Princess	The Princess	Historical	Underground
The Princess	The Princess	Historical	Surface
The Queen-The Democrat	The Queen	Historical	Underground
The Queen-The Democrat	The Queen	Historical	Surface
The Queen-The Democrat	The Democrat	Historical	Underground
The Queen-The Democrat	The Democrat	Historical	Surface

COMPANIES:

OREBODY: Cowarra (D)

PRESENT OPERATORS:
Horizon Pacific Ltd

PRESENT OWNERS:	EQUITY%
Horizon Pacific Ltd	100.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 700
Average recovered grade primary ore mined 1940-1942 (457 kg) 8.4 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

YEAR	PRODUCTION
1987	157
1988	242

MAIN PRODUCTION PERIODS: 1891-1920, 1940-1942, 1986-1988,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Molong-South Coast Anticlinorial Zone(S)
SUB-PROVINCE: Cullarin Block

HOST ROCKS:

FORMATION NAME & AGE: Unnamed Turbidite Sequence (Q8L4) - Late Ordovician
LITHOLOGY: Quartz sandstone, siltstone, shale; metamorphosed equivalents metasandstone, quartzite, slate, phyllite, schist.
RELATIONSHIP TO MINERALISATION: Mineralisation comprises quartz-carbonate-sulphide lodes in shear fractures.

FORMATION NAME & AGE: Bega Batholith - Late Silurian-Early Devonian
LITHOLOGY: Hornblende-biotite granodiorite.
RELATIONSHIP TO MINERALISATION: Intrudes metasedimentary sequence close to mineralised rocks; possibly genetically related to source of mineralisation.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Metasedimentary

STRUCTURAL FEATURES:

MAJOR: Shearing,
SIGNIFICANT: Faulting, Folding

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

METAMORPHISM:

Regional metamorphic grade is low greenschist facies. A narrow belt of higher grade regional metamorphic rocks (biotite- and andalusite-bearing schists) occurs close to the edge of the Bega Batholith, just E of Cowarra. (McQueen, 1986).

ALTERATION:

OREBODY: Cowarra (Victoria)-The King
Individual veins show limited wall rock alteration including chloritisation, sericitisation, and silicification of adjacent slates (McQueen, 1986).

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Auriferous lodes (alteration zones) in fault/shear zones in flysch-type metasediments (slate/greywacke sequences).

STYLE:

MAJOR: Discordant

MORPHOLOGY: Lenticular

DIMENSIONS/ORIENTATION:

OREBODY: Cowarra (D)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			2000.0
TRUE WIDTH	(m)		300.0	500.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		E
STRIKE		180		

OREBODY: Cowarra (Victoria)-The King

		MIN	AVE	MAX
DEPTH OXIDATION	(m)		60.0	
STRIKE LENGTH	(m)	320.0	380.0	1320.0
TRUE WIDTH	(m)	1.8	3.7	6.0
VERTICAL DEPTH	(m)	30.0		200.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		E
PITCH		30; 60		N; S
STRIKE		180		

OREBODY: Ironclad-Vanderbilt-Ambassador-etc

		MIN	AVE	MAX
DEPTH OXIDATION	(m)	12.0	27.0	
STRIKE LENGTH	(m)	80.0	300.0	2000.0
TRUE WIDTH	(cm)	23.0	90.0	12000.0
VERTICAL DEPTH	(m)	18.0		46.0
		ANGLE (deg.)		DIRECTION
DIP				E
PITCH				S
STRIKE		180		

OREBODY: Never Never

		MIN	AVE	MAX
STRIKE LENGTH	(m)		120.0	450.0
TRUE WIDTH	(m)		1.9	40.0
VERTICAL DEPTH	(m)		20.0	
		ANGLE (deg.)		DIRECTION
DIP				E
STRIKE		100		

OREBODY: The Princess

		MIN	AVE	MAX
STRIKE LENGTH	(m)			320.0
TRUE WIDTH	(m)		23.0	4000.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		E
STRIKE		180		

OREBODY: The Queen-The Democrat

		MIN	AVE	MAX
STRIKE LENGTH	(m)	200.0	400.0	650.0
TRUE WIDTH	(m)	0.2	0.9	40.0
VERTICAL DEPTH	(m)	24.0	46.0	
		ANGLE (deg.)		DIRECTION
DIP		75-90		E
PITCH				S
STRIKE		180		

ORE TEXTURE:
Oxidised, Primary

NATURE OF MINERALISATION:
PRIMARY ORE: Dissemination, Fault/Shear Filling, Lode (Alteration Zone)

Vein (Reef),
SECONDARY ORE: Detrital (Alluvial), Supergene Enrichment

MINERALOGY:

OREBODY: Cowarra (D)

Sulphide zone: pyrite, pyrrhotite, (arsenopyrite, chalcopyrite, bornite, galena, sphalerite, marcasite (Canavan, 1953).
Gold occurs as fine inclusions in sulphide minerals (Canavan, 1953).
Above 200 m, gold content followed sulphide content (Canavan, 1965).
Oxide zone: gold, limonite.
Gangue: quartz, calcite.

OREBODY: Cowarra (Victoria)-The King

Ore consists of i) massive and irregular sulphide veins in a deformed quartz-rich gangue, ii) massive sulphide veinlets in slate, and iii) banded carbonate-sulphide veins. A number of texturally distinct sulphide types can be recognised and there appear to have been several generations of sulphide deposition. (McQueen, 1986).

Sulphide zone: pyrite, pyrrhotite, (chalcopyrite, sphalerite, galena, bornite, marcasite) (Herzberger & Barnes, 1978; McQueen, 1986).

Gold occurs mainly as sub-microscopic (0.5 mm) inclusions in subhedral pyrite, also in pyrrhotite, chalcopyrite, and arsenopyrite (McQueen, 1986). Some gold occurs in quartz and in pyrite in late-stage fractures suggesting later introduction, or redistribution of gold (McQueen, 1986 - see 'GENETIC MODELS').

Gangue: quartz, chlorite, magnetite, calcite, dolomite, ferroan ankerite, (sericite, epidote, albite) (McQueen, 1986).

CONTROLS OF MINERALISATION:

Mineralisation is strongly structurally controlled, being localised in shear related fractures. The main local control appears to have been the development of dilational zones, particularly at contacts between slate units and more competent sandstone beds, and at intersecting fractures. (McQueen, 1986).

Termination of mineralisation against the pre-ore 'M' fault is interpreted by Canavan (1953, 1965) to suggest that the fault acted as a barrier to ore-fluid migration.

McQueen (1986): 'fluid inclusion studies indicate temperatures between 300-480 deg C for quartz deposition in the lodes. Geothermometry based on partitioning of Fe and Mg between co-existing calcite and ferroan dolomite and on chlorite compositions indicate temperatures of 290+-30 deg C and 255-340 deg C respectively (Gordon, 1985, reported by McQueen, 1986). Phase relations in the sulphides together with compositions of FeS-buffered arsenopyrite inclusions indicate temperatures for major sulphide deposition in the range 320-400 deg C. Textural and mineralogical evidence suggests that deposition in the lodes occurred over an extended period with decreasing temperature, and that the main sulphide-gold deposition occurred between 300 deg C and 400 deg C.
The mineralising fluids had low salinity (3-8 eq. wt% NaCl, from fluid inclusions) and were probably neutral to weakly alkaline, as suggested by the stability of carbonate in the veins. They were rich in S and Ag and became more oxidising with time and lower temperature. Gold transport was most likely via bisulphide or arsenic-bearing complexes.' (McQueen, 1986).

GENETIC MODELS:

PRINCIPAL SOURCES: Canavan (1953, 1965), McQueen (1986).

Canavan (1953, 1965) proposed a multi-stage metamorphic-hydrothermal origin involving two phases of shearing movement with introduction of mineralising hydrothermal fluids after each stage.
McQueen (1986) also favours a late- or post-metamorphic structurally controlled origin, possibly from a granitic source.

Formation of mineralisation is related to the regional deformation history. Structural, mineralogical, and temperature data suggest the following sequence (Canavan, 1953, 1965; McQueen, 1986):-

i) Early folding with development of segregation cleavage S1.
ii) Major tight to isoclinal folding accompanied by development of penetrative axial plane cleavage S2.
iii) Principal deformation, including peak metamorphism, minor kink folding, crenulation of the S2 cleavage, and pre-ore faulting.
(The lodes are not folded and in places cut across mesoscopic F2 folds.)
iv) Shearing, and introduction of pyrite-gold mineralisation in

dilational zones in shear fractures. Shearing and lode formation evidently post-dated major folding and cleavage development: microfabrics suggest that the main sulphide mineralisation was introduced after cleavage development; mineralogy and temperature data favour a late- or post-metamorphic timing for introduction of mineralisation (McQueen, 1986).
(Canavan (1965) suggests that shearing preceded faulting, and was followed by introduction of mineralisation).
v) Further shear movement.
vi) Second stage deposition of pyrite-gold mineralisation.
vii) Post-ore faulting.

McQueen (1986) considers three possible sources for the mineralising fluids:-
1./ Metamorphic dewatering of the Ordovician sedimentary pile.
2./ Convection of brines derived from overlying Silurian seawater.
3./ Hydrothermal fluids derived from underlying intrusive rocks.

McQueen (1986) favours 3./ for the following reasons:-
i) low salinities of fluid inclusions, which would generally preclude derivation from seawater or early-stage dewatering;
ii) elevated fluid temperatures, indicated by presence of wall-rock alteration and geothermometry data, which would be higher than expected under late metamorphic conditions alone;
iii) proximity of magnetic I-type granodiorite bodies and possibility of existence of similar intrusive body at shallow depth beneath deposit, suggested by aeromagnetic data;
iv) comparison with sulphide-gold deposits associated with similar intrusives elsewhere in southeastern NSW. These fields show mineralogical and alteration features which distinguish them from typical metamorphic slate-hosted deposits. The source granites contain abundant magnetite indicative of high oxygen fugacity which would favour separation of sulphur during crystallisation.
Gold and metals could be carried in the fluid phase as S-bearing complexes and precipitated under changing chemical conditions in structural sites in the upper levels of the granite or in the overlying or adjacent country rocks (McQueen, 1986).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Cowarra (D)

PRINCIPAL SOURCES: Canavan (1953, 1965), Barnes & Herzberger (1975), Herzberger & Barnes (1978), Markham (1982), McQueen (1986).

SUMMARY

The Cowarra (or Cowra Creek) goldfield lies in the south-central part of the Cullarin Block. Mineralisation comprises quartz-chlorite-carbonate-sulphide lodes in steeply-dipping shear fractures which parallel cleavage, in tightly folded and metamorphosed Late Ordovician slates and sandstones. The largest orebody of the field is the Cowarra (or Victoria) mine, which accounted for half of historical production, and has been redeveloped in the 1980s.

GEOLOGICAL SETTING: COWARRA

PRINCIPAL SOURCES: Barnes & Herzberger (1975), McQueen (1986).

The Cowarra field is part of a N-S belt of gold mineralisation 15 km x up to 1.5 km wide that includes Bredbo River to the N of Cowarra, and Macanally Creek and Fiery Creek to the S (McQueen, 1986).

Host rocks to all the deposits are metamorphosed, tightly folded and cleaved Late Ordovician slates and sandstones (Q8L4 on Bega metallogenic map). Lithologies include metasandstone, quartzite, slate, schist, phyllite; slates are in part silicified.
The metasediments are intruded by granite of the Bega Batholith (gamma2L-gamma4L), which occurs 5 km E of Cowarra.
To the W, the metasedimentary sequence is overlain by Silurian volcanics and sediments (B5L4, B5L5) of the Cowra-Yass Synclinorial Zone.
N of Cowarra, the sequence is intruded by Late Silurian-Early Devonian granites of the Michelago Igneous Complex (gamma3L9 on Canberra metallogenic map; gc on Michelago 1:100 000 geological map).
The granitoid rocks in the deposit region are magnetic I-type potassic hornblende-biotite granodiorites (McQueen, 1986).

The metasedimentary rocks have been strongly folded and cleaved, and intensely sheared and faulted (Canavan, 1953; Markham, 1982).
Regional trends are N-S. Fold pitches range between 25 deg S and 60 deg N, average 30 deg N. (Canavan, 1953).

LOCAL SETTING: MINERALISATION

PRINCIPAL SOURCES: Canavan (1953, 1965), Markham (1982), McQueen (1986).

The lodes occur in fractures that apparently developed as a result of shearing, particularly in the more sandstone-rich parts of the sequence (McQueen, 1986).
The fracture system is related to a prominent shear zone that trends N-S, dips 70 deg E (Canavan, 1965).
On a broad scale, ore zones plunge N, sub-parallel to major fold axes (McQueen, 1986).

Mineralisation comprises zones of silicification and sulphide impregration within the slates, with some quartz vein and stringer material (Markham, 1982). Ore consists mainly of massive and irregular sulphide veins in a deformed quartz-rich gangue, massive sulphide veinlets in slate, and banded carbonate-sulphide veins (McQueen, 1986). According to Canavan (1953), units of favourable chemical and/or physical composition are preferentially mineralised.

The Cowarra field comprises five main parallel lines of lode, from E to W:-
i) Princess
ii) Cowarra (Victoria)-King
iii) Queen-Democrat
iv) Ironclad-Vanderbilt-Ambassador-Prime Minister-Polar Star
v) Never Never

Each line comprises several parallel but discontinuous lenticular mineralised shoots separated by barren sections within the shear zone. The names listed above refer to the main concentrations of mineralised sections (Markham, 1982).
The orebody dimension data have been recorded as follows:-
. STRIKE LENGTH (MAX): total length of line of lode.
. STRIKE LENGTH (MIN, AVE): extent of workings on mineralised sections.
. TRUE WIDTH (MAX): total width of line of lode.
. TRUE WIDTH (MIN, AVE): width of mineralised shoots.
(Herzberger & Barnes, 1978).

OREBODY: Cowarra (Victoria)-The King

The Cowarra (Victoria) mine was the most productive centre of the field and has been redeveloped in the 1980s.
The King occurs about 500 m S along strike from Cowarra (Victoria).

Structural relationships are complex. Canavan (1953) identified four principal faults, two pre-ore, termed 'L' and 'M,' and two post-ore, termed 'G' and 'N'. All strike close to N-S, and dip at various angles to the E. Movement was predominantly horizontal, E side to the S and up on three of the faults, and N and up on the 'G' post-ore fault; slickensides pitch shallowly N. The faults intersect the ore zones at acute angles both along strike and down dip. In addition to the principal faults, numerous minor flat post-ore overthrusts strike N, and a few near-vertical cross-faults (also post-ore) strike E.
Ore shoots are in places rimmed by massive quartz. (Canavan, 1953).

OREBODY: Ironclad-Vanderbilt-Ambassador-etc

Ironclad: ore lenses were 6-12 m long
Vanderbilt: consisted of three separate reefs 2.4-3.7 m apart.
Ore lenses were 5.5-12.2 m long.
Polar Star: ore lenses were 6-12 m long.
Also includes The Prime Minister.
(Herzberger & Barnes, 1978).

OREBODY: The Queen-The Democrat

Ore lenses at The Democrat were 20-25 m long (Herzberger & Barnes,1978).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Barnes R.G., Herzberger G.A., 1975
Bega 1:250 000 metallogenic series map. Sheet SJ 55-04 and parts of SJ 55-08 and SJ 55-03.
Geological Survey of New South Wales
1v

Canavan F., 1953
Cowarra gold mine. IN Edwards A.B.(ed) - Geology of Australian ore deposits. 5th Empire Mining & Metallurgical Congress, Australia & New Zealand, 1953, Melbourne.
AusIMM
1 P941-943

Canavan F., 1965
The relation between faulting and mineralization at the Cowarra gold mine in New South Wales.

AusIMM. Proceedings
216 P13-16

Gordon I.F., 1985
The Cowarra gold mine: a research report.
Australian National University. Unpublished Report
1v

Herzberger G.A., Barnes R.G., 1978
Mine data sheets to accompany metallogenic map Bega 1:250 000 sheet.
Sheet SJ 55-04 (plus parts of SJ 55-08 and SJ 55-03).
Geological Survey of New South Wales
1v

Herzberger G.A., Barnes R.G., Bowman H.N., 1978
A metallogenic study of the Bega 1:250 000 sheet. Sheet SJ 55-04.
Geological Survey of New South Wales
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geologiaal Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

McQueen K.G., 1986
The Cowarra gold deposit - a granitic gold source? IN Geological setting of precious metals in New South Wales. One-day symposium, Sydney, October 1986. Abstracts.
Geological Society of Australia
18

Richardson S.J., 1979
Geology of the Michelago 1:100 000 sheet 8726.
Geological Survey of New South Wales
1v

oooooooooooooooooooooooooooooooooooooo

DEPOSIT: 47 YALWAL-GRASSY GULLY

DEPOSIT IDENTIFICATION:

COMMODITIES: Au, Ag

DISTRIBUTION:
Record covers small group of deposits in Danjera Creek just S of its confluence with the Shoalhaven River. Nos. 130-142 on Sydney 1:500 000 metallogenic map.

OREBODIES:
Yalwal-Grassy Gully (D), Caledonian-Star, Golden Crown-Fountainhead, Grassy Gully, Hidden Treasure-Buck Reef , Pinnacle-Eclipse , Pioneer-Homeward Bound, Poor Man, Robert Bruce, Usher-Golden Quarry Victory

MINES:
Caledonian, Eclipse, Fountainhead, Golden Crown, Golden Quarry, Grassy Gully, Hidden Treasure (Danjera Treasure), Homeward Bound, Isons, Pinnacle, Pioneer, Poor Man, Robert Bruce, Sandemans, Star, Thomas, Underwoods, Usher, Victory

GROUP: Eden-Comerong-Yalwal Group

COMMENTS:
See Deposit No.50 PAMBULA for regional setting of Eden-Comerong-Yalwal Rift Zone and Eden-Comerong-Yalwal group.

LOCATION:

LATITUDE: 34 56 LONGITUDE: 150 23
250K SHEET: SI56 9 100K SHEET: 8928

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Wollongong
LOCAL GOVERNMENT AREA (LGA): Shoalhaven

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD	COMMENTS
1852		Date approximate

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Caledonian-Star	Caledonian	Historical	Underground
Caledonian-Star	Caledonian	Historical	Surface
Caledonian-Star	Caledonian	Historical	Open-Cut
Caledonian-Star	Star	Historical	Underground
Caledonian-Star	Star	Historical	Open-Cut
Caledonian-Star	Star	Historical	Surface
Caledonian-Star	Isons	Historical	Underground
Caledonian-Star	Isons	Historical	Open-Cut
Caledonian-Star	Isons	Historical	Surface
Caledonian-Star	Underwoods	Historical	Underground
Caledonian-Star	Underwoods	Historical	Open-Cut
Caledonian-Star	Underwoods	Historical	Surface
Caledonian-Star	Sandemans	Historical	Underground
Caledonian-Star	Sandemans	Historical	Open-Cut
Caledonian-Star	Sandemans	Historical	Surface
Caledonian-Star	Thomas	Historical	Underground
Caledonian-Star	Thomas	Historical	Open-Cut
Caledonian-Star	Thomas	Historical	Surface
Golden Crown-Fountainhead	Golden Crown	Historical	Unknown
Golden Crown-Fountainhead	Fountainhead	Historical	Unknown
Grassy Gully	Grassy Gully	Historical	Underground
Grassy Gully	Grassy Gully	Historical	Surface
Hidden Treasure-Buck Reef	Hidden Treasure (Danjera Treasure)	Historical	Unknown
Pinnacle-Eclipse	Pinnacle	Historical	Underground
Pinnacle-Eclipse	Pinnacle	Historical	Open-Cut

Pinnacle-Eclipse	Eclipse	Historical	Underground
Pinnacle-Eclipse	Eclipse	Historical	Open-Cut
Pioneer-Homeward Bound	Homeward Bound	Historical	Underground
Pioneer-Homeward Bound	Homeward Bound	Historical	Open-Cut
Pioneer-Homeward Bound	Pioneer	Historical	Underground
Pioneer-Homeward Bound	Pioneer	Historical	Open-Cut
Poor Man	Poor Man	Historical	Unknown
Robert Bruce	Robert Bruce	Historical	Unknown
Usher-Golden Quarry	Usher	Historical	Unknown
Usher-Golden Quarry	Golden Quarry	Historical	Unknown
Victory	Victory	Historical	Unknown

COMPANIES:

OREBODY: Yalwal-Grassy Gully (D)

PRESENT OPERATORS:
Alkane Exploration N L

PRESENT OWNERS:	EQUITY%
Alkane Exploration N L	100.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 2,579
Average recovered grade 2-6 g/t Au (main workings of field - Pioneer, Homeward Bound).

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1901-1938), 1885-1900,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Molong-South Coast Anticlinorial Zone(S)
SUB-PROVINCE: Eden-Comerong-Yalwal Rift Zone

HOST ROCKS:

FORMATION NAME & AGE: Yalwal Volcanics - Middle-Late Devonian
LITHOLOGY: Rhyolite, rhylite agglomerate; spilitic basalt, sediments.
RELATIONSHIP TO MINERALISATION: Primary gold mineralisation is associated with pyrite which occurs as disseminations and breccia infill material in volcanics.

FORMATION NAME & AGE: Budawang Volcanic Complex - Middle-Late Devonian
LITHOLOGY: Felsic lava, breccia, tuff, agglomerate; basalt; sediments.
RELATIONSHIP TO MINERALISATION: Name proposed to encompass volcanic sequence throughout rift zone, i.e. Yalwal Volcanics in N, Comerong Volcanics in centre, Boyd Volcanics in S.

FORMATION NAME & AGE: Hell Hole Beds - Ordovician
LITHOLOGY: Greywacke, slate, phyllite.
RELATIONSHIP TO MINERALISATION: Host to minor mineralisation adjacent to mineralised Devonian volcanics.

GEOCHRONOLOGY:
Host volcanics dated at 370 my (Late Devonian) (Glaser, 1986).

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Felsic Extrusive,
MINOR: Metasedimentary

STRUCTURAL FEATURES:

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

MAJOR: Stratigraphic Boundary

IGNEOUS ACTIVITY:

MAJOR: Volcanism (Felsic)

METAMORPHISM:

The volcanics were thermally metamorphosed as a result of intrusion of Carboniferous granite. The contact metamoprhic effects have been shown (Wall, 1965, reported by McIlveen, 1975) to have post-dated silicification-sericitisation associated with mineralisation. Thermal metamorphism resulted in overprinting of the alteration mineral assemblage with an albite-epidote hornfels assemblage comprising andalusite-sericite-quartz hornfels (Wall, 1965, reported by McIlveen, 1975).

ALTERATION:

OREBODY: Yalwal-Grassy Gully (D)

PRINCIPAL SOURCES: Love (1965), Wall (1965), Kesson (1968), and Wall & Kesson (1969); all variously reported by Markham & Basden (1974), McIlveen (1975, 1980b), and Markham (1982); Glaser & Keays (1988).

The volcanic sequence has been extensively altered by low pressure/low temperature hydrothermal alteration (Markham & Basden, 1974). Alteration effects in the felsic rocks are devitrification of originally glassy lavas, silicification, pyritisation, kaolinisation/ sericitisation, and pyrophyllisation (Love, 1965; and Wall, 1965; both reported by Markham & Basden, 1974, McIlveen, 1975, 1980b, and Markham, 1982).

Secondary mineral assemblage = quartz-sericite-pyrite-kaolinite+- albite, adularia, alunite, muscovite, chlorite, epidote, hematite (Wall & Kesson, 1969, reported by McIlveen, 1975, 1980b; and Markham, 1982).
Variations in mineral proportions may reflect varying initial lithologies (Chapman & Degeling, 1981).
Secondary quartz occurs as chalcedonic spheruloids, veining, and breccia cement, silica replacement, and siliceous sinters.
Pyrite occurs as small flecks and clusters (Love, 1965, reported by Markham & Basden, 1974).
Within the alteration zone, intensely silicified conglomerates appear to overlie cross-cutting lenticular 'chimney'-like zones of sericite-quartz-pyrophyllite alteration+-albite, chlorite, pyrite, hematite, anhydrite (Wall & Kesson, 1969, reported by Markham & Basden, 1974; Chapman & Degeling, 1981).
The pyrophyllite zones display interpenetrating lamellar texture possibly related to flash boiling of hydrothermal fluids (Chapman & Degeling, 1981).

Alteration in the mafic volcanics apparently involved redistribution of components with a common convergence to chlorite-silica mixtures (Vallance, 1967, reported by Markham & Basden, 1974).
Epidote, prehnite, ?pumpellyite, and ?laumontite have been recorded (Wall, 1965, reported by McIlveen, 1975).
Albitisation was not widespread (plagioclase is labradorite); amygdules contain chlorite, cryptocrystalline silica, ?chalcedony and calcite (McIlveen, 1975).

Glaser & Keays (1988): deposit is associated with an advanced argillic alteration feature in the nearer surface zone of an adularia-sericite type system.

OREBODY: Grassy Gully

Strong silicification.

DEPOSIT CHARACTERISTICS:

TYPES:

MAJOR: Disseminated/quartz stockwork epithermal gold-silver-pyrite in altered felsic volcanics.
SIGNIFICANT: Alluvial.

STYLE:

SIGNIFICANT: Discordant

MORPHOLOGY: Elliptical, Pipe-Like

AGE OF MINERALISATION: Palaeozoic Late Devonian

DIMENSIONS/ORIENTATION:

OREBODY: Yalwal-Grassy Gully (D)

		MIN	AVE	MAX
DEPTH OXIDATION	(m)	30.0		50.0
VERTICAL DEPTH	(m)		40.0	

OREBODY: Grassy Gully

		MIN	AVE	MAX
TRUE WIDTH	(m)	100.0		150.0
STRIKE LENGTH	(m)			200.0
VERTICAL DEPTH	(m)			61.0
		ANGLE (deg.)		DIRECTION
DIP				W
STRIKE		360		

OREBODY: Pioneer-Homeward Bound

	ANGLE (deg.)	DIRECTION
STRIKE	180	

ORE TEXTURE:
Disseminated, Oxidised

NATURE OF MINERALISATION:
PRIMARY ORE: Breccia, Dissemination, Multiple Veins,
SECONDARY ORE: Detrital (Alluvial), Supergene Enrichment

MINERALOGY:

OREBODY: Yalwal-Grassy Gully (D)

PRINCIPAL SOURCES: Andrews (1901), Love (1965); both reported by Markham & Basden (1974); and McIlveen (1975); McIlveen (1975, 1980b), Markham (1982).

Sulphide zone: pyrite, (arsenopyrite, sphalerite) (Love, 1965, reported by Markham & Basden, 1974).
Pyrite occurs as veinlets, nodules, and disseminated patches (Andrews, 1901, reported by Markham & Basden, 1974).
Gold probably occurred in solid solution within pyrite or as sub-microscopic inclusions (Markham, 1982).
Oxide zone: gold, limonite, (jarosite, sulphur) (Kesson, 1968, reported by Markham & Basden, 1974).
Gold in the oxide zone was extremely fine-grained (Andrews, 1901, reported by Markham & Basden, 1974; and Markham, 1982).
Gangue (altered rhyolitic volcanics - see also 'ALTERATION'): quartz, sericite, kaolinite, pyrophyllite, altered feldspar (Wall, 1965, reported by McIlveen, 1980b).

OREBODY: Grassy Gully

Sulphide zone: pyrite, (gold).
Oxide zone: gold.
Gangue: quartz, host rock.

CONTROLS OF MINERALISATION:
See 'CONTROLS OF MINERALISATION', Deposit No.50 PAMBULA.

GENETIC MODELS:
PRINCIPAL SOURCES: Andrews (1901), Love (1965), Wall (1965), Steiner (1966), Kesson (1968); all variously reported by Markham & Basden (1974); McIlveen (1975); and Markham (1982).

Andrews (1901): mineralisation derived from intrusion of Carboniferous granite.
Love (1965): Yalwal represents near-surface late-stage or post-depositional volcanic activity.
Wall (1965): mineralisation was associated with kaolinisation, which pre-dated thermal metamorphism associated with granite intrusion.
High surface grades were at least partly due to pre-Permian weathering.
Steiner (1966): mineralisation was formed during the later stages of crystallisation such as vapour phase and the stage of fumarolic activity, and localised in zones of collapse along fracture and shear zones.
Kesson (1968): Yalwal-Grassy Gully and Pambula had a similar origin in an environment analogous to present day active thermal areas (see 'GENETIC MODELS', Deposit No.50 PAMBULA).
Chapman & Degeling (1981):

i) generation of hydrothermal system by cooling magma chamber at depth.
ii) fluid movement localised by high-angle faults or feeder systems, resulting in pervasive alteration and deposition of disseminated gold in permeable basement rocks.
iii) in the impermeable rhyolites, channelling of fluids along structures and upward-sloped chimney-shaped zones of microfracturing, giving rise to intense alteration, and into open structures which were subsequently infilled by chalcedonic silica.
iv) release of confining pressure at the top of the rhyolite, resulting in flash boiling and deposition of the last gold in the system.
v) dispersal of spent fluids into overlying unconsolidated sediments where remaining silica was dumped to form a cap of intensely silicified conglomerates.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Yalwal-Grassy Gully (D)

PRINCIPAL SOURCES: Markham & Basden (1974), McIlveen (1975, 1980a,b), Chapman & Degeling (1981), Markham (1982), Glaser (1986), Glaser & Keays (1988).

Yalwal-Grassy Gully lies in the northern part of the Eden-Comerong-Yalwal Rift Zone, in a small inlier of Devonian rocks beneath a thin cover of Sydney Basin Permian and Carboniferous sediments. The inlier is exposed in deeply incised valleys of the Danjera, Bundundah, Yalwal, and Ettrema Creeks, and for a short section of the Shoalhaven River upstream of its confluence with Yalwal Creek. Underlying Ordovician metasediments are exposed in Yalwal Creek. Yalwal occurs in cuttings of Yalwal Creek; Grassy Gully in the banks of the Shoalhaven River. Mineralisation at both deposits consists of stratabound disseminated, breccia-fill, and vein stockwork gold-silver-pyrite in early Late Devonian altered felsic volcanics (Yalwal Volcanics).

REGIONAL SUCCESSION: 'YALWAL INLIER'
PRINCIPAL SOURCES: McIlveen (1980a), Glaser (1986).

The Pre-Permian sequence exposed in the river valleys comprises:-
1./ Hell Hole Beds (Q8L3 on Sydney metallogenic map) (Ordovician) - quartz greywacke, siltstone, slate, phyllite. Beds represent basement rocks of the Molong-South Coast Anticlinorial Zone (McIlveen, 1980a). The unit is host to minor disseminated mineralisation; the bulk of gold mineralisation of the Yalwal-Grassy Gully field is contained in the overlying Devonian volcanics but occurs close to or at the unconformable contact with Ordovician metasediments (McIlveen, 1975).
2./ Yalwal Volcanics (K5LM) (late Middle-early Late Devonian) - bimodal suite of peraluminous flow-banded rhyolite and rhyolite agglomerate, and lesser splitic basalt and sediments (conglomerate, siltstone).
The volcanics are host to the principal gold mineralisation at Yalwal-Grassy Gully.
3./ Merrimbula Group (K4LM) (Late Devonian) - sandstone, conglomerate, siltstone, limestone.
4./ Granite (gammaLM) (Carboniferous) - intrudes mineralised volcanics; formerly, but now not, considered to be genetically related to mineralisation (see 'GENETIC MODELS').

GEOLOGICAL SETTING: YALWAL-GRASSY GULLY
PRINCIPAL SOURCES: Chapman & Degeling (1981).

The volcanics in the deposit area are gently up-domed. Silicified coarse conglomerates, which locally control the topography, may have been deposited on the rhyolites and pyroclastics in a central, graben-like structure which possibly hosts feeders or vents for the volcanics. Outside the graben, on the flanks of the dome, the rhyolites are overlain by finer-grained sedimentary rocks which are in turn overlain by basalts erupted in the latter phase of volcanic activity. (Chapman & Degeling, 1981).

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: McIlveen (1975), Chapman & Degeling (1981), Markham (1982).

Primary gold mineralisation occurs within zones of highly altered and brecciated rhyolitic volcanics. The deposit is associated with the most extensive alteration zone which occurs in the lower part of the Yalwal Volcanics, and extends over an area of at least 1000 m x 500 m. (Chapman & Degeling, 1981; Markham, 1982).
Within the zone, original glassy rhyolitic lavas plus conglomerate and siltstone have been converted to massive chert-like rocks containing fine granular aggregates of quartz and sericite, and occasional altered plagioclase crystals (Markham, 1982 - see also 'ALTERATION').

Known primary mineralisation coincides with the zone of silicification

and takes the following forms (Markham, 1982):-
i) broad zones of disseminated pyrite within silicified rhyolite or chert, e.g. Pinnacle.
ii) pyrite cementing a chert breccia, e.g. Hidden Treasure.
iii) thin stringers of massive pyrite within chert, e.g. Golden Crown.
Pyrite seems more abundant in coarser altered sediments and rhyolites, apparently showing an association with N-S belts of coarse 'breccia' (Love, 1965, Wall, 1965; both reported by Markham & Basden, 1974).

Some mineralisation occurs in the Orovician metasediments (Hell Hole Beds) immediately adjacent to the volcanic sequence (Markham & Basden, 1974).

Economic gold grades were developed only in the zone of oxidation, where gold occurred in irregularly distributed limonitic pockets and joint coatings (Markham, 1982).

OREBODY: Caledonian-Star
Mineralisation was contained in narrow high-grade, cross-cutting chalcedonic quartz veins (McIlveen, 1975); there was no broad zone of disseminated mineralisation as e.g. at Pioneer-Homeward Bound (Markham, 1982).
Colloform textures indicate that chalcedonic veins are open-space filling (Chapman & Degeling, 1981).
Economic concentrations apparently extended beneath the thin veneer of overlying Sydney Basin sediments (Markham & Basden, 1974).

OREBODY: Golden Crown-Fountainhead
Mineralisation included primary pyrite in a steeply-dipping chimney-like zone of intensely altered silicified rhyolite. Higher grades occurred in ill-defined structures. (Chapman & Degeling, 1981).

OREBODY: Grassy Gully
PRINCIPAL SOURCES: McIlveen (1975, 1980b), Markham (1982).

Style of mineralisation was apparently similar to that at Yalwal.
Mineralisation occurred in breccias in narrow crush zones in silicified flow-banded rhyolite and devitrified volcanic glass.
Ore occurred in two parallel elongate zones 23 m apart, which dip 40-70 deg W.
Rhyolite breccia is cemented by chalcedonic quartz and crossed by numerous chalcedonic quartz veinlets.
Gold occurred as fine fracture coatings and disseminated patches confined to a narrow section (1-1.5 m) of the crush zones, above a zone of disseminated pyrite. (McIlveen, 1975).
Contact with country rock is gradational.
Country rock commonly has perlitic cracking (McIlveen, 1980b).

OREBODY: Hidden Treasure-Buck Reef
Host rocks recorded as rhyolite (Yalwal Volcanics) and ?Ordovician metagreywacke and phyllite (McIlveen, 1980b).

OREBODY: Pinnacle-Eclipse
Orebody was developed within highly altered rhyolitic volcanics adjacent to an unconformable contact, represented by crushed conglomerate, known as the Buck reef, between the volcanics and Ordovician metasediments (Hell Hole Beds - metagreywacke, phyllite) (Markham & Basden, 1974; McIlveen, 1980b; Markham, 1982).
Gold values were localised along fault and crush zones within the volcanics (Markham, 1982).
Relatively coarse gold was obtained at or near the surface, but the outcrop was apparently not gossanous (Markham & Basden, 1974).

OREBODY: Pioneer-Homeward Bound
The largest orebody of the field, Pioneer-Homeward Bound lay on the W side of the field. Orebody was approximately conformable with strike of country rock, with elliptical form both in plan and in section (Markham & Basden, 1974; McIlveen, 1980b).
Gold occurred in pyrite disseminated in poorly sorted, possibly basement sandstones (Chapman & Degeling, 1981). Higher grades occurred along structures (Chapman & Degeling, op.cit).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Andrews E.C., 1901
Report on the Yalwal goldfield.
Geological Survey of New South Wales. Mineral Resources
9

Chapman J., Degeling P.R., 1981

Some disseminated gold deposits in New South Wales.
Geological Survey of New South Wales. Report
GS1981/567

Gibbons C.S., Le Messurier P., 1963
Report on the Yalwal gold-field.
Geological Survey of New South Wales. Report
46

Glaser L.M., 1986
Geochemical zonation and source rocks for epithermal gold-silver mineralization, Eden-Yalwal rift. IN Geological setting of precious metals in New South Wales. One-day symposium, Sydney, October 1986. Abstracts.
Geological Society of Australia
18

Glaser L.M., 1988
Genesis of volcanogenic epithermal gold-silver mineralisation, Budawang Rift, New South Wales, Australia. Ph.D. thesis.
University of Melbourne. Unpublished
1v

Glaser L.M., Keays R.R., 1988
Genesis of volcanogenic epithermal gold-silver mineralisation, Budawang, Rift, New South Wales. IN Bicentennial Gold 88, Extended Abstracts.
Geological Society of Australia. Abstracts
23 P268-270

Hall L.R., 1960
The stratigraphy, structure and mineralisation of the Devonian strata near Eden, N.S.W.
New South Wales. Department of Mines. Technical Report
5(1957) P103-116

Hamilton T.W., Ellis J., Florence T.M., Fardy J.J., 1983
Analysis of gold in surface waters from Australian goldfields: an investigation into direct hydrogeochemical prospecting for gold.
Economic Geology
78(7) P1335-1341

Jaquet J.B., 1900
Notes upon the occurrence of gold in volcanic glass at Grassy Gully, Yalwal district, New South Wales.
Geological Survey of New South Wales. Records
7(1) P17-19

Kesson S.E., 1968
The geology of an area west of Pambula, N.S.W. B.Sc. (Hons) thesis.
University of Sydney. Unpublished
1v

Love J.L., 1965
The geology and mineral deposits of the Yalwal goldfields, New South Wales. B.Sc. (Hons) thesis.
University of New South Wales. Unpublished
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

McIlveen G.R., 1975
The Eden-Comerong-Yalwal Rift Zone and the contained gold mineralization.
Geological Survey of New South Wales. Records
16(3) P245-277

McIlveen G.R., 1980
Sydney, New South Wales, 1:500 000 metallogenic series map. 1st edition.
Geological Survey of New South Wales
1v

McIlveen G.R., 1980
Mine data sheets to accompany metallogenic map Sydney 1:500 000 sheet.
Geological Survey of New South Wales
1v

Steiner J., 1966
Depositional environments of the Devonian rocks of the Eden-Merrimbula area, N.S.W. Ph. D. thesis.
Australian National University. Unpublished
1v

Wall V.J., 1965
The geology of Yalwal south. B.Sc. (Hons) thesis.
University of Sydney. Unpublished
1v

Wall V.J., Kesson S.E., 1969
Pyrophyllite bearing rocks in a regionally altered volcanic sequence.
Geological Society of America. Abstracts with Programs
7 P232

Wyborn D., Owen M., 1986
Araluen, New South Wales, 1:100 000 geological map commentary.
Bureau Mineral Resources, Australia
1v

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 48 ARALUEN-MAJORS CREEK

DEPOSIT IDENTIFICATION:

SYNONYMS: Majors Creek, Araluen, Jembaicumbene

COMMODITIES: Au, Ag, Pb, Cu, Zn

DISTRIBUTION:
Record covers 3 primary centres in NW zone 14 km x 7 km N of Majors Creek; deposits were concentrated in area 2 km x 2 km at M C; also alluvials along 13 km of Jembaicumbene Ck and 20 km along Araluen Ck. Nos.186-226 on Canberra metall.map.

OREBODIES:
Araluen-Majors Creek (D), Araluen Creek, Bells Creek, Dargues, Jembaicumbene, Jembaicumbene Creek, Majors Creek, Majors Creek (East), Majors Creek (West), Merricumbene, Mount Waddell , Scotsmans Gully-Whiteman & Merton, Snobs

MINES:
Araluen Creek, Banner (Shekamuno), Browns, Burkes, Camages, Dargues, Dunsheas, Golden Gully, Great Star, Hanlons, Heazlitt & Crandell, Jembaicumbene Creek, Lady Belmore, Mathesons, Merricumbene Creek, Mobbs, Mount Waddell, Nimrod, Perseverance & Hindhaughs, Rise & Shine No. 1, Rise & Shine No. 2, Scotsmans Gully (N), Scotsmans Gully (S), Snobs (Mount Hope), Spencers, Sperantum, Sphinx No. 1, Sphinx No. 2, Stalkers, Stewart & Mertons, United Miners, Whiteman & Merton, Young Australia

GROUP: -

COMMENTS:
Record includes regional setting of Molong-South Coast Anticlinorial Zone (S).

LOCATION:

LATITUDE: 35 35 LONGITUDE: 149 46
250K SHEET: SI55 16 100K SHEET: 8826

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Goulburn
LOCAL GOVERNMENT AREA (LGA): Tallaganda

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1851	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Araluen Creek	Araluen Creek	Historical	Dredging &/Or Sluicing
Bells Creek	Golden Gully	Historical	Underground
Bells Creek	Banner (Shekamuno)	Historical	Underground
Bells Creek	Banner (Shekamuno)	Historical	Open-Cut
Bells Creek	Banner (Shekamuno)	Historical	Surface
Bells Creek	Lady Belmore	Historical	Underground
Bells Creek	Browns	Historical	Underground
Bells Creek	Browns	Historical	Open-Cut
Bells Creek	Browns	Historical	Surface
Dargues	Dargues	Historical	Underground
Dargues	Dargues	Possible	Underground
Jembaicumbene	Spencers	Historical	Open-Cut
Jembaicumbene	Burkes	Historical	Underground
Jembaicumbene	Burkes	Historical	Surface
Jembaicumbene	Stalkers	Historical	Underground
Jembaicumbene	Mathesons	Historical	Underground
Jembaicumbene Creek	Jembaicumbene Creek	Historical	Placer (Dredging)
Majors Creek (East)	Young Australia	Historical	Underground
Majors Creek (East)	Mobbs	Historical	Underground

Majors Creek (East)	Camages	Historical	Underground
Majors Creek (East)	Rise & Shine No. 1	Historical	Underground
Majors Creek (East)	Rise & Shine No. 2	Historical	Underground
Majors Creek (East)	Dunsheas	Historical	Underground
Majors Creek (East)	Sperantum	Historical	Underground
Majors Creek (West)	Nimrod	Historical	Underground
Majors Creek (West)	Heazlitt & Crandell	Historical	Underground
Majors Creek (West)	Hanlons	Historical	Underground
Majors Creek (West)	Sphinx No. 1	Historical	Underground
Majors Creek (West)	Sphinx No. 2	Historical	Underground
Majors Creek (West)	Great Star	Historical	Underground
Majors Creek (West)	Perseverance & Hindhaughs	Historical	Underground
Majors Creek (West)	Perseverance & Hindhaughs	Historical	Open-Cut
Merricumbene	Merricumbene Creek	Historical	Underground
Mount Waddell	Mount Waddell	Historical	Underground
Mount Waddell	Mount Waddell	Historical	Open-Cut
Scotsmans Gully-Whiteman & Merton	Scotsmans Gully (N)	Historic	Underground
Scotsmans Gully-Whiteman & Merton	Scotsmans Gully (N)	Histori	Surface
Scotsmans Gully-Whiteman & Merton	Scotsmans Gully (S)	Historical	Underground
Scotsmans Gully-Whiteman & Merton	Whiteman & Merton	Historical	Underground
Snobs	Snobs (Mount Hope)	Historical	Underground
Snobs	United Miners	Historical	Underground
Snobs	Stewart & Mertons	Historical	Underground

COMPANIES:

OREBODY: Araluen Creek

PRESENT OPERATORS:
Moruya Gold Mines (1983) N L.

PRESENT OWNERS:	EQUITY%
Eastern Gold Exploration Pty Ltd	50.00
Moruya Gold Mines (1983) N L.	50.00

OREBODY: Dargues

PRESENT OPERATORS:
Horizon Resources NL

PRESENT OWNERS:	EQUITY%
Horizon Resources NL	100.00

OREBODY: Majors Creek

PRESENT OPERATORS:
Delta Gold N L.

PRESENT OWNERS:	EQUITY%
Delta Gold N L.	50.00
Kaldina Resources Ltd	50.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 35,378
Araluen 13 809 kg Au; Majors Creek 21 569 kg Au. Recovered grades reef ore mostly 30-60 g/t Au, locally >100 g/t Au; alluvial ore 0.1-0.3 g/cubic m Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1901-1920), (1934-1937), (1941-1942), 1851-1875, 1875-1900,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION			
Dec 1988	57	7.5	425	Subeconomic Demonstrated	In-Situ	u/g	Dargues
Dec 1988	57	6.1	346	Subeconomic Inferred	In-Situ	u/g	Dargues

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Molong-South Coast Anticlinorial Zone(S)
SUB-PROVINCE: South Coast Anticlinorium

HOST ROCKS:

FORMATION NAME & AGE: Braidwood Granodiorite - Early Devonian
LITHOLOGY: Hornblende-biotite granodiorite, aplite.
RELATIONSHIP TO MINERALISATION: Primary mineralisation comprised quartz-calcite-sulphide veins associated with joint-controlled E-W pyritic aplite dykes and altered pyritised granodiorite.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to alluvial and deep lead deposits in Araluen and Jembicumbene Creeks.

GEOCHRONOLOGY:
Braidwood Granodiorite dated at:-
415+-4 my, 412+-4 my (biotite K-Ar) (considered anomalous),
403+-4 my, 401+-6 my (hornblende K-Ar), and
399+-6 my (biotite-whole-rock Rb/Sr) (Wyborn & Owen, 1986).
Wyborn & Owen (1986) consider best age to be 395-405 my (Early Devonian).

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Alluvium, Granitic

STRUCTURAL FEATURES:

MAJOR: Jointing,
SIGNIFICANT: Faulting

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Aplite/Pegmatite), Plutonism (Granodiorite)

METAMORPHISM:
Ordovician turbidite sequence has generally been metamorphosed to greenschist facies. Metasediments have been hornfelsed within contact aureole about 1 km wide adjacent to Braidwood Granodiorite. Long Flat Volcanics have been altered by low-grade burial metamorphism. (Wyborn & Owen, 1986).

ALTERATION:

OREBODY: Araluen-Majors Creek (D)
Mineralisation was associated with hydrothermal alteration - greisenisation and pyritisation of aplite and granodiorite in less well mineralised reefs; and propylitisation in richer reefs (Kennedy, 1962, reported by Markham & Basden, 1974).

OREBODY: Bells Creek
Greisenous alteration of granodiorite adjacent to quartz vein (Gilligan, 1975).

OREBODY: Dargues
Disseminated pyrite in wallrock (Gilligan, 1975).

OREBODY: Jembaicumbene
Mineralisation was associated with greisenisation of wallrock (Gilligan, 1975).

OREBODY: Scotsmans Gully-Whiteman & Mellon
Host rock at Scotsmans Gully is kaolinised, greisenised, gossanous granodiorite (Gilligan, 1975).

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Alluvial.
SIGNIFICANT: Auriferous quartz veins in granitoid.
Deep lead.

STYLE:

MAJOR: Discordant

AGE OF MINERALISATION: Cainozoic Recent Quaternary, Palaeozoic Early Devonian

DIMENSIONS/ORIENTATION:

OREBODY: Araluen-Majors Creek (D)

		ANGLE (deg.)		DIRECTION
STRIKE		270-290		

OREBODY: Araluen Creek

		MIN	AVE	MAX
DEPTH OF COVER	(m)			8.0
STRIKE LENGTH	(m)			20000.0
TRUE WIDTH	(m)			500.0

OREBODY: Bells Creek

		MIN	AVE	MAX
STRIKE LENGTH	(m)	200.0		800.0
TRUE WIDTH	(cm)	5.0	15.0	40.0
VERTICAL DEPTH	(m)			85.0
		ANGLE (deg.)		DIRECTION
STRIKE		270-280		

OREBODY: Dargues

		MIN	AVE	MAX
TRUE WIDTH	(cm)		180.0	240.0
STRIKE LENGTH	(m)			366.0
VERTICAL DEPTH	(m)	70.0		
		ANGLE (deg.)		DIRECTION
DIP		90		
STRIKE		270		

OREBODY: Jembaicumbene

		MIN	AVE	MAX
VERTICAL DEPTH	(m)	10.0		15.0
TRUE WIDTH	(cm)		5.0	
STRIKE LENGTH	(m)			30.0
		ANGLE (deg.)		DIRECTION
STRIKE		275,292		

OREBODY: Jembaicumbene Creek

		MIN	AVE	MAX
TRUE WIDTH	(m)			400.0
STRIKE LENGTH	(m)			13000.0

OREBODY: Majors Creek (East)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			82.0
TRUE WIDTH	(cm)	1.2	2.5	760.0
VERTICAL DEPTH	(m)	18.0		67.0
		ANGLE (deg.)		DIRECTION
DIP		86		S
PLUNGE		40-50		
STRIKE		280-290		

OREBODY: Majors Creek (West)

		MIN	AVE	MAX
STRIKE LENGTH	(m)	61.0		150.0
TRUE WIDTH	(cm)	1.2	2.5	23.0
VERTICAL DEPTH	(m)	27.0	40.0	152.0
DEPTH OXIDATION	(m)		8.0	
		ANGLE (deg.)		DIRECTION
DIP		85-90		N
PITCH				E;W
STRIKE		265		

OREBODY: Merricumbene

		MIN	AVE	MAX
STRIKE LENGTH	(m)			30.0

OREBODY: Mount Waddell

		MIN	AVE	MAX
STRIKE LENGTH	(m)			244.0

OREBODY: Scotsmans Gully-Whiteman & Merton

		MIN	AVE	MAX
STRIKE LENGTH	(m)	30.0		80.0
TRUE WIDTH	(cm)	23.0	900.0	1590.0
VERTICAL DEPTH	(m)	8.0		
		ANGLE (deg.)		DIRECTION
DIP		87-90		N
STRIKE		240-283		

OREBODY: Snobs

		MIN	AVE	MAX
STRIKE LENGTH	(m)	183.0		750.0
TRUE WIDTH	(cm)	7.6	10.0	
VERTICAL DEPTH	(m)	97.5		152.0
		ANGLE (deg.)		DIRECTION
DIP		85		N
STRIKE		290		

ORE TEXTURE:

NATURE OF MINERALISATION:
PRIMARY ORE: Lode (Alteration Zone), Vein (Reef),
SECONDARY ORE: Deep Lead, Detrital (Alluvial), Supergene Enrichment

MINERALOGY:

OREBODY: Araluen-Majors Creek (D)
Stage 1: pyrite, gold, chalcopyrite, (galena, sphalerite).
Stage 2: pyrite, tetrahedrite, chalcopyrite, arsenopyrite, galena, sphalerite, tetradymite.
Stage 3: auriferous galena, caleverite, tetrahedrite, chalcopyrite, gold, argentite, hessite, sylvanite.
(Kennedy, 1962, reported by Markham & Basden, 1974; and Gilligan, 1975).

Gold occurs as inclusions in galena and pyrite (deposited from galena), as telluride, and as native gold. (Kennedy, 1962, reported by Gilligan, 1975).

Gangue: quartz and/or calcite, (host rock). (Gilligan, 1975).

OREBODY: Bells Creek
Sulphide zone: arsenopyrite, (gold, galena, tetradymite, chalcopyrite, ?barite, ?pyrite) (Kennedy, 1962, reported by Gilligan, 1975).
Veins represent stages 1 and 2 mineralisation (see 'GENETIC MODELS').
(Kennedy, 1962, reported by Markham, 1982).
Gangue: quartz+-calcite.

OREBODY: Dargues
Sulphide zone: pyrite, (chalcopyrite, gold)
(Kennedy, 1962, reported by Gilligan, 1975).
Gold occurred in solid solution in sulphides (Kennedy, op.cit).
Vein represents Stage 1 mineralisation (see 'GENETIC MODELS')
(Kennedy, 1962, reported by Markham & Basden, 1974).

OREBODY: Jembaicumbene
Sulphide zone: pyrite, (gold, galena, sphalerite, chalcopyrite)
(Kennedy, 1962, reported by Gilligan, 1975).
Veins represent Stage 1 mineralisation (see 'GENETIC MODELS')
(Kennedy, 1962, reported by Markham, 1982).

Paragenesis: deposition of pyrite during greisenisation; replacement of pyrite by sphalerite; exsolution of chalcopyrite from sphalerite; replacement of sphalerite, pyrite, and muscovite by galena (Kennedy, 1962, reported by Gilligan, 1975).
Gold apparently occurred in interstitial solid solution in pyrite (Kennedy, op.cit).

OREBODY: Majors Creek (East)
Sulphide zone: pyrite, sphalerite, galena, chalcopyrite, (gold, tedtrahedrite, hessite, argentite, sylvanite, marcasite, enargite, magnetite, calaverite). Local secondary covellite, (anglesite).
Gangue: quartz+-calcite. (Gilligan, 1975).

Veins contain both Stages 2 and 3 mineralisation (see 'GENETIC MODELS')

(Kennedy, 1962, reported by Markham & Basden, 1974).

Paragenesis:- Stage 2: replacement of early pyrite by sphalerite or chalcopyrite; exsolution of chalcopyrite from sphalerite; healing of pyrite by tetrahedrite/chalcopyrite exsolution, replacement of galena by sphalerite (Kennedy, 1962, reported by Gilligan, 1975).
Stage 3: replacement of pyrite and tetrahedrite by galena, which carries inclusions of gold; deposition of gold tellurides (calaverite, sylvanite), argentite, and hessite. Gold was deposited in pyrite from auriferous galena and chalcopyrite (Kennedy, 1962, reported by Gilligan, 1975).

OREBODY: Majors Creek (West)
Sulphide zone: sphalerite, pyrite, galena (gold, tetrahedrite, calaverite, chalcopyrite), local argentite, arsenopyrite.
Local secondary anglesite, covellite. (Gilligan, 1975).
Gangue: quartz and/or calcite.
Gold occurred as native gold and telluride in auriferous galena, and as inclusions in pyrite, tetrahedrite, and quartz (Kennedy, 1962, reported by Gilligan, 1975).
Veins contain both stages 2 and 3 mineralisation (see 'GENETIC MODELS') (Kennedy, 1962, reported by Markham & Basden, 1974).

Paragenesis:-
Stage 2: deposition of pyrite, brecciation, healing by auriferous quartz; deposition of sphalerite; exsolution of chalcopyrite from sphalerite, replacement of sphalerite by galena, which carries native gold, calaverite, argentite; replacement of pyrite, sphalerite, galena by chalcopyrite/tetrahedrite exsolution; exsolution of tetrahedrite from chalcopyrite.
Brecciation and Stage 3 mineralisation (late-stage carbonate-telluride): introduction of calcite, galena, calaverite, gold, tetradedrite, chalcopyrite, pyrite and quartz; which replace first generation sphalerite, (and pyrite), i.e. replacement of sphalerite by galena, and replacement of pyrite by tetrahedrite.
(Kennedy, 1962, reported by Gilligan, 1975).

OREBODY: Merricumbene
Sulphide zone: gold, pyrite.

OREBODY: Mount Waddell
Sulphide zone: pyrite, (gold).

OREBODY: Scotsmans Gully-Whiteman & Merton
Sulphide zone: pyrite, (chalcopyrite, gold, tetrahedrite) (Gilligan, 1975).
Pyrite contains rare chalcopyrite, gold inclusions (Markham, 1982).
Oxide zone: limonite.
The Scotsman Gully reefs represent Stage 1 mineralisation (Markham, 1982); Whiteman & Merton represents Stage 2 (Kennedy, 1962, reported by Markham & Basden, 1974) (see 'GENETIC MODELS').

OREBODY: Snobs
Sulphide zone: pyrite, chalcopyrite, (tetrahedrite, galena, gold, sphalerite) (Gilligan, 1975).
Gangue: quartz.
Vein is zoned from outer coarse pyrite-chalcopyrite to inner fine pyrite-tetrahedrite-sphalerite to core disseminated sulphides.
Vein contains both Stages 2 and 3 mineralisation (Kennedy, 1962, reported by Markham, 1982) (see 'GENETIC MODELS').
Paragenesis:-
Stage 2: replacement of pyrite by auriferous chalcopyrite; exsolution of tetrahedrite from chalcopyrite; deposition of gold in pyrite from auriferous chalcopyrite; replacement of minor sphalerite by chalcopyrite and tetrahedrite; replacement of chalcopyrite by later auriferous tetrahedrite.
Stage 3: replacement of all earlier sulphides by auriferous telluric galena; deposition of gold in pyrite from galena.
(Kennedy, 1962, reported by Gilligan, 1975).

CONTROLS OF MINERALISATION:
Main cntrol is lithological, provided by granitic source (Braidwood Granodiorite).
Localisation of mineralisation within granite was controlled by
i) lithology/chemistry: proximity to aplite/leucogranite; and
ii) structure: jointing.

GENETIC MODELS:
Magmatic hydrothermal: derived from Braidwood Granodiorite (Kennedy, 1962, reported by Gilligan, 1975).
Kennedy (1962, reported by Markham & Basden, 1974) identified three successive stages of mineralisation and associated hydrothermal

alteration:-
1./ a) Gold-pyrite mineralisation.
1./ b) Magnetite-ilmenite mineralisation.
2./ Copper-lead-zinc-tennantite-tetrahedrite mineralisation.
3./ Pyrite-gold and silver-telluride mineralisation.
(Kennedy, 1962, reported by Markham & Basden, 1974).

Presence of hornblende phenocrysts in granite indicates water-rich magma with potential to provide hydrothermal solutions during crystallisation and differentiation (Wyborn & Owen, 1986).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Araluen-Majors Creek (D)

PRINCIPAL SOURCES: Kennedy (1962, reported by Markham & Basden, 1974; and Markham, 1982), Middleton (1970), Gilligan (1974), Markham & Basden (1974), Gilligan (1975), Markham (1982), Wyborn & Owen (1986).
SUMMARY

Araluen-Majors Creek lies in the central part of the South Coast Anticlinorium of the Molong-South Coast Anticlinorial Zone (S). Aprroximately 80% of recorded production was from alluvial and deep lead sources in two sub-parallel NW-trending river valleys, the Araluen and Jembaicumbene Creeks. The creeks traversed Early Devonian Braidwood Granodiorite, Ordovician metasediments to the E, and Silurian volcanics to the W. (Alluvial deposits were also extensive downstream in the Shoalhaven River into which Jembaicumbene Creek discharges, and in the Deua River into which Araluen Creek discharges.)
Primary deposits, which accounted for 20% of recorded production, comprise hydrothermal quartz-calcite-sulphide veins in joint-controlled E-W trending pyritic aplite dykes and altered pyritised granodiorite of the Early Devonian Braidwood Granodiorite.

REGIONAL SETTING: MOLONG-SOUTH COAST ANTICLINORIAL ZONE (SOUTH)
PRINCIPAL SOURCES: Gilligan (1974), Markham & Basden (1974), Felton (1977), Herzberger & others (1978), Wyborn & Owen (1986).

The southern part of the Molong-South Coast Anticlinorial Zone is a composite structural unit which interfingers with the Cowra-Yass, Hill End, and Captains Flat-Goulburn Synclinorial Zones (Markham & Basden, 1974).
The intervening synclinoria divide the Anticlinorial Zone (S) into five anticlinorial blocks, from W to E: the Cotter, Cullarin, Rockley (in the N)-Rocky Pic (S of Rockley), and South Coast Blocks (Gilligan, 1974). The anticlinoria consist largely of Ordovician-Early Silurian metasediments and volcanics extensively intruded by large composite granitoid batholiths of Silurian, Devonian, and Carboniferous age (Markham & Basden, 1974).

According to Scheibner (1976), during the Early Ordovician a continental slope and oceanic basin, the Monaro Slope and Basin, lay W of a volcanic arc, the Molong Volcanic Arc, which developed on a microcontinental block E of the Australian craton (Felton, 1977).
Volcanics and associated sediments of the arc are more abundant in the northern part of the Anticlinorial Zone; in the southern part arc volcanics are known only from the Cotter Block, where they are represented by the Kiandra Beds (Q6L on Canberra and Bega metallogenic maps) (Markham & Basden, 1974). The Kiandra Beds are host to hydrothermal vein gold mineralisation at KIANDRA (Deposit No.22).

The Monaro Slope and Basin received principal sedimentation in the Middle-Late Ordovician, when thick sequences of quartz-rich turbidites accumulated. The sediments were deformed during the Quidongan Orogeny in the Early Silurian, and are now intensely folded and generally metamorphosed to greenschist facies. (Markham & Basden, 1974).
The metasediments (Q8L on Canberra and Bega metallogenic maps) are host to metamorphic-hydrothermal vein and shear-fill deposits at COWARRA (Deposit No.46) and NERRIGUNDAH (Deposit No.49).

During the Silurian thick sequences of calc-alkaline arch and rift volcanics and shallow marine sediments were deposited on the Yass-Canberra Rise, which developed over the southern part of the Molong Volcanic Arc, and in the Hill End and Captains Flat troughs, which developed from rifting of the Ordovician rocks (Felton, 1977; Herzberger & others, 1978). The volcanics are now preserved in the Cowra-Yass (B5L), Hill End, and Captains Flat-Goulburn (B7L) Synclinorial Zones (Gilligan, 1974).

From Late Silurian-Early Devonian, granite plutonism resulted in the emplacement of composite I-type granitoid batholiths, now exposed in the anticlinorial blocks (gamma2, 3, 4) (Markham & Basden, 1974; Herzberger & others, 1978; Wyborn & Owen, 1986). The batholiths comprise

multiple intrusions, from older syn- and late-kinematic foliated phases to younger massive concordant late- and post-kinematic phases (Herzberger & others, 19?3).
Some of the batholiths are comagmatic with Silurian calc-alkaline volcanic units of the intervening synclinoria (Wyborn & Owen, 1986).
Primary gold mineralisation at Araluen-Majors Creek is hosted by the (probably) Early Devonian Braidwood Granodiorite.

Following cratonisation in the Middle Devonian, extensional faulting and monoclinal flexing of the folded Ordovician strata formed the Eden-Comerong-Yalwal or Budawang Rift Zone (Wyborn & Owen, 1986).
The rift zone is a meridionally elongate graben containing subaerial volcanics and associated sediments (Markham & Basden, 1974).
Felsic volcanics are host to epithermal gold mineralisation at PAMBULA (Deposit No.50) and YALWAL-GRASSY GULLY (Deposit No.47); see Deposit No.50 (PAMBULA) for description of Eden-Comerong-Yalwal Rift Zone.

REGIONAL SUCCESSION: ARALUEN-MAJORS CREEK
PRINCIPAL SOURCES: Gilligan (1974), Wyborn & Owen (1986).

1./ Unnamed turbidite sequence (Ouf, Ous on Araluen 1:100 000 geological map) (Middle-Late Ordovician) - interbedded quartz sandstone, siltstone and shale; metamorphic equivalents quartzite, slate, phyllite, schist.
Unit occurs in meridional belts in the eastern part of the South Coast Anticlinorium. Unconformably overlain by:-
2./ De Drack Formation (Sud, etc) (Late Silurian) - interbedded quartz arenite, siltstone, shale, chert and limestone lenses, black mudstones, volcaniclastic arenite. Unit occurs in southern part of Captains Flat-Goulburn Synclinorial Zone. Apparently conformably overlain by:-
3./ Long Flat Volcanics (Suk, Sut, Sur, Spk) (Late Silurian) - porphyritic dacite (at base), dacite and rhyolite (at top), ignimbrite; includes high level intrusive dacite and rhyodacite porphyry.

Ordovician sediments and Silurian sediments and volcanics are intruded by:-
4./ Braidwood Granodiorite (Dgb, Dmb) (Early Devonian) - I-type hornblende-biotite granodiorite, minor quartz diorite, aplite-pegmatite, leucogranite. Comagmatic with rhyolite and rhyodacite units of the Long Flat Volcanics (Wyborn & Owen, 1986).
5./ Minuma Range Group (Duu) (Late Devonian) - conglomerate, shale, sandstone. Overlies Silurian sedimentary-volcanic succession in Captains Flat-Goulburn Synclinorial Zone.

GEOLOGICAL SETTING: ARALUEN-MAJORS CREEK
PRINCIPAL SOURCES: Gilligan (1974), Wyborn & Owen (1986).

The Araluen-Majors Creek field occurs at the western margin of the Braidwood Granodiorite, which in the deposit region forms the boundary between the South Coast Anticlinorium to the E and the Captains Flat-Goulburn Synclinorial Zone to the W (Gilligan, 1974).

The Braidwood Granodiorite is a meridionally elongate, massive, multiple intrusion comprising two main phases of approximately the same composition - hornblende-biotite granodiorite (Dgb1 and Dgb2 on Araluen 1:100 000 geological map) - plus minor differentiates of mafic quartz diorite (Dmb) and aplite and leucogranite (Dgl) (Wyborn & Owen, 1986).
Dgb1 occupies the eastern two-thirds of the intrusion and is zoned from a relatively mafic rim to a more felsic core (Wyborn & Owen, op.cit).
Dgb1 is distinguished from the western phase, Dgb2, by the presence of euhedral hornblende phenocrysts in the latter (Wyborn & Owen, 1986).
Aplite and leucogranite are more abundant in the western phase which probably represents a more hydrous magma (Wyborn & Owen, op.cit).

The Braidwood Granodiorite is cut by a number of NW to WNW transcurrent faults, e.g. Jembaicumbene and Majors Creek Faults, which through their control on drainage patterns and Cainozoic sedimentation, have controlled the distribution of placer gold deposits.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Kennedy (1962, summarised by Markham & Basden, 1974; and Markham, 1982), Wyborn & Owen (1986).

Most primary deposits occur in the western phase of the granodiorite, Dgb2, in an area where aplite and pegmatite dykes are abundant, and a stock of leucogranite occurs (Wyborn & Owen, 1986).
Majors Creek occurs at the contact of Dgb2 with the rhyodacite unit of the Long Flat Volcanics (Wyborn & Owen, 1986).
Gold-sulphide mineralisation is associated with a suite of E-trending pyritic aplite and pegmatite dykes, and altered pyritised granodiorite, adjacent to the leucogranite stock (Kennedy, 1962, reported by Markham & Basden, 1974; Wyborn & Owen, 1986).
Some mineralisation is present also in the central more felsic part of

the eastern phase, e.g. Bells Creek.

On the basis of vein mineralogy and cross-cutting relationships, Kennedy (1962, reported by Markham & Basden, 1974) distinguished three stages of mineralisation and accompanying hydrothermal alteration:-
1./ a) Gold-pyrite and b) magnetite-ilmenite:- deposition of pyrite-chalcopyrite-gold or magnetite-ilmenite-gold in quartz reefs up to 9 m wide in coarse aplitic bodies, accompanied by slight greisenisation of aplite. 1a) occurs mainly on the periphery of the Majors Creek field; 1b) occurs near Jembaicumbene.
2./ Copper-lead-zinc-tennantite-tetrahedrite:- deposition of quartz, base metal sulphides and precious metals in narrow veinlets (up to 15 cm wide) in aplite veins up to 30 cm wide, accompanied by propylitisation of the greisenised aplite.
Stage 2 occurs in the centre of the Majors Creek field.
3./ Pyrite-gold and silver telluride:- introduction of galena-gold telluride-silver telluride in calcite veinlets up to 7 cm wide.
Stage 3 occurs in the core of the field.

Most of the richer veins represent superimposition of Stage 3 on Stage 2 mineralisation. In Stage 3, auriferous calcite veinlets were introduced into the brecciated aggregates of Stage 2 sulphides (Kennedy, 1962). The highest gold grades of the field were associated with the more complex and diverse mineralogies of the Stage 2 and Stage 3 veins. (Kennedy, 1962, reported by Markham & Basden, 1974; and Markham, 1982).

OREBODY: Araluen Creek

PRINCIPAL SOURCES: Gilligan (1974), Markham (1982).

Araluen Creek is largely incised in granodiorite of the Braidwood Granodiorite. It trends and flows SE from S of Majors Creek, its course controlled by a major transcurrent fault. Structural control is less pronounced where the stream channel traverses Ordovician metasediments which occur to the E of the granodiorite. Cainozoic sediments are well developed: thickness = 9–10 m, width = 500 m. Sediments comprise river gravels, sand and clay, with large granite boulders being characteristic of the basal gravels. (Markham, 1982).

Alluvial gold occurred over the whole length of Araluen Creek to its junction with the Deua River, about 20 km distance, (and for much of the length of the Deua River) (Markham, 1982).
Thickness of auriferous leads = up to 3 m (Markham, 1982).
Many of the reef deposits, the source of the alluvials, were on elevated ground which forms the watershed between the Majors Creek/Araluen River system to the E and the Shoalhaven River system to the W (Markham, 1982).
Alluvial gold was shed from the reefs into both river systems (Markham, 1982).

OREBODY: Bells Creek

Bells Creek lies E of Majors Creek and is hosted by the eastern phase of the Braidwood Granodiorite (Dgb1 on Araluen 1:100 000 geological map). (Wyborn & Owen, 1986).
Orebody comprised 17 auriferous veins associated with aplite dykes (Gilligan, 1975; Markham, 1982).

OREBODY: Dargues

Host rock is the western phase of Braidwood Granodiorite (Dgb2 on Araluen 1:100 000 geological map) (Wyborn & Owen, 1986).
Mineralisation comprises a highly pyritic coarse-grained aplitic dyke intruded along a sheared contact between diorite porphyry and hornblende granodiorite (Markham & Basden, 1974).
Strike of cross-shears = 240 deg (Gilligan, 1975).

OREBODY: Jembaicumbene

Mineralisation was associated with zones of aplite and pyritic greisen (Markham, 1982) in the eastern phase of Braidwood Granodiorite (Dgb1 on Araluen 1:100 000 geological map) (Wyborn & Owen, 1986).

OREBODY: Jembaicumbene Creek

Jembaicumbene Creek flows WNW through granitic rocks of the Braidwood Granodiorite and felsic volcanics of the Long Flat Volcanics before entering the Shoalhaven River (Markham, 1982; Gilligan, 1974).

Gold-bearing alluvial deposits occur along Jembaicumbene Creek upstream from its junction with the Shoalhaven River for a distance of about 13 km and over an average width of some 400 m. The alluvials are up to 12 m thick, the average thickness being about 4.5–6 m with 0.6–0.9 m of gold-bearing wash. The gold was derived largely from wash layers at the base of the alluvial ground and on 'false bottoms' of black clay. (Markham, 1982).

OREBODY: Majors Creek (East)

The orebody refers to a group of veins which comprise the eastern part of the Majors Creek field (see Orebody/Mine listing under 'DEVELOPMENT HISTORY' above) (Gilligan, 1974, 1975).
Host rock is the western phase of the Braidwood Granodiorite (Dgb2 on Araluen 1:100 000 geological map) (Wyborn & Owen, 1986).

OREBODY: Majors Creek (West)

The orebody refers to a group of veins which comprise the western part of the Majors Creek field (see Orebody/Mine listing under 'DEVELOPMENT HSTORY' above) (Gilligan, 1974, 1975).
Host granodiorite is the western phase of Braidwood Granodiorite (Dgb2 Araluen 1:100 000 geological map) (Wyborn & Owen, 1986).

OREBODY: Merricumbene

See OREBODY: MOUNT WADDELL

OREBODY: Mount Waddell

The orebodies Mount Waddell and Merricumbene occur SE of Araluen, near the downstream section of alluvial deposits of Araluen Creek (Gilligan, 1974).
Host rocks for both orebodies are a sequence of unnamed Ordovician flysch sediments comprising interbedded quartz sandstone, siltstone and shale (Ouf on Araluen 1:100 000 geological map; Q8L7 on Canberra 1:250 000 metallogenic map).

OREBODY: Scotsmans Gully-Whiteman & Merton

Host granodiorite is the western phase of Braidwood Granodiorite (Dgb2 on Araluen 1:100 000 geological map) (Wyborn & Owen, 1986).
The orebody includes vein mineralisation hosted by felsic crystal tuff in a shear zone adjacent to a contact with Braidwood Granodiorite (Whiteman & Merton), and lode mineralisation associated with aplite in hornblende granodiorite (Scotsmans Gully (North) and (South)) (Gilligan, 1975).
Lode mineralisation consisted of a 15 m-wide zone of altered granodicrite flanked to the S by a 0.9 m-wide pyritic quartz vein in coarse-grained aplite (Gilligan, 1975).

OREBODY: Snobs

The orebody refers to the main vein system of the northern part of the Majors Creek field (Gilligan, 1975).
Host granodiorite is the western phase of the Braidwood Granodiorite (Dgb2 on Araluen 1:100 000 geological map) (Wyborn & Owen, 1986).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Clift D.S.L., 1975
Gold dredging in New South Wales.
Geological Survey of New South Wales. Mineral Resources
41

Felton E.A., Huleatt M.B., 1975
Braidwood, New South Wales, 1:100 000 geological series map. Sheet 8827, 1st edition.
Geological Survey of New South Wales
1v

Felton E.A., 1977
Part 2. A metallogenic study of the Goulburn 1:250 000 sheet.
Geological Survey of New South Wales
1v

Gilligan L.B., 1974
Canberra, New South Wales, 1:250 000 metallogenic series map. Sheet SI 55-16, 1st edition.
Geological Survey of New South Wales
1v

Gilligan L.B., 1975
Part I. Mine data sheets to accompany metallogenic map, Canberra 1:250 000 sheet. Sheet SI55-16.
Geological Survey of New South Wales
1v

Herzberger G.A., Barnes R.G., Bowman H.N., 1978
A metallogenic study of the Bega 1:250 000 sheet. Sheet SJ 55-04.
Geological Survey of New South Wales
1v

Kennedy D.R., 1962

The geology of the Braidwood–Major's Creek area. B.Sc. (Hons) thesis.
University of Sydney. Unpublished
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

Middleton T.W., 1970
A summary report of the available information on the goldfields of the Upper Shoalhaven–Araluen area.
Geological Survey of New South Wales. Report
GS1970/195

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

Wyborn D., Owen M., 1986
Araluen, New South Wales, 1:100 000 geological map commentary.
Bureau Mineral Resources, Australia
1v

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 49 NERRIGUNDAH

DEPOSIT IDENTIFICATION:

COMMODITIES: Au, Pb, Ag, Cu

DISTRIBUTION:
Record covers primary deposits in broad N-S zone 20 km x 7 km, plus alluvial deposits along 5 km in Gulph Creek. Nos. 52-102, 311 on Bega metallogenic map.

OREBODIES:
Nerrigundah (D), Brassknocker, Bumbo, Gulph Creek, Little Belimbla Creek , Nerrigundah (East) , Nerrigundah (West) , Quartpot-Tinpot-Grasstree, Utopia

MINES:
After Dark, Big Bonser, Boomerang, Brassknocker, Bumbo, Bumbo No. 2, Cherry Tree, Christmas Box, Clara Bell, Crams, Eureka, Frenchmans, Golden Dyke, Golden Gate, Grasstree, Gulph Creek, Gurneys (Lonsdale Creek), Healeys, Hopkins, Little Belimbla Creek, Mount Coman (Radiant), Mount Pleasant, Nixons, Ocean View, Quart Pot, Queensland Utopia, Red Creek, River View, Russels (Lonsdale Creek), Sawpit, Sawtells, Scotchmans, Sid Lakes, Wandella Mountain

GROUP: -

COMMENTS:
See Deposit No.48 ARALUEN-MAJORS CREEK for regional setting of Molong-South Coast Anticlinorial Zone (S).

LOCATION:

LATITUDE: 36 7 LONGITUDE: 149 54
250K SHEET: SJ55 4 100K SHEET: 8825

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Cooma
LOCAL GOVERNMENT AREA (LGA): Eurobodalla

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD	COMMENTS
1865		Alluvial
1875		Reef

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Brassknocker	Brassknocker	Historical	Underground
Bumbo	Bumbo	Historical	Underground
Bumbo	Bumbo No. 2	Historical	Underground
Gulph Creek	Gulph Creek	Historical	Dredging &/Or Sluicing
Little Belimbla Creek	Little Belimbla Creek	Historical	Underground
Little Belimbla Creek	Little Belimbla Creek	Historical	Open-Cut
Little Belimbla Creek	Little Belimbla Creek	Historical	Surface
Nerrigundah (East)	Mount Pleasant	Historical	Underground
Nerrigundah (East)	Frenchmans	Historical	Underground
Nerrigundah (East)	After Dark	Historical	Underground
Nerrigundah (East)	After Dark	Historical	Surface
Nerrigundah (East)	Healeys	Historical	Underground
Nerrigundah (East)	Sawpit	Historical	Underground
Nerrigundah (East)	Russels (Lonsdale Creek)	Historical	Unknown
Nerrigundah (East)	Gurneys (Lonsdale Creek)	Historical	Underground
Nerrigundah (East)	Scotchmans	Historical	Underground
Nerrigundah (East)	Big Bonser	Historical	Underground
Nerrigundah (East)	Nixons	Historical	Underground
Nerrigundah (East)	Crams	Historical	Underground
Nerrigundah (East)	Crams	Historical	Surface
Nerrigundah (West)	Eureka	Historical	Underground
Nerrigundah (West)	Golden Gate	Historical	Underground
Nerrigundah (West)	Mount Coman (Radiant)	Historical	Underground

Nerrigundah (West)	Golden Dyke	Historical	Underground
Nerrigundah (West)	Ocean View	Historical	Underground
Nerrigundah (West)	Boomerang	Historical	Underground
Nerrigundah (West)	Clara Bell	Historical	Underground
Nerrigundah (West)	Sid Lakes	Historical	Underground
Nerrigundah (West)	Sid Lakes	Historical	Surface
Nerrigundah (West)	Christmas Box	Historical	Underground
Nerrigundah (West)	Christmas Box	Historical	Surface
Quartpot-Tinpot-Grasstree	Quart Pot	Historical	Underground
Quartpot-Tinpot-Grasstree	Cherry Tree	Historical	Underground
Quartpot-Tinpot-Grasstree	Cherry Tree	Historical	Surface
Quartpot-Tinpot-Grasstree	Grasstree	Historical	Underground
Quartpot-Tinpot-Grasstree	Grasstree	Historical	Surface
Quartpot-Tinpot-Grasstree	Red Creek	Historical	Underground
Quartpot-Tinpot-Grasstree	Wandella Mountain	Historical	Unknown
Quartpot-Tinpot-Grasstree	Hopkins	Historical	Unknown
Utopia	Sawtells	Historical	Underground
Utopia	Sawtells	Historical	Open-Cut
Utopia	Sawtells	Historical	Surface
Utopia	River View	Historical	Underground
Utopia	Queensland Utopia	Historical	Underground

COMPANIES:

OREBODY: Little Belimbla Creek

PRESENT OPERATORS:
Millaroo Mines Pty Ltd

PRESENT OWNERS:	EQUITY%
Epoch Mining NL	50.00
Millaroo Mines Pty Ltd	50.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 1,418
Recovered grades (reef ore) ranged from <10 g/t Au to >60 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1906, 1908), (1920-1921), 1865-1900,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Molong-South Coast Anticlinorial Zone(S)
SUB-PROVINCE: South Coast Anticlinorium

HOST ROCKS:

FORMATION NAME & AGE: Unnamed Turbidite Sequence (Q8L4) - Late Ordovician
LITHOLOGY: Quartz sandstone, siltstone, shale; metamorphosed equivalents metasandstone, quartzite, slate, phyllite, schist.
RELATIONSHIP TO MINERALISATION: Mineralisation comprised narrow joint-controlled gold-quartz veins in slate units of flysch sequence.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to secondary mineralisation.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Metasedimentary

STRUCTURAL FEATURES:

MAJOR: Faulting, Jointing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

SIGNIFICANT: Fault/Fault

IGNEOUS ACTIVITY:

MINOR: Plutonism (Dolerite)

METAMORPHISM:
Regional metamorphic grade is greenschist facies.

ALTERATION:

OREBODY: Nerrigundah (D)
Hydrothermal alteration of slate adjacent to quartz vein was recorded from one locality (Herzberger & Barnes, 1978).

DEPOSIT CHARACTERISTICS:

TYPES:
SIGNIFICANT: Metamorphic auriferous quartz veins in flysch-type metasediments (slate/greywacke sequences); no granitoid rocks in proximity.
Alluvial.
Auriferous quartz veins in fault/shear zones.

STYLE:

MAJOR: Discordant

MORPHOLOGY: Lenticular

AGE OF MINERALISATION: Palaeozoic Early Silurian

DIMENSIONS/ORIENTATION:

OREBODY: Nerrigundah (D)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			60.0
TRUE WIDTH	(cm)	1.0		500.0
VERTICAL DEPTH	(m)			130.0

OREBODY: Brassknocker

		MIN	AVE	MAX
STRIKE LENGTH	(m)	18.0		400.0
TRUE WIDTH	(cm)			30.0
VERTICAL DEPTH	(m)			45.0
		ANGLE (deg.)		DIRECTION
DIP		80		W
STRIKE		330		

OREBODY: Bumbo

		MIN	AVE	MAX
STRIKE LENGTH	(m)			50.0
		ANGLE (deg.)		DIRECTION
STRIKE		090		

OREBODY: Little Belimbla Creek

		MIN	AVE	MAX
VERTICAL DEPTH	(m)		18.0	

OREBODY: Nerrigundah (East)

		MIN	AVE	MAX
STRIKE LENGTH	(m)	5.0		91.0
TRUE WIDTH	(cm)	1.0	10.0	210.0
VERTICAL DEPTH	(m)	18.0	43.0	125.0

OREBODY: Nerrigundah (West)

		MIN	AVE	MAX
STRIKE LENGTH	(m)	9.0		76.0
TRUE WIDTH	(cm)	15.0	30.0	500.0
		ANGLE (deg.)		DIRECTION
STRIKE		090,165-180		

OREBODY: Quartpot-Tinpot-Grasstree

		MIN	AVE	MAX
STRIKE LENGTH	(m)			162.0
TRUE WIDTH	(cm)	1.0		4.0
VERTICAL DEPTH	(m)	6.0		94.5

OREBODY: Utopia

		MIN	AVE	MAX
VERTICAL DEPTH	(m)	9.0		80.0
		ANGLE (deg.)		DIRECTION
DIP		45		N,E
STRIKE		045,135		

ORE TEXTURE:

NATURE OF MINERALISATION:
PRIMARY ORE: Fault/Shear Filling, Multiple Veins, Stockwork, Vein (Reef),
SECONDARY ORE: Detrital (Alluvial)

MINERALOGY:

OREBODY: Nerrigundah (D)
Sulphide zone: pyrite (chalcopyrite, arsenopyrite, galena, gold, silver, sphalerite).
Gold was coarse-grained and occurred in association with pyrite.
Gangue: quartz.

OREBODY: Brassknocker
Gold, quartz.

OREBODY: Bumbo
Gold, quartz.

OREBODY: Little Belimbla Creek
Sulphide zone: pyrite, galena, gold, arsenopyrite.
Gangue: quartz.

OREBODY: Nerrigundah (East)
Sulphide zone: pyrite, (galena, gold, silver).
Oxide zone: limonite.
Gangue: quartz.

OREBODY: Nerrigundah (West)
Sulphide zone: pyrite, (galena, sphalerite, chalcopyrite, arsenopyrite, silver, gold).
Oxide zone: limonite.
Gangue: quartz.

OREBODY: Quartpot-Tinpot-Grasstree
Gold, quartz.

OREBODY: Utopia
Sulphide zone: gold, pyrite.
Gangue: quartz.

CONTROLS OF MINERALISATION:
Controls are structural, provided by cleavage planes, joint or shear zones, and joint intersections.

GENETIC MODELS:
Metamorphic hydrothermal, possibly associated with the later stages of the Benambran-Quidongan Orogeny (Early Silurian) (Herzberger & others, 1978).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Nerrigundah (D)
PRINCIPAL SOURCES: Barnes & Herzberger (1975), Herzberger & Barnes (1978), Herzberger & others (1978), Markham (1982).
SUMMARY

The Nerrigundah field lies in the south-central part of the South Coast Anticlinorium, close to part of the Eden-Comerong-Yalwal Rift Zone. Gold was won from alluvial and primary sources in approximately equal proportions.

GEOLOGICAL SETTING: NERRIGUNDAH
PRINCIPAL SOURCES: Barnes & Herzberger (1975), Herzberger & others (1978).

The field comprised numerous orebodies distributed over a large area, hosted entirely by metamorphosed Late Ordovician flysch sequences (Q8L4 on Bega metallogenic map) characterised by tight to isoclinal meridional folding. The metasedimentary belt is overlain to the E by Devonian sediments (Merrimbula Group, K4LM4) of the Eden-Comerong-Yalwal Rift Zone, and intruded 7 km to the W by Late Silurian-Early Devonian granitic rocks of the Bega Batholith (gamma2L-gamma4L). (Barnes & Herzberger, 1975).
Nerrigundah was the largest of a number of fields hosted by the Ordovician metasediments.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Herzberger & Barnes (1978), Herzberger & others (1978), Markham (1982).

Host rocks are greywacke-subgreywacke, slate, phyllite, and minor chlorite schist and quartz breccia (Herzberger & Barnes, 1978).
Mineralisation comprised narrow gold-quartz veins in shear zones or along joint and cleavage planes in slates (Herzberger & others, 1978).
Some veins were localised along the contacts of small dolerite dykes (Herzberger & others, 1978).
One orebody (Little Belimbla Creek) comprised a zone of quartz stockwork mineralisation 20 m wide (Herzberger & others, 1978).

Alluvial gold derived from the weathering of the quartz reefs occurred along Gulph Creek and its tributaries and along the Tuross River (Herzberger & others, 1978). According to Foster (1876, reported by Herzberger & others, 1978), in Gulph Creek the gold was concentrated in three successive layers of drift sand and fine gravel which passed downwards into a basal bed of quartz, sandstone and slate boulders intermixed with clay. In other creeks no sand or gravel was present and the boulder beds were overlain by a thin clay layer.
The best gold values occurred in the boulder beds with workings ranging in depth from less than 1 m to about 10 m. (Herzberger & others, 1978).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Barnes R.G., Herzberger G.A., 1975
Bega 1:250 000 metallogenic map. Sheet SJ55-04 and parts of SJ55-08 and SJ55-03.
Geological Survey of New South Wales
1v

Clift D.S.L., 1975
Gold dredging in New South Wales.
Geological Survey of New South Wales. Mineral Resources
41

Herzberger G.A., Barnes R.G., 1978
Mine data sheets to accompany metallogenic map Bega 1:250 000 sheet. SJ55-04 (plus parts of SJ55-08 and SJ55-03).
Geological Survey of New South Wales
1v

Herzberger G.A., Barnes R.G., Bowman H.N., 1978
A metallogenic study of the Bega 1:250 000 sheet. Sheet SJ55-04.
Geological Survey of New South Wales
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

oooooooooooooooooooooooooooooooooooooo

DEPOSIT: 50 PAMBULA

DEPOSIT IDENTIFICATION:

SYNONYMS: Panbula, Yowaka

COMMODITIES: Au, Pyrophyllite, Ag

DISTRIBUTION:
Record covers field of approx 12 deposits in an area 1.5 km diameter. Nos. 245-256 on Bega metallogenic map.

OREBODIES:
Pambula (D), Brassknocker, Mount Lewisson-Great Southern , Pilot-Hidden Treasure-Diorite

MINES:
Bartleys Happy Moments, Black & Berrys, Blands Freehold, Brassknocker, Britisher, Bulldog, Diorite-Killaloe, Falkner, Great Southern, Harrisons, Hidden Treasure, Morning Star, Mount Gahan, Mount Lewisson, Victory

GROUP: Eden-Comerong-Yalwal Group

COMMENTS:
Record includes regional setting of Eden-Comerong-Yalwal Rift Zone and Eden-Comerong-Yalwal group.

LOCATION:

LATITUDE: 36 56 LONGITUDE: 149 52
250K SHEET: SJ55 4 100K SHEET: 8824

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Cooma
LOCAL GOVERNMENT AREA (LGA): Bega Valley

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1889	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Brassknocker	Brassknocker	Historical	Underground
Mount Lewisson-Great Southern	Great Southern	Historical	Open-Cut
Mount Lewisson-Great Southern	Mount Lewisson	Historical	Underground
Pilot-Hidden Treasure-Diorite	Morning Star	Historical	Unknown
Pilot-Hidden Treasure-Diorite	Victory	Historical	Underground
Pilot-Hidden Treasure-Diorite	Hidden Treasure	Historical	Underground
Pilot-Hidden Treasure-Diorite	Hidden Treasure	Historical	Open-Cut
Pilot-Hidden Treasure-Diorite	Mount Gahan	Historical	Underground
Pilot-Hidden Treasure-Diorite	Blands Freehold	Historical	Underground
Pilot-Hidden Treasure-Diorite	Bartleys Happy Moments	Historical	Underground
Pilot-Hidden Treasure-Diorite	Diorite-Killaloe	Historical	Underground
Pilot-Hidden Treasure-Diorite	Falkner	Historical	Underground
Pilot-Hidden Treasure-Diorite	Black & Berrys	Historical	Underground
Pilot-Hidden Treasure-Diorite	Black & Berrys	Historical	Open-Cut
Pilot-Hidden Treasure-Diorite	Harrisons	Historical	Underground
Pilot-Hidden Treasure-Diorite	Britisher	Historical	Underground
Pilot-Hidden Treasure-Diorite	Bulldog	Historical	Underground

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 1,406
Average recovered grade 29.8 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: 1892-1915,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: Lachlan Fold Belt
PROVINCE: Molong-South Coast Anticlinorial Zone(S)
SUB-PROVINCE: Eden-Comerong-Yalwal Rift Zone

HOST ROCKS:

FORMATION NAME & AGE: Eden Rhyolite - Middle-Late Devonian
LITHOLOGY: Rhyolite, rhyolite breccia, rhyolite agglomerate, ignimbritic and rhyolitic tuff.
RELATIONSHIP TO MINERALISATION: Primary gold mineralisation is associated with pyrite which occurs as disseminations and breccia-fill material in volcanics.

FORMATION NAME & AGE: Boyd Volcanics - Middle-Late Devonian
LITHOLOGY: Felsic lava, breccia, tuff, agglomerate; basalt; sediments.
RELATIONSHIP TO MINERALISATION: Includes Eden Rhyolite. (Formation comprises Eden Rhyolite and a mafic unit Lochiel Formation).

FORMATION NAME & AGE: Budawang Volcanic Complex - Middle-Late Devonian
LITHOLOGY: Felsic lava, breccia, tuff, agglomerate; basalt; sediments.
RELATIONSHIP TO MINERALISATION: Name proposed to encompass volcanic sequence throughout rift zone, i.e. Boyd Volcanics in S, Comerong Volcanics in centre, Yalwal Volcanics in N.

GEOCHRONOLOGY:
Host volcanics dated at 370 my (Late Devonian) (Glaser, 1986).

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Felsic Extrusive

STRUCTURAL FEATURES:

SIGNIFICANT: Faulting, Jointing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

MAJOR: Volcanism (Felsic)

ALTERATION:

OREBODY: Pambula (D)
PRINCIPAL SOURCES: Markham & Basden (1974), McIlveen (1975), Herzberger & others (1978), Chapman & Degeling (1981), Markham (1982), Glaser (1986), Glaser & Keays (1988).

The Budawang Volcanic Complex, particularly in the mineralised areas of the Eden-Comerong-Yalwal Rift Zone, has been subjected to extensive low pressure/low temperature hydrothermal alteration (Markham & Basden, 1974; McIlveen, 1975).

Alteration systems are typified by:-
i) silicification, ii) iron-alteration (pyritisation, and hematite replacement of pyrite within the boiling zone), and
iii) pyrophyllisation and sericitisation.
(Chapman & Degeling, 1981; Glaser, 1986).

Felsic rocks exhibit effects of devitrification and silicification in the form of perlitic structure, quartz and secondary chalcedony veining, siliceous sinters, and microcrystalline silica infilling

(Markham & Basden, 1974; McIlveen, 1975).
Silicification is less intense at Pambula than at YALWAL-GRASSY GULLY (Deposit No.47) (Chapman & Degeling, 1981).

Other alteration minerals in the rhyolite breccias are sericite, kaolinite, alunite, albite, chlorite, adularia, epidote, as well as pyrite and hematite (McIlveen, 1975; Markham, 1982).

Alteration has also resulted in the development in the felsic volcanics of cross-cutting lenticular bodies of massive pyrophyllite, which is accompanied by minor muscovite, albite, quartz, disseminated pyrite, hematite, and anhydrite (Wall & Kesson, 1969, reported by Markham & Basden, 1974). Within the pyrophyllite bodies there is a gradation from relatively unaltered rhyolite through a zone of pyrophyllite containing siliceous fragments and relict spherulites with thin irregular quartz veins, to a central zone of pyrophyllite exhibiting a pronounced foliation parallel to the N trend of the pyrophyllite lenses (McIlveen, 1975; Herzberger & others, 1978).
Fractures are filled with quartz containing pyrite euhedra (Kesson, 1968, reported by McIlveen, 1975).
Pyrite abundance is directly related to abundance of siliceous matrix (Kesson, op.cit).
Pyrophyllite bodies occur both peripheral to, and separate from, gold mineralisation at Pambula (Herzberger & others, 1978; Chapman & Degeling, 1981; Glaser, 1986).
The separate bodies have no associated silicification and or gold mineralisation (Chapman & Degeling, 1981).

Glaser & Keays (1988): the Pambula gold deposit is associated with an advanced argillic alteration feature in the nearer surface zone of an adularia-sericite type system.

Mafic volcanics are partially spilitised with alteration assemblage of epidote-prehnite-pumpellyite, plus quartz, albite, chlorite, carbonate, sphene, actinolite, hematite (Markham & Basden, 1974; McIlveen, 1975).
In addition, white mica, adularia, and minor waikarite, tremolite, sulphides, opaques, and ?jasper have been recorded (Wall & Kesson, reported by McIlveen, 1975).

DEPOSIT CHARACTERISTICS:

TYPES:

MAJOR: Disseminated/quartz stockwork epithermal gold-silver-pyrite in altered felsic volcanics.

STYLE:

MAJOR: Discordant, Stratabound

AGE OF MINERALISATION: Palaeozoic Late Devonian

DIMENSIONS/ORIENTATION:

OREBODY: Brassknocker

		MIN	AVE	MAX
TRUE WIDTH	(m)		1.0	
VERTICAL DEPTH	(m)			43.0
		ANGLE (deg.)		DIRECTION
DIP		90		
STRIKE		064		

OREBODY: Mount Lewisson-Great Southern

		MIN	AVE	MAX
STRIKE LENGTH	(m)	21.0		61.0
VERTICAL DEPTH	(m)			18.0
		ANGLE (deg.)		DIRECTION
DIP		70		E

OREBODY: Pilot-Hidden Treasure-Diorite

		MIN	AVE	MAX
VERTICAL DEPTH	(m)	15.0		137.0
TRUE WIDTH	(m)	1.0		7.0
STRIKE LENGTH	(m)	21.0	30.0	61.0
		ANGLE (deg.)		DIRECTION
DIP		20,75-90;20;-		E
STRIKE		045-090;140;170		

ORE TEXTURE:
Disseminated, Oxidised, Primary

NATURE OF MINERALISATION:
PRIMARY ORE: Breccia, Dissemination, Fault/Shear Filling,
SECONDARY ORE: Supergene Enrichment

MINERALOGY:

OREBODY: Pambula (D)
PRINCIPAL SOURCES: Markham & Basden (1974), McIlveen (1975), Glaser & Keays (1988).

Sulphide zone: auriferous pyrite, electrum, (chalcopyrite, galena, sphalerite, chalcocite, chalcostibnite, tetrahedrite, tennantite, arsenopyrite, kermesite, paratellurite, metastibnite) (McIlveen, 1975; Glaser & Keays, 1988).
The bulk of the sulphides are co-depositional with electrum (Glaser & Keays, 1988).
Pyrite generally occurs as disseminated euhedral and subhedral grains from micron size up to 1 mm (McIlveen, 1975).
Gold occurs as electrum. Pyrite was deposited in multiple post-brecciation/shearing, but pre-electrum, episodes (Glaser & Keays, 1988).
Oxide zone: limonite after pyrite, fine-grained free gold.
Gold-limonite was concentrated in clay-rich material along joints (Kesson, 1968, reported by Markham, 1982).
Gangue: quartz, muscovite, sericite, kaolinite, pyrophyllite.

CONTROLS OF MINERALISATION:
EDEN-COMERONG-YALWAL GROUP
PRINCIPAL SOURCES: Kesson (1968, reported by McIlveen, 1975), McIlveen (1975), Glaser (1986), Glaser & Keays (1988).

Gold-silver-pyrite deposits of the Eden-Comerong-Yalwal Rift Zone are similar in form and origin (Kesson, 1968) and are considered to be co-genetic (Glaser, 1986; Glaser & Keays, 1988).
Data recorded under this field ('CONTROLS OF MINERALISATION') and under 'GENETIC MODELS' below apply to all deposits of the Eden-Comerong-Yalwal group, including Wolumla (Glaser, 1986; Glaser & Keays, 1988).

1.) Mineralisation is stratabound in its restriction to altered felsic volcanics and may have a broad structural control related to location of volcanic fissures and alteration cores (McIlveen, 1975).
2.) Fluid inclusion studies indicate conditions of formation of mineralisation (Glaser, 1986; Glaser & Keays, 1988):-
Pambula 300-320 deg C, 1200 m max depth; Yalwal 340-360 deg C, 1300 m max depth; Grassy Gully 360-380 deg C, 1450 m max depth; Wolumla 380 deg C, >1600 m max depth.
3.) Geochemistry (Glaser, 1986; Glaser & Keays, 1988):
i) relative to unaltered rhyolite, ore zones are characterised by:- enrichment in Si, Cr, Au, Ag, S, Se, As; and depletion in Al, Ca, Mn, Na, Zn, Cd, Mo. Fe and P are enriched at Pambula and depleted at Yalwal.
ii) vertically zoned enrichment/depletion patterns are correlated with depth/temperature profiles: the deeper deposits have the highest concentrations of base metals, Se, and Ag and the lowest concentrations of traces Th, Nd, La, Ga, Nb, Be. I.e. in the deeper Yalwal and Grassy Gully deposits base and precious metals show similar concentration patterns at depth, indicating transportation and precipitation under similar conditions, but base and precious metals are de-coupled in the shallower, lower temperature Pambula deposit.
4.) Pb isotope data indicate co-genesis of the Au-Ag deposits and the largest pyrophyllite deposits (Glaser & Keays, 1988).

GENETIC MODELS:
EDEN-COMERONG-YALWAL GROUP
PRINCIPAL SOURCES: Kesson (1968) and Wall & Kesson (1969); both summarised by Markham & Basden (1974) and McIlveen (1975); Chapman & Degeling (1981), Glaser (1986), Glaser & Keays (1988).

Volcanogenic epithermal, related to late-stage hydrothermal alteration of cooling lava sheets, formed at comparatively shallow depths (McIlveen, 1975; Markham, 1982).

Kesson (1968): Pambula and Yalwal-Grassy Gully had a similar origin in an environment similar to present day active thermal areas:-
i) formation of sulphur and sulphates as a result of fumarolic activity during initial cooling of the felsic lavas,
ii) resolution, reduction, and precipitation of sulphur/sulphates as (gold-bearing) sulphide phases during burial and alteration,
iii) release of gold under near-surface acid oxidising conditions (pyrite oxidised to limonite) and preferential adsorption of Au onto

clay,
iv) oxidation of H2S in fumarolic hot springs to produce acid sulphate waters; reaction of these with rhyolitic country rocks,
v) supergene enrichment.

Glaser (1986), Glaser & Keays (1988): depletion of Au and Se in altered basalts relative to less strongly altered co-magmatic dykes and plutons and ore zone enrichment in Au, Se, Cr, and V, suggest that the source of the gold was the mafic component of the volcanic pile.
Gold would have been leached from Au-anomalous mafic flows by hydrothermal activity, possibly driven by sub-volcanic granitic intrusion of A-type affinity (Glaser, 1986).
Pb isotope data support the co-genesis of the Pambula, Yalwal, Grassy Gully, and Wolumla gold deposits, and the three largest pyrophyllite deposits. Combined with fluid inclusion and alteration mineralogy results, the isotope data suggest that the current pyrophyllite deposits are the nearer surface manifestations of as yet unidentified deeper zones of Au-Ag mineralisation (Glaser & Keays, 1988).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Pambula (D)

PRINCIPAL SOURCES: Willis (1973), Markham & Basden (1974), Barnes & Herzberger (1975), McIlveen (1975), Herzberger & Barnes (1978), Herzberger & others (1978), Chapman & Degeling (1981), Markham (1982), Glaser (1986), Wyborn & Owen (1986), Glaser & Keays (1988).
SUMMARY

Pambula lies in the southern part of the Eden-Comerong-Yalwal Rift Zone. Mineralisation comprises stratabound disseminated, breccia-fill, and vein stockwork gold-silver-pyrite in Middle-Late Devonian altered felsic rift volcanics (Eden Rhyolite). Historically, economic concentrations of gold were restricted to the enriched oxidised zone.

REGIONAL SETTING: EDEN-COMERONG-YALWAL RIFT ZONE
PRINCIPAL SOURCES: Markham & Basden (1974), Barnes & Herzberger (1975), McIlveen (1975), Herzberger & others (1978).

The Eden-Comerong-Yalwal Rift Zone is a meridional graben between 5 and 20 km wide which extends discontinuously for 320 km from Cape Howe at the NSW/Victorian border northwards to the Shoalhaven River W of Nowra. The northerly section of the zone between Nerriga and Nowra is mostly concealed beneath Carboniferous and Permian sediments of the Sydney Basin (Markham & Basden, 1974; McIlveen, 1975).
YALWAL-GRASSY GULLY (Deposit No.47) occurs in rift volcanics exposed in stream channels which cut the Devonian rocks beneath the basin cover (McIlveen, 1980).

The rift zone (excluding the Yalwal inliers) is preserved in two main synclinorial belts, termed the Budawang Synclinorium, between Nowra and Narooma, and the Eden Synclinorium, between Merimbula and Cape Howe (Markham & Basden, 1974). The synclinoria represent second-order structural zones (Markham & Basden, op.cit).
The rift zone is bounded by normal faults and lies entirely within the cratonised South Coast Anticlinorium of the Molong-South Coast Anticlinorial Zone (S) (Markham & Basden, 1974; Barnes & Herzberger, 1975). Basement rocks consist of multiply deformed Ordovician flysch sequences intruded in the SE portion of the anticlinorial zone by composite batholiths ranging in age from Late Silurian to Middle Devonian (Markham & Basden, 1974).

The rift zone contains late Middle to early Late Devonian felsic (calk-alkaline) and mafic (tholeiitic transitional to alkaline) volcanics (Glaser, 1986; Wyborn & Owen, 1986), which were deposited in a tectonic setting transitional from a volcanic rift to a rift valley during the initiation of the Lambian transitional province (McIlveen, 1975).
The tectonic setting has been compared to an incipient terrestrial rift resulting from extension in an area of continental crust (Barnes & Herzberger, 1975).

The volcanics are overlain by Late Devonian paralic and fluviatile shelf sediments which accumulated in structural depressions between highs of consolidated volcanics after the cessation of rifting (McIlveen, 1975).
The volcanics are exposed mainly along the rift margins, the sediments in the central portion of the zone.
The Devonian rocks were cratonised after the Kanimblan Orogeny (Middle Carboniferous) (Herzberger & others, 1978).

The rift sequences are folded into meridionally trending open synclines and anticlines as a result of moderate E-W compression. The intensity of folding apparently increased northwards where the sequence has been intruded by Carboniferous granitoids. (Markham & Basden, 1974).

REGIONAL SUCCESSION: EDEN-COMERONG-YALWAL RIFT ZONE
PRINCIPAL SOURCES: Hall (1960, reported by McIlveen, 1975), Markham & Basden (1974), Barnes & Herzberger (1975), McIlveen (1975), Wyborn & Owen (1986), Glaser & Keays (1988).

The volcanic sequence consists of a bimodal suite of felsic and mafic units produced by meridional fissure eruptions and deposited mainly subaerially, together with associated coarse talus slope to alluvial fan sediments (Steiner, 1966, reported by McIlveen, 1975; Markham & Basden, 1974; Wyborn & Owen, 1986).

Note on nomenclature:- the volcanics have been named separately in different parts of the rift zone:-
i) Eden Synclinorium - Boyd Volcanics = Eden Rhyolite + Lochiel Formation (mafic unit) (Hall, 1960, reported by McIlveen, 1975).
ii) Budawang Synclinorium - Comerong Volcanics (Best & others, 1964, reported by McIlveen, 1975).
iii) Yalwal inliers - Yalwal Volcanics (Wall, 1965 unpublished; Pogson, 1972; both reported by McIlveen, 1975).
Glaser & Keays (1988) proposed the name Budawang Volcanic Complex to encompass the Boyd, Comerong, and Yalwal Volcanics, on the basis of geochemical, isotopic, structural, and lithologic correlations.
In this report the term Budawang Volcanic Complex has been used for the purpose of general description of the volcanics but the more specific names are used to refer to host sequences of particluar deposits, e.g. Eden Rhyolite, host to Pambula; Yalwal Volcanics, host to YALWAL-GRASSY GULLY (Deposit No.47).

1./ Budawang Volcanic Complex (K5LM on Bega, Canberra metallogenic maps) (late Middle Devonian-early Late Devonian) (max. thickness 500-1300 m) -
i) peraluminous, potassic rhyolite, rhyolite breccia, ignimbritic and rhyolitic tuffs, rhyolitic agglomerate, rhyodacite (Barnes & Herzberger, 1975; McIlveen, 1975; Glaser, 1986; Wyborn & Owen, 1986).
Host to Pambula and YALWAL-GRASSY GULLY (Deposit No.47) gold deposits.
ii) continental tholeiitic olivine basalt, transitional to alkali basalt, including porphyritic and amygdaloidal basalts (McIlveen, 1975; Glaser, 1986; Wyborn & Owen, 1986).
iii) minor intercalated intraflow sediments - arkosic sandstone, siltstone, conglomerate.
The basalts are spilitised and the felsic volcanics marked by the development of pyrophyllite, secondary chalcedonic silica, and quartz-sericite-pyrite assemblage as a result of alteration under low pressure/low temperature conditions (McIlveen, 1975 - see 'ALTERATION').
2./ Merrimbula Group (K4LM) (Late Devonian) (max. thickness 2000 m) - arkosic redbed sequence of basal conglomerate, brown and purple quartzofeldspathic sandstone and interbedded shale, red to brown quartzofeldspathic sandstone and siltstone, red shale (Barnes & Herzberger, 1975; McIlveen, 1975).
3./ Intrusive rocks - small mafic and granitic intrusives of Middle-Late Devonian age form part of the magmatism associated with the rift zone. Gabbroic and granophyric complexes, and dolerite dyke swarms W of the rift zone, are considered by Wyborn & Owen (1986) to form a fractional crystallisation series with basalt of the Comerong Volcanics; and Late Devonian A-type granitoids are considered to be the intrusive equivalents of the rhyolites of the Comerong Volcanics (Wyborn & Owen, 1986).

ASSOCIATED MINERALISATION: EDEN-COMERONG-YALWAL RIFT ZONE (EDEN-COMERONG-YALWAL GROUP)
PRINCIPAL SOURCES: McIlveen (1975), Glaser (1986), Glaser & Keays (1988)

The rift zone is characterised by a distinctive mineral association of disseminated gold-silver-pyrite and pyrophyllite hosted by altered felsic volcanics.
Deposits are concentrated at the northern and southern ends of the zone, the principal gold deposits occurring at YALWAL-GRASSY GULLY (Deposit No.47) in the N and Pambula in the S (McIlveen, 1975).
Similar smaller deposits occur at Sugarloaf Mountain, Wolumla, Yambulla, and possibly also Wagonga, at the southern end of the zone.
The pyrophyllite deposits occur mainly in the southern part of the zone, close to the Pambula field. (McIlveen, 1975).

The gold and pyrophyllite deposits lie on N-trending faults of similar orientation. Pambula and Wolumla plus at least two proximally located pyrophyllite deposits are adjacent to E-W cross-graben block faults which pre-date rifting but were reactivated by that event (Glaser & Keays, 1988).

Mineralisation at the precious metal deposits is localised along the margins of separate rhyolite flow domes within cumulo flow dome complexes (Glaser & Keays, 1988).

Mineralisation consists of high angle fault-controlled rhyolite breccias which grade laterally into pyritiferous ore-bearing chalcedonic stockwork systems (Glaser, 1986).

LOCAL SETTING: PAMBULA
PRINCIPAL SOURCES: Hall (1960), Barnes & Herzberger (1975), McIlveen (1975), Herzberger & others (1978), Chapman & Degeling (1981), Markham (1982).

The Pambula field consists of approximately twelve orebodies hosted by Eden Rhyolite (Barnes & Herzberger, 1975, Herzberger & others, 1978). Gold-pyrite mineralisation occurs mainly in rhyolite close to contacts with coarse pyroclastics (rhyolite agglomerate) (Chapman & Degeling, 1981).
Lenses of pyrophyllite are associated with the gold, and larger bodies of pyrophyllite, which have been commercially exploited, occur peripherally to the goldfield and several km away (McIlveen, 1975; Herzberger & others, 1978; Chapman & Degeling, 1981; Glaser, 1986).

Gold mineralisation exhibits a broad linear control, leading Hall (1960) to regard the orebodies as occurring in four well-defined N-striking fissures, which he designated Pilot, Hidden Treasure, Diorite, and Brassknocker (Hall, 1960).
However, the apparent structural control is at least partly a function of near-surface remobilisation of the gold, and mineralisation, especially in the primary zone, is disseminated in the volcanics without well-defined walls to ore zones (McIlveen, 1975).

The highest gold concentrations were contained in clay-rich material filling joints and fissures, and forming breccia matrix (Kesson, 1968, reported by Herzberger & others, 1978).

OREBODY: Brassknocker
Orebody lay 1.5 km SE of the main workings of the Pambula field. Ore zone corresponds with a cross-fault trending 064 deg (Markham, 1982).

OREBODY: Mount Lewisson-Great Southern
Orebody lay S along strike from the Pilot and Hidden Treasure lines of workings (Willis, 1973).

OREBODY: Pilot-Hidden Treasure-Diorite
PRINCIPAL SOURCES: Hall (1960, reported by Markham, 1982), Willis (1973), McIlveen (1975).

Orebody comprises three lines of workings - Pilot, Hidden Treasure, and Diorite - interpreted by Hall (1960, reported by McIlveen, 1975) as representing three fissures (see, however, OREBODY: Pambula (D) above).

Strike of the fissures varied along their length, curving southwards from NE to SE (McIlveen, 1975).
The ore zones are marked by the presence of quartz, in part vein, in part chalcedonic, together with clay gouge, breccia and other evidence of extensive faulting (Hall, 1960, reported by Markham, 1982).

The Pilot 'fissure' included the richest mines of the field (Markham, 1982). Although the 'fissure' is characterised by the presence of a regular tabular body of quartz in part of vein type, this quartz is barren of gold (Hall, 1960, reported by Markham, 1982).
Gold occurrence along the lode is restricted to clay-rich and sheared material on either side of the quartz reef (Markham, 1982).
Hidden Treasure line of lode lies 210 m E of and roughly parallel to the Pilot line; the Diorite line lies parallel to and E of Hidden Treasure. (Hall, 1960, reported by Markham, 1982).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Anderson W., 1891
Report on Pambula gold-field.
New South Wales. Department of Mines. Annual Report
1890 Appendix 3C P263-264

Barnes R.G., Herzberger G.A., 1975
Bega 1:250 000 metallogenic series map. Sheet SJ 55-04 and parts of SJ 55-08 and SJ 55-03.
Geological Survey of New South Wales
1v

Carne J.E., 1897
Preliminary notes on the Yowaka or Pambula gold-field.

New South Wales. Department of Mines. Annual Report
1896 Appendix 8 P107-122

Chapman J., Degeling P.R., 1981
Some disseminated gold deposits in New South Wales.
Geological Survey of New South Wales. Report
GS1981/567

Glaser L.M., 1986
Geochemical zonation and source rocks for epithermal gold-silver mineralization, Eden-Yalwal rift. IN Geological setting of precious metals in New South Wales. One-day symposium, Sydney, October 1986. Abstracts.
Geological Society of Australia
18

Glaser L.M., 1988
Genesis of volcanogenic epithermal gold-silver mineralisation, Budawang Rift, New South Wales, Australia. Ph.D. thesis.
University of Melbourne. Unpublished
1v

Glaser L.M., Keays R.R., 1988
Genesis of volcanogenic epithermal gold-silver mineralisation, Budawang, Rift, New South Wales. IN Bicentennial Gold 88, Extended Abstracts.
Geological Society of Australia. Abstracts
23 P268-270

Hall L.R., 1960
The stratigraphy, structure and mineralisation of the Devonian strata near Eden, N.S.W.
New South Wales. Department of Mines. Technical Report
5(1957) P103-116

Hamilton T.W., Ellis J., Florence T.M., Fardy J.J., 1983
Analysis of gold in surface waters from Australian goldfields: an investigation into direct hydrogeochemical prospecting for gold.
Economic Geology
78(7) P1335-1341

Herzberger G.A., Barnes R.G., 1978
Mine data sheets to accompany metallogenic map Bega 1:250 000 sheet. Sheet SJ 55-04 (plus parts of SJ 55-08 and SJ 55-03).
Geological Survey of New South Wales
1v

Herzberger G.A., Barnes R.G., Bowman H.N., 1978
A metallogenic study of the Bega 1:250 000 sheet. Sheet SJ 55-04.
Geological Survey of New South Wales
1v

John Taylor and Sons., 1970
The Pambula goldfield, New South Wales.
Geological Survey of New South Wales. Report
GS1971/731

Kesson S.E., 1968
The geology of an area west of Pambula, N.S.W. B.Sc. (Hons) thesis.
University of Sydney. Unpublished
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1982
Gold deposits of the Lachlan Fold Belt.
Geological Survey of New South Wales. Report
Unpublished

McIlveen G.R., 1975
The Eden-Comerong-Yalwal Rift Zone and the contained gold mineralization.
Geological Survey of New South Wales. Records
16(3) P245-277

McIlveen G.R., 1980
Sydney, New South Wales, 1:500 000 metallogenic series map. 1st edition.
Geological Survey of New South Wales
1v

Power F.D., 1893

The Pambula gold deposits.
Geological Society of London. Journal
49 P233-235

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

Steiner J., 1966
Depositional environments of the Devonian rocks of the Eden-Merrimbula area, N.S.W. Ph. D. thesis.
Australian National University. Unpublished
1v

Steiner J., 1972
Eruptive history and depositional environment of the Devonian extrusive rocks, Eden, New South Wales.
Geological Society of Australia. Journal
19(2) P261-271

Steiner J., 1975
Merimbula Group of the Eden-Merimbula area, NSW.
Royal Society of New South Wales. Journal and Proceedings
108(1/2) P37-51

Wall V.J., 1965
The geology of Yalwal south. B.Sc. (Hons) thesis.
University of Sydney. Unpublished
1v

Wall V.J., Kesson S.E., 1969
Pyrophyllite bearing rocks in a regionally altered volcanic sequence.
Geological Society of America. Abstracts with Programs
7 P232

Williams K.L., Edwards A.B., 1959
Gold ore from Pambula, New South Wales.
CSIRO. Mineragraphic Report
773

Willis J.L., 1973
Mining history of gold deposits of the Far South Coast, New South Wales.
Geological Survey of New South Wales. Bulletin
24

Wyborn D., Owen M., 1986
Araluen, New South Wales, 1:100 000 geological map commentary.
Bureau Mineral Resources, Australia
1v

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 51 BINGARA

DEPOSIT IDENTIFICATION:

COMMODITIES: Au, Cr, Cu, Hg

DISTRIBUTION:
Record covers reef and alluvial deposits in NNW zone 38 km long along Great Serp. Belt between Tea Tree Creek 18 km N of Bingara and Paling Yards 6 km S of Upper Bingara. All Nations (New Bingara) is

OREBODIES:
Bingara (D), All Nations (New Bingara), Barrack Creek, Bingara Creek, Bobby Whitlow Creek, Cemetery, Doctor, Gouron Gouron Creek, Gwydir River, Jackass, Lady Mary, Maid Of Ashford, Mountain Maid, Spring Creek, Star, Tea Tree Creek, Upper Bingara, West Bingara, White

MINES:
All Nations, Ballarat, Barrack Creek, Bingara Creek, Bobby Whitlow Creek, Cemetery, Doctor, Gowan Gowan Creek, Gwydir River, Jackass, Lady Mary, Maid Of Ashford, Mountain Maid, Spring Creek, Star, Tea Tree Gully, Upper Bingara, West Bingara, White

GROUP: -

COMMENTS:
Record includes regional setting of Great Serpentinite Belt. Mining methods unknown; probably surface workings in addition to underground mines.

LOCATION:

LATITUDE: 29 52 LONGITUDE: 150 34
250K SHEET: SH56 5 100K SHEET: 9038

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Armidale
LOCAL GOVERNMENT AREA (LGA): Bingara

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1852	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
All Nations (New Bingara)	All Nations	Historical	Underground
Barrack Creek	Barrack Creek	Historical	Underground
Bingara Creek	Bingara Creek	Historical	Underground
Bobby Whitlow Creek	Bobby Whitlow Creek	Historical	Underground
Cemetery	Cemetery	Historical	Underground
Doctor	Doctor	Historical	Underground
Gouron Gouron Creek	Gowan Gowan Creek	Historical	Underground
Gwydir River	Gwydir River	Historical	Underground
Jackass	Jackass	Historical	Underground
Lady Mary	Lady Mary	Historical	Underground
Maid Of Ashford	Maid Of Ashford	Historical	Underground
Mountain Maid	Mountain Maid	Historical	Underground
Spring Creek	Spring Creek	Historical	Underground
Star	Star	Historical	Underground
Tea Tree Creek	Tea Tree Gully	Historical	Underground
Upper Bingara	Upper Bingara	Historical	Underground
Upper Bingara	Ballarat	Historical	Underground
West Bingara	West Bingara	Historical	Underground
White	White	Historical	Underground

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 1,316
Recovered grades primary ore 10-20 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

YEAR	PRODUCTION
1987	57

MAIN PRODUCTION PERIODS: (1907-1912), (1932-1940), (1987-, 1876-1906,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: New England Fold Belt
PROVINCE: Great Serpentinite Belt
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Great Serpentinite Belt - Pre-Late Permian
LITHOLOGY: Serpentinised harzburgite, dunite, associated ophiolitic rocks.
RELATIONSHIP TO MINERALISATION: Primary mineralisation comprised gold-quartz and/or calcite veins and stockworks at the contact of, or adjacent to, serpentinite.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to alluvial and deep lead mineralisation.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Alluvium, Ultramafic

STRUCTURAL FEATURES:

MAJOR: Faulting,
SIGNIFICANT: Jointing, Shearing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

SIGNIFICANT: Intrusive Contact

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Ultramafic)

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Alluvial.
SIGNIFICANT: Deep lead.
Auriferous veins and stockworks associated with mafic/ultramafic intrusive.

STYLE:

MAJOR: Discordant

AGE OF MINERALISATION: Palaeozoic Late Permian

DIMENSIONS/ORIENTATION:

OREBODY: Bingara (D)

	MIN	AVE	MAX
DEPTH OXIDATION (m)			30.0

OREBODY: All Nations (New Bingara)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			76.0
TRUE WIDTH	(cm)		100.0	480.0
VERTICAL DEPTH	(m)			100.0

ORE TEXTURE:
Free Milling

NATURE OF MINERALISATION:
PRIMARY ORE: Multiple Veins, Stockwork, Vein (Reef),
SECONDARY ORE: Deep Lead, Detrital (Alluvial), Supergene Enrichment

MINERALOGY:

OREBODY: Bingara (D)
Gangue (veins): quartz and/or calcite. Gold occurs free in veins and joints or in auriferous pyrite in gabbroic or doleritic hosts (Barnes & others, 1988).
Sulphide zone: veins are generally devoid of sulphides, although pyrite, arsenopyrite, (chalcopyrite) occur locally (Markham, 1975; Barnes & others, 1988).
At least some of the gold apparently was associated with sulphides at depth (Markham, op.cit; Barnes & others, op.cit).

CONTROLS OF MINERALISATION:
Controls are i) lithological: association with serpentinite; and ii) structural: vein localisation in shear/fracture zones adjacent to major fault zone.

GENETIC MODELS:
Barnes & others (1988): 'The origin of the gold deposits is contentious. Their consistent development within, or proximal to serpentinites suggests a genetic link. However, whether the serpentinites supplied the bulk of the Au, or merely acted as sources for a precipitating chemistry is unknown. The Peel Fault was probably actively involved in deposit formation, by creating suitable fault and fracture systems for deposit localization, and by acting as a channel way for mineralizing solutions. Whether these solutions carried Au from a deep source, or the gold was mobilized from the serpentinites into veins by the fluids, is open to debate.'

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Bingara (D)
PRINCIPAL SOURCES: Chesnut & Cameron (1971), Markham & Basden (1974), Markham (1975), Barnes & others (1988).
SUMMARY

Bingara lies on the northern section of the Peel Fault System, in the Great Serpentinite Belt. Mineralisation includes numerous vein deposits within serpentinite, and deep lead and alluvial deposits of Tertiary and Quaternary age derived from the reefs.

GEOLOGICAL SETTING: GREAT SERPENTINITE BELT
PRINCIPAL SOURCES: Markham & Basden (1974), Barnes & others (1988).

The Peel Fault System is a major tectonic feature which forms the boundary between the Tamworth Belt and the Central Block. Ultramafic masses emplaced along the fault system form the Great Serpentinite Belt. The belt is a curvilinear discontinuous line of serpentinised ultramafic bodies which extends along the Peel Fault and subsidiary faults for more than 300 km N of Nundle, and occupies major faults in the region E of Nundle between Nundle and the coast (Markham & Basden, 1974; Barnes & others (1988).

In the Bingara region the fault separates Palaeozoic sediments of the Central Block (Pzw on Inverell 1:250 000 geological map - Woolomin Beds in part), from Bingara Mela[illegible] (Cb-D-S) of the Tamworth Belt (fault slivers of Woolomin Beds and units of the Early Devonian-Middle Carboniferous succession (Chesnut & Cameron, 1971).

The ultramafic bodies vary in size from small lenses to masses over 40 km long and up to 3 km wide. They are generally concordant, steeply inclined, narrow lensoid bodies, and commonly have a planar (faulted) contact on one side and a more irregular contact on the other (Markham & Basden, 1974).

The ultramafic material consists of massive serpentinised harzburgite and minor dunite, with local masses of included altered dolerite, gabbro, anorthosite, and other ophiolitic rocks (Markham & Basden, 1974;

Barnes & others, 1988). Sheared schistose serpentinite is common along the eastern margin of the belt (Markham & Basden, 1974).

The age and mode of tectonic emplacement of the ultramafic rocks is contentious; however, final emplacement as solid slices of oceanic crust in pre-Late Permian time is widely favoured (Barnes & others, 1988). The age of formation of the ophiolites has not been determined (Barnes, op.cit).

ASSOCIATED MINERALISATION: GREAT SERPENTINITE BELT
PRINCIPAL SOURCES: Markham & Basden (1974), Barnes & others (1988).

Mineral deposits within or associated with the serpentinite belt include magmatic, hydrothermal or secondary deposits of: chromite, Cu, Ni, Au, Hg, asbestos, talc, magnesite, lateritic iron, nephrite, pseudophite, prehnite, chrysoprase, and common opal (Markham & Basden, 1974; Barnes & others, 1988).

More than 1600 kg of gold have been produced from reef and alluvial deposits along the belt. Bingara accounted for the bulk of production; other producing centres were Crow Mountain, Woodsreef, Mummel River, and Paling Yards (Markham & Basden, 1974: Barnes & others, 1988). NUNDLE (Deposit No.52), although adjacent to the Peel Fault System, is regarded as a structurally controlled ?metahydrothermal deposit (Barnes & others, 1988).

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Markham & Basden (1974), Markham (1975), Barnes & others (1988).

Reef deposits of Bingara are either stockworks or simple vein systems localised within or along the contact of serpentinite, or within meta-sediments up to 1 km from serpentinite (e.g. All Nations (New Bingara)). Stockworks comprise one or more sets of variously oriented veins and/or mineralised joint/shear zones. The veins are narrow, impersistent, and of highly variable grade (Barnes & others, 1988).
Simple vein systems are either single or multiple, generally parallel veins, also of highly variable grade but much greater lateral persistence (Barnes, op.cit).

Alluvial deposits occurred on watercourses draining the serpentinite belt, including Tea Tree Creek, Bobby Whitlow Creek, Spring Creek, Bingara Creek, Gouron Gouron Creek, and Barrack Creek. Some Recent alluvials have also formed from the redistribution of Teriary deep leads. (Markham & Basden, 1974; Markham, 1975).

Deep lead deposits adjacent to Bingara include the Cemetery and White leads. The deep leads are generally capped by Tertiary basalt, and consist of variable proportions of sand, clay, gravel (Markham, 1975).
On the Bingara diamond field, diamond and gold-bearing gravels and pipe clays lie directly on Devonian basement, and are overlain by two basalt layers each about 90 m thick separated by 36 m of sub-economic gem- and gold-bearing fine sand (Markham & Basden, 1974; Markham, 1975).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Anderson W., 1889
The geology of the Bingera and Barraba gold-field.
New South Wales. Department of Mines. Annual Report
1888 Appendix 3A P179-182

Barnes R.G., Brown R.E., Brownlow J.W., Gilligan L.B., Krynen J., Willis I.L., 1988
A review of the mineral deposits of the New England Orogen in New South Wales. IN Kleeman J.D.(ed) - New England Orogen - tectonics and metallogenesis. Proceedings of symposium, University of New England, November, 1988.
University of New England. Department of Geology and Geophysics
1v P211-227

Chesnut W.S., Cameron R.G., 1971
Inverell, New South Wales, 1:250 000 geological series map. Sheet SH 56-5, 1st edition.
Geological Survey of New South Wales
1v

Clift D.S.L., 1975
Gold dredging in New South Wales.
Geological Survey of New South Wales. Mineral Resources
41

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1975
Gold deposits of the New England Fold Belt.
Geological Survey of New South Wales. Report
GS1975/378

Pittman E.F., 1882
Report on the Bingara and Ironbark goldfields.
New South Wales. Department of Mines. Annual Report
1881 P141-143

Pogson D.J., Clift D.S.L., 1969
Barraba gold prospect.
Geological Survey of New South Wales. Report
GS1969/362

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 52 NUNDLE

DEPOSIT IDENTIFICATION:

COMMODITIES: Au, Sb, Cu, W, As, Ag

DISTRIBUTION:
Record covers reef deposits in NNW field 15 km x 5 km, E of Nundle, between Bowling Alley Point and Hanging Rock, plus alluvial deposits at W and SW margins of reef field. Nos 138-203, 324-327 on Tamworth-Hastings metallogenic map.

OREBODIES:
Nundle (D), Alliance/Heymanns (BAP), Black Snake (HR), Bourkes/Kanaka/D'Uasons (BAP), Bowling Alley Point, Brands (BAP), Cement Hill, Cemetery Hill/Harden Hill, Dirty Hole Creek, Foleys/Golden Hole (BAP), Folly Creek, Gohanna-Wrights Spur (HR), Golden Bar & Brumby Charlie, Hanging Rock, John Bull/Connollys etc (BAP), Kinbalu, Moonlight (BAP), Mount Ephraim, Norton-John Norton, Opossum/Lord Carrington etc (BAP), Peel River, Ruzickas/Lady Of The Mountain etc (HR), Scandinavian/Bonny Dundee etc (BAP), Scrubby Gully (HR), Sheba/ Red Hill/Mount Misery etc, Spring Gully/Lady Mary (HR), Tamworth etc/Opossum Gully (HR), Tarvainens/Brown Snake/Shamrock, The Folly/Bonds (HR), The Gap/Marquis Of Lorne etc (BAP), Thompsons (BAP), Tom Tiger (BAP), Trevena (HR), Verden Road (HR), Wombat Gully

MINES:
Alliance, Black Snake, Blackfellows (Knob), Blairmore, Bonds, Bonny Dundee, Bourkes, Buckleys, Carrington, Cement Hill, Chamberlains, Christmas, Connollys, D'Uasons, Daylight, Dirty Hole Creek, Duke Of York, Excelsior, Foleys, Foleys Folly, Golden Gate, Golden Hole, Happy Valley, Heymanns, John Bull (Hard-Up), Kanakas, Kennedys, Kinbalu, Klondyke, Lady Mary, Lady Of The Mountain, Lord Carrington, Maitland, Marquis Of Lorne, Mount Ephraim, Oakenville, Opossum, Opossum Gully, Peel River, Possum, Prices, Prices Hill, Ruzickas, Scandinavian, Spring Creek, Spring Gully, Swamp Creek, Tamworth, The Gap, Trevena (Trevenna), White Rose, Wombat Gully (Dog Trap Hill), Yankee Jack

GROUP: -

COMMENTS:
Record includes regional setting of Tamworth Belt.

LOCATION:

LATITUDE: 31 27 LONGITUDE: 151 8
250K SHEET: SH56 13 100K SHEET: 9135

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Armidale
LOCAL GOVERNMENT AREA (LGA): Nundle

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1852	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Alliance/Heymanns (BAP)	Alliance	Historical	Underground
Alliance/Heymanns (BAP)	Alliance	Historical	Open-Cut
Alliance/Heymanns (BAP)	Heymanns	Historical	Underground
Alliance/Heymanns (BAP)	Heymanns	Historical	Open-Cut
Black Snake (HR)	Black Snake	Historical	Underground
Bourkes/Kanaka/D'Uasons (BAP)	Bourkes	Historical	Surface
Bourkes/Kanaka/D'Uasons (BAP)	Kanakas	Historical	Underground
Bourkes/Kanaka/D'Uasons (BAP)	Kanakas	Historical	Surface
Bourkes/Kanaka/D'Uasons (BAP)	D'Uasons	Historical	Underground
Bourkes/Kanaka/D'Uasons (BAP)	D'Uasons	Historical	Surface
Cement Hill	Cement Hill	Historical	Underground

Cement Hill	Cement Hill	Historical	Open-Cut
Dirty Hole Creek	Dirty Hole Creek	Historical	Underground
Dirty Hole Creek	Dirty Hole Creek	Historical	Open-Cut
Foleys/Golden Hole (BAP)	Foleys	Historical	Underground
Foleys/Golden Hole (BAP)	Golden Hole	Historical	Underground
John Bull/Connollys etc (BAP)	John Bull (Hard-Up)	Historical	Underground
John Bull/Connollys etc (BAP)	Maitland	Historical	Underground
John Bull/Connollys etc (BAP)	Connollys	Historical	Underground
John Bull/Connollys etc (BAP)	Connollys	Historical	Surface
John Bull/Connollys etc (BAP)	Blairmore	Historical	Underground
John Bull/Connollys etc (BAP)	Blairmore	Historical	Surface
John Bull/Connollys etc (BAP)	Kinbalu	Historical	Unknown
Mount Ephraim	Mount Ephraim	Historical	Underground
Mount Ephraim	Mount Ephraim	Historical	Open-Cut
Mount Ephraim	Mount Ephraim	Historical	Sluicing
Opossum/Lord Carrington etc (BAP)	Possum	Historical	Underground
Opossum/Lord Carrington etc (BAP)	Possum	Historical	Open-Cut
Opossum/Lord Carrington etc (BAP)	Carrington	Historical	Underground
Opossum/Lord Carrington etc (BAP)	Carrington	Historical	Surface
Opossum/Lord Carrington etc (BAP)	Opossum	Historical	Underground
Opossum/Lord Carrington etc (BAP)	Opossum	Historical	Open-Cut
Opossum/Lord Carrington etc (BAP)	Lord Carrington	Historical	Underground
Opossum/Lord Carrington etc (BAP)	Lord Carrington	Historical	Surface
Opossum/Lord Carrington etc (BAP)	Blackfellows (Knob)	Historical	Underground
Peel River	Spring Creek	Historical	Dredging &/Or Sluicing
Peel River	Happy Valley	Historical	Dredging &/Or Sluicing
Peel River	Peel River	Historical	Dredging &/Or Sluicing
Peel River	Oakenville	Historical	Dredging &/Or Sluicing
Peel River	Swamp Creek	Historical	Dredging &/Or Sluicing
Ruzickas/Lady Of The Mountain etc (HR)	Ruzickas	Historical	Underground
Ruzickas/Lady Of The Mountain etc (HR)	Ruzickas	Historical	Surface
Ruzickas/Lady Of The Mountain etc (HR)	Lady Of The Mountain	Historical	Underground
Ruzickas/Lady Of The Mountain etc (HR)	Lady Of The Mountain	Historical	Surface
Scandinavian/Bonny Dundee etc (BAP)	Scandinavian	Historical	Underground
Scandinavian/Bonny Dundee etc (BAP)	Bonny Dundee	Historical	Underground
Scandinavian/Bonny Dundee etc (BAP)	Bonny Dundee	Historical	Surface
Scandinavian/Bonny Dundee etc (BAP)	Daylight	Historical	Underground
Scandinavian/Bonny Dundee etc (BAP)	Daylight	Historical	Open-Cut
Spring Gully/Lady Mary (HR)	Lady Mary	Historical	Underground
Spring Gully/Lady Mary (HR)	Spring Gully	Historical	Underground
Spring Gully/Lady Mary (HR)	Spring Gully	Historical	Surface
Tamworth etc/Opossum Gully (HR)	Excelsior	Historical	Underground
Tamworth etc/Opossum Gully (HR)	White Rose	Historical	Underground
Tamworth etc/Opossum Gully (HR)	Christmas	Historical	Underground
Tamworth etc/Opossum Gully (HR)	Tamworth	Historical	Underground
Tamworth etc/Opossum Gully (HR)	Kennedys	Historical	Underground
Tamworth etc/Opossum Gully (HR)	Opossum Gully	Historical	Underground
The Folly/Bonds (HR)	Klondyke	Historical	Underground
The Folly/Bonds (HR)	Golden Gate	Historical	Underground
The Folly/Bonds (HR)	Golden Gate	Historical	Open-Cut
The Folly/Bonds (HR)	Foleys Folly	Historical	Underground
The Folly/Bonds (HR)	Foleys Folly	Historical	Open-Cut
The Folly/Bonds (HR)	Duke Of York	Historical	Underground
The Folly/Bonds (HR)	Buckleys	Historical	Underground
The Folly/Bonds (HR)	Bonds	Historical	Underground
The Folly/Bonds (HR)	Bonds	Historical	Open-Cut
The Folly/Bonds (HR)	Bonds	Historical	Surface
The Folly/Bonds (HR)	Yankee Jack	Historical	Underground
The Folly/Bonds (HR)	Yankee Jack	Historical	Open-Cut
The Gap/Marquis Of Lorne etc (BAP)	The Gap	Historical	Underground
The Gap/Marquis Of Lorne etc (BAP)	The Gap	Histroical	Surface
The Gap/Marquis Of Lorne etc (BAP)	Marquis Of Lorne	Historical	Underground
The Gap/Marquis Of Lorne etc (BAP)	Prices Hill	Historical	Underground
The Gap/Marquis Of Lorne etc (BAP)	Chamberlains	Historical	Underground
The Gap/Marquis Of Lorne etc (BAP)	Prices	Historical	Underground
Trevena (HR)	Trevena (Trevenna)	Historical	Underground
Trevena (HR)	Trevena (Trevenna)	Historical	Open-Cut
Wombat Gully	Wombat Gully (Dog Trap Hill)	Historical	Underground
Wombat Gully	Wombat Gully (Dog Trap Hill)	Historical	Surface

COMPANIES:

OREBODY: Nundle (D)

PRESENT OPERATORS:
Delta Gold N L.

PRESENT OWNERS:	EQUITY%
Delta Gold N L.	100.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 9,405
Recovered grades mostly in range 20-60 g/t Au (reef ore); 50-200 g/t Au (alluvial ore); locally higher reef and alluvial grades.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1915-1944), 1852-1914,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: New England Fold Belt
PROVINCE: Tamworth Belt
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Tamworth Group - Early-Middle Devonian
LITHOLOGY: Cherty argillite, sandstone, conglomerate, limestone, tuff, keratophyre, basalt, dolerite.
RELATIONSHIP TO MINERALISATION: Principal host to mineralisation in veins, breccia-fillings, and disseminations in structurally controlled sites associated principally with dolerite, also with mafic volcanics and sediments.

FORMATION NAME & AGE: Great Serpentinite Belt - Permian
LITHOLOGY: Serpentinite.
RELATIONSHIP TO MINERALISATION: Host to relatively small proportion of mineralisation in structural sites.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to alluvial and deep lead deposits.

GEOCHRONOLOGY:

Nundle Plutonic Suite dated at:- 255-262 my (Rb-Sr) (Cross, 1983; and Hensel & others, 1985; both reported by Ashley & Hartshorn, 1988); 264-273 my (Rb-Sr) (Hensel & others, 1982, reported by Gilligan & Brownlow, 1987); i.e. Late Permian (see Explanatory Notes).
Mineralisation probably no older than latest Permian (Ashley & Hartshorn, 1988).

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Mafic Intrusive,
MINOR: Clastic Sedimentary, Ultramafic

STRUCTURAL FEATURES:

MAJOR: Faulting,
SIGNIFICANT: Jointing, Shearing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

MAJOR: Intrusive Contact.
SIGNIFICANT: Stratigraphic Boundary

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Dolerite),
SIGNIFICANT: Plutonism (Granite)

METAMORPHISM:

Metamorphic grade of Tamworth and Parry Groups is prehnite-pumpellyite to lower greenschist facies (Ashley & Hartshorn, 1988).

ALTERATION:

OREBODY: Nundle (D)
PRINCIPAL SOURCES: Ashley & Hartshorn (1988).

Hydrothermal alteration effects occur about the vein and stockwork systems with their extent and intensity dependent on host rock type. Siliclastic sediments are strongly fractured but have narrow alteration selvedges; volcaniclastic sediments, mafic rocks and felsic dykes have well developed alteration haloes; serpentinite is enveloped by extensive alteration zones.

Relatively unaltered assemblages are:-
. siliceous siltstone: quartz (albite, carbonate, pyrite, ?illite).
. volcaniclastic sediments, mafic igneous rocks: albite, CPX, Ti-magnetite, (quartz, hornblende, chlorite, pumpellyite, prehnite, pyrite, actinolite, sphene, apatite).
. serpentinite: lizardite-chrysotile or antigorite, magnetite, Cr-spinel.
. felsic-intermediate dykes: plagioclase, hornblende, biotite, (quartz, magnetite).

Alteration assmeblages developed include:-
. mafics and sediments: peripheral carbonate+chlorite+pyrite, zoning to intense carbonate+quartz+sericite+pyrite+Ti oxides (+arsenopyrite+ chalcopyrite+chlorite).
. ultramafics: magnesite+talc+quartz(+-pyrite) grading to magnesite+quartz+Cr-sericite+pyrite+-chlorite.

Corresponding chemical changes are:-
. increase in K_2O, Rb, S, As, Au, CO_2, (and locally SiO_2, H_2O, CaO, Sr, Ba, W, Sb, Cr, and Cu).
. leaching of Na_2O and Sr from mafics and sediments.
. reduction of Fe^{3+} to Fe^{2+}.
. Al_2O_3, TiO_2, Zr, and Y remain essentially immobile (although diluted). (Ashley & Hartshorn, 1988).

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Metamorphic auriferous veins/disseminated gold in fault/shear zones in conformable mafic intrusions in volcanogenic sediments.
SIGNIFICANT: Deep lead.
Alluvial.
MINOR: Auriferous veins and stockworks associated with mafic/ultramafic intrusive.

STYLE:

MAJOR: Discordant, Stratabound

AGE OF MINERALISATION: Palaeozoic Late Permian

DIMENSIONS/ORIENTATION:

OREBODY: Nundle (D)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			600.0
TRUE WIDTH	(cm)	1.0		100.0
VERTICAL DEPTH	(m)			113.0
		ANGLE (deg.)		DIRECTION
DIP		60,80		SW,NE
STRIKE		315-316		

OREBODY: Alliance/Heymanns (BAP)

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			20.0
STRIKE LENGTH	(m)			100.0
TRUE WIDTH	(cm)	15.0		100.0
		ANGLE (deg.)		DIRECTION
STRIKE		60		

OREBODY: Black Snake (HR)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			100.0
TRUE WIDTH	(cm)		20.0	60.0
VERTICAL DEPTH	(m)			80.0

OREBODY: Bourkes/Kanaka/D'Uasons (BAP)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			250.0
TRUE WIDTH	(cm)			100.0
VERTICAL DEPTH	(m)			12.0

OREBODY: Cement Hill

		MIN	AVE	MAX
STRIKE LENGTH	(m)			50.0
TRUE WIDTH	(m)			50.0

OREBODY: Cemetery Hill/Harden Hill

		MIN	AVE	MAX
STRIKE LENGTH	(m)			250.0
TRUE WIDTH	(m)			30.0
VERTICAL DEPTH	(m)			25.0

OREBODY: Dirty Hole Creek

		MIN	AVE	MAX
STRIKE LENGTH	(m)			70.0
TRUE WIDTH	(m)			20.0
VERTICAL DEPTH	(m)			4.0

OREBODY: Foleys/Golden Hole (BAP)

		MIN	AVE	MAX
TRUE WIDTH	(cm)		45.0	200.0
STRIKE LENGTH	(m)			450.0
VERTICAL DEPTH	(m)			70.0
		ANGLE (deg.)		DIRECTION
STRIKE		045		

OREBODY: John Bull/Connollys etc (BAP)

		MIN	AVE	MAX
STRIKE LENGTH	(m)	30.0		150.0
TRUE WIDTH	(cm)		20.0	
		ANGLE (deg.)		DIRECTION
STRIKE		135		

OREBODY: Kinbalu

		MIN	AVE	MAX
STRIKE LENGTH	(m)			400.0
TRUE WIDTH	(m)			100.0

OREBODY: Mount Ephraim

		MIN	AVE	MAX
STRIKE LENGTH	(m)			250.0
TRUE WIDTH	(cm)			150.0
VERTICAL DEPTH	(m)			34.0

OREBODY: Opossum/Lord Carrington etc (BAP)

		MIN	AVE	MAX
STRIKE LENGTH	(m)	100.0		350.0
TRUE WIDTH	(cm)	3.0	30.0	100.0
VERTICAL DEPTH	(m)	30.0		60.0

OREBODY: Ruzickas/Lady Of The Mountain etc (HR)

		MIN	AVE	MAX
TRUE WIDTH	(cm)			10.0
STRIKE LENGTH	(m)			200.0
VERTICAL DEPTH	(m)			90.0
		ANGLE (deg.)		DIRECTION
STRIKE		130		

OREBODY: Scandinavian/Bonny Dundee etc (BAP)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			200.0
TRUE WIDTH	(cm)	30.0		100.0
VERTICAL DEPTH	(m)			20.0
		ANGLE (deg.)		DIRECTION
STRIKE		150		

OREBODY: Sheba/ Red Hill/Mount Misery etc

		MIN	AVE	MAX
TRUE WIDTH	(m)	20.0		80.0
STRIKE LENGTH	(m)	200.0		800.0
VERTICAL DEPTH	(m)	10.0		30.0

OREBODY: Spring Gully/Lady Mary (HR)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			300.0
TRUE WIDTH	(cm)			50.0
VERTICAL DEPTH	(m)			60.0
		ANGLE (deg.)		DIRECTION
STRIKE		130		

OREBODY: Tamworth etc/Opossum Gully (HR)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			300.0
TRUE WIDTH	(cm)		30.0	200.0
VERTICAL DEPTH	(m)			60.0

OREBODY: Tarvainens/Brown Snake/Shamrock

		MIN	AVE	MAX
STRIKE LENGTH	(m)	50.0		500.0
TRUE WIDTH	(cm)	2.0	20.0	40.0
VERTICAL DEPTH	(m)			50.0
		ANGLE (deg.)		DIRECTION
STRIKE		056		

OREBODY: The Folly/Bonds (HR)

		MIN	AVE	MAX
TRUE WIDTH	(m)	1.0		6.0
STRIKE LENGTH	(m)	20.0		260.0
VERTICAL DEPTH	(m)			50.0
		ANGLE (deg.)		DIRECTION
DIP		75,-		W
STRIKE		160,170		

OREBODY: The Gap/Marquis Of Lorne etc (BAP)

		MIN	AVE	MAX
STRIKE LENGTH	(m)	20.0		400.0
TRUE WIDTH	(cm)		100.0	200.0
VERTICAL DEPTH	(m)			113.0
		ANGLE (deg.)		DIRECTION
STRIKE		015		

OREBODY: Trevena (HR)

		MIN	AVE	MAX
STRIKE LENGTH	(m)		6.0	80.0
VERTICAL DEPTH	(m)			7.0

OREBODY: Wombat Gully

		MIN	AVE	MAX
STRIKE LENGTH	(m)			150.0
VERTICAL DEPTH	(m)			3.0

ORE TEXTURE:

NATURE OF MINERALISATION:

PRIMARY ORE: Breccia, Dissemination, Fault/Shear-Filling, Multiple Veins, Vein (Reef),
SECONDARY ORE: Deep Lead, Detrital (Alluvial), Supergene Enrichment

MINERALOGY:

OREBODY: Nundle (D)

Sulphide zone: veins: pyrite, (gold, scheelite, arsenopyrite, stibnite, rare sphalerite, galena, pyrrhotite).
Disseminated zones: pyrite, (chalcopyrite, arsenopyrite).
(Gilligan & Brownlow, 1987; Ashley & Hartshorn, 1988).
Pyrite and arsenopyrite are more abundant in adjacent wallrocks, reflecting Fe availability (Ashley & Hartshorn, 1988).
Gold in veins has patchy distribution and occurs both as free gold and within pyrite (Gilligan & Brownlow, 1987).
Higher gold values (>0.1 ppm) are always confined to well-veined material, indicating a close correlation with quartz abundance and little dispersion into adjacent altered wallrock (Ashley & Hartshorn

1988).
Oxide zone: (gold, malachite, chrysocolla, goethite, cervantite).
Gangue: quartz+-calcite (ferroan dolomite), (minor sericite, chlorite, rare anatase, albite, tourmaline) (Ashley & Hartshorn, 1988).
Vein quartz is milky to clear crystalline, incorporating scattered vughs. Comb structure occurs locally, with central portions of veins occupied by carbonate and sericite. (Ashley & Hartshorn, 1988).
Veins in serpentinite may contain quartz, talc, ferroan magnesite, pyrite (Ashley & Hartshorn, 1988).

CONTROLS OF MINERALISATION:

PRINCIPAL SOURCES: Weber (1979a), Ashley & Hartshorn (1988), Barnes & others (1988).

The Nundle goldfield is structurally controlled on both regional and local scales. On a regional scale, the deposit is adjacent to the Peel Fault System, and occurs at the conjunction of the Peel Fault with a regional NNE-trending belt of Au and Au-Sb mineralisation (Barnes & others, 1988).
On a local scale, veins are controlled by joints or faults (but not cleavage or bedding planes) (Weber, 1979a).
However, most veins strike between 310-330 deg, compared with strike of the Peel Fault of 340 deg, implying that the Peel Fault may not have had a direct influence on localisation of host structures (Ashley & Hartshorn, 1988).

A lithological control is indicated by the concentration of auriferous veins in doleritic intrusives, which may be genetically related to the gold mineralisation (Weber, 1979a).

Mineralisation post-dates emplacement of serpentinite and development of the Peel Fault System. Mineralisation also post-dates regional metamorphism, and intrusion of porphyritic felsic dykes related to the Duncans Creek Trondhjemite (Nundle Plutonic Suite).
A probable maximum age of mineralisation is therefore inferred to be latest Permian. (Ashley & Hartshorn, 1988).

Fluid inclusion and mineralogical data (Ashley & Hartshorn, 1988) indicate a hydrothermal fluid rich in CO_2, of low salinity (average 4 equivalent wt % NaCl), pH approximately 5-6, oxygen fugacity 10E-10.5 to 10E-11.5 bars. Temperature of formation of quartz- and scheelite-bearing veins is 310 deg C; of stibnite-bearing veins 300 deg C.
Depth of formation is estimated at 2-3 km (maximum), pressure 0.6-0.9 kb (Ashley & Hartshorn, 1988).

GENETIC MODELS:

PRINCIPAL SOURCES: Weber (1979a), Gilligan & Brownlow (1987), Ashley & Hartshorn (1988), Barnes & others (1988).

Weber (1979a), Ashley & Hartshorn (1988), and Barnes & others (1988) favour a metamorphic hydrothermal origin, in which gold(-stibnite-scheelite)-quartz veins were formed at shallow depths after emplacement of serpentinite, possibly during or after major deformation and intrusion of the Late Permian Nundle Plutonic Suite.

Barnes & others (1988) grouped Nundle with metahydrothermal deposits typified by HILLGROVE (Deposit No.57), although these authors noted that Nundle was similar to other gold deposits associated with the Great Serpentinite Belt (e.g. BINGARA, Deposit No.51).

Gilligan & Brownlow (1987) listed four possible sources of mineralisation:-
1) Mantle-sourced hydrothermal solutions.
2) Granitoid-derived hydrothermal solutions (Nundle Plutonic Suite).
3) Mobilisation out of dolerite during deformation and regional metamorphism or during subsequent granitoid emplacement.
4) Derivation from a deep crustal source either through the leaching of sediments and volcanics or remobilisation of pre-existing stratabound Au(-Sb-W) mineralisation (Weber, 1979a).

1) Barnes & others (1988) consider a mantle source unlikely for the metahydrothermal deposits of the New England Fold Belt in general (see Deposit No.57 (HILLGROVE)).
2) Ashley & Hartshorn (1988) note that the metal association, alteration and fluid inclusion characteristics argue against a direct granitoid involvement; however, granitic intrusions may have initiated metamorphic devolatilisation reactions, thereby forming hydrothermal fluids capable of carrying the Au-As(-Sb-W) metal association.
3), 4) Ashley & Hartshorn (1988): The metal source could be more deeply buried complexes of sedimentary, mafic and ultramafic rocks (including submarine exhalative rocks enriched in Au, As, Sb, W), perhaps part of the Tamworth Group or its presumed ophiolitic substrate.

Ashley & Hartshorn (1988): lode gold development at Nundle is probably no older than latest Permian (see 'CONTROLS OF MINERALISATION', 'GEOCHRONOLOGY'), originating from metamorphic devolatilisation processes, possibly triggered by a heat engine related to Late Permian granitoid intrusion.
Devolatilisation reactions could have produced a low-salinity H_2O-CO_2 (-CH_4-reduced S) fluid which leached gold and associated elements, but not base metals or significant Fe, from ophiolitic igneous rocks and sediments.
Gold is interpreted to have been transported largely in bisulphide complexes.
Metamorphic fluid movement may have been focussed along or near the Peel Fault.
Deposition of Au was evidently largely in response to wallrock reactions especially i) sulphidation, leading to a lowering of H_2S activity, and ii) carbonatisation, leading to precipitation of carbonates and decrease in fluid pH. Both sets of reactions are effective in reducing solubility of Au as $Au(HS)_2^-$ (Ashley & Hartshorn, 1988).
Salinity remained constant as temperature fell, suggesting that fluid cooling occurred without mixing with more dilute (e.g. meteoric) fluids. (Ashley & Hartshorn, 1988).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Nundle (D)

PRINCIPAL SOURCES: Markham & Basden (1974), Markham (1975), Weber (1979a), Gilligan & Brownlow (1987), Gilligan & others (1987), Ashley & Hartshorn, (1988), Barnes & others (1988).
SUMMARY

Nundle lies in the east-central part of the Tamworth Belt, adjacent to the Peel Fault System which separates the belt from the Central Block to the E. Approximately 25% of recorded production was derived from reefs, 75% from alluvial deposits in Tertiary and Recent fluvial systems.
The deposit is adjacent to a major fault system, the Peel Fault System.
Primary mineralisation comprises structurally controlled veins, breccia-fills and disseminations in fault and shear zones associated with:-
i) doleritic intrusions in the lower part of the Early-Middle Devonian Tamworth Group (dominant host rock association), to a lesser extent with ii) mafic volcanics and sediments (chert, argillite) of the Tamworth Group, and locally with iii) serpentinite.

REGIONAL SETTING: TAMWORTH BELT
PRINCIPAL SOURCES: Markham & Basden (1974), Gilligan & Brownlow (1987), Gilligan & others (1987), Ashley & Hartshorn (1988), Barnes & others (1988).

The Tamworth Belt is an arcuate structural zone bounded to the SW by the Mooki and Hunter Fault Systems and to the E and NE by the Peel and Manning River Fault Systems (Markham & Basden, 1974).
The belt contains mainly thick sequences of pre-Permian volcanogenic sediments and minor volcanics, overlain by Permian sediments and volcanics, including coal measures, and locally intruded by Late Permian granitoids of the Nundle and Moonbi Plutonic Suite (Gilligan & Brownlow, 1987; Gilligan & others, 1987; Barnes & others, 1988).
The pre-Permian succession has been interpreted as a fore-arc basin sequence for which the source of sedimentation was a westerly-lying volcanic arc chain (various references reported by Gilligan & Brownlow, 1987).

Basement rocks of the Tamworth Belt are Cambro-Ordovician submarine fore-arc complexes deposited at the base of the slope (represented by the Murrawong Creek and Haedon Formations) (Gilligan & Brownlow, 1987).
A major disconformity separates the Cambro-Ordovician rocks from the overlying Devonian sequences (Gilligan & others, 1987).
Predominantly marine deposition in the Early Devonian resulted in thick sequences of volcanogenic sediments forming in near-shore to offshore shelf environments (represented by the Tamworth and Parry Groups and equivalents, including Bowman beds) (Gilligan & Brownlow, 1987).
Sediments of the Bowman beds are the principal host to gold-quartz veins at COPELAND (BARRINGTON) (Deposit No.54).
Two episodes of major local volcanism, possibly associated with intrabasinal rifting, produced keratophyric andesites and dacites in the basal sections of the Tamworth Group and ?comagmatic basalts and dolerites at higher levels within the groups (Gilligan & Brownlow,1987).
The dolerites and associated country rocks are the principal host to reef gold at Nundle.

From the Late Devonian to the Carboniferous, deposition changed progressively to predominantly terrestrial (upper Parry Group, Merlewood and equivalent Isismurra and Woolooma Formations, and the Temi and

Currabubula Formations) (Gilligan & Brownlow, 1987).
Sediments of the Parry Group and Woolooma Formation are host to gold mineralisation at UPPER HUNTER (Deposit No.53).

The overlying Late Carboniferous-Early Permian succession reflects marine regression, ?resulting from rifting and subsidence, and associated basaltic (Werrie Basalt) and felsic and intermediate volcanism (Stroud Volcanics) (Gilligan & Brownlow, 1987).

The basin succession is intruded locally by minor I-type granitoids of the New England Batholith.
The Nundle Plutonic Suite, which forms the southernmost plutons of the batholith, includes bodies which occur on both sides of the Peel Fault System at Nundle (Mount Ephraim Granodioritie, Duncans Creek Trondhjemite), and between the deposits of UPPER HUNTER and COPELAND (BARRINGTON) (Deposit Nos.53,54) (Barrington Tops Granodiorite) (Hensel & others, 1982, reported by Gilligan & Brownlow, 1987; Hensel & others, 1985, reported by Ashley & Hartshorn, 1988).
The Nundle Plutonic Suite has been dated at Late Permian (see 'GEOCHRONOLOGY') and inferred by Hensel & others (1985, reported by Ashley & Hartshorn, 1988) to predate the more voluminous NEB suites further to the N.
The Moonbi Plutonic Suite, which has been dated as slightly younger than the Nundle Plutonic Suite (see 'GEOCHRONOLOGY') transects the Peel Fault System 40 km NNW of Nundle (Gilligan & others, 1987).

A suite of ultramafic/mafic rocks is associated with major fault zones in the Tamworth and Central Blocks, and is represented in the Nundle area. Tectonic blocks of serpentinite and serpentinised ultramafics as well as metamorphosed mafic igneous rocks occur in lensoid bodies which comprise the Great Serpentinite Belt (see Deposit No.51 BINGARA). Closely associated with the ultramafic rocks are mafic igneous rocks - gabbro, dolerite, basalt, dacite, trondhjemite, and diorite - plus chert and siltstone (Gilligan & Brownlow, 1987).

The Tamworth Belt is characterised by (and distinguished from the Central Block by) broad upright folding, absence of intense penetrative deformation, and sparseness of granitoid intrusions (Gilligan & Brownlow, 1987).
Regional trends in the southern part of the Tamworth Belt (where gold mineralisation is concentrated) are N-S (Gilligan & Brownlow, op.cit).

ASSOCIATED MINERALISATION: TAMWORTH BELT
PRINCIPAL SOURCES: Gilligan & Brownlow (1987).

The principal mineral deposits of the Tamworth Belt are gold-bearing quartz veins which occur in three major gold fields - Nundle, UPPER HUNTER (Deposit No.53), and COPELAND (BARRINGTON) (Deposit No.54) - and in a few smaller occurrences. In addition, a number of stibnite, scheelite, and base metal occurrences are recorded. Stibnite is also present in some orebodies of the Nundle and UPPER HUNTER fields, and scheelite is present in the Nundle field.
The gold-quartz veins occur in fracture or shear zones at Nundle and UPPER HUNTER; bedding plane veins also occur at COPELAND (BARRINGTON).
Host rocks at Nundle are mainly doleritic intrusives into volcanogenic sediments; UPPER HUNTER and COPELAND (BARRINGTON) are hosted by Late Devonian-Early Carboniferous mudstones and lithic sandstones. Deposits of the latter two fields may be genetically related to the Barrington Tops Granodiorite. (Gilligan & Brownlow, 1987).

REGIONAL SUCCESSION: NUNDLE-UPPER HUNTER-COPELAND (BARRINGTON) REGION
PRINCIPAL SOURCES: Gilligan & Brownlow (1987), Gilligan & others (1987), Ashley & Hartshorn (1988).

1./ Haedon Formation, Pipeclay Creek Formation, Murrawong Creek Formation (Cop on Tamworth-Hastings metallogenic map)(Cambro-Ordovician) (2150 m thick) - cherty siltstone, sandstone, conglomerate, limestone.
2./ Tamworth Group (Det) (Early-Middle Devonian) (3700 m) - cherty argillite, sandstone, conglomerate, limestone, tuff, keratophyre, basalt, dolerite.
Principal host formation to gold mineralisation at Nundle and host to some orebodies at COPELAND (BARRINGTON) (Deposit No.54).
3./ i) Parry Group (Dcp) (Late Devonian-Early Carboniferous) (3000 m) - mudstone, minor lithic and feldspathic sandstone, conglomerate, limestone, andesitic ?sills near top.
Host to significant proportion of gold mineralisation at UPPER HUNTER (Deposit No.53).
ii) Bowman beds (Dcb) (Late Devonian-Early Carboniferous) - laminated siltstone, sandstone, minor limestone.
Host to majority of orebodies at COPELAND (BARRINGTON).
4./ Woolooma Formation and equivalents (Cem, Ceg) (late Early Carboniferous) (1300 m) - lithic sandstone, polymictic conglomerate

siltstone, mudstone, felsic and intermediate pyroclastics, limestone, andesite ?sills or ?flows.
Woolooma Formation is host to a significant proportion of the gold at UPPER HUNTER.
5./ Johnsons Creek Conglomerate and equivalents (Clt, Clk) (Late Carboniferous) (2070 m) - conglomerate, sandstone, siltstone, mudstone.
6./ Werrie Basalt, Manning Group and Stroud Volcanics (Pew, Pem, Pes) (Early Permian). The Manning Group is represented in the Nundle area by the Andersons Flat beds (Ashley & Hartshorn, 1988).
7./ Nundle Plutonic Suite (Pn) (Late Permian) - low-K I-type granitoids - granodiorite, trondhjemite, adamellite. Includes Rockisle Granodiorite (Pnr), Mount Ephraim Granite (Pne), Duncans Creek Trondhjemite (Pnd) and Barrington Tops Granodiorite (Pnb). Pne and Pnd occur in Nundle area; Pnb occurs in UPPER HUNTER and COPELAND (BARRINGTON) areas.
8./ Liverpool Range Beds, Comboyne Basalt and equivalents (Tv) (Tertiary) - basalt, sediments. Forms extensive cover across Nundle-Upper Hunter region.

GEOLOGICAL SETTING: NUNDLE
PRINCIPAL SOURCES: Weber (1979a), Gilligan & Brownlow (1987), Gilligan & others (1987), Ashley & Hartshorn (1988).

The lode gold deposits of the Nundle field are located along and up to 5 km W of the Peel Fault. Orebodies are clustered around the townships of Bowling Alley Point (indicated in this report by the suffix (BAP) on the orebody name), and Hanging Rock (indicated by suffix (HR)).
The deposits are largely restricted to a narrow NNW-trending belt of upper Tamworth Group rocks which are overlain to the W by formations of the Parry Group (Gilligan & Brownlow, 1987).

The Tamworth Group is represented in the Nundle area by (Gilligan & Brownlow, 1987):-
i) Bog Hole Formation - keratophyre, tuff, limestone, siltstone.
ii) Copes Creek Quartz Keratophyre.
iii) Northcotte Formation - feldspathic sandstone, conglomerate.
iv) Silver Gully Formation - sandstone, conglomerate, minor chert, limestone, metabasalt, metadolerite.
v) Dolerite, related to overlying unit vi).
vi) Spilitic basalt and dolerite interbedded with lithic sediments and limestone.
vii) Yarramie Formation - siltstone, siliceous siltstone, chert, minor sandstone, limestone, metadolerite.
The dolerites interbedded with the Tamworth Group sediments are mostly conformable sills with chilled margins and are up to 1 km thick and several km in length (Hartshorn, 1986, reported by Ashley & Hartshorn, 1988). According to Vallance (1969) and Glenton (1980) (both reported by Gilligan & Brownlow, 1987), the dolerites were intruded under a very shallow cover of unconsolidated marine sediments and were essentially contemporaneous with sedimentation and volcanism.

The Parry Group is represented by (Gilligan & Brownlow, 1987):-
i) Baldwin Formation - sandstone, mudstone, conglomerate.
ii) Goonoo Goonoo Mudstone - mudstone, minor sandstone.

The Tamworth and Parry Group rocks have a combined thickness approaching 3 km and are consistently steeply dipping, W-facing with no evidence of fold closures (Ashley & Hartshorn, 1988). According to these authors, it is likely that steeply-dipping faults parallel to the Peel Fault lying approximately in bedding planes, have resulted in thrust slice repetition of stratigraphy.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Markham (1975), Weber (1979a), Gilligan & Brownlow (1987), Ashley & Hartshorn (1988).

Several types of mineralisation occur (Markham, 1975; Weber, 1979a; Gilligan & Brownlow, 1987):-
a) auriferous quartz veins and disseminated mineralisation in adjacent shear zones in i) mafic intrusions, ii) basalt, and iii) sediments;
b) stibnite-bearing veins (three such orebodies in field);
c) scheelite-bearing veins (two such orebodies in field);
d) Tertiary deep leads;
e) Recent alluvial deposits.

The economically important reefs are localised within or along the margins of intrusive dolerite ('diorite') within the Tamworth Group. The most productive reefs of the field, their host lithologies, estimated production and recovered grades are (Weber, 1979a) :-
. Marquis of Lorne - diorite, andesite, dolerite, chert (250 kg Au, 64 g/t Au).
. Foleys - 'diorite'-gabbro, andesite, chert (235 kg, 13 g/t Au primary; 100-200 g/t Au secondary).

. Tamworth - dolerite, chert, siltstone, limestone (170 kg, 28-32 g/t Au).
. Kanaka - 'diorite', claystone, chert (102 kg).
. Black Snake - 'diorite', chert, limestone, claystone (63 kg, 20-100 g/t Au).
. Lady Mary - chert, siltstone (30 kg, 35 g/t Au).
. Thompsons - banded claystone (30 kg).
. Alliance - dolerite, siltstone (30 kg, 15 g/t Au primary; 40-160 g/t Au secondary).
. Brown Snake - cherty sediments (27 kg, 30-60 g/t Au).

Some veins occur wholly in sediments, e.g. Brown Snake, Lady Mary. Host sediments generally consist of chert, claystone, siltstone, and locally include intermediate-mafic volcanics and limestone. (Weber, 1979a).

Minor orebodies are also scattered in the Baldwin Formation, Andersons Flat beds, and serpentinite (e.g. Trevena) (Ashley & Hartshorn, 1988).

Veins are fault- or joint-controlled and are mostly planar. Host structural sites are mostly transgressive to cleavage and bedding planes. Two generations of veining are common (Ashley & Hartshorn,1988). Some reefs are characterised by development of wallrock stockwork in shear zones. Disseminated zones are up to 7.6 m wide. (Weber, 1979a; Gilligan & Brownlow, 1987; Ashley & Hartshorn, 1988).

Gold-bearing Tertiary gravels (Type d) above) are of wide areal extent and up to 30 m thick. Host gravels consist of pebbles and boulders up to 3 m in diameter of slate, serpentinite, jasper and quartzite within a sandy and clayey matrix. The main localities worked were Mount Ephraim, Sheba/Red Hill/Mount Misery etc, and Cemetery Hill/Harden Hill. (Markham, 1975; Weber, 1979a).

Recent alluvial deposits (Type e) above) were worked at numerous localities along present-day stream channels draining W or NW into the Peel River. Boulder and cobble conglomerates on terraces of the Peel River were worked at Kinbalu and Golden Bar & Brumby Charlie. (Markham, 1975; Weber, 1979a).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Ashley P.M., Hartshorn G.K., 1988
Geological and geochemical characteristics of lode gold deposits in the Nundle Goldfield, northeastern New South Wales. IN Kleeman J.D.(ed) - New England Orogen - tectonics and metallogenesis. Proceedings of symposium, Armidale, November,
University of New England. Department of Geology and Geophysics
1v P249-263

Barnes R.G., Brown R.E., Brownlow J.W., Gilligan L.B., Krynen J., Willis I.L., 1988
A review of the mineral deposits of the New England Orogen in New South Wales. IN Kleeman J.D.(ed) - New England Orogen - tectonics and metallogenesis. Proceedings of symposium, University of New England, November, 1988.
University of New England. Department of Geology and Geophysics
1v P211-227

Benson W.F., 1914
The geology and petrology of the Great Serpentinite Belt of New South Wales. Part 2. The geology of the Nundle district.
Linnean Society of New South Wales. Proceedings
38 P569-596

Clift D.S.L., 1975
Gold dredging in New South Wales.
Geological Survey of New South Wales. Mineral Resources
41

Gilligan L.B., Cameron R.G., 1981
An index of mineral deposits on the Tamworth and Hastings 1:250 000 sheets.
Geological Survey of New South Wales. Report
GS1981/149

Gilligan L.B., Brownlow J.W., 1987
Tamworth-Hastings 1:250 000 metallogenic map. Sheets SH 56-13, SH 56-14 (plus parts of SI 56-1 and SI 56-2). Mineral deposit data sheets and metallogenic study.
Geological Survey of New South Wales. Metallogenic Map Series

1v

Gilligan L.B., Brownlow J.W., Cameron R.G., 1987
Tamworth-Hastings, New South Wales, 1:250 000 metallogenic series map. Sheets SH 56-13, SH/56-14, 1st edition.
Geological Survey of New South Wales. Metallogenic Map Series
1v

Hartshorn G.K., 1986
The geology of the Nundle goldfield in the Hanging Rock district, northeastern N.S.W. B.Sc. (Hons) thesis.
University of New England. Unpublished
1v

Lloyd A.C., 1936
Hanging Rock goldfield.
New South Wales. Department of Mines. Annual Report
1935 P89-92

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1975
Gold deposits of the New England Fold Belt.
Geological Survey of New South Wales. Report
GS1975/378

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

Weber C.R., 1979
The Nundle gold field, New South Wales.
Geological Survey of New South Wales. Quarterly Notes
37 P2-14

Weber C.R., 1979
Mineral resources assessment and geology of the Nundle goldfield, NSW.
Geological Survey of New South Wales. Report
GS1979/032

Weber C.R., Paterson I.B.L., 1979
The Opossum Reef, Bowling Alley Point, NSW.
Geological Survey of New South Wales. Report
GS1979/001

Wilkinson C.S., 1886
Report on the Hanging Rock and Nundle goldfield.
New South Wales. Department of Mines. Annual Report
1885 Appendix C P132-136

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 53 UPPER HUNTER

DEPOSIT IDENTIFICATION:

SYNONYMS: Moonan Flat

COMMODITIES: Au, Ag, Sb

DISTRIBUTION:
Record covers numerous orebodies in narrow N-trending zone 24 km x up to 5 km W of Barrington Tops. Nos.357-420 on Tamworth-Hastings metallogenic map.

OREBODIES:
(New) Standard/Dixon/New Years Gift, Upper Hunter (D), Bluey, Fullers, Gold Diggers Creek, Golden Dream/Carters/Lady Maude, Hidden Treasure/Garry Owen, Jewellers Shop (Denison), Johnsons, Martins Creek-Tiverton, Perseverance/Omadale/Blue, Pride Of The Brook, Welcome Stranger/King Solomon etc, Welshmans/Scotchmans

MINES:
Blue, Bluey, Carters, Dixon, Ethel May, Federation, Fullers, Fullers North, Garry Owen (Wyndham), Giros, Gleam Of Hope, Gold Diggers Creek, Golden Dream, Great Britain, Hidden Treasure (Stewarts Brook), Jewellers Shop (Denison), Johnsons, King Solomon, Lady Maude, Little Nell, Maid O'Galla, Martins Creek, Mountain Maid, New Royal Standard, New Years Gift, O'Briens, Omadale, Peppertree, Perseverance, Pride Of The Brook, Scotchmans, Smails, Standard, Sugarloaf, Tiverton, Welcome Stranger, Welshmans, Wet

GROUP: -

COMMENTS:
See Deposit No.52 NUNDLE for regional setting of Tamworth Belt.

LOCATION:

LATITUDE: 31 57 LONGITUDE: 151 3
250K SHEET: SH56 13 100K SHEET: 9134

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Newcastle
LOCAL GOVERNMENT AREA (LGA): Scone

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1858	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
(New) Standard/Dixon/New Years Gift	Great Britain	Historical	Underground
(New) Standard/Dixon/New Years Gift	Standard	Historical	Underground
(New) Standard/Dixon/New Years Gift	Little Nell	Historical	Underground
(New) Standard/Dixon/New Years Gift	Mountain Maid	Historical	Underground
(New) Standard/Dixon/New Years Gift	New Years Gift	Historical	Underground
(New) Standard/Dixon/New Years Gift	New Royal Standard	Historical	Underground
(New) Standard/Dixon/New Years Gift	New Royal Standard	Historical	Surface
(New) Standard/Dixon/New Years Gift	Dixon	Historical	Underground
(New) Standard/Dixon/New Years Gift	Wet	Historical	Underground
Bluey	Bluey	Historical	Underground
Bluey	Maid O'Galla	Historical	Underground
Bluey	Smails	Historical	Underground
Fullers	Fullers	Historical	Underground
Fullers	Fullers	Historical	Surface
Fullers	Fullers North	Historical	Underground
Fullers	Fullers North	Historical	Surface
Gold Diggers Creek	Gold Diggers Creek	Historical	Surface
Golden Dream/Carters/Lady Maude	Golden Dream	Historical	Underground
Golden Dream/Carters/Lady Maude	Carters	Historical	Underground
Golden Dream/Carters/Lady Maude	Carters	Historical	Open-Cut

Golden Dream/Carters/Lady Maude	Carters	Historical	Surface
Golden Dream/Carters/Lady Maude	Ethel May	Historical	Underground
Golden Dream/Carters/Lady Maude	Ethel May	Historical	Open-Cut
Golden Dream/Carters/Lady Maude	Ethel May	Historical	Surface
Golden Dream/Carters/Lady Maude	Lady Maude	Historical	Underground
Golden Dream/Carters/Lady Maude	Lady Maude	Historical	Surface
Hidden Treasure/Garry Owen	Hidden Treasure (Stewarts Brook)	Historical	Underground
Hidden Treasure/Garry Owen	Garry Owen (Wyndham)	Historical	Underground
Jewellers Shop (Denison)	Jewellers Shop (Denison)	Historical	Underground
Jewellers Shop (Denison)	Jewellers Shop (Denison)	Historical	Open-Cut
Jewellers Shop (Denison)	Jewellers Shop (Denison)	Historical	Surface
Johnsons	Johnsons	Historical	Underground
Martins Creek-Tiverton	Martins Creek	Historical	Underground
Martins Creek-Tiverton	Peppertree	Historical	Underground
Martins Creek-Tiverton	Tiverton	Historical	Underground
Martins Creek-Tiverton	Tiverton	Historical	Open-Cut
Martins Creek-Tiverton	Tiverton	Historical	Surface
Perseverance/Omadale/Blue	Perseverance	Historical	Underground
Perseverance/Omadale/Blue	Omadale	Historical	Underground
Perseverance/Omadale/Blue	Omadale	Historical	Surface
Perseverance/Omadale/Blue	Blue	Historical	Underground
Perseverance/Omadale/Blue	Blue	Historical	Surface
Pride Of The Brook	Pride Of The Brook	Historical	Underground
Welcome Stranger/King Solomon etc	Federation	Historical	Underground
Welcome Stranger/King Solomon etc	O'Briens	Historical	Underground
Welcome Stranger/King Solomon etc	Welcome Stranger	Historical	Underground
Welcome Stranger/King Solomon etc	King Solomon	Historical	Underground
Welcome Stranger/King Solomon etc	Gleam Of Hope	Historical	Underground
Welcome Stranger/King Solomon etc	Sugarloaf	Historical	Underground
Welcome Stranger/King Solomon etc	Giros	Historical	Underground
Welshmans/Scotchmans	Scotchmans	Historical	Underground
Welshmans/Scotchmans	Scotchmans	Historical	Surface
Welshmans/Scotchmans	Welshmans	Historical	Underground
Welshmans/Scotchmans	Welshmans	Historical	Surface

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 1,228
Average recovered grade reef ore 34 g/t Au; alluvial ore 6-12 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1873-1887), (1903-1906), 1858-1872, 1888-1902,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: New England Fold Belt
PROVINCE: Tamworth Belt
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Goonoo Goonoo Mudstone - Late Devonian-Early Carboniferous
LITHOLOGY: Lithic mudstone, siltstone.
RELATIONSHIP TO MINERALISATION: Host to northern part of field, including Welshmans/Scotchmans, Johnsons, & Welcome Stranger/King Solomon etc: auriferous quartz(-calcite)-sulphide veins in joints and fault and shear zones.

FORMATION NAME & AGE: Woolooma Formation - Early Carboniferous
LITHOLOGY: Lithic-feldspathic sandstone, conglomerate, siltstone, felsic-intermediate pyroclastics.
RELATIONSHIP TO MINERALISATION: Host to southern part of field, including major producers Bluey, Fullers, Martins Creek-Tiverton, Jewellers Shop

(Denison), & (New) Standard/Dixon/New Years Gift: auriferous quartz(-calcite)-sulphide veins in structurally controlled sites.

FORMATION NAME & AGE: Parry Group - Late Devonian-Early Carboniferous
LITHOLOGY: Mudstone, sandstone, conglomerate, limestone, andesitic ?sills near top.
RELATIONSHIP TO MINERALISATION: Includes Goonoo Goonoo Mudstone.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Clastic Sedimentary,
SIGNIFICANT: Volcanogenic Sedimentary

STRUCTURAL FEATURES:

MAJOR: Faulting, Shearing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

SIGNIFICANT: Fault/Fault

IGNEOUS ACTIVITY:

SIGNIFICANT: Plutonism (Granodiorite)

METAMORPHISM:
Regional metamorphic grade is up to prehnite-pumpellyite facies (Gilligan & Brownlow, 1987).

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Metamorphic auriferous quartz veins in fault/shear zones in metasediments.
MINOR: Alluvial.

STYLE:

MAJOR: Discordant, Stratabound

DIMENSIONS/ORIENTATION:

OREBODY: (New) Standard/Dixon/New Years Gift

		MIN	AVE	MAX
STRIKE LENGTH	(m)			260.0
TRUE WIDTH	(cm)		15.0	100.0
VERTICAL DEPTH	(m)			300.0
		ANGLE (deg.)		DIRECTION
DIP		90,-		
STRIKE		022,057		

OREBODY: Upper Hunter (D)

		MIN	AVE	MAX
TRUE WIDTH	(cmm)		30.0	200.0

OREBODY: Bluey

		MIN	AVE	MAX
STRIKE LENGTH	(m)			213.0
TRUE WIDTH	(cm)	25.0		150.0
VERTICAL DEPTH	(m)			122.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		W
STRIKE		010		

OREBODY: Fullers

		MIN	AVE	MAX
TRUE WIDTH	(cm)	15.0	45.0	125.0
		ANGLE (deg.)		DIRECTION
DIP		90		
STRIKE		042		

OREBODY: Golden Dream/Carters/Lady Maude

		MIN	AVE	MAX
TRUE WIDTH	(cm)	10.0	25.0	30.0
VERTICAL DEPTH	(m)			100.0

		ANGLE (deg.)		DIRECTION
DIP		85		E
STRIKE		057		

OREBODY: Hidden Treasure/Garry Owen

		MIN	AVE	MAX
TRUE WIDTH	(cm)		30.0	150.0
		ANGLE (deg.)		DIRECTION
STRIKE		027		

OREBODY: Jewellers Shop (Denison)

		MIN	AVE	MAX
TRUE WIDTH	(cm)			30.0
		ANGLE (deg.)		DIRECTION
DIP		70		W
STRIKE		047		

OREBODY: Johnsons

		ANGLE (deg.)		DIRECTION
DIP		90		
STRIKE		072,112		

OREBODY: Martins Creek-Tiverton

		MIN	AVE	MAX
STRIKE LENGTH	(m)	40.0		120.0
TRUE WIDTH	(cm)		30.0	
DEPTH OXIDATION	(m)		55.0	
		ANGLE (deg.)		DIRECTION
DIP		75,-		S
STRIKE		107,039		

OREBODY: Perseverance/Omadale/Blue

		MIN	AVE	MAX
STRIKE LENGTH	(m)	244.0		700.0
TRUE WIDTH	(cm)		15.0	20.0
VERTICAL DEPTH	(m)	18.0		
		ANGLE (deg.)		DIRECTION
DIP		-,75-90		E,N
STRIKE		160,102		

OREBODY: Pride Of The Brook

		MIN	AVE	MAX
STRIKE LENGTH	(m)			30.0
TRUE WIDTH	(cm)			60.0
VERTICAL DEPTH	(m)			35.0
		ANGLE (deg.)		DIRECTION
STRIKE		022		

OREBODY: Welcome Stranger/King Solomon etc

		MIN	AVE	MAX
TRUE WIDTH	(cm)	30.0		45.0
		ANGLE (deg.)		DIRECTION
DIP		-,75-90,-,-		NE
STRIKE		040,060,120,147		

OREBODY: Welshmans/Scotchmans

		MIN	AVE	MAX
TRUE WIDTH	(cm)	90.0		120.0
STRIKE LENGTH	(m)			500.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		
STRIKE		80-90		

ORE TEXTURE:

NATURE OF MINERALISATION:

PRIMARY ORE: Fault/Shear-Filling, Vein (Reef),
SECONDARY ORE: Detrital (Alluvial), Supergene Enrichment

MINERALOGY:

OREBODY: Upper Hunter (D)

Sulphide zone: pyrite, (arsenopyrite, chalcopyrite, silver).
Oxide zone: (gold, limonite).

Gangue: quartz(+-calcite). (Gilligan & Brownlow, 1987).
Grade decreased sharply at depth (Lishmund, 1973).

CONTROLS OF MINERALISATION:

PRINCIPAL SOURCES: Gilligan (1981), Gilligan & Brownlow (1987).

Mineralisation shows an apparent regional stratigraphic control and a strong structural control (Gilligan & Brownlow, 1987).

i) A regional stratigraphic control is indicated by the almost exclusive concentration of gold orebodies in the Late Devonian host rocks in preference to Carboniferous rocks (Gilligan, 1981), which may indicate a source rock control.

ii) Mineralisation occurs in fault breccia and shear zones related to a regional NNE fracture system which post-dates regional folding Gilligan, 1981; Gilligan & Brownlow, 1987).
As emplacement of aplite dykes presumed to be comagmatic with the Barrington Tops Granodiorite was also controlled by the NNE fracture system, Gilligan & Brownlow (op.cit) concluded that the host structures to gold mineralisation pre-dated intrusion of the granodiorite.

iii) Vitrinite phytoclast reflectance data indicate a correlation between gold mineralisation and high reflectance (Baker, 1983, reported by Gilligan & Brownlow, 1987). If, as suggested by Baker (op.cit), the reflectance anomalies correspond to apophyses of granodiorite at shallow depth, a genetic link between gold and granodiorite may be indicated. However the stratigraphic distribution of deposits argues against the intrusive being a direct source of gold. (Gilligan & Brownlow, 1987).

GENETIC MODELS:

PRINCIPAL SOURCES: Lishmund (1973), Markham & Basden (1974), Markham (1975), Gilligan (1981), Gilligan & Brownlow (1987).

Lishmund (1973) suggested that the Upper Hunter group of deposits were simple quartz veins derived from the Barrington Tops Granodiorite.

Markham (1975) described the orebodies as fissure and replacement veins localised in shear zones.

Markham & Basden (1974) considered Upper Hunter in a regional context, noting a radial spatial distribution of base metal, gold, and antimony mineralisation around the Barrington Tops Granodiorite, suggesting a geothrmal grading with increasing distance from the intrusion.
Markham & Basden (op.cit) advanced the alternative suggestion that the mineral zones may represent several overlapping mineral associations, the base metals being derived from the granodiorite, but the gold possibly being of metamorphic hydrothermal origin.

Gilligan & Brownlow (1987) proposed a metamorphic hydrothermal model:-
i) intrusion of the Barrington Tops Granodiorite into deformed Devonian and Carboniferous sediments provided a thermal flux to drive hot waters through the sediment pile.
ii) auriferous pyrite was leached from enriched Late Devonian sediments and deposited in pre-existing structural sites.
The fluid pressure could have buoyed open pre-existing fractures, allowing deposition of quartz, pyrite, and gold, which could have been precipitated in response to falling hydrostatic pressure (Gilligan, 1981; Gilligan & Brownlow, 1987).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Upper Hunter (D)

PRINCIPAL SOURCES: Lishmund (1973), Markham & Basden (1974), Markham (1975), Gilligan & Brownlow (1987), Gilligan & others (1987).
SUMMARY

Upper Hunter lies in the south-central part of the Tamworth Belt. Mineralisation comprised auriferous quartz(-calcite)-sulphide veins in fault and shear zones within Late Devonian-Early Carboniferous mudstones and lithic-feldspathic sandstones of the Goonoo Goonoo Mudstone and Woolooma Formation. Alluvial deposits were not significant.

REGIONAL SUCCESSION & ASSOCIATED MINERALISATION: UPPER HUNTER
PRINCIPAL SOURCES: Gilligan & Brownlow (1987), Gilligan & others (1987).

1./ Tamworth Group (Det on Tamworth-Hastings metallogenic map) (Early-Middle Devonian) - cherty argillite, sandstone, conglomerate, limestone, tuff, keratophyre, basalt, dolerite.
2./ Goonoo Goonoo Mudstone (Dcp) (formation of Parry Group) (Late Devonian-Early Carboniferous) - lithic mudstone, siltstone.
Host to orebodies in northern part of field, including among the larger

producers Welshmans/Scotchmans, Johnsons, and Welcome Stranger/King Solomon etc.
3./ Woolooma Formation (Cem) (Early Carboniferous) - lithic-feldspathic sandstone, conglomerate, siltstone, felsic-intermediate pyroclastics.
Host to orebodies in southern part of field, including major producers (New) Standard/Dixon/NewYears Gift, Fullers, Jewellers Shop (Denison), Bluey, and Martins Creek-Tiverton.
Woolooma Formation is intruded several km E of field by:-
4./ Barrington Tops Granodiorite (Pnb) (Late Permian) - granodiorite, minor adamellite, microgranite.
In topographically high areas both sediments and intrusives are overlain by:-
5./ Liverpool Range Beds, Comboyne Basalt (Tv) (Tertiary) - basalt, dolerite, sediments. Units form extensive regional cappings within and to N and E of Upper Hunter district.

GEOLOGICAL SETTING: UPPER HUNTER
PRINCIPAL SOURCES: Lishmund (1973), Markham & Basden (1974), Markham (1975), Gilligan (1981), Gilligan & Brownlow (1987), Gilligan & others (1987).

The Upper Hunter field consists of at least 65 reefs in a narrow N-trending zone W of Barrington Tops.
Host rocks are sequences of essentially uncleaved lithic mudstone, siltstone, lithic-feldspathic sandstone, and conglomerate (Gilligan & Brownlow, 1987).
The sequence is intruded by the Barrington Tops Granodiorite and by presumably comagmatic aplite dykes (Gilligan & Brownlow, 1987).
Host rocks are folded about a N-trending axial surface (Gilligan, 1981).
The Devonian and Carboniferous sediments are transected by regional faults which generally trend NE, also N and E (Gilligan, 1981).
The fault zones have been imposed on the folded fabric (Gilligan, 1981).
Aplite dyke emplacement was controlled, at least in part, by the NE fracture system, which on that basis pre-dates intrusion of the Barrington Tops Granodiorite (Gilligan & Brownlow, 1987).
The goldfield is localised on or near major NNW-trending faults across the faulted contacts between Woolooma Formation and Goonoo Goonoo Mudstone (Gilligan & others, 1987).

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Lishmund (1973), Markham & Basden (1974), Markham (1975), Gilligan & Brownlow (1987).

The orebodies occurred as pyritic quartz(+-calcite) veins localised in planar joints, fault zones and shear zones that are oblique to the trend of the hinge surface of the folded sediments (Gilligan & Brownlow, 1987). The host structures are therefore inferred to post-date folding (Gilligan & Brownlow, op.cit).
The lode structures parallel the regional fracture system, striking dominantly NNE, also N and E (Gilligan & Brownlow, 1987).

The orebodies occur in two largely distinct areas (Lishmund, 1973):- a southerly group characterised by dominantly NNE strikes and sub-vertical dips; and a northerly group displaying varying orientations. (Antimony deposits occur geographically between the two groups).

Orebodies may consist of breccia zones, zones of intense shearing, or discrete quartz-calcite veins. The quartz veins are commonly irregular, with pinch-and-swell structures. (Gilligan & Brownlow, 1987).
Gold values were reportedly higher in mudstone-hosted veins or shoots than in those in interbedded coarser sediments (Lishmund, 1973).
Disseminated pyrite and gold occurred in the mudstones adjacent to veins (Lishmund, op.cit).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Barnes R.G., Brown R.E., Brownlow J.W., Gilligan L.B., Krynen J., Willis I.L., 1988
A review of the mineral deposits of the New England Orogen in New South Wales. IN Kleeman J.D.(ed) - New England Orogen - tectonics and metallogenesis. Proceedings of symposium, University of New England, November, 1988.
University of New England. Department of Geology and Geophysics
1v P211-227

Gilligan L.B., 1981
Notes on some auriferous deposits in the Upper Hunter gold field.
Geological Survey of New South Wales. Report
GS1981/107

Gilligan L.B., Cameron R.G., 1981
An index of mineral deposits on the Tamworth and Hastings 1:250 000 sheets.
Geological Survey of New South Wales. Report
GS1981/149

Gilligan L.B., 1986
Precious metal mineralization in the New England region. IN Geological setting of precious metals in New South Wales. One-day symposium, Sydney, October 1986. Abstracts.
Geological Society of Australia
18

Gilligan L.B., Brownlow J.W., 1987
Tamworth-Hastings 1:250 000 metallogenic map. Sheets SH 56-13, SH 56-14 (plus parts of SI 56-1 and SI 56-2). Mineral deposit data sheets and metallogenic study.
Geological Survey of New South Wales. Metallogenic Map Series
1v

Gilligan L.B., Brownlow J.W., Cameron R.G., 1987
Tamworth-Hastings, New South Wales, 1:250 000 metallogenic series map. Sheets SH 56-13, SH/56-14, 1st edition.
Geological Survey of New South Wales. Metallogenic Map Series
1v

Lishmund S.R., 1973
The Upper Hunter gold field.
Geological Survey of New South Wales. Records
15(2) P109-162

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1975
Gold deposits of the New England Fold Belt.
Geological Survey of New South Wales. Report
GS1975/378

ooooooooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 54 COPELAND (BARRINGTON)

DEPOSIT IDENTIFICATION:

SYNONYMS: Barrington

COMMODITIES: Au, Ag

DISTRIBUTION:
Record covers numerous orebodies in two main parallel N-trending zones 20 km x up to 5 km, and one smaller zone, within an area 20 km x 20 km E of Barrington Tops. Nos.434-537 on Tamworth-Hastings metallogenic map.

OREBODIES:
Copeland (Barrington) (D), Anderson (C), Centennial&Golden Crown/Town&Country(C), Cobark, Commonwealth (CC), Commonwealth Creek, Copeland, Craven Plateau (IXL), Federation (UB), Gloucester River, Golden Crystal (CC), Golden Spur (C), Hidden Treasure (C), Kerripit (Rawdon Vale), Kin San (CC), Mechanics (C), Melbourne (C), Mount Copeland (C), Mount Peerless (UB), Mountain Maid (C), Rainbow (C), Rose & Thistle (C), Saxbys (UB), The Mint (C), Tuckers Creek, Upper Bowman

MINES:
Albion, Anderson (Lady Belmore), Barrington River, Barrys, Benduck, Bonanza, Boranel, Boranel Creek, Buckleys, Cantwells, Capulet, Centennial & Golden Crown, Christmas Box, Commonwealth (Cravens Creek), Exhibition, Federation, Fitzgeralds, Germania, Gloucester River, Golden Consuls, Golden Crown, Golden Crystal, Golden Spur Northern, Golden Spur Southern, Great Cobark, Harris, Hidden Treasure, Holmes Brothers, Homeward Bound, IXL, Kerripit, Kerripit River, Kin San (Bartletts), Lady Lizzie, Lady Loftus, Lady Mary, Lady Matilda, Masonic (Golden Eagle), Mechanics, Melbourne, Millers, Mount Bromley, Mount Copeland, Mount Peerless, Mountain Hero, Mountain Maid, Mountain Rose, Murphys, New Year, Prince Edward, Queen Of Beauty, Rainbow, Red Hill, Riddicks, Rose & Thistle (Sydney Flag), Royal Bengal Tiger, Sawyers, Saxbys (Bowman River), The Bank, The Mint, Town & Country, Tuckers Creek, Wealth Of Nations, Yellokok

GROUP: -

COMMENTS:
See Deposit No.52 NUNDLE for regional setting of Tamworth Belt.

LOCATION:

LATITUDE: 32 0	LONGITUDE: 151 49
250K SHEET: SH56 14	100K SHEET: 9234

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1876	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Anderson (C)	Anderson (Lady Belmore)	Historical	Underground
Anderson (C)	Anderson (Lady Belmore)	Historical	Surface
Centennial&Golden Crown/Town&Country(C)	Centennial & Golden Crown	Historical	Underground
Centennial&Golden Crown/Town&Country(C)	Town & Country	Historical	Underground
Cobark	Golden Crown	Historical	Underground
Cobark	Golden Crown	Historical	Surface
Cobark	Great Cobark	Historical	Underground
Cobark	Masonic (Golden Eagle)	Historical	Underground
Cobark	Masonic (Golden Eagle)	Historical	Surface
Cobark	Mountain Hero	Historical	Underground
Cobark	Mountain Hero	Historical	Surface
Cobark	Capulet	Historical	Underground
Cobark	Bonanza	Historical	Underground
Cobark	Bonanza	Historical	Surface
Cobark	Fitzgeralds	Historical	Underground

Cobark	Fitzgeralds	Historical	Surface
Cobark	Lady Loftus	Historical	Underground
Commonwealth (CC)	Commonwealth (Cravens Creek)	Historical	Underground
Craven Plateau (IXL)	IXL	Historical	Underground
Federation (UB)	Federation	Historical	Underground
Gloucester River	Gloucester River	Historical	Underground
Gloucester River	Gloucester River	Historical	Surface
Golden Crystal (CC)	Golden Crystal	Historical	Underground
Golden Crystal (CC)	Golden Crystal	Historical	Surface
Golden Spur (C)	Christmas Box	Historical	Underground
Golden Spur (C)	Christmas Box	Historical	Dredging &/Or Sluicing
Golden Spur (C)	Germania	Historical	Underground
Hidden Treasure (C)	Hidden Treasure	Historical	Underground
Kerripit (Rawdon Vale)	Boranel Creek	Historical	Underground
Kerripit (Rawdon Vale)	Boranel Creek	Historical	Dredging &/Or Sluicing
Kerripit (Rawdon Vale)	Boranel	Historical	Underground
Kerripit (Rawdon Vale)	Barrington River	Historical	Underground
Kerripit (Rawdon Vale)	Yellokok	Historical	Underground
Kerripit (Rawdon Vale)	Albion	Historical	Underground
Kerripit (Rawdon Vale)	Cantwells	Historical	Underground
Kerripit (Rawdon Vale)	Benduck	Historical	Underground
Kerripit (Rawdon Vale)	Kerripit	Historical	Underground
Kerripit (Rawdon Vale)	Barryr	Historical	Underground
Kerripit (Rawdon Vale)	Kerr[illegible]t River	Historical	Underground
Kerripit (Rawdon Vale)	Kerripit River	Historical	Surface
Kin San (CC)	Kin San (Bartletts)	Historical	Underground
Mechanics (C)	Mechanics	Historical	Underground
Melbourne (C)	Melbourne	Historical	Underground
Melbourne (C)	Sawyers	Historical	Underground
Mount Copeland (C)	Exhibition	Historical	Underground
Mount Copeland (C)	Homeward Bound	Historical	Underground
Mount Copeland (C)	Mount Copeland	Historical	Underground
Mount Peerless (UB)	Mount Peerless	Historical	Underground
Mount Peerless (UB)	Mount Peerless	Historical	Surface
Mountain Maid (C)	Murphys	Historical	Underground
Mountain Maid (C)	Mountain Maid	Historical	Underground
Mountain Maid (C)	Lady Lizzie	Historical	Underground
Rainbow (C)	Rainbow	Historical	Underground
Rose & Thistle (C)	Red Hill	Historical	Underground
Rose & Thistle (C)	Rose & Thistle (Sydney Flag)	Historical	Underground
Rose & Thistle (C)	Buckleys	Historical	Underground
Rose & Thistle (C)	Buckleys	Historical	Surface
Rose & Thistle (C)	Millers	Historical	Underground
Rose & Thistle (C)	Millers	Historical	Surface
Rose & Thistle (C)	Prince Edward	Historical	Underground
Rose & Thistle (C)	Mount Bromley	Historical	Underground
Rose & Thistle (C)	Lady Matilda	Historical	Underground
Rose & Thistle (C)	Royal Bengal Tiger	Historical	Underground
Rose & Thistle (C)	Mountain Rose	Historical	Underground
Saxbys (UB)	Saxbys (Bowman River)	Historical	Underground
Saxbys (UB)	Saxbys (Bowman River)	Historical	Surface
The Mint (C)	The Mint	Historical	Underground
The Mint (C)	The Mint	Historical	Open-Cut
The Mint (C)	The Bank	Historical	Underground
The Mint (C)	New Year	Historical	Underground
The Mint (C)	Queen Of Beauty	Historical	Underground
Tuckers Creek	Tuckers Creek	Historical	Underground
Tuckers Creek	Tuckers Creek	Historical	Surface
Tuckers Creek	Tuckers Creek	Historical	Dredging &/Or Sluicing
Upper Bowman	Lady Mary	Historical	Underground
Upper Bowman	Wealth Of Nations	Historical	Underground
Upper Bowman	Wealth Of Nations	Historical	Surface
Upper Bowman	Harris	Historical	Underground
Upper Bowman	Riddicks	Historical	Underground
Upper Bowman	Riddicks	Historical	Surface
Upper Bowman	Holmes Brothers	Historical	Underground

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 2,867
Recovered grades (reef ore) mostly in range 20-60 g/t Au, average 42 g/t Au, locally >80 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1887-1907), 1876-1886,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: New England Fold Belt
PROVINCE: Tamworth Belt
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Bowman Beds - Late Devonian-Early Carboniferous
LITHOLOGY: Laminated siltstone, sandstone, minor limestone.
RELATIONSHIP TO MINERALISATION: Host to majority of orebodies of field, including those at Copeland, Upper Bowman, Tuckers Creek, Cobark, Kerripit (Rawdon Vale), & Gloucester River: auriferous quartz(-calcite)-sulphide veins in fracture and shear zones.

FORMATION NAME & AGE: Tamworth Group - Early-Middle Devonia.
LITHOLOGY: Cherty argillite, sandstone, conglomerate, limestone, tuff, keratophyre, basalt, dolerite.
RELATIONSHIP TO MINERALISATION: Host to some orebodies, princ:_.ally at Commonwealth Creek and Craven Plateau (IXL), in fracture/shear zones and bedding planes.

FORMATION NAME & AGE: Parry Group - Late Devonian-Early Carboniferous
LITHOLOGY: Mudstone, sandstone, conglomerate, limestone, andesitic ?sills near top.
RELATIONSHIP TO MINERALISATION: Bowman beds is equivalent of Parry Group.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to alluvial mineralisation.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Clastic Sedimentary,
SIGNIFICANT: Volcanogenic Sedimentary

STRUCTURAL FEATURES:

MAJOR: Fracturing, Shearing,
SIGNIFICANT: Fold Axis

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

SIGNIFICANT: Plutonism (Granodiorite)

METAMORPHISM:

Regional metamorphic grade is up to prehnite-pumpellyite facies (Gilligan & Brownlow, 1987).

DEPOSIT CHARACTERISTICS:

TYPES:

MAJOR: Alluvial.
Metamorphic auriferous quartz veins in fault/shear zones in metasediments.
SIGNIFICANT: Stratabound conformable auriferous quartz veins in metasediments.

STYLE:

MAJOR: Discordant, SIGNIFICANT: Conformable, Stratabound

DIMENSIONS/ORIENTATION:

OREBODY: Copeland (Barrington) (D)

	MIN	AVE	MAX

		MIN	AVE	MAX
VERTICAL DEPTH	(m)			180.0

OREBODY: Anderson (C)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			182.0
TRUE WIDTH	(cm)	10.0		60.0
VERTICAL DEPTH	(m)			40.0
		ANGLE (deg.)		DIRECTION
DIP		72,-		SE
STRIKE		045,090		

OREBODY: Centennial&Golden Crown/Town&Country(C)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			447.0
TRUE WIDTH	(cm)	15.0		183.0
VERTICAL DEPTH	(m)			190.0
		ANGLE (deg.)		DIRECTION
DIP		40-45		W
STRIKE		180		

OREBODY: Cobark

		MIN	AVE	MAX
STRIKE LENGTH	(m)	100.0		180.0
TRUE WIDTH	(cm)	30.0		500.0
VERTICAL DEPTH	(m)	10.0		60.0
		ANGLE (deg.)		DIRECTION
DIP		-,-,75,75,35		W,-,N,N,W
STRIKE		32,55,72,92,10		

OREBODY: Commonwealth (CC)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			150.0
TRUE WIDTH	(cm)	10.0		15.0
VERTICAL DEPTH	(m)			24.0
		ANGLE (deg.)		DIRECTION
DIP		55		W
STRIKE		180		

OREBODY: Commonwealth Creek

		MIN	AVE	MAX
STRIKE LENGTH	(m)			200.0
TRUE WIDTH	(cm)	30.0	60.0	120.0
VERTICAL DEPTH	(m)			53.0
		ANGLE (deg.)		DIRECTION
DIP		45, 55		SE, W
STRIKE		045, 180		

OREBODY: Craven Plateau (IXL)

		MIN	AVE	MAX
TRUE WIDTH	(cm)	15.0		33.0
VERTICAL DEPTH	(m)			17.0
STRIKE LENGTH	(m)			120.0
DEPTH OXIDATION	(m)		13.0	
		ANGLE (deg.)		DIRECTION
DIP		75-90		S
STRIKE		090		

OREBODY: Federation (UB)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			250.0
TRUE WIDTH	(cm)	20.0		25.0
VERTICAL DEPTH	(m)			128.0
		ANGLE (deg.)		DIRECTION
DIP		85-90		E
STRIKE		315		

OREBODY: Gloucester River

		MIN	AVE	MAX
STRIKE LENGTH	(m)			60.0
TRUE WIDTH	(m)	5.0		
VERTICAL DEPTH	(m)			60.0
		ANGLE (deg.)		DIRECTION
STRIKE		110		

OREBODY: Golden Crystal (CC)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			140.0
VERTICAL DEPTH	(m)			23.0

OREBODY: Golden Spur (C)

		MIN	AVE	MAX
STRIKE LENGTH	(m)	30.0		300.0
TRUE WIDTH	(cm)	10.0		110.0
VERTICAL DEPTH	(m)			115.0
		ANGLE (deg.)		DIRECTION
DIP		38		SE
STRIKE		075		

OREBODY: Hidden Treasure (C)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			120.0
TRUE WIDTH	(cm)	15.0		300.0
VERTICAL DEPTH	(m)			190.0
		ANGLE (deg.)		DIRECTION
DIP		45		SW
STRIKE		340		

OREBODY: Kerripit (Rawdon Vale)

		MIN	AVE	MAX
STRIKE LENGTH	(m)	30.0		240.0
TRUE WIDTH	(cm)	0.5	5.0	30.0
VERTICAL DEPTH	(m)	6.0		67.0
		ANGLE (deg.)		DIRECTION
STRIKE		45,70,90,135,00		

OREBODY: Kin San (CC)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			30.0
VERTICAL DEPTH	(m)			53.0

OREBODY: Mechanics (C)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			300.0
TRUE WIDTH	(cm)	15.0	45.0	75.0
VERTICAL DEPTH	(m)			100.0
		ANGLE (deg.)		DIRECTION
DIP				SE,-
STRIKE		067,090		

OREBODY: Melbourne (C)

		MIN	AVE	MAX
STRIKE LENGTH	(m)	67.0		200.0
TRUE WIDTH	(cm)	3.0		30.0
VERTICAL DEPTH	(m)	30.0		40.0
		ANGLE (deg.)		DIRECTION
DIP				E,W
STRIKE		022,162		

OREBODY: Mount Copeland (C)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			200.0
TRUE WIDTH	(cm)	30.0	60.0	130.0
VERTICAL DEPTH	(m)			60.0
		ANGLE (deg.)		DIRECTION
DIP		60,75-90		W,SE
STRIKE		052,062		

OREBODY: Mount Peerless (UB)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			180.0
TRUE WIDTH	(cm)			70.0
VERTICAL DEPTH	(m)			56.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		NE
STRIKE		315		

OREBODY: Mountain Maid (C)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			305.0
TRUE WIDTH	(cm)	10.0	15.0	60.0
VERTICAL DEPTH	(m)			180.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		SE
STRIKE		045		

OREBODY: Rainbow (C)

		MIN	AVE	MAX
TRUE WIDTH	(cm)	30.0		43.0
STRIKE LENGTH	(m)	100.0		
VERTICAL DEPTH	(m)			43.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		SE
STRIKE		059		

OREBODY: Rose & Thistle (C)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			550.0
TRUE WIDTH	(cm)	5.0	60.0	200.0
VERTICAL DEPTH	(m)			30.0
		ANGLE (deg.)		DIRECTION
DIP		75-90,70		W,N
STRIKE		025-040,090		

OREBODY: Saxbys (UB)

		MIN	AVE	MAX
TRUE WIDTH	(cm)			45.0
STRIKE LENGTH	(m)			240.0
VERTICAL DEPTH	(m)			52.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		E
STRIKE		022		

OREBODY: The Mint (C)

		MIN	AVE	MAX
STRIKE LENGTH	(m)			300.0
TRUE WIDTH	(cm)	38.0		100.0
VERTICAL DEPTH	(m)			43.0
		ANGLE (deg.)		DIRECTION
DIP		-,12		SW
STRIKE		072,135		

OREBODY: Tuckers Creek

		MIN	AVE	MAX
TRUE WIDTH	(cm)			30.0
VERTICAL DEPTH	(m)			18.0
		ANGLE (deg.)		DIRECTION
DIP		-,55,-		-,NE,-
STRIKE		90,157,180		

OREBODY: Upper Bowman

		MIN	AVE	MAX
STRIKE LENGTH	(m)			90.0
TRUE WIDTH	(m)			25.0
VERTICAL DEPTH	(m)			17.0
		ANGLE (deg.)		DIRECTION
STRIKE		115, 165		

ORE TEXTURE:

NATURE OF MINERALISATION:
PRIMARY ORE: Dissemination, Fault/Shear-Filling, Multiple Veins, Pipe, Vein (Reef),
SECONDARY ORE: Detrital (Alluvial), Supergene Enrichment

MINERALOGY:

OREBODY: Copeland (Barrington) (D)
Sulphide zone: (pyrite, arsenopyrite, cerargyrite, chalcopyrite, sphalerite, galena).
Oxide zone: (gold).
Gangue: quartz+-calcite, (muscovite, chlorite, sericite).
(Gilligan & Brownlow, 1987).

Grade decreased sharply at depth (Markham & Basden, 1974).

CONTROLS OF MINERALISATION:

PRINCIPAL SOURCES: Markham & Basden (1974), Gilligan & Brownlow (1987).

Controls are apparently both stratigrap'ic and structural.

i) The restriction of gold deposits to the Late Devonian-Early Carboniferous rocks may indicate a regional host rock control on gold source (Gilligan & Brownlow, 1987).
ii) The regional stratigraphic ... rol may be attributable to either anomalous gold concentration (probably as auriferous pyrite) in the host horizon, or the presence of thinly interbedded units of markedly differing viscosity, allowing bedding plane slip and separation during folding, and localisation of quartz veins (Gilligan & Brownlow, 1987).
iii) Structures controlling mineralisation are faults, joints, shear zones, and bedding plane contacts. (Gilligan & Brownlow, 1987).

GENETIC MODELS:

PRINCIPAL SOURCES: Markham & Basden (1974), Gilligan & Brownlow (1987).

Markham & Basden (1974) considered Copeland (Barrington) in a regional context, noting a regional concentric zoning of mineral deposits around the Barrington Tops Granodiorite, with an apparent outwards grading from base metals to gold to antimony.
Markham & Basden (1974) advanced a possible alternative formation by dewatering of 'aty sediments and movement of hot gold-bearing alkaline brines.

Gilligan & Brownlow (1987) suggested a multi-stage model in which gold was remobilised from sediments and emplaced in previously prepared structural sites:-
i) Folding and faulting prior to the intrusion of Barrington Tops Granodiorite resulted in the development of structurally favourable sites for later deposition of gold mineralisation.
ii) Intrusion of granitoids provided a thermal flux to drive hydrothermal fluids through the sediment pile.
iii) Hydrothermal fluids leached gold and pyrite from carbonaceous, pyritic, and cherty sediments.
iv) Emplacement of mineralisation occurred in fault and shear zones and bedding plane surfaces that were opened by the fluid pressure of the hydrothermal solutions.

In the case of bedding plane contacts, gaping at lithological boundaries facilitated localisation of quartz veins. The gaping is consistent with folding by flexural slip. During folding, failure may have occurred in the hinge area of the major anticline, resulting in mobilisation of quartz and gold mineralisation into fault zones.
Hydrofracturing accompanying introduction of hydrothermal fluids could have produced the observed breccias in the lode rocks, which would then be of hydraulic rather than tectonic origin (Gilligan & Brownlow, 1987).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Copeland (Barrington) (D)

PRINCIPAL SOURCES: Markham & Basden (1974), Markham (1975), Gilligan & Brownlow (1987), Gilligan & others (1987).

SUMMARY

Copeland (Barrington) lies in the southeastern section of the Tamworth Belt. For the purpose of this report, the following centres in the area E of the Barrington Tops Granodiorite are grouped as the deposit Copeland (Barrington):- Copeland, Upper Bowman, Commonwealth Cree', Craven Plateau, Tuckers Creek, Cobark, Kerripit (Rawdon Vale), and Gloucester River. The principal orebodies of the main centres are indicated by the appropriate suffix on the orebody name:-
(C) - Copeland; (CC) - Commonwealth Creek; (UB) - Upper Bowman.
Both re... an' deposits occurred. Primary mineralisation comprised au '(-calcite)-sulphide veins in fractures or shear zones, ...ding planes, within Devonian-Carboniferous volcaniclastic the Bowman beds and, locally, the Tamworth Group.

REGIONAL SUCCESSION & ASSOCIATED MINERALISATION: COPELAND (BARRINGTON)

PRINCIPAL SOURCES: Gilligan & Brownlow (1987), Gilligan & others (1987).

1./ Tamworth Group (Det on Tamworth-Hastings metallogenic map) (Early-Middle Devonian) - see HOST ROCKS for lithology.
Host to Commonwealth Creek group of orebodies and to Craven Plateau (IXL). Conformably overlain by:-
2./ Bowman beds (Dcb) (Parry Group equivalent) (Late Devonian-Early Carboniferous) - see HOST ROCKS.

Host to majority of orebodies of Copeland (Barrington) field.
3./ Copeland Road Formation and equivalents (Ceg) (Early Carboniferous) lithic sandstone, polymictic conglomerate, mudstone, minor limestone, rhyodacitic volcanics.
4./ Johnsons Creek Conglomerate and equivalents (Clk) (Late Carboniferous) - lithic sandstone, siltstone, mudstone, conglomerate, diamictite, rhyodacite, rare coal bands.

Equivalent sequences 10 km to the W of Copeland (Barrington) are intruded by:-
5./ Barrington Tops Granodiorite (Pnb) (part of Nundle Plutonic Suite) (Late Permian) - granodiorite, minor adamellite, microgranite.
Possibly genetically related to the gold mineralisation.

GEOLOGICAL SETTING: COPELAND (BARRINGTON)
PRINCIPAL SOURCES: Markham & Basden (1974), Markham (1975), Gilligan & Brownlow (1987), Gilligan & others (1987).

In the Copeland (Barrington) area the Devonian and Carboniferous sediments are exposed in a complex series of fault blocks (Gilligan & others, 1987). Gold deposits are mainly restricted to two fault blocks of Late Devonian-Early Carboniferous Bowman beds, which are separated by blocks of younger Carboniferous sediments (Ceg, Clk) (Gilligan & Brownlow, 1987; Gilligan & others, 1987).
Some orebodies, principally those at Commonwealth Creek and Craven Plateau (IXL), are hosted by volcaniclastic sediments of the Early-Middle Devonian Tamworth Group (Gilligan & others, 1987).
The host succession is intruded to the W by the Barrington Tops Granodiorite, which forms a structural high between the Copeland (Barrington) and UPPER HUNTER (Deposit No.53) fields.
Lithologies of the host rocks are: interbedded mudstone, siltstone, lithic tuffaceous sandstone, conglomeratic sandstone, minor cherts.
The mudstone is commonly carbonaceous and volcaniclastic.
(Gilligan & Brownlow, 1987).
The sequence is folded about N-trending axial surfaces, and little or no cleavage has developed (Gilligan & Brownlow, op.cit).

The majority of deposits lie on one of two broadly NNW-trending belts: the westerly belt comprising the centres of Tuckers Creek, Cobark, Kerripit (Rawdon Vale), and Gloucester River; the easterly belt comprising the centres of Craven Plateau, Copeland, and Upper Bowman.
Commonwealth Creek lies E of the easterly belt.
(Markham, 1975; Gilligan & others, 1987).
The distribution may reflect a regional structural control (Markham, 1975 - see 'CONTROLS OF MINERALISATION').
In the Copeland area, distribution of deposits parallels stratigraphy in following a major horizon around a regional S-plunging anticline.
The Commonwealth Creek orebodies may also lie on the same horizon.
The most productive orebodies at Copeland are restricted to the hinge zone of the fold, where they are localised in discordant fault zones.
(Gilligan & Brownlow, 1987).

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Markham & Basden (1974), Markham (1975), Gilligan & Brownlow (1987), Gilligan & others (1987).

The auriferous quartz veins are largely controlled by fault or shear zones discordant to bedding, or, at Copeland and Commonwealth Creek, by bedding plane contacts (Gilligan & Brownlow, 1987).
Shearing and brecciation along veins is common (Markham, 1975).
No consistent vein orientation can be discerned (Markham, op.cit).
Orebodies which yielded >50 kg Au were:- Mountain Maid (C), Hidden Treasure (C). Centennial & Golden Crown/Town & Country (C), Anderson (C) Mount Copeland (C), Mechanics (C), and Golden Spur (C).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Baker C.J., 1981
Gold mines at Boranel Mountain, Cobark, Upper Bowman and Commonwealth Creek, west of Gloucester, NSW.
Geological Survey of New South Wales. Report
GS1981/451

Barnes R.G., Brown R.E., Brownlow J.W., Gilligan L.B., Krynen J., Willis I.L., 1988
A review of the mineral deposits of the New England Orogen in New South Wales. IN Kleeman J.D.(ed) - New England Orogen - tectonics and metallogenesis. Proceedings of symposium, University of New England, November, 1988.
University of New England. Department of Geology and Geophysics

1v P211-227

Gilligan L.B., Cameron R.G., 1981
An index of mineral deposits on the Tamworth and Hastings 1:250 000 sheets.
Geological Survey of New South Wales. Report
GS1981/149

Gilligan L.B., Brownlow J.W., 1987
Tamworth-Hastings 1:250 000 metallogenic map. Sheets SH 56-13, SH 56-14 (plus parts of SI 56-1 and SI 56-2). Mineral deposit data sheets and metallogenic study.
Geological Survey of New South Wales. Metallogenic Map Series
1v

Gilligan L.B., Brownlow J.W., Cameron R.G., 1987
Tamworth-Hastings, New South Wales, 1:250 000 metallogenic series map. Sheets SH 56-13, SH/56-14, 1st edition.
Geological Survey of New South Wales. Metallogenic Map Series
1v

Hamilton T.W., Ellis J., Florence T.M., Fardy J.J., 1983
Analysis of gold in surface waters from Australian goldfields: an investigation into direct hydrogeochemical prospecting for gold.
Economic Geology
78(7) P1335-1341

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1975
Gold deposits of the New England Fold Belt.
Geological Survey of New South Wales. Report
GS1975/378

Suppel D.W., 1966
The Tomalla gold mine.
Geological Survey of New South Wales. Report
47

oooooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 55 URALLA

DEPOSIT IDENTIFICATION:

SYNONYMS: Rocky River

COMMODITIES: Au, Sb, Ag

DISTRIBUTION:
Record covers minor reef deposits scattered over an area approx 15 km x 10 km centred on Uralla, plus secondary deposits along the Gwydir and Rocky Rivers and tributaries flowing N & W from Uralla, oc

OREBODIES:
Uralla (D), Browns, Diggers Ridge, Dohertys Hill, Frasers Find, Goldsworth, Gwydir River, Kentucky Creek, Little Gracie, Mount Jones, Mount Mutton, Mount Walsh, Rocky Creek, Rocky River, S.C. Martins, Sawpit Gully, Shanahans, Sueys, Sydney Flat

MINES:
Browns, Diggers Ridge, Dohertys Hill, Frasers Find, Goldsworth, Little Gracie, Mount Jones, Mount Mutton, Mount Walsh, S.C. Martins, Sawpit Gully

GROUP: -

COMMENTS:
See Deposit No.56 ARMIDALE-ROCKVALE for regional setting of Central Block; Deposit No.58 TIMBARRA-POVERTY POINT for setting of Permo-Triassic igneous-associated mineralisation. See Gilligan & others (1986b) for additional mining methods.

LOCATION:

LATITUDE: 30 38 LONGITUDE: 151 30
250K SHEET: SH56 10 100K SHEET: 9236

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Armidale
LOCAL GOVERNMENT AREA (LGA): Uralla

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1856	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Browns	Browns	Historical	Underground
Diggers Ridge	Diggers Ridge	Historical	Underground
Dohertys Hill	Dohertys Hill	Historical	Underground
Frasers Find	Frasers Find	Historical	Underground
Goldsworth	Goldsworth	Historical	Underground
Little Gracie	Little Gracie	Historical	Underground
Mount Jones	Mount Jones	Historical	Underground
Mount Mutton	Mount Mutton	Historical	Underground
Mount Walsh	Mount Walsh	Historical	Underground
S.C. Martins	S.C. Martins	Historical	Underground
Sawpit Gully	Sawpit Gully	Historical	Underground

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 5,192
Average recovered grade Sydney Flat deep lead 12 g/cubic m Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1886-1920), (1933-1938), 1858-1885,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: New England Fold Belt
PROVINCE: Central Block
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Uralla Plutonic Suite - Late Permian
LITHOLOGY: Biotite-hornblende granodiorite, adamellite, tonalite.
RELATIONSHIP TO MINERALISATION: Includes immediate host to primary mineralisation - Uralla Granodiorite.

FORMATION NAME & AGE: Uralla Granodiorite - Late Permian
LITHOLOGY: Biotite-hornblende granodiorite, minor adamellite.
RELATIONSHIP TO MINERALISATION: Host to primary mineralisation (minor) in veins and disseminations. Part source of extensive deep lead and alluvial deposits.

FORMATION NAME & AGE: Sandon Beds - Carboniferous
LITHOLOGY: Greywacke, argillite, chert, jasper, mafic volcanics.
RELATIONSHIP TO MINERALISATION: Host to some primary mineralisation (minor) in veins and disseminations. Part source of extensive deep lead and alluvial deposits.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to extensive deep lead and alluvial deposits.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Alluvium,
SIGNIFICANT: Granitic,
MINOR. Metasedimentary

STRUCTURAL FEATURES:

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

SIGNIFICANT: Intrusive Contact

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Granite)

METAMORPHISM:
Sandon beds are regionally metamorphosed to greenschist facies.

ALTERATION:

OREBODY: Uralla (D)
Sandon beds are thermally altered adjacent to Uralla Granodiorite.

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Alluvial.
SIGNIFICANT: Deep lead.
MINOR: Auriferous quartz veins in granitoid.
Auriferous quartz veins in metasediments adjacent to granitoid.
Disseminated gold in granitoid.

STYLE:

MAJOR: Discordant

AGE OF MINERALISATION: Palaeozoic Late Permian

DIMENSIONS/ORIENTATION:

OREBODY: Rocky River

		MIN	AVE	MAX
STRIKE LENGTH	(m)			7000.0

OREBODY: Sydney Flat

		MIN	AVE	MAX
STRIKE LENGTH	(m)			2200.0
TRUE WIDTH	(m)			200.0
VERTICAL DEPTH	(m)		15.0	60.0
DEPTH OF COVER	(m)		9.0	35.0

ORE TEXTURE:

NATURE OF MINERALISATION:
PRIMARY ORE: Dissemination, Vein (Reef),
SECONDARY ORE: Deep Lead, Detrital (Alluvial)

MINERALOGY:

OREBODY: Uralla (D)
Sulphide zone: pyrite, stibnite, arsenopyrite.

CONTROLS OF MINERALISATION:
Mineralisation is apparently related to magmatism but is also structurally controlled (Gilligan & others, 1986a).

GENETIC MODELS:
PRINCIPAL SOURCES: Gilligan & others (1986a), Barnes & others (1988).

In a regional assessment of the metallogenesis of epigenetic gold-antimony mineralisation in the Central Block (including Uralla), Gilligan & others (1986a) concluded that although much of the mineralisation appears to be related to magmatism, i.e. fluids derived from cooling granitoids, some Au- and Sb-bearing veins are controlled by shear and fracture systems. These are hence more closely allied to Hillgrove-type veins, and may have been formed by hydrothermal leaching of deep crustal rocks some time after the main granite bodies were emplaced (Gilligan & others, 1986a; Barnes & others, 1988).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Uralla (D)
PRINCIPAL SOURCES: Leitch & others (1971), Markham & Basden (1974), Markham (1975), Gilligan & others (1986a), Barnes & others (1988).
SUMMARY

Uralla lies in the south-central part of the Central Block. The field comprised very minor primary but extensive alluvial deposits. Primary mineralisation consisted of vein and disseminated gold in hornblende-bearing adamellite of the Late Permian Uralla Plutonic Suite and in adjacent altered sediments of the Carboniferous Sandon beds. Primary deposits were the source of large Tertiary deep lead and Recent placer deposits in the drainage systems of the Rocky and Gwydir Rivers. Deep lead and alluvial deposits accounted for almost all of past production from the Uralla field.

GEOLOGICAL SETTING: URALLA
PRINCIPAL SOURCES: Leitch & others (1971), Gilligan & others (1986a).

The Uralla Plutonic Suite (Late Permian) is a transitional I-S type intrusive complex (Gilligan & others, 1986a).
The suite includes the following granitoid bodies significant for epigenetic mineralisation:-
i) Uralla Granodiorite (Pgu on Dorrigo-Coffs Harbour 1:250 000 geological map) - Au, ?Sb.
Host to some primary gold mineralisation at Uralla.
ii) Khatoun Tonalite - Au, ?Sb.
Host to some primary mineralisation at Uralla.
iii) Tilbuster Granodiorite (Pgt) - Ag, Au, As, Sb.
See Deposit No.56 (ARMIDALE-ROCKVALE).
iv) Mount Duval Adamellite (Pad) - Fe, Ag, Pb, Zn, ?Sb.
v) ?Llangothlin Adamellite (Pal) - Mo, Ag.
(Leitch & others, 1971; Gilligan & others, 1986a).

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Leitch & others (1971), Barnes & others (1988).

Primary mineralisation occurs mainly within adamellite phases of the Uralla Granodiorite, some in more mafic intrusive bodies at the western boundary of the pluton (Khatoun Tonalite), and some in metamorphosed greywacke and argillite of the Sandon beds close to the intrusive contact (Leitch & others, 1971; Barnes & others, 1988).
Granite in mineralised areas is jointed and traversed by lamprophyric and felsite dykes (Leitch & others, 1971; Markham & Basden, 1974).

OREBODY: Rocky River
PRINCIPAL SOURCES: Markham & Basden (1974), Markham (1975).

Recent alluvials accounted for about 80% of past production from Uralla. Present day streams worked include the Rocky River and its tributaries Kentucky and Uralla Creeks, Green Cabbage Tree, Wallaby, Post Office, Mount Walsh and Sawpit Gullies, and the Gwydir River (Markham, 1975). Auriferous wash consisted of up to 6 m of quartzose sand and gravel intermixed with greenish, micaceous soapy clay, derived from weathered granodiorite (Markham & Basden, 1974; Markham, 1975).
Gold was reported as being coarser and more angular than in the Tertiary leads, possibly indicating derivation from a primary source rather than by reworking of deep lead gold (Markham, 1975).

OREBODY: Sydney Flat
PRINCIPAL SOURCES: Markham & Basden (1974), Markham (1975), Barnes & others (1988).

Deep lead accounted for about 20% of past production from Uralla. The deposits occur in Tertiary sediments which were deposited in topographic lows on a granitic basement and preserved beneath basalt cappings (Markham & Basden, 1974).
The main gold-bearing lead was Sydney Flat, which extended NE from several kilometres N of Uralla (Markham & Basden, op.cit).
Host sediments are composed mostly of a fine, well rounded, yellowish to grey quartz sand, coarsening at depth, plus clay bands (Markham, 1975).
Average thickness of auriferous wash = 45 cm (Markham & Basden, 1974).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Barnes R.G., Brown R.E., Brownlow J.W., Gilligan L.B., Krynen J., Willis I.L., 1988
A review of the mineral deposits of the New England Orogen in New South Wales. IN Kleeman J.D.(ed) - New England Orogen - tectonics and metallogenesis. Proceedings of symposium, University of New England, November, 1988.
University of New England. Department of Geology and Geophysics
1v P211-227

Chesnut W.S., Flood R.H., McKelvey B.C., Cameron R.G., 1973
Manilla, New South Wales, 1:250 000 geological series map. Sheet SH/56-09, 1st edition.
Geological Survey of New South Wales
1v

Clift D.S.L., 1975
Gold dredging in New South Wales.
Geological Survey of New South Wales. Mineral Resources
41

David T.W.E., 1887
Rocky River and Uralla goldfield.
New South Wales. Department of Mines. Annual Report
1886 P153

Gilligan L.B., Brownlow J.W., Cameron R.G., Henley H.F., Tenison Woods K.L., 1986
Excursion guide, precious metal-antimony mineralization, Dorrigo-Coffs Harbour 1:250 000 sheet area.
Geological Survey of New South Wales. Report
GS1986/023

Gilligan L.B., Brownlow J.W., Cameron R.G., Henley H.F., 1986
Dorrigo-Coffs Harbour, New South Wales, 1:250 000 metallogenic series map and metallogenic study. Sheets SH 56-10, SH 56-11.
Geological Survey of New South Wales. Report
GS1986/033

Leitch E.C., Neilson M.J., Hobson E., 1971

Dorrigo-Coffs Harbour, New South Wales, 1:250 000 geological series map. Sheets SH/56-10 & 11, 1st edition.
Geological Survey of New South Wales
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1975
Gold deposits of the New England Fold Belt.
Geological Survey of New South Wales. Report
GS1975/378

Stonier G.A., 1896
Report on the Uralla goldfield.
New South Wales. Department of Mines. Annual Report
1895 P162-165(Appendix 1)

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 56 ARMIDALE-ROCKVALE

DEPOSIT IDENTIFICATION:

SYNONYMS: Rockvale, Tilbuster

COMMODITIES: Au, Ag, As, Sb, Cu

DISTRIBUTION:
Record covers primary and alluvial deposits in two areas: a narrow zone 20 km long NE of Armidale, and within the area 5 km E, SE, and S of Rockvale.

OREBODIES:
Armidale-Rockvale (D), All Nations (A), Brackins Spur (A), Brooklyn (R), Burying Ground Creek (R), Camerons Creek (Guyra or Gara R.) (R), Comet (R), Duval Creek (A), Great Britain (A), Little Nell (A), Mary Anderson (A), Phoenix (R), Puddledock Creek (A), Rockvale (Wollomombi) Creek (R), Taits Gully (A), Tilbuster Creek (A), Whybatong, Zulu (A)

MINES:
All Nations, Brackins Spur, Brooklyn, Burying Ground Creek, Camerons Creek, Comet, Duval Creek, Great Britain, Little Nell, Mary Anderson, Phoenix, Puddledock Creek, Rockvale Creek, Taits Gully, Tilbuster Creek, Whybatong, Zulu

GROUP: -

COMMENTS:
Record includes regional setting of Central Block; see Deposit No.58 TIMBARRA-POVERTY POINT for setting of Permo-Triassic igneous-associated mineralisation. See Gilligan & others (1986b) for additional mining methods.

LOCATION:

LATITUDE: 30 31 | LONGITUDE: 151 40
250K SHEET: SH56 10 | 100K SHEET: 9236

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Armidale
LOCAL GOVERNMENT AREA (LGA): Dumaresq

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1852	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
All Nations (A)	All Nations	Historical	Underground
Brackins Spur (A)	Brackins Spur	Historical	Underground
Brooklyn (R)	Brooklyn	Historical	Underground
Burying Ground Creek (R)	Burying Ground Creek	Historical	Underground
Camerons Creek (Guyra or Gara R.) (R)	Camerons Creek	Historical	Underground
Comet (R)	Comet	Historical	Underground
Comet (R)	Comet	Possible	Underground
Duval Creek (A)	Duval Creek	Historical	Underground
Great Britain (A)	Great Britain	Historical	Underground
Little Nell (A)	Little Nell	Historical	Underground
Mary Anderson (A)	Mary Anderson	Historical	Underground
Phoenix (R)	Phoenix	Historical	Underground
Puddledock Creek (A)	Puddledock Creek	Historical	Underground
Puddledock Creek (A)	Whybatong	Historical	Underground
Rockvale (Wollomombi) Creek (R)	Rockvale Creek	Historical	Underground
Taits Gully (A)	Taits Gully	Historical	Underground
Tilbuster Creek (A)	Tilbuster Creek	Historical	Underground
Zulu (A)	Zulu	Historical	Underground

COMPANIES:

OREBODY: Brackins Spur (A)

PRESENT OPERATORS:
Mount Gipps Ltd

PRESENT OWNERS:	EQUITY%
Mount Gipps Ltd	90.00
Omega Mines NL	10.00

OREBODY: Comet (R)

PRESENT OPERATORS:
Mount Gipps Ltd

PRESENT OWNERS:	EQUITY%
Mcunt Gipps Ltd	90.00
Omega Mines NL	10.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 636

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: 1856-1898,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIF. CATION		
June 1988	122	8.7	1,061	Subeconomic Demonstrated	Recoverable u/g	Comet, (Brackins Spur)

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: New England Fold Belt
PROVINCE: Central Block
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Mount Duval Adamellite - Late Permian
LITHOLOGY: Biotite-hornblende adamellite.
RELATIONSHIP TO MINERALISATION: Host to some auriferous quartz veins N of Armidale.

FORMATION NAME & AGE: Tilbuster Granodiorite - Late Permian
LITHOLOGY: Biotite-hornblende granodiorite.
RELATIONSHIP TO MINERALISATION: Host to some auriferous quartz veins N of Armidale.

FORMATION NAME & AGE: Pine Tree Adamellite - Late Permian
LITHOLOGY: Biotite-hornblende adamellite.
RELATIONSHIP TO MINERALISATION: Host to some auriferous quartz veins N of Armidale.

FORMATION NAME & AGE: Highlands Monzonite - Late Permian
LITHOLOGY: Two-pyroxene monzonite.
RELATIONSHIP TO MINERALISATION: Host to some auriferous quartz veins N of Armidale.

FORMATION NAME & AGE: Rockvale Adamellite - Late Permian
LITHOLOGY: Microcline-biotite adamellite, granodiorite.
RELATIONSHIP TO MINERALISATION: Host to some auriferous vein and lode mineralisation in Rockvale area.

FORMATION NAME & AGE: Mornington Diorite - Late Permian
LITHOLOGY: Pyroxene-biotite diorite.
RELATIONSHIP TO MINERALISATION: Occurs close to main orebodies in Rockvale area.

FORMATION NAME & AGE: Sandon Beds - Carboniferous
LITHOLOGY: Greywacke, argillite, chert, jasper, mafic volcanics.
RELATIONSHIP TO MINERALISATION: Host to minor vein mineralisation adjacent to intrusive contact.

FORMATION NAME & AGE: Girrakool Beds - ?Late Carboniferous-Early Permian
LITHOLOGY: Greywacke, slate, rare chert, metabasalt.
RELATIONSHIP TO MINERALISATION: Host to minor vein mineralisation adjacent to intrusive contact.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to alluvial deposits.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Alluvium,
SIGNIFICANT: Granitic,
MINOR: Metasedimentary

STRUCTURAL FEATURES:

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

SIGNIFICANT: Intrusive Contact

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Granite)

METAMORPHISM:
Girrakool and Sandon beds are regionally metamorphosed to greenschist facies.

ALTERATION:

OREBODY: Comet (R)
Wall rock alteration adjacent to the vein involved sericitisation, kaolinisation, and quartz-stockworking over a 2-10 m-wide zone in the hanging wall and 1-5 m wide in the footwall. Pyritisation extended 2-3 m into the hanging wall and 1-2 m into the footwall. (Gilligan & others, 1986a).

OREBODY: Phoenix (R)
Mineralised vein is rimmed by zone of silicification up to 60 cm wide (Markham, 1975).

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Alluvial.
SIGNIFICANT: Auriferous quartz veins in granitoid.
Auriferous lodes (alteration zones) in granitoid.
MINOR: Auriferous quartz veins in metasediments adjacent to granitoid.

STYLE:

MAJOR: Discordant

AGE OF MINERALISATION: Palaeozoic Late Permian

DIMENSIONS/ORIENTATION:

OREBODY: Comet (R)

		MIN	AVE	MAX
TRUE WIDTH	(cm)	20.0	150.0	250.0
STRIKE LENGTH	(m)			1500.0
		ANGLE (deg.)		DIRECTION
DIP		45-60		SE
STRIKE		067		

OREBODY: Phoenix (R)

		MIN	AVE	MAX
TRUE WIDTH	(cm)		120.0	250.0
STRIKE LENGTH	(m)	305.0		610.0
VERTICAL DEPTH	(m)			50.0
		ANGLE (deg.)		DIRECTION

DIP 34-55 SE
STRIKE 045

ORE TEXTURE:

NATURE OF MINERALISATION:
PRIMARY ORE: Dissemination, Lode (Alteration Zone), Vein (Reef),
SECONDARY ORE: Deep Lead, Detrital (Alluvial), Supergene Enrichment

MINERALOGY:

OREBODY: Armidale-Rockvale (D)
Deposits show similar complex mineralogies but with different proportions of ore minerals (Barnes & others, 1988).

OREBODY: Comet (R)
Sulphide zone (quartz-pyrite ore): pyrite (gold, pyrrhotite, chalcopyrite, covellite, proustite-pyrargyrite, arsenopyrite, sphalerite, stibnite, marcasite).
Sulphides comprise 10% of the lode.
Sulphide zone (quartz-massive pyrrhotite ore):- pyrrhotite, pyrite, (chalcopyrite, marcasite).
Pyrrhotite occurs as irregular slugs and stringers in quartz, and commonly contains clasts of white quartz.
Gangue: laminated or irregular quartz.
(Gilligan & others, 1986a).

OREBODY: Phoenix (R)
Sulphide zone: pyrite, arsenopyrite, (chalcopyrite, gold, silver).
Gold and silver contents vary proportionately with sulphide concentration, which itself varies considerably up to 10%.
Sulphides apparently occurred in parallel bands and clusters within quartz. Gold occurred partly free within quartz, partly as fine inclusions within pyrite. (Markham & Basden, 1974; Markham, 1975).

CONTROLS OF MINERALISATION:
Mineralisation is controlled by proximity to granitic intrusions, and by structure: deposit occurs on NE-trending fracture system; and mineralisation is localised in fault/shear zones proximal to or within granite (Gilligan & others, 1986a).

GENETIC MODELS:
A magmatic hydrothermal origin was proposed by Gilligan & others (1986a) both for deposits associated with plutons of the Uralla Plutonic Suite in the Armidale area, and for deposits associated with the Rockvale Adamellite (Hillgrove Plutonic Suite) in the Rockvale area.

Gilligan & others (1986a): although a metamorphic-hydrothermal model is generally favoured for gold deposits associated with granitoids of the Hillgrove Plutonic Suite (e.g. HILLGROVE, Deposit No.57), Gilligan (1984, reported by Gilligan & others, 1986a) recognised a metallogenic association between the Uralla and Hillgrove suites in the Armidale-Uralla area. Mineralisation associated with the Rockvale Adamellite contains a similar range of metals as was introduced by granitoids of the Uralla Plutonic Suite, e.g. Au-Sb at URALLA (Deposit No.55) and Au-Sb-Ag-As at Tilbuster (Armidale-Rockvale). Gilligan (1984, reported by Gilligan & others, 1986a) tentatively attributed the metallogenic association to a common source for the plutonic suites in antimony-bearing metasediments in the lower crust.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Armidale-Rockvale (D)
PRINCIPAL SOURCES: Leitch & others (1971), Markham & Basden (1974), Markham (1975), Gilligan & others (1986a), Barnes & others (1988).
SUMMARY

This deposit is a geographical grouping of small goldfields in the Armidale-Rockvale district. The fields lie in the central part of the Central Block adjacent to its eastern boundary with Nambucca Block. (The Rockvale area is shown as lying within western Nambucca Block in Markham & Basden, 1974).
Mineralisation includes both vein and alluvial deposits (1) associated with Uralla Plutonic Suite in the Tilbuster area N of Armidale (herein distinguished by suffix (A) on orebody name), and (2) associated with Hillgrove Plutonic Suite in Rockvale area (indicated by suffix (R)).

REGIONAL SETTING: CENTRAL BLOCK
PRINCIPAL SOURCES: Leitch & others (1971), Gilligan & others (1986a), Barnes & others (1988).

The Central Block contains ?pre-Devonian-Carboniferous sequences of deformed and metamorphosed deep-marine argillites and greywackes derived from a calc-alkaline felsic volcanic arc, and locally abundant chert/jasper/metabasalt of oceanic crustal origin, which were deposited in an accretionary prism complex (Gilligan & others, 1986a; Barnes & others, 1988). The metasedimentary sequence is represented in the southern part of the block by the Sandon beds and Girrakool beds (Leitch & others, 1971). The metasedimentary terrains are locally covered by Early Permian basin sequences (Leitch & others, op.cit).

The accretionary complex rocks are intruded by extensive suites of syn-orogenic Carboniferous-Early Permian S-type granitoids, and by late-orogenic Permo-Triassic ?I-type granitoids, and overlain by felsic volcanics comagmatic with the latter (Gilligan & others, 1986a; Barnes & others, 1988).

The main Permo-Carboniferous plutonic complexes are the Bundarra Plutonic Suite along the western margin of the Central Block, and the Hillgrove Plutonic Suite (Markham & Basden, 1974; Barnes & others,1988). Permo-Triassic complexes (New England Batholith) are extensive in the NE portion of the Central Block. Gold deposits occur mainly near the southern limit of the NEB in the south-central part of the block; the main plutonic suite in the Armidale-Rockvale/Uralla/Hillgrove region is the Uralla Plutonic Suite (Gilligan & others, 1986a; Barnes & others, 1988).

REGIONAL SUCCESSION: CENTRAL BLOCK (SOUTH)
PRINCIPAL SOURCES: Leitch & others (1971), Gilligan & others (1986a).

1./ Sandon beds (Cs on Dorrigo-Coffs Harbour 1:250 000 geological map) (Carboniferous) - grewacke, argillite, chert, jasper, mafic volcanics.
Host to some vein deposits at URALLA (Deposit No.55).
Minor host (to Whybatong) in Armidale area.
2./ Girrakool beds (Pl on Dorrigo-Coffs Harbour 1:250 000 geological map, Ccgs on Dorrigo-Coffs Harbour 1:250 000 metallogenic map) (?Late Carboniferous-Early Permian) - greywacke, slate, rare chert, metabasalt.
The Girrakool beds occur W of Sandon beds, from which they are separated by the Mihi Fault (Leitch & others, 1971).
The unit is host to much of the mineralisation at HILLGROVE (Deposit No. 57), and to some orebodies at Rockvale (adjacent to granite contacts).
3./ Dummy Creek Conglomerate (Pd) (Early Permian) - polymictic ortho-conglomerate, sandstone, carbonaceous siltstone. The unit is host to Taits Gully silver-base metal(-gold) and antimony-gold mineralisation.
4./ Hillgrove Plutonic Suite (Permo-Carboniferous) - foliated, sheared, S-type, syn-orogenic multiple intrusive complexes, mainly granodiorites and adamellites, late stocks of gabbroic to granophyric composition.
Host to most of the mineralisation at Rockvale, some at HILLGROVE.
5./ Variety of small stocks and dykes (Late Permian) - syenite, lamprophyre, microdiorite, porphyritic felsic bodies.
Abundant in Hillgrove and Rockvale areas. The dykes at Hillgrove clearly cut across earlier foliation and mylonite zones, whereas those at Rockvale commonly follow the trend of an earlier foliation without showing evidence of deformation. Epigenetic veins at HILLGROVE mainly pre-date the dykes, but veins both pre-date and post-date the dykes in the Rockvale area. (Gilligan & others, 1986a).
6./ Uralla Plutonic Suite (Late Permian), part of New England Batholith - transitional I-S-type, massive biotite-hornblende granodiorites and adamellites. Host to some primary mineralisation in Armidale area and at URALLA (Deposit No.55).
7./ Sediments and volcanics (Tertiary) - sand, gravel, clay, porphyritic olivine basalt. Form extensive cover between Uralla and Armidale.
Host to deep leads at URALLA.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Leitch & others (1971), Markham & Basden (1974), Markham (1975), Gilligan & others (1986a), Barnes & others (1988).

(1) Primary deposits in Tilbuster area include Whybatong, Zulu, Great Britain, All Nations, Little Nell, Mary Anderson, and Taits Gully; alluvial deposits are Puddledock, Tilbuster, and Duval Creeks.
(2) Primary deposits in Rockvale area are Comet, Phoenix, and Home Rule; alluvial deposits are Camerons Creek (Guyra or Gara River) and Rockvale (Wollomombi) Creek. Brooklyn is a deep lead.
(Markham, 1975).
Most primary mineralisation in the area N of Armidale is associated with granitic intrusions of the Uralla Plutonic Suite. Great Britain, All Nations, Little Nell, Mary Anderson, Zulu, and Whybatong are associated with either of two plutonic complexes of the suite:-
i) Tilbuster Granodiorite (Pgt on Dorrigo-Coffs Harbour 1:250 000 geological map) and Mount Duval Adamellite (Pad), and
ii) Pine Tree Adamellite (Pap) and Highlands Monzonite (Pmh).
Both suites intrude Sandon beds in the Armidale area.

Taits Gully silver-base metal-gold and antimony-gold mineralisation is hosted by fine siliceous sediments of the Permian Dummy Creek Conglomerate, which locally overlies Mount Duval Adamellite and Sandon beds. Mineralisation is considered to be related to the granite (Markham & Basden, 1974, p385).

Primary mineralisation in the Rockvale district - Phoenix, Comet, Home Rule - is associated with the Rockvale Adamellite (Phra), which is part of the Hillgrove Plutonic Suite (see Deposit No.57, HILLGROVE). Phoenix and Comet occur within the adamellite near its margin and close to small intermediate intrusives that form the Mornington Diorite (Pmd). These deposits are narrow, steeply-dipping tabular veins in fissure-type lodes within and adjacent to the intrusive (Markham, 1975; Barnes & others, 1988). Mineralisation is controlled by NE-trending fault or shear zone systems (Gilligan & others, 1986a).

OREBODY: Comet (R)

Orebody lies 1 km NE of Phoenix apparently on same line of mineralisation, within Rockvale Adamellite adjacent to its contact with Girrakool beds (Markham, 1975; Gilligan & others, 1986a).
Two main lode variations can be recognised (Gilligan & others, 1986a):-
i) a laminated quartz-pyrite type, and
ii) an irregular quartz-massive pyrrhotite type.
The laminated quartz-pyrite type is characterised by inter-laminated pyrite and quartz, interpreted to have formed from crack-seal events (Gilligan & others, 1986a).
The quartz-massive pyrrhotite type features textures indicative of post-depositional ductile flow of pyrhhotite and quartz fragment incorporation (Gilligan & others, op.cit).

OREBODY: Phoenix (R)

Mineralisation occurs in a prominent quartz vein traceable for several thousand metres closely adjoining an irregular contact between granite and phyllite, locally cutting the line of contact.
(Markham & Basden, 1974; Markham, 1975).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Ashley P.M., Cook N.D.J., 1988
Geology of the Whybatong gold prospect and associated Tertiary deep lead. IN Kleeman J.D.(ed) - New England Orogen - tectonics and metallogenesis. Proceedings of symposium, Armidale, November, 1988.
University of New England. Department of Geology and Geophysics
1v P228-234

Barnes R.G., Brown R.E., Brownlow J.W., Gilligan L.B., Krynen J., Willis I.L., 1988
A review of the mineral deposits of the New England Orogen in New South Wales. IN Kleeman J.D.(ed) - New England Orogen - tectonics and metallogenesis. Proceedings of symposium, University of New England, November, 1988.
University of New England. Department of Geology and Geophysics
1v P211-227

Gilligan L.B., Brownlow J.W., Cameron R.G., Henley H.F., Tenison Woods K.L., 1986
Excursion guide, precious metal-antimony mineralization, Dorrigo-Coffs Harbour 1:250 000 sheet area.
Geological Survey of New South Wales. Report
GS1986/023

Gilligan L.B., Brownlow J.W., Cameron R.G., Henley H.F., 1986
Dorrigo-Coffs Harbour, New South Wales, 1:250 000 metallogenic series map and metallogenic study. Sheets SH 56-10, SH 56-11.
Geological Survey of New South Wales. Report
GS1986/033

Leitch E.C., Neilson M.J., Hobson E., 1971
Dorrigo-Coffs Harbour, New South Wales, 1:250 000 geological series map. Sheets SH/56-10 & 11, 1st edition.
Geological Survey of New South Wales
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1975
Gold deposits of the New England Fold Belt.
Geological Survey of New South Wales. Report

GS1975/378

Peterson A.J., 1936
Report on Phoenix gold mine, Rockvale, near Armidale, NSW.
Geological Survey of New South Wales. Report
GS1936/025

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 57 HILLGROVE

DEPOSIT IDENTIFICATION:

SYNONYMS: Metz

COMMODITIES: Sb, Au, Ag, As, W

DISTRIBUTION:
Record covers over 194 mines and prospects, of which some 30 were significant producers, within a WNW-trending area 3 km x 6 km to the S and W of Hillgrove, and concentrated between the towns of Hillg

OREBODIES:
Hillgrove (D), Baalgammons (BC), Bakers Creek, Big Reef (BC), Black Lode , Cosmopolitan-South Cosmopolitan , Eleanora-Carrington , Freehold-Freehold Eastern, Garibaldi, Golden Gate, Hills (BC), Hopetoun, Little Reef (BC), Middle Reef (BC), Smiths, Sunlight-West Sunlight, Syndicate

MINES:
Bakers Creek, Carrington, Consols, Cosmopolitan, Eleanora, Freehold, Freehold Eastern, Garibaldi, Hillgrove, South Cosmopolitan, Sunlight, West Sunlight

GROUP: -

COMMENTS:
Record includes regional setting of Hillgrove Plutonic Suite; see Deposit No.56 ARMIDALE-ROCKVALE for setting of Central Block. See Gilligan & others (1986b) for additional mining methods.

LOCATION:

LATITUDE: 30 34 LONGITUDE: 151 54
250K SHEET: SH56 10 100K SHEET: 9236

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Armidale
LOCAL GOVERNMENT AREA (LGA): Dumaresq

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD	COMMENTS
1877	Prospecting	
1881		Reef
1881		Extension To Known Mineralisation

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Hillgrove (D)	Hillgrove	Operating	Underground
Bakers Creek	Bakers Creek	Historical	Underground
Cosmopolitan-South Cosmopolitan	Cosmopolitan	Historical	Underground
Cosmopolitan-South Cosmopolitan	South Cosmopolitan	Historical	Underground
Eleanora-Carrington	Eleanora	Historical	Underground
Eleanora-Carrington	Carrington	Historical	Underground
Freehold-Freehold Eastern	Consols	Historical	Underground
Freehold-Freehold Eastern	Freehold	Historical	Underground
Freehold-Freehold Eastern	Freehold Eastern	Historical	Underground
Garibaldi	Garibaldi	Historical	Underground
Sunlight-West Sunlight	Sunlight	Historical	Underground
Sunlight-West Sunlight	West Sunlight	Historical	Underground

COMPANIES:

OREBODY: Hillgrove (D)

PRESENT OPERATORS:

New England Antimony Mines N L

PRESENT OWNERS:	EQUITY%
New England Antimony Mines N L	100.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 17,109
Average recovered grades 45.9 g/t Au (Bakers Creek), 15.3 g/t Au (Sunlight-West Sunlight), 12.1 g/t (Eleanora).

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

YEAR	PRODUCTION
1965	5
1966	5
1967	30
1968	4
1969	12
1970	5
1971	1
1972	36
1973	12
1974	17
1975	86
1976	100
1977	57
1978	80
1979	254
1980	108
1981	115
1982	156
1983	88
1984	88
1985	276
1986	186
1987	250
1988	175

MAIN PRODUCTION PERIODS: (1900-1921), (1970-, 1891-1899,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION		
June 1988	119	9.1	1,080	Economic Demonstrated (Measured)	In-Situ	u/g
June 1988	9	6.2	56	Economic Demonstrated (Indicated)	In-Situ	u/g

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: New England Fold Belt
PROVINCE: Central Block
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Girrakool Beds - ?Late Carboniferous
LITHOLOGY: Shale, quartzite, greywacke, chert, metabasalt.
RELATIONSHIP TO MINERALISATION: Host to major reefs of field, including the principal gold producers.

FORMATION NAME & AGE: Hillgrove Adamellite - Early Permian
LITHOLOGY: Microcline-biotite adamellite.
RELATIONSHIP TO MINERALISATION: Host to a significant proportion of reefs, including the scheelite-rich lodes.

FORMATION NAME & AGE: Bakers Creek Diorite - Early Permian
LITHOLOGY: Diorite, adamellite.
RELATIONSHIP TO MINERALISATION: Host to a relatively small proportion of reefs.

GEOCHRONOLOGY:

Hillgrove Plutonic Suite dated at 312+-10 my (Rb-Sr)(Late Carboniferous)

and 258 my (K-Ar) (latest Permian); latter probably age of deformation.
Hillgrove Adamellite dated at 280+-6 my (K-Ar) (Early Permian).
Bakers Creek Diorite dated at 291+-6 my, 286+-6 my (K-Ar)(Early Permian)
Post-mineralisation lamprophyre dyke dated at 246, 251+-5 my (K-Ar) (latest Permian).
Above data from various sources reported by Boyle & Hill (1988).
(see also Explanatory Notes).

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Metasedimentary,
SIGNIFICANT: Granitic

STRUCTURAL FEATURES:

MAJOR: Shearing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

SIGNIFICANT: Plutonism (Granite), Plutonism (Lamprophyre)

METAMORPHISM:

The Girrakool beds have been regionally metamorphosed to greenschist facies (Boyle & Hill, 1988), and contact metamorphosed adjacent to Hillgrove Plutonic Suite intrusives to hornblende hornfels facies, expressed by spotted cordierite hornfels (Boyle, 1986; Boyle & Hill, 1988).

ALTERATION:

OREBODY: Hillgrove (D)

Gold occurs in zones of sericitic alteration, silicification, and sulphide dissemination which rim quartz-scheelite/quartz-stibnite veins (Boyle & Hill, 1988).

DEPOSIT CHARACTERISTICS:

TYPES:

MAJOR: Metamorphic auriferous quartz veins in fault/shear zones in metasediments.
SIGNIFICANT: Auriferous quartz veins associated with mafic intrusive in granitoid.
Breccia/disseminated gold in fault/shear zones in granitoid.
Breccia/disseminated gold in fault/shear zones in metasediments.

STYLE:

MAJOR: Discordant

AGE OF MINERALISATION: Palaeozoic Late Permian

DIMENSIONS/ORIENTATION:

OREBODY: Hillgrove (D)

		MIN	AVE	MAX
TRUE WIDTH	(cm)	10.0		150.0
STRIKE LENGTH	(m)			700.0
DOWN-DIP DEPTH	(m)			600.0
		ANGLE (deg.)		DIRECTION
DIP		75-90		
PLUNGE				S
STRIKE		305-350		

OREBODY: Bakers Creek

		MIN	AVE	MAX
TRUE WIDTH	(cm)		15.0	120.0
VERTICAL DEPTH	(m)			610.0
		ANGLE (deg.)		DIRECTION
DIP		75		NE
STRIKE		295-330		

OREBODY: Cosmopolitan-South Cosmopolitan

	ANGLE (deg.)	DIRECTION
STRIKE	320	

OREBODY: Eleanora-Carrington

		MIN	AVE	MAX
TRUE WIDTH	(cm)			600.0
		ANGLE (deg.)		DIRECTION
STRIKE		330		

OREBODY: Freehold-Freehold Eastern

		MIN	AVE	MAX
STRIKE LENGTH	(m)			975.0
		ANGLE (deg.)		DIRECTION
STRIKE		330		

OREBODY: Sunlight-West Sunlight

	ANGLE (deg.)	DIRECTION
STRIKE	290	

ORE TEXTURE:
Primary

NATURE OF MINERALISATION:
PRIMARY ORE: Breccia, Dissemination, Fault/Shear-Filling, Vein (Reef)

MINERALOGY:

OREBODY: Hillgrove (D)
PRINCIPAL SOURCES: Gilligan & others (1986a), Boyle & Hill (1988).

Sulphide zone: quartz, pyrite, arsenopyrite, stibnite, scheelite, calcite, gold, (jamesonite, stannite, sphalerite, galena, bournonite, stephanite, pyrargyrite, chalcopyrite, berthierite, pyrrhotite, mackinawite, melnikovite, marcasite, haematite, ?gudmundite, ?realgar, and tetrahedrite). Native antimony, cassiterite and wolframite have been also identified. (Boyle & Hill, 1988).
Oxide zone: cervantite, scorodite, stibiconite, valentinite, senarmontite, limonite, geothite. and covellite. (Boyle & Hill, op.cit).

Boyle & Hill (1988):- 'Gold occurs both as free gold and in solid solution with arsenopyrite in the proportion of 2 to 10 g/t per one percent of arsenopyrite. When visible the free gold is often orange in colour because of a fine ?gold antimonide dust coating.
The gold can act as a nucleus for crystallization for the stibnite.
Silver occurs in free gold in a ratio of silver to gold of up to 1:3.
Stibnite concentrate (approximately 65% Sb) carries from 60-240 g/t Ag.
It is presumed that the silver in the stibnite occurs as stephanite and pyrargyrite since this is the form in which it occurs in several silver mining areas in the district.
Some free gold is corroded, presumably caused by leaching of the silver which then combined with the antimony in the mineralising fluids.'

Granitoids of the Hillgrove Plutonic Suite are characterised by the presence of co-existing colourless and opalescent bluish quartz, co-existing red-brown and green biotite, two generations of plagioclase, highly-ordered alkali feldspar (microcline), ilmenite as the sole Fe-Ti oxide, and minor but ubiquitous graphite (Hensel, 1982; reported by Gilligan & others, 1986a).

OREBODY: Bakers Creek
Sulphide zone: Stibnite was present in only the top level of the mine; at depth ore comprised gold, pyrite, quartz (Harrison, 1953).

CONTROLS OF MINERALISATION:
The deposit is strongly struturally controlled: mineralisation occurs in fault and shear zones across a range of lithologies (Barnes & others, 1988; Boyle & Hill, 1988).
Fluid inclusions indicate temperatures of deposition of 240-190 deg C for the main stibnite phase, and down to 110 deg C for the stibnite-calcite phase. Inclusions also indicate a drop in salinity during crystallisation. (Comsti & Taylor, 1984; Boyle & Hill, 1988).
There is no evidence of fluid boiling and this plus the presence of open space breccias would indicate a depth of burial of between 800 m and 3 km (Boyle & Hill, 1988).

GENETIC MODELS:
PRINCIPAL SOURCES: Gilligan & others (1986a), Barnes & others (1988), Boyle & Hill (1988).

Gilligan & others (1986a), Barnes & others (1988), and Boyle & Hill (1988) favour a metahydrothermal origin in which Au-Sb mineralisation was formed by magmatism and metamorphic leaching (latter process being dominant) or deep crustal Sb-rich metasedimentary-metavolcanic complexes (Gilligan & others, 1986a).

Possible sources of mineralising hydrothermal fluids include:-
i) Hillgrove Plutonic Suite - discounted on the basis of evidence that mineralisation post-dated granite deformation (Boyle & Hill, 1988);
ii) metasediments - precluded on low degree of metamorphism and apparent lack of leaching (Boyle & Hill, 1988);
iii) mantle, favoured by sulphur isotope data (Robinson & Farrand, 1982, reported by Gilligan & others, 1986a; and by Barnes & others, 1988), but in conflict with lead isotope evidence that Sb is derived from continental crust (Gilligan & others, 1986a), and with structural relationships: host shears are not related to any major regional lineaments (Boyle & Hill, 1988);
iv) metamorphic remobilisation of pre-existing stratabound Sb-W-Au deposits at depth (Woolomin beds or Tamworth Group) (Weber, IN Markham & Basden, 1974; Plimer, 1982, reported by Barnes & others, 1988);
v) metamorphic hydrothermal leaching from deep Sb-rich crustal rocks (Gilligan & others, 1986a; Boyle & Hill, 1988);
vi) Late Permian granites of the New England Batholith - possible heat source, supported by close temporal association of mineralisation with lamprophyric dykes; also possible source of metals (Boyle & Hill, 1988).

Complex mineralogical and alteration sequences and textures indicate a multi-stage history of overpressuring, hydrofracturing, and mineralisation associated with a cooling multi-stage hydrothermal system (Barnes & others, 1988).

Magmatic activity and associated high thermal flux, possibly related to intrusion of Late Permian (New England Batholith) granitoids, may have driven hydrothermal systems. Deformation processes may have been important for both the generation and focussing of metahydrothermal fluids (Barnes & others, 1988).

Veins were formed by a mumber of separate episodes of mineralisation at relatively low temperature (Boyle & Hill, 1988):-
i) deposition of auriferous sulphide mineralisation, accompanied by silicification and hydraulic brecciation,
ii) re-brecciation, accompanied by two stages of stibnite-quartz+-carbonate deposition. (Gilligan & others, 1986a).

Comsti & Taylor (1984) suggested that metals were transported by sulphur-poor, low temperature, low salinity solutions (5% NaCl), possibly as carbonate complexes, with the trigger for crystallisation being mixing with cooler, less saline meteoric water.

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Hillgrove (D)

PRINCIPAL SOURCES: Harrison (1953), Leitch & others (1971), Markham & Basden (1974), Markham (1975), Boyle (1986), Gilligan & others (1986a,b), Barnes & others (1988), Boyle & Hill (1988).
SUMMARY

The Hillgrove antimony-gold field lies in the east-central part of the Central Block adjacent to the block's faulted eastern boundary with the Nambucca Block. (The field is shown as lying within the Nambucca Block in Markham & Basden, 1974). Mineralisation consists of a large number of stibnite-gold-quartz veins localised in sub-parallel, WNW- and NW-trending shear zones within ?Late Carboniferous metasediments of the Girrakool beds and Early Permian intrusives of the Hillgrove Plutonic Suite.
(Bakers Creek orebodies are herein identified by the suffix (BC) on the orebody name.)

REGIONAL SETTING: CENTRAL BLOCK (EAST)
PRINCIPAL SOURCES: Leitch & others (1971), Gilligan & others (1986a), Barnes & others (1988), Boyle & Hill (1988).

The eastern part of the Central Block comprises mainly ?Late Carboniferous metasediments intruded by a heterogeneous assemblage of granitoids, small complexes, and dykes of latest Carboniferous to Middle Triassic age (Gilligan & others, 1986a).
The metasediments (represented in the Hillgrove region by the Girrakool beds) consist of volcanically-derived turbidites of andesitic affinities (Boyle & Hill, 1988) plus oceanic crustal rocks (Barnes & others, 1988).
The assemblage is considered to represent an accretionary prism complex (Gilligan & others, 1986a; Barnes & others, 1988).
The main intrusive rocks are plutons of the Hillgrove Plutonic Suite and younger dykes associated with the New England Batholith (Gilligan & others, 1986).

Regional structural trends are complex: overall, bedding strikes NW and dips subvertically; cleavage is commonly well developed and strikes generally NE. These trends are overprinted by ENE- and NNW-trending mylonite and cataclasite zones. Regional faults strike NE. The main deformation occurred in the Late Permian, in association with a Late Permian thermal episode which resulted in emplacement of plutonic complexes of the New England Batholith. These intrude metasedimentary sequences to the W and N of Hillgrove. (Gilligan & others, 1986a).

REGIONAL SETTING: HILLGROVE PLUTONIC SUITE
PRINCIPAL SOURCES: Leitch & others (1971), Gilligan & others (1986a), Barnes & others (1988), Boyle & Hill (1988).

The Hillgrove Plutonic Suite is a series of syntectonic, generally elongate, sheared S-type intrusive complexes which occur at the SE end of the New England Batholith (Barnes & others, 1988).
Age range of the suite is Late Carboniferous-Early Permian (Boyle & Hill, 1988 - see 'GEOCHRONOLOGY'). Compositions are mainly microcline-biotite granodiorite to adamellite (Gilligan & others, 1986a).
Hillgrove suite granitoids are typically medium-grained, sparsely porphyritic, and deformed, commonly exhibiting an early ?primary foliation on which has been imposed a cataclastic fabric, well developed in fault zones, wider shear zones, and mylonite zones (Gilligan & others, 1986a; Barnes & others, 1988).
Associated with the Hillgrove suite granitoids are several small calc-alkali and tholeiitic complexes which range in composition from gabbro to granophyre. Included in this group is the Bakers Creek Diorite at Hillgrove. These bodies may be only slightly younger (Early Permian) than the Permo-Carboniferous bodies. (Gilligan & others, 1986a).

The region is intruded by a variety of younger stocks and dykes. These include small syenitic bodies W of the Rockvale Adamellite (part of Hillgrove Plutonic Suite - see Deposit No.56 ARMIDALE-ROCKVALE), and lamprophyre, microdiorite and porphyritic felsic dykes, which are abundant at Hillgrove and Rockvale. (Leitch & others, 1971; Gilligan & others, 1986a). The dykes generally post-date mineralisation at Hillgrove, but commonly pre-date mineralisation in the Rockvale area (Gilligan & others, 1986a). The dykes are considered to be temporally related to much of the mineralisation at Hillgrove (Boyle & Hill, 1988 - see 'GENETIC MODELS').

ASSOCIATED MINERALISATION: HILLGROVE PLUTONIC SUITE
PRINCIPAL SOURCES: Gilligan & others (1986a), Barnes & others (1988). Boyle & Hill (1988).

Granitoids of the Hillgrove Plutonic Suite have proximally related Au+-Sb+-Ag+-As+-W mineralisation at Hillgrove, Rockvale, Enmore/Melrose, and Kookabookra-Bear Hill (Gilligan & others, 1986a).
The main Au and Au-Sb deposits are distributed in a NNE-trending belt which broadly follows the distribution of Hillgrove Plutonic Suite granitoids, and parallels the trend of Permian post-orogenic granitoids to the W (Barnes & others, 1988).
The majority of deposits are localised in regional shear or mylonite zones and many occur in structures occupied by ?Early Permian dykes (Barnes & others, 1988; Boyle & Hill, 1988). Deposits are associated with hydrothermal alteration which post-dates granite deformation (Barnes & others, 1988).
Much of the structurally controlled Au-Sb mineralisation is considered to be of syndeformational origin, formed after Hillgrove Plutonic Suite granites were emplaced, in association with a hydrothermal system that was possibly related to Late Permian plutonism (Gilligan & others,1986a; Barnes & others, 1988; Boyle & Hill, 1988 - see 'GENETIC MODELS'). However, some deposits, in particular those at Rockvale (ARMIDALE-ROCKVALE, Deposit No.56) may be of direct magmatic origin (Gilligan & others, 1986a).

REGIONAL SUCCESSION AND ASSOCIATED MINERALISATION: HILLGROVE
PRINCIPAL SOURCES: Harrison (1953), Leitch & others (1971), Boyle (1986), Gilligan & others (1986a,b), Boyle & Hill (1988).

1./ Girrakool beds (Pl on Dorrigo-Coffs Harbour 1:250 000 geological map; Ccgs on Dorrigo-Coffs Harbour 1:250 000 metallogenic map) (?Late Carboniferous) - shales (mudstone, siliceous siltstone), silty quartzite, lithic wacke, rare chert, metabasalt. Occupies central area of field. Unit is host to most of major reefs of the Hillgrove field, including Black Lode, Sunlight, Golden Gate, Eleanora-Carrington, Garibaldi, Freehold-Freehold Eastern, Smiths, and the Bakers Creek group of lodes (Harrison, 1953; Boyle & Hill, 1988).
Production statistics indicate that 97% of gold production was from metasediment-hosted veins, although figures are biased by the large proportion of output from a small number of major producers.

The Girrakool beds are intruded by two granitoid bodies of the Hillgrove Plutonic Suite:-

2./ Hillgrove Adamellite (Phah on Dorrigo-Coffs Harbour 1:250 000 geological map; Phhg on metallogenic map) (Early Permian) - S-type granitoid, medium to coarse-grained, commonly foliated microline-biotite adamellite, commonly characterised by blue quartz, and feldspar phenocrysts (Boyle & Hill, 1988).
Occupies northern part of field and has overall E-W striking but irregular steep contact with the metasediments (Boyle & Hill, 1988).
Host to a large number of reefs, including Cosmopolitan-South Cosmopolitan (Harrison, 1953; Boyle & Hill, 1988).
90% of scheelite production was from veins in adamellite.

3./ Bakers Creek Diorite (Pdb on Dorrigo-Coffs Harbour 1:250 000 geological map; Pkbo on metallogenic map) (Early Permian) - complex intrusive body ranging in composition from adamellite to diorite, apparently related to the Hillgrove Adamellite (Boyle & Hill, 1988).
The diorite forms an irregular mass striking E-W across the southern part of the field (Boyle & Hill, 1988). The diorite is host to a relatively small proportion of mineralisation of the Hillgrove field (Harrison, 1953; Boyle, 1986).
Both intrusive bodies are truncated on the E by the NE-trending Chandler Fault (Markham & Basden, 1974).

Metasediments and intrusives are cut by:-

4./ Stocks and dykes (Late Permian) - range of compositions including microgranite, aplite, and microlitic trachyte, and lamprophyre dykes including lamprophyre/tinguaite, olivine-augite-phlogopite basanite, microdiorite, and biotite microdiorite. The dykes have chilled margins, are irregular in width and strike, although they generally trend NW to NNW, and are commonly spatially related to mineralised veins. The dykes may also follow non-mineralised shears. (Gilligan & others, 1986a; Boyle & Hill, 1988). The dykes generally cross-cut, and are hence inferred to post-date, mineralisation, although some dykes apparently pre-dated mineralisation or were contemporaneous with it.
Dating of post-mineralisation dykes (see 'GEOCHRONOLOGY') places them with the Late Permian post-orogenic New England Batholith intrusives. (Gilligan & others, 1986a; Boyle & Hill, 1988).

5./ Basalt (Tertiary) - flows cap plateau tops at E and W margins of field.

STRUCTURE & LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Harrison (1953), Markham & Basden (1974), Markham (1975), Boyle (1986), Boyle & Hill (1988).

Mineralisation is strongly structurally controlled. Deposits occur as:- i) veins which range from simple fissure infillings to breccia-fills in faults, and ii) replacement veins and disseminations in ductile shear zones (mylonites) (Barnes & others, 1988).
Mineralised reefs occupy well developed NNW- to NW-trending shear zones (Boyle & Hill, 1988). Subordinate NE- and E-trending shears are generally unmineralised (Boyle & Hill, op.cit).
The direction of principal foliation in the adamellite and metasediments - W to WNW - is also unmineralised (Boyle & Hill, op.cit).
Mineralised shear zones dip subvertically NE, locally flattening to 30-45 deg; dimensions are: strike length:- maximum 1.1 km, average <700 m; width:- 5 m maximum, average 1 cm-1 m. Shears are very narrow (<10 cm) in the adamellite. Mineralised shears are crosscut and offset by vertical N-S and NE-trending shears. (Boyle & Hill, 1988).
The trend of the mineralised shears is parallelled by the strike of the lamprophyric and felsic dyke rocks; dykes and mineralised veins commonly occupy the same shear positions. (Markham, 1975; Boyle & Hill, 1988).

Three episodes of quartz veining have been identified (Harrison, 1953; Boyle & Hill, 1988):-
i) barren quartz,
ii) ore-bearing veining, and
iii) barren quartz-calcite-chlorite.
The ore-bearing veins were the result of four episodes of which the last two can be transitional, viz:-
i) quartz-scheelite,
ii) quartz-arsenopyrite-pyrite-gold,
iii) quartz-stibnite-gold-silver, and
iv) quartz-stibnite-calcite.

The four phases occur in varying proportions in the mineralised shears. Scheelite phase commonly occurs alone (apparently sealing the shear), but in some lodes occurs in equal proportions with stibnite. Scheelite is normally a minor component of the stibnite lodes. The arsenopyrite-gold phase occurs in all shears not sealed by the scheelite phase.
The scheelite and stibnite phases generally occur along shear margins, in zones of quartz stringers, quartz-wallrock breccias, and massive

single veins. (Boyle & Hill, 1988).
Multi-layering and shearing of veins indicate that shearing continued during and after mineralisation (Boyle & Hill, op.cit).
The gold-arsenopyrite phase normally forms an alteration halo around veins, consisting of a zone up to 10 cm wide, average width 1 cm, of sericitic alteration, silicification, and sulphide dissemination (Boyle & Hill, 1988).
Ore-grade zones generally define vertical or steeply S-plunging shoots 15-200 m long (Boyle & Hill, 1988).
No systematic metal zoning is apparent in the Hillgrove field.
Individual deposits show vertical zoning e.g. in the Freehold mine, stibnite diminishes with depth. (Boyle & Hill, 1988).

OREBODY: Bakers Creek
The Bakers Creek group of orebodies includes at least five separate reefs - Big Reef, Little Reef, Middle Reef, Hills, and Baalgammons - hosted by metasediments of the Girrakool beds (Harrison, 1953, Markham, 1975).

OREBODY: Cosmopolitan-South Cosmopolitan
The Cosmopolitan line is one of the few major lodes hosted by adamellite (Hillgrove Adamellite) (Harrison, 1953; Boyle & Hill, 1988).
The line may represent a northerly extension of the Eleanora-Carrington line of lode (Markham, 1975).
The lode is represented by a series of subparallel or en echelon fissures rather than a single shear (Markham, 1975).

OREBODY: Eleanora-Carrington
The orebody is part of the most prominent line of mineralisation of the field, and is hosted by metasediments (Girrakool beds) (Harrison, 1953).
A feature of the Eleanora lode is that the fissure follows a lamprophyre or porphyritic microdiorite dyke over the whole of its length.
Mineralisation occurs in strongly brecciated zones flanking the dyke.
The Cosmopolitan-South Cosmopolitan and Garibaldi lines may lie on the same shear zone as Eleanora-Carrington. (Harrison, 1953; Markham, 1975).

OREBODY: Freehold-Freehold Eastern
Two sub-parallel reefs - Freehold and Freehold Eastern - are hosted by metasediments (Girrakool Beds) (Harrison, 1953; Boyle & Hill, 1988).
The reefs converge as mineralisation extends N into the adamellite (Markham, 1975).
In places the lode zone is occupied by a prominent lamprophyre dyke (Markham, op.cit).

OREBODY: Sunlight-West Sunlight
Orebody comprised a series of parallel reefs in metasediments (Girakool beds) adjacent to Bakers Creek Diorite (Harrison, 1953).
Lodes have been classified as antimony (Black Lode, Prendergasts), antimony-scheelite (Syndicate, Oscars, Smiths), and antimony-gold (Sunlight, West Sunlight) (Harrison, 1953).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Andrews E.C., 1900
Report on the Hillgrove gold-field.
Geological Survey of New South Wales. Mineral Resources
8

Barnes R.G., Brown R.E., Brownlow J.W., Gilligan L.B., Krynen J., Willis I.L., 1988
A review of the mineral deposits of the New England Orogen in New South Wales. IN Kleeman J.D.(ed) - New England Orogen - tectonics and metallogenesis. Proceedings of symposium, University of New England, November, 1988.
University of New England. Department of Geology and Geophysics
1v P211-227

Bichan H.R., Gaskell J.L., Hancock R.G. 1971
An appraisal of the antimony-gold reserves of the Hillgrove-Metz area of New South Wales.
Geological Survey of New South Wales. Report
GS1971/312

Bichan H.R., Hancock R.G., 1972
A further assessment of the Brereton Falls antimony-gold prospect with recommendations for future work.
Geological Survey of New South Wales. Report
GS1973/263

Binns R.A., 1968

Report on the Hillgrove mineral field.
Geological Survey of New South Wales. Report
GS1968/310

Booker F.W., 1950
New Baker's Creek gold mine, Hillgrove, New South Wales.
New South Wales. Department of Mines. Annual Report
1946 P70-71

Boyle G.O., 1986
Hillgrove antimony-gold field. IN Gilligan L.B. & others - Excursion guide, precious metal-antimony mineralization, Dorrigo-Coffs Harbour 1:250 000 sheet area.
Geological Survey of New South Wales. Report
GS1986/023 P28-34

Boyle G.O., Hill R.L., 1988
The Hillgrove antimony-gold field. IN Kleeman J.D.(ed) - New England Orogen - tectonics and metallogenesis. Proceedings of symposium, University of New England, November, 1988.
University of New England. Department of Geology and Geophysics
1v P235-239

Comsti E.C., Taylor G.R., 1984
Implications of fluid inclusion data on the origin of the Hillgrove gold-antimony deposits, N.S.W.
AIMM. Bulletin and Proceedings
289(6) P195-203

Gaskell J.L., Bichan H.R., 1972
Geological investigation conducted at the Brereton Falls antimony-gold prospect, Hillgrove.
Geological Survey of New South Wales. Report
GS1973/263

Gilligan L.B., Brownlow J.W., Cameron R.G., Henley H.F., Tenison Woods K.L., 1986
Excursion guide, precious metal-antimony mineralization, Dorrigo-Coffs Harbour 1:250 000 sheet area.
Geological Survey of New South Wales. Report
GS1986/023

Gilligan L.B., Brownlow J.W., Cameron R.G., Henley H.F., 1986
Dorrigo-Coffs Harbour, New South Wales, 1:250 000 metallogenic series map and metallogenic study. Sheets SH 56-10, SH 56-11.
Geological Survey of New South Wales. Report
GS1986/033

Harrison E.J., 1953
Scheelite-gold-antimony deposits of the Hillgrove district. IN Edwards A.B.(ed) - Geology of Australian ore deposits. 5th Empire Mining & Metallurgical Congress, Australia & New Zealand, 1953, Melbourne.
AusIMM
1 P930-934

Leitch E.C., Neilson M.J., Hobson E., 1971
Dorrigo-Coffs Harbour, New South Wales, 1:250 000 geological series map. Sheets SH/56-10 & 11, 1st edition.
Geological Survey of New South Wales
1v

Loudon A.G., 1966
Burying Ground Creek gold prospect.
Geological Survey of New South Wales. Report
GS1966/093

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1975
Gold deposits of the New England Fold Belt.
Geological Survey of New South Wales. Report
GS1975/378

Plimer I.R., 1982
The Hillgrove antimony deposits. IN Flood P.G. & Runnegar B.(eds) - New England geology. Proceedings of a symposium on the geology of the New England area, Armidale, July, 1982.
University of New England. Department of Geology & AHV Club
1v P277-284

Robertson Research (Australia), Endurance Mining Corporation N, 1970
Economic appraisal of the Hillgrove-Metz area.
Geological Survey of New South Wales. Report
GS1970/740

Weber C.R., 1978
Geology and genesis of the antimony, gold and tungsten deposits in Smiths, The Freehold and Breretons Falls mines, Hillgrove, NSW.
Geological Survey of New South Wales. Report
GS1978/023

oooooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 58 TIMBARRA-POVERTY POINT

DEPOSIT IDENTIFICATION:

SYNONYMS: Poverty Point, Rocky River, Timbarra River

COMMODITIES: Au

DISTRIBUTION:
Record covers reefs in four areas within a zone 5 km x 2 km, plus alluvial deposits in channels draining SE into the Timbarra (Rocky) River. Mineral locality nos. 81-84 on Grafton 1:250 000 geological

OREBODIES:
Timbarra-Poverty Point (D), Poverty Point, Surface Hill, Timbarra, Timbarra (Rmt, Hortons), Timbarra (Rocky) River

MINES:
Argentine (Aplite Dykes or Blacks), Bonnie Doon, Cowan & McClifty, Poverty Point, Surface Hill, The New Eldorado

GROUP: -

COMMENTS:
Record includes regional setting of Permo-Triassic igneous-associated mineralisation; see Deposit No.60 CORAMBA-ORARA for setting of Coffs Harbour Block. Mining methods unknown; probably surface workings in addition to underground mines.

LOCATION:

LATITUDE: 29 8   LONGITUDE: 152 19
250K SHEET: SH56 6   100K SHEET: 9339

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Inverell
LOCAL GOVERNMENT AREA (LGA): Tenterfield

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD	COMMENTS
1855		Date approximate

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Poverty Point	Argentine (Aplite Dykes or Blacks)	Historical	Underground
Poverty Point	Bonnie Doon	Historical	Underground
Poverty Point	Cowan & McClifty	Historical	Underground
Poverty Point	The New Eldorado	Historical	Underground
Poverty Point	Poverty Point	Possible	Open-Cut
Poverty Point	Poverty Point	Possible	Heap-Leach
Surface Hill	Surface Hill	Historical	Underground

COMPANIES:

OREBODY: Poverty Point

PRESENT OPERATORS:
Auralia Resources N L

PRESENT OWNERS:	EQUITY%
Auralia Resources N L	100.00

OREBODY: Timbarra

PRESENT OPERATORS:
North Broken Hill Peko Ltd

PRESENT OWNERS: | EQUITY%
North Broken Hill Peko Ltd 49.00
Timbarra Mines NL 51.00

OREBODY: Timbarra (Rmt, Hortons)

PRESENT OPERATORS:
North Broken Hill Peko Ltd

PRESENT OWNERS:	EQUITY%
Electrolytic Zinc Co Of Australasia Ltd.	49.00
North Broken Hill Peko Ltd	51.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 2,330

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1901-1911), (1933-1938), 1859-1866,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION			
Mar 1989	750	1.4	1,080	Subeconomic Inferred	In-Situ	o/c	Poverty Point, soil & oxidised granite to 30 m

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: New England Fold Belt
PROVINCE: Coffs Harbour Block
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Stanthorpe Adamellite - ?Late Permian-Triassic
LITHOLOGY: Biotite adamellite, leucogranite.
RELATIONSHIP TO MINERALISATION: Host to primary mineralisation disseminated in adamellite, quartz veins, and aplite dykes.

FORMATION NAME & AGE: Unnamed - Cainozoic
LITHOLOGY: Alluvium.
RELATIONSHIP TO MINERALISATION: Host to secondary mineralisation.

STRATIGRAPHIC ENVIRONMENT:

MAJOR: Alluvium, Granitic

STRUCTURAL FEATURES:

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

MAJOR: Plutonism (Granite),
SIGNIFICANT: Plutonism (Aplite/Pegmatite)

ALTERATION:

OREBODY: Timbarra-Poverty Point (D)
Mineralisation occurred in large zones of pervasive low-grade alteration within adamellite (Barnes & others, 1988).

DEPOSIT CHARACTERISTICS:

TYPES:

MAJOR: Alluvial.
Disseminated gold in granitoid.

STYLE:

MAJOR: Discordant

AGE OF MINERALISATION: Mesozoic Triassic, Palaeozoic Late Permian

DIMENSIONS/ORIENTATION:

ORE TEXTURE:
Oxidised

NATURE OF MINERALISATION:
PRIMARY ORE: Dissemination,
SECONDARY ORE: Detrital (Alluvial)

MINERALOGY:

OREBODY: Timbarra-Poverty Point (D)
Sulphide zone: auriferous pyrite, mostly fine-grained but occasionally present as bunches up to 3 cm in diameter, is disseminated in quartz veins, aplite dykes, and adamellite (Markham & Basden, 1974).
Distribution of pyrite, and hence also of gold, was irregular.
Some gold was possibly contained in silicate minerals, i.e. disseminated within the adamellite itself (Markham, 1975).
Historically, only the oxidised zone was worked.
Molybdenite and cassiterite also occur in Stanthorpe Adamellite (Barnes & others, 1988).

CONTROLS OF MINERALISATION:
Control is lithological: deposit is localised in host granite, which is presumed to be the source of mineralisation (Barnes & others, 1988).

GENETIC MODELS:
Magmatic hydrothermal, related to late-stage high-level hydrothermal activity (Barnes & others, 1988).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Timbarra-Poverty Point (D)
PRINCIPAL SOURCES: Markham & Basden (1974), Markham (1975), Brunker & others (1976), Gilligan & others (1986), Barnes & others (1988).
SUMMARY

Timbarra-Poverty Point lies in the northwestern part of the Coffs Harbour Block (Demon Block in Markham & Basden, 1974), 6 km E of the Demon Fault. Significant production was derived from both alluvial and primary sources. Primary mineralisation comprised disseminated gold associated with the Permo-Triassic Stanthorpe Adamellite.

REGIONAL SETTING: PERMO-TRIASSIC IGNEOUS-ASSOCIATED MINERALISATION
PRINCIPAL SOURCES: Markham & Basden (1974), Gilligan & others (1986), Barnes & others (1988).

A major period of plutonism, from about 265 Ma-220 Ma (Late Permian - see Explanatory Notes), followed major folding and thrusting in the New England Fold Belt. Several hundred individual plutons, in aggregate cropping out over many thousand square kilometres, extend semi-continuously through central New England forming the New England Batholith (Barnes & others, 1988).
The granitoids are calc-alkaline in character, and show variable I-type characteristics (Barnes & others, 1988). The main mineralising granitoids are highly siliceous leucogranites which, in many areas, are commonly the youngest plutons (Barnes & others, op.cit).

Several thousand small to medium-sized mineral deposits are associated with late-orogenic granitoids in the New England Fold Belt (Markham & Basden, 1974; Gilligan & others, 1986).
Included are deposits which vary from almost direct magmatic derivation to deposits which are spatially related to granites, but are controlled by major shear zones and fracture systems and may have resulted from hydrothermal leaching of deep crustal rocks (Gilligan & others, 1986).
Commodities include Sn, Mo, Bi, W, Au, Ag, As, Pb, Cu, Zn, and Sb, as well as topaz, fluorite, beryl, and quartz (Markham & Basden, 1974; Barnes & others, 1988).

The orebodies are generally small, but include local high-grade zones.
Lodes occur within granitoid, within silexite, pegmatites, and aplites.
They also occur in adjacent sediments, volcanics, and porphyries.
They are characteristically hydrothermal, having associated wallrock

alteration. (Markham & Basden, 1974).
Deposits are commonly in the form of veins controlled by (pre-existing) steeply-dipping faults, shears, or joints. Mineralisation commonly occurs as steeply-pitching shoots within lode structures.
True pipe deposits also occur, localised at the margins of granitoids.
Disseminated mineralisation (e.g. Timbarra-Poverty Point) occurs rarely. (Markham & Basden, 1974).

Gold is commonly associated with antimony in NNE-trending belts parallel to belts of tin and molybdenum mineralisation.
Gold occurs mainly as veins, pipes and disseminated deposits at the outer contacts of leucogranitoids and in country rock around the margins of granitic plutons, e.g. Timbarra-Poverty Point and URALLA (Deposit No.55), and as skarns (Barnes & others, 1988).
Lodes are commonly associated with areas of aplite dykes and with alteration zones, and tend to be structurally controlled as described above. Ore occurs as steeply-plunging shoots within lodes.
(Markham & Basden, 1974; Barnes & others, 1988).

GEOLOGICAL SETTING: TIMBARRA-POVERTY POINT
PRINCIPAL SOURCES: Markham (1975), Brunker & others (1976).

The deposit region is underlain by Permo-Triassic plutonic igneous rocks, represented by the Stanthorpe Adamellite and the Bungulla Adamellite (Markham, 1975; Brunker & others, 1976).
1./ Stanthorpe Adamellite (Pas on Grafton 1:250 000 geological map) (Late Permian-Triassic) - biotite adamellite, leucogranite.
Host to primary reef mineralisation at Timbarra-Poverty Point.
2./ Bungalla Adamellite (Pab) (?Late Permian-Triassic) - coarsely feldspar porphyritic, sphene-rich adamellite.
The Bungalla Adamellite occurs as a southerly phase of the main pluton (Stanthorpe Adamellite) and is exposed along the Rocky River.

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Markham & Basden (1974), Markham (1975), Brunker & others (1976), Barnes & others (1988).

Mineralisation occurs in large zones of pervasive low-grade alteration, typically within biotite-perthite-oligoclase adamellite that is cut by abundant aplite dykes and traversed by quartz veins (Brunker & others, 1976; Barnes & others, 1988).
The mineralised alteration zones probably lie at or near the upper surface of the pluton (Barnes & others, op.cit).
Gold was recorded as having occurred in pyrite disseminated in all three of the rock types: quartz veins, aplite dykes and host adamellite (Markham & Basden, 1974).

The Poverty Point deposits are situated on a prominent spur which juts out from the Timbarra tableland and which lies at an elevation of some 600 m above the level of the Rocky River. The Rocky River itself, and especially the numerous streams draining the tableland, have been worked extensively for alluvial gold. (Markham & Basden, 1974).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Ashley P.M., Cook N.D.J., 1988
Geology of the Whybatong gold prospect and associated Tertiary deep lead. IN Kleeman J.D.(ed) - New England Orogen - tectonics and metallogenesis. Proceedings of symposium, Armidale, November, 1988.
University of New England. Department of Geology and Geophysics
1v P228-234

Brunker R.L., Chesnut W.S., Cameron R.G., Hitchins B.L., 1976
Grafton, New South Wales 1:250 000 geological series map. Sheet SH 55-6, 1st Edition.
Geological Survey of New South Wales
1v

Crawford E., 1968
Timbarra or Rocky River goldfield.
Geological Survey of New South Wales. Report
GS1968/011

Gilligan L.B., Brownlow J.W., Cameron R.G., Henley H.F., Tenison Woods K.L., 1986
Excursion guide, precious metal-antimony mineralization, Dorrigo-Coffs Harbour 1:250 000 sheet area.
Geological Survey of New South Wales. Report
GS1986/023

Griffin R.J., 1956
Poverty Point-Timbarra.
Geological Survey of New South Wales. Report
GS1956/032

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1975
Gold deposits of the New England Fold Belt.
Geological Survey of New South Wales. Report
GS1975/378

oooooooooooooooooooooooooooooooooooooooo

DEPOSIT: 59 DRAKE

DEPOSIT IDENTIFICATION:

COMMODITIES. Ag, Au, Cu, Pb, Zn, As, Hg

DISTRIBUTION:
Record covers 12 main centres: 6 centres in 6 km x 4 km centred on Drake, 3 centres 10-15 km NNE of Drake, 3 centres 6 km S of Drake. Highest concentration of orebodies was Mt. Carrington.

OREBODIES:
Drake (D), Adeline, All Nations (MC), Bellbird (MC), Bellbottom, Doctor Watson (MC), Emu Creek, Gladstone, Golden Drake, Guy Bell (MC), Hot Scone (MC), Kylo, Lady Hampden, Lady Jersey, Lady Mary/Lady Mary Extended (MC), Lone Hand (MC), Mascotte, Mount Carrington, Nil Desperandum (MC), No. 9 (MC), Perseverance (MC), Pig & Whistle (MC), Pioneer (MC), Rainbow (MC), Red Rock, Silver King, Spirit Of Iron, Strauss (MC), White Rock

MINES:
Adeline, All Nations, Bellbird, Bellbottom, Carrington, Doctor Watson, Drake, Emu Creek, Gladstone, Golden Drake, Guy Bell, Hot Scone, Kylo, Lady Hampden, Lady Jersey, Lady Mary, Lady Mary Extended, Lone Hand, Mascotte, Mount Carrington, Nil Desperandum, No. 9, North Kylo, Perseverance, Pig & Whistle, Pioneer, Rainbow, Red Rock, Silver King, Spirit Of Iron, Strauss, White Rock

GROUP: -

COMMENTS:
See Deposit No.60 CORAMBA-ORARA for regional setting of Coffs Harbour Block.

LOCATION:

LATITUDE: 28 55 LONGITUDE: 152 22
250K SHEET: SH56 2 100K SHEET: 9340

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Inverell
LOCAL GOVERNMENT AREA (LGA): Tenterfield

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD
1886	Prospecting

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Drake (D)	Drake	Historical	Underground
Drake (D)	Drake	Operating	Open-Cut
Adeline	Adeline	Historical	Underground
All Nations (MC)	All Nations	Historical	Underground
Bellbird (MC)	Bellbird	Historical	Underground
Bellbottom	Bellbottom	Historical	Underground
Doctor Watson (MC)	Doctor Watson	Historical	Underground
Emu Creek	Emu Creek	Historical	Underground
Gladstone	Gladstone	Historical	Underground
Golden Drake	Golden Drake	Historical	Underground
Guy Bell (MC)	Guy Bell	Historical	Underground
Guy Bell (MC)	Guy Bell	Operating	Open-Cut
Hot Scone (MC)	Hot Scone	Historical	Underground
Kylo	Kylo	Historical	Underground
Kylo	North Kylo	Operating	Open-Cut
Lady Hampden	Lady Hampden	Historical	Underground
Lady Hampden	Lady Hampden	Operating	Open-Cut
Lady Jersey	Lady Jersey	Historical	Underground
Lady Mary/Lady Mary Extended (MC)	Lady Mary	Historical	Underground
Lady Mary/Lady Mary Extended (MC)	Lady Mary Extended	Historical	Underground
Lone Hand (MC)	Lone Hand	Historical	Underground

Mascotte	Mascotte	Historical	Underground
Mount Carrington	Mount Carrington	Historical	Underground
Mount Carrington	Carrington	Operating	Open-Cut
Nil Desperandum (MC)	Nil Desperandum	Historical	Underground
No. 9 (MC)	No. 9	Historical	Underground
Perseverance (MC)	Perseverance	Historical	Underground
Pig & Whistle (MC)	Pig & Whistle	Historical	Underground
Pioneer (MC)	Pioneer	Historical	Underground
Rainbow (MC)	Rainbow	Historical	Underground
Red Rock	Red Rock	Historical	Underground
Silver King	Silver King	Historical	Underground
Spirit Of Iron	Spirit Of Iron	Historical	Underground
Strauss (MC)	Strauss	Historical	Underground
Strauss (MC)	Strauss	Operating	Open-Cut
White Rock	White Rock	Historical	Underground

COMPANIES:

OREBODY: Drake (D)

PRESENT OPERATORS:
Mount Carrington Mines Ltd.

PRESENT OWNERS:	EQUITY%
Mount Carrington Mines Ltd.	100.00

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 2,531

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

YEAR	PRODUCTION
1988	167

MAIN PRODUCTION PERIODS: (1912-1950), 1886-1911, 1988-,

RESOURCES:

DATE	ORE ('000t)	GRADE (g/t)	GOLD (kg)	CLASSIFICATION			
June 1987	180	0.9	162	Economic Inferred	In-Situ	o/c	Red Rock, high Ag grade
June 1987	300	0.2	60	Economic Inferred	In-Situ	o/c	Silver King, high Ag grade
June 1987	931	10.4	9,682	Economic Inferred	In-Situ	o/c	Lady Hampden
June 1987	1,400	0.1	140	Economic Inferred	In-Situ	o/c	White Rock, high Ag grade
Mar 1988	65	3.6	234	Economic Inferred	In-Situ	o/c	Hot Scone
Mar 1988	124	3.1	384	Economic Inferred	In-Situ	o/c	Carrington
Mar 1988	127	4.9	622	Economic Inferred	In-Situ	o/c	Guy Bell
Mar 1988	228	2.7	616	Economic Inferred	In-Situ	o/c	North Kylo
Mar 1988	335	1.7	570	Economic Inferred	In-Situ	o/c	North Kylo
Mar 1988	701	3.3	2,313	Economic Inferred	In-Situ	o/c	Strauss

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: New England Fold Belt
PROVINCE: Coffs Harbour Block
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Drake Volcanics - Late Permian
LITHOLOGY: Dominantly andesitic pyroclastic and epiclastic rocks and lavas, plus compositionally similar sub-volcanic intrusives.
RELATIONSHIP TO MINERALISATION: Host to (sub-)volcanic epithermal gold, silver and base metal mineralisation in structurally controlled fissure-fillings and in stratabound disseminated and breccia orebodies.

GEOCHRONOLOGY:
Palaeontological determinations indicate an age of 260-240 my (Late Permian) for the Drake Volcanics and Gilgurry Mudstone (Herbert, 1983a).

STRATIGRAPHIC ENVIRONMENT:

SIGNIFICANT: Felsic Extrusive, Intermediate Extrusive

STRUCTURAL FEATURES:

SIGNIFICANT: Shearing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

SIGNIFICANT: Fault/Fault, Fault/Stratigraphic Unit

IGNEOUS ACTIVITY:

SIGNIFICANT: Plutonism (Granite), Sub-Volcanism (Felsic Porphyry), Sub-Volcanism (Intermediate), Volcanism (Felsic), Volcanism (Intermediate)

METAMORPHISM:
The Drake Volcanics have undergone sub-sea floor alteration to a lower greenschist facies assemblage (Perkins, 1988).

ALTERATION:

OREBODY: Drake (D)
Alteration (argillic grade) is extensive and includes assemblages of quartz (pervasive silica flooding), sericite, adularia, chlorite, illite, kaolinite, montmorillonite, carbonate, pyrite, (muscovite).

Illitic and propylitic alteration zones surround hydrothermal breccia mineralisation at Red Rock (Perkins, 1988).

DEPOSIT CHARACTERISTICS:

TYPES:
MAJOR: Sub-volcanic epithermal vein, disseminated and breccia mineralisation in felsic intermediate volcanics and sub-volcanic intrusives.

STYLE:

SIGNIFICANT: Discordant, Stratabound

AGE OF MINERALISATION: Palaeozoic Late Permian

DIMENSIONS/ORIENTATION:

OREBODY: Drake (D)

	MIN	AVE	MAX
DEPTH OXIDATION (m)		60.0	

ORE TEXTURE:

NATURE OF MINERALISATION:
PRIMARY ORE: Breccia, Dissemination, Multiple Veins, Stockwork, Vein (Reef)

MINERALOGY:

OREBODY: Drake (D)
PRINCIPAL SOURCES: Markham & Basden (1974), Offenberg & Cochrane (1975), Herbert (1983b).

Orebodies have complex mineralogies indicative of multiple episodes of mineralisation, which fall into two main stages:-
i) quartz/pyrite.
ii) base metal sulphide/silver-gold.
(Herbert, 1983b; Barnes & others, 1988).

Sulphide zone: varying proportions of pyrite, sphalerite, chalcopyrite, galena, tennantite, argentiferous tetrahedrite-freibergite, (gold).
The sulphides occur as space fillings and selectively replace host rock fragments (Offenberg & Cochrane, 1975).
Gold occurs as gold and/or in electrum; silver occurs in electrum and in a wide variety of sulphosalts (pearceite-proustite), silver sulphides, and mixed copper-silver sulphides (Herbert, 1983b).

Offenberg & Cochrane (1975) identified the general paragenetic sequence: early primary pyrite, second generation pyrite, galena, chalcopyrite-.ennantite-tetrahedrite, (gold), sphalerite, gold and late-stage pyrite. Chalcopyrite is replaced by secondary bornite, covellite, chalcocite. Ag/Au ratios range from about 1000:1 to unity (Barnes & others, 1988).

Herbert (1983b) distinguished two mineralogical associations within the fissure-filling style of mineralisation:-
i) carbonate-Au-Cu paragenesis, characterised by assemblage of Cu, Cu-Fe and Cu-Ag sulphides, tennantite, gold, (pyrite), in massive carbonate or carbonate-quartz gangue.
ii) pyritic Cu and Cu-Zn+-Au paragenesis, characterised by pyrite, chalcopyrite, sphalerite, tetrahedrite-tennantite, (gold, galena). Gold occurs at sulphide or quartz-sulphide boundaries.

Hypogene opaque mineral phases of the disseminated ores include in addition to those present in fissure-filling ores a variety of complex sulphosalts, silver sulphides, and mixed copper-silver sulphides (Herbert, 1983b).

Gangue: quartz, illite (sericite), kaolinite, montmorillonite, calcite, muscovite, chlorite, feldspar, apatite, barite, gypsum.

Andesite: phenocryst assemblage of plagioclase and clinopyroxene, +- orthopyroxene; no primary hydrous phases (Herbert, 1983a).

Herbert (1983b) noted distinctive mineralogical features of the volcanic -hosted orebodies compared with granitoid-associated mineralisation in the Drake region:-
i) Volcanic-hosted ores are characterised by absence of pyrrhotite, arsenopyrite, stannite-kersterite, which are ubiquitous phases in ores of granitoid affiliation.
ii) Pearceite-arsenopolybasite occurs in all volcanic-hosted ores, but is absent from granitoid-associated deposits.

The volcanic-hosted ores are also distinguished from the granitoid ores by distinctive mineral chemistries. (Herbert, 1983b).

CONTROLS OF MINERALISATION:

PRINCIPAL SOURCES: Herbert (1983a,b), Bottomer (1986), Barnes & others (1988), Perkins (1988).

1./ Regional controls are (1) lithostratigraphic, and (2) structural.

(1) i) Au-Ag-base metal mineralisation in the Drake region is hosted largely by the Drake Volcanics. Calc-alkaline volcanics of similar age in the NE part of the New England Fold Belt - Emmaville Volcanics, Dundee Rhyodacite, and equivalents - contain little co-genetic mineralisation (Bottomer, 1986; Barnes & others, 1988).
Distinctive features of the Drake Volcanics that may be significant for mineralisation are: a) their slightly more mafic composition,
b) abundance of late felsic sub-volcanic intrusions in the Drake area,
c) presence of marine volcanogenic sediments within the Drake Volcanics,
d) presence of overlying mudstone (Gilgurry Mudstone)
(Bottomer, 1986; Barnes & others, 1988).

Within the volcanics, mineralisation is commonly proximal to sub-volcanic intrusives, suggesting a localising influence of the intrusives on precious and base metal mineralisation (Perkins, 1988).

ii) Chemical data (Herbert, 1983a) suggest different source rocks for the dacite-rhyodacite-rhyolite series and the andesites within the volcanics. Different source rocks are also indicated for the felsic and mafic/intermediate plutonic rocks.
Implications are: a) polygenetic origin for the volcanically-hosted ores, and b) separate Ag-Au mineralising episode associated with the Permo-Triassic granitoids (Herbert, 1983a,b; Bottomer, 1986).

iii) A separate granitoid-associated episode of mineralisation has been distinguished on the basis of spatial relationships and and distinct mineralogical associations of volcanic-hosted and granitoid-associated ores (see 'MINERALOGY'), and Pb isotope data.
Sulphides from volcanic-hosted ores are characterised by Pb isotopic compositions collinear with those of the host volcanics, indicating a volcanic metal source (Gulson & Bottomer, 1984, reported by Bottomer, 1986).
In the Drake region, the Lunatic and Boorook fields N of Drake have probable granite-related Pb isotopic signatures (Gulson & others, 1985, reported by Perkins, 1988).
All the orebodies included in this datafile fall within the group of volcanic-associated ores.

(2) Distribution of mineralisation is controlled by prominent sets of fractures, principally NE, to a lesser extent NW and N (Herbert, 1983b). Orebodies broadly cluster at intersections of fracture sets.
The inferred axis of the tensional graben in which the Drake Volcanics accumulated is parallel to a NNW-trending zone of mineralisation through Red Rock, Drake, and Mascotte (Herbert, 1983a,b).

2./ On a local scale orebodies are controlled by:-
(1) structural features, which are dominant in the fissure veins, and
(2) lithostratigraphic factors, which are the dominant control in the stratabound orebodies (Herbert, 1983b).

(1) Vein orientations parallel regional structural trends.
Mineralisation is concentrated in pipe-like zones whose axes parallel principal stress axes (Herbert, 1983b).

(2) Stratabound disseminated mineralisation is localised in particular stratigraphic units characterised by high porosity (Herbert, 1983b).
In areas of both vein and disseminated mineralisation, e.g. Red Rock, the disposition of ore types suggests that the fissures acted as feeders to disseminated mineralisation, which formed at intersections of faults with units of high permeability (Bottomer, 1986).
Faulting and shearing apparently preceded mineralisation, providing channelways and sites of deposition for mineralising fluids (Herbert, 1983b).

3./ Isotope data.
i) Sulphur isotope data indicate a predominantly magmatic source of sulphur, with sulphur derivation probably by leaching of volcanic country rock at depth (Herbert & Smith, 1978, reported by Herbert, 1983b; Perkins, 1988).

ii) Oxygen isotope determinations by Perkins (1988) differ from those of Herbert (1983b). Herbert (1983b) reported delta18 O compositions of the Drake ore fluids to be around -2 per mil (based on temperature of calcite formation of <200 deg C), which was inferred to indicate a fluid of mixed meteoric/magmatic derivation.
Perkins (1988) reported delta18 O values in the range +7.1-11.4 per mil (based on temperature of ore formation of 200-300 deg C), which suggests a predominantly marine ore fluid.

iii) Lead isotope data define two ore groups associated with two sources of lead. The major volcanic-hosted deposits derived metals from the volcanic pile; a smaller group of minor deposits (including Lunatic and Boorook - not included in this report) have probable granitoid-associated isotopic compositions (Gulson & others, 1985, reported by Perkins, 1988).

4./ Fluid inclusion studies at Red Rock (Perkins, 1988) indicate conditions of ore formation:-
. temperature - 222-295 deg C.
. ore fluid salinity - 3 equivalent wt % NaCl.
. depth - 800 m maximum, probably within 500 m; including up to 130 m water depth.

GENETIC MODELS:
PRINCIPAL SOURCES: Chapman & Degeling (1981), Herbert (1983a,b), Bottomer (1986), Perkins (1988).

Chapman & Degeling (1981), Herbert (1983b), Bottomer (1986), and Perkins (1988) proposed a sub-volcanic epithermal origin for Drake, in which gold, silver, base metals, and sulphur were leached from a volcanic pile by fluids associated with late-stage subvolcanic intrusion and deposited in structural sites at a high level in the volcanics.

Recent workers (Bottomer, 1986; Perkins, 1988) have compared Drake with epithermal models described by Berger & Eimon (1983), Bonham (1986), and other authors quoted by Bottomer (1986) and Perkins (1988).
By comparison with circum-Pacific Tertiary epithermal systems, Drake is distinctive in that it represents the rarer low sulphur or adularia sericite type system, and was deposited in shallow marine rather than terrestrial environment (Perkins, 1988).

The Drake Volcanics were extruded mainly subaqueously from a series of volcanic cauldrons onto continental shelf at the site of rifting or graben formation in a convergent plate margin setting (Chapman & Degeling, 1981; Bottomer, 1986; Barnes & others, 1988).

Two main stages of mineralisation and accompanying alteration were associated with the later stages of a complex history of volcanism and broadly contemporaneous sub-volcanic intrusion:-
1./ Chapman & Degeling (1981) identified three main stages of volcanism:

rhyolitic pyroclastics and breccias, andesitic lavas, and rhyolitic extrusives and intrusives, although the subdivision of the volcanics presented by Herbert (1983a - see 'GEOLOGICAL SETTING: DRAKE' below) would seem to indicate a more complex sequence of rhyolitic-dacitic and andesitic volcanism.

2./ Mineralisation and alteration were principally associated with late-stage rhyolitic volcanism and sub-volcanic intrusion (Chapman & Degeling, 1981; Herbert, 1983a; Bottomer & others, 1984).
The sub-volcanic intrusions may have provided the heat source to establish convection cells thereby facilitating movement of hydrothermal fluids through fractured and porous rocks with attendant leaching of metals and sulphur (Herbert, 1983b; Bottomer & others, 1984).

3./ The general paragenetic sequence determined from Lady Hampden, Silver King, White Rock, and Red Rock, is:-
i) pervasive propylitic/illitic alteration.
ii) hydrothermal brecciation (Red Rock).
iii) Stage 1 mineralisation: quartz-pyrite alteration - silica flooding, pyrite deposition, accompanied by argillic alteration and carbonation.
iv) Stage 2 mineralisation: deposition of complex base metal sulphides and sulphosalts/gold-silver/electrum, accompanied by silica alteration.
v) argillic alteration.
(Herbert, 1983b; Bottomer, 1986; Perkins, 1988).

4./ Mechanism for precipitation could have been either:-
i) episodic boiling in zones of increased porosity and permeability (Chapman & Degeling, 1981; Bottomer, 1986; Perkins, 1988), or
ii) mixing of hot hydrothermal fluids with cooler dilute meteoric water in permeable zones and structures, thereby modifying the physicochemical environment (Chapman & Degeling, 1981; Herbert, 1983b).

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Drake (D)

PRINCIPAL SOURCES: Olgers (1972), Markham & Basden (1974), Olgers (1974), Olgers & others (1974), Markham (1975), Offenberg & Cochrane (1975), Thomson (1976), Herbert (1983a,b), Bottomer & others (1984), Bottomer (1986), Perkins (1988).

SUMMARY

Drake lies in the northern part of the Coffs Harbour Block. Mineralisation comprises (sub-)volcanic epithermal gold, silver, and base metal deposits in (1) fissure veins, (2) vein stockworks, (3) stratabound and lenticular disseminations, and (4) 'crackle' breccia infillings, in silicate+-pyrite alteration zones within felsic-intermediate volcanics of the Late Permian Drake Volcanics.

REGIONAL SETTING: DRAKE

PRINCIPAL SOURCES: Markham & Basden (1974), Olgers (1974), Herbert (1983a), Bottomer & others (1984), Perkins (1988).

The northern part of the Coffs Harbour Block (Demon Block in Markham & Basden, 1974) consists of Carboniferous and Permian sediments and volcanics (Emu Creek Formation, Drake Volcanics, Gilgurry Mudstone), intruded by Triassic post-kinematic granitoids of the New England Batholith (Markham & Basden, 1974; Bottomer & others, 1984).

The Permian volcano-sedimentary sequence (Drake Volcanics and Gilgurry Mudstone) is exposed in a partly fault-bounded NNW-trending graben 60 km x 10-20 km (Bottomer & others, 1984).
To the W the block is truncated by granitoids of the Stanthorpe Adamellite, along a largely faulted contact which is part of the right-lateral transcurrent Demon Fault System (Herbert, 1983a; Perkins, 1988).
To the S, the Drake Volcanics unconformably overlie Ordovician-Silurian strata (Herbert, 1983a).
To the E, the Permian sequence is partly fault-bounded against Emu Creek Formation, intruded by Bruxner Adamellite (NEB), and unconformably overlain by Mesozoic sediments of the Clarence-Moreton Basin (Olgers, 1974; Thomson, 1976; Bottomer, 1986).

REGIONAL SUCCESSION AND ASSOCIATED MINERALISATION: DRAKE

PRINCIPAL SOURCES: Olgers (1974), Offenberg & Cochrane (1975), Thomson (1976), Bottomer & others (1984), Perkins (1988).

1./ Emu Creek Formation (Cue on Warwick 1:250 000 geological map) (Late Carboniferous) (1500+ m thick) - volcanic-epiclastic sequence of mudstone with subordinate greywacke, sandstone, siltstone, shale, conglomerate; up to 15% volcanic lithologies - mainly rhyolite-dacite.
The sequence is part of a deformed Carboniferous subduction complex (Flood & Fergusson, 1984, reported by Perkins, 1988) that is structurally more deformed than the overlying Drake Volcanics (Thomson

1976; Bottomer, 1986). The unit is host to fissure vein Sb-Au at the Lunatic field NE of Drake. The Emu Creek Formation is partly faulted against and partly unconformably overlain by:-

2./ Drake Volcanics, including Mount Carrington Rhyolite and Drake Andesite (Bottomer, 1986) (Pv) (Late Permian) (max. thicknes 900 m) - calc-alkaline volcanic and sub-volcanic suite composed of:-
i) dominantly andesitic porphyritic lavas, agglomerates, breccias, fine coarse and lapilli tuffs, epiclastic breccias, volcanogenic sandstones, and laharic deposits (Herbert, 1983a); and
ii) penecontemporaneous dacitic to rhyolitic porphyritic and flow-banded sub-volcanic intrusions (Herbert, 1983a; Bottomer, 1986).
The environment of deposition was mainly high energy shallow marine, locally terrestrial (Herbert, 1983a; Bottomer, 1986).
The Drake Volcanics are mostly flat-lying and relatively undeformed (Bottomer, 1986).
The Drake Volcanics is the principal host to Ag-Au mineralisation in the Drake region.
The formation is conformably overlain, with locally transitional contact, by:-

3./ Gilgurry Mudstone (Pul) (Late Permian) (150 m) - fossiliferous marine mudstone, minor sandstone. Host to Ag lodes at Boorook NW of Drake, and to minor Zn-Pb-Ag veins W of White Rock.

The Drake Volcanics and Gilgurry Mudstone are intruded in the Drake area by stocks and plutons of:-

4./ Stanthorpe Adamellite (Rls) (Early Triassic) - diorite, gabbro, quartz diorite, leucoadamellite, granodiorite (Herbert, 1983a).
Host to fissure vein Au(-Ag) emplaced along NNE fractures SW of Drake (Bottomer, 1986).

The Drake Volcanics and Gilgurry Mudstone are intruded to the E of Drake by:-

5./ Bruxner Adamellite (Pua) (Late Permian or Early Triassic) - adamellite, leucogranite, granite, granodiorite, diorite.
Possibly genetically related to mineralisation in Lunatic field.

6./ Mafic dykes and plugs (Tertiary) - were emplaced along major faults and fractures.

GEOLOGICAL SETTING: DRAKE
PRINCIPAL SOURCES: Thomson (1976), Herbert (1983a), Bottomer & others (1984), Bottomer (1986).

The Drake Volcanics have been subdivided into a series that broadly represents alternating phases of predominantly rhyolitic and predominantly andesitic volcanism (Crabb, 1966, reported by Bottomer & others, 1984; Herbert, 1983a):-
i) Cataract River Member - mudstones, siltstones, sandstones, rhyolitic to dacitic tuffs and breccias. Host to Red Rock.
ii) Gattum Gully Member - rhyolitic to rhyodacitic tuffs, agglomerates, breccias, conglomerates. Host to some orebodies at Mount Carrington.
iii) Hampden Member - rhyolitic to rhyodacitic tuffs, lapilli tuffs and agglomerates. Host to Lady Hampden, Adeline, some orebodies at Mount Carrington.
iv) Sawpit Gully Member - andesitic breccias and tuffs. Host to Silver King; andesitic tuffs intruded by rhyolitic breccia that is host to White Rock may correlate with Sawpit Gully Member (Bottomer, 1986).
v) Fairfield Creek Member - laminated rhyolitic crystal-lithic tuff.
vi) Drake Andesite - andesitic to dacitic flows, autobrecciated flows, agglomerates, breccias, tuffs, epiclastic breccias, sandstones, conglomerates. Host to Lady Jersey, Golden Drake, Mascotte.
vii) Newman Member - laminated rhyolitic crystal-lithic tuff.

Faulting is the dominant mode of structural accommodation within the volcanics (Bottomer & others, 1984).

Shear zones and minor faults locally controlling mineralisation have NNW to NNE trends (Offenberg & Cochrane, 1975).

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Markham & Basden (1974), Markham (1975), Offenberg & Cochrane (1975), Herbert (1983b), Bottomer & others (1984), Bottomer (1986), Perkins (1988).

Four styles of mineralisation are represented in the Drake field (Markham & Basden, 1974; Offenberg & Cochrane, 1975):-

1) fissure veins (simple fissure fillings).

2) vein stockworks (multiple fissure fillings).
3) stratabound and lenticular disseminations.
4) breccia infillings.

1) and 2) Simple and multiple fissure fillings are characteristically small shoots in narrow siliceous lodes along shear zones which have a dominant NNE to NE and NW trend with steep W dips (Offenberg & Cochrane, 1975; Herbert, 1983b).
The majority of orebodies are associated with the Gattum Gully Member. Vein contact with country rock is commonly gradational. In places, multiple veins form a stratabound stockwork in rhyolitic and rhyodacitic tuffs (Herbert, 1983b).
Several sub-types of fissure vein mineralisation are distinguished on the basis of mineralogy (see 'MINERALOGY').
Simple fissure veins occurs at Mount Carrington, Lady Jersey, Red Rock, Mascotte, Adeline, (Lady Hampden, and Silver King).
This type of ore provided the bulk of historical production but has little current economic potential (Herbert, 1983b; Bottomer, 1986).
Stockwork mineralisation occurs at White Rock, Strauss.

3) Disseminated mineralisation is economically the most important ore type, in terms of both known and potential occurrences (Herbert, 1983b). Examples are Lady Hampden, Silver King, White Rock, Emu Creek, Mandrake, Red Rock.

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Amos Q.G., 1977
The geology and mineralisation of the Emu Creek-Red Rock-Boorook mineral fields, northeastern New South Wales. B.Sc.(Hons) thesis.
University of New England. Unpublished
1v

Andrews E.C., 1908
Report on Drake gold and copper field.
Geological Survey of New South Wales. Mineral Resources
12

Barnes R.G., Brown R.E., Brownlow J.W., Gilligan L.B., Krynen J., Willis I.L., 1988
A review of the mineral deposits of the New England Orogen in New South Wales. IN Kleeman J.D.(ed) - New England Orogen - tectonics and metallogenesis. Proceedings of symposium, University of New England, November, 1988.
University of New England. Department of Geology and Geophysics
1v P211-227

Biddle W.J.C., 1977
The geology and ore mineralisation in the Cheviot Hills-Lunatic area, near Drake, NSW. B.Sc.(Hons) thesis.
University of New England. Unpublished
1v

Bottomer L.R., Richards S.M., 1982
The Drake mineral field. IN Flood P.G. and Runnegar B.(eds) - New England Geology.
University of New England and AHV Club
Addendum

Bottomer L.R., 1983
Mineral deposits of the Drake area, NSW. IN Geological summary of New South Wales. Symposium, Sydney, September 1983.
Sydney Mineral Exploration Discussion Group
1v P2-3

Bottomer L.R., Simmons R.J., Joyce R.M., 1984
Mineralization in the Drake area. IN Herbert H.K. & Rynn J.M.W.(eds) - Volcanics, granites and mineralisation of the Stanthorpe-Emmaville-Drake region. Geological Society of Australia, Queensland Division. 1984 field conference.
Geological Society of Australia. Queensland Division
1v P79-90

Bottomer L.R., 1984
Mineral deposits of the Drake area, NSW, Australia IN Fyfe W.S.(ed) - Geological Association of Canada-Mineralogical Association of Canada Joint Annual Meeting, London Ontario, May, 1984. Abstracts.
Geological Association of Canada
9 P47

Bottomer L.R., 1986
Epithermal silver-gold mineralization in the Drake area, northeastern New South Wales.
Australian Journal of Earth Sciences
33(4) P457-473

Chapman J., Degeling P.R., 1981
Some disseminated gold deposits in New South Wales.
Geological Survey of New South Wales. Report
GS1981/567

Crabb D.N., 1966
Lady Hampden prospect - final report.
Geological Survey of New South Wales. Report
GS1966/046

Herbert H.K., 1983
The Drake mineral field - an unique entity in eastern Australia. IN Permian geology of Queensland. Proceedings of symposium, Brisbane, July 1982.
Geological Society of Australia. Queensland Division
1v P367-377

Herbert H.K., 1983
Gold-silver mineralisation within the Drake Volcanics of northeastern New South Wales. IN Permian geology of Queensland. Proceedings of symposium, Brisbane, July 1982.
Geological Society of Australia. Queensland Division
1v P401-412

Herbert H.K., 1984
Mineralisation of volcanic & granitoid association in Stanthorpe-Emmaville-Drake region, NE NSW & SE Qld. IN Herbert & Rynn(eds)- Volcanics, granites & mineralisation of Stanthorpe-Emmaville-Drake region. GSA Qld Div. 1984 field conference.
Geological Society of Australia. Queensland Division
1v P76-78

Jaquet J.B., 1897
Report on Lunatic goldfield.
New South Wales. Department of Mines. Annual Report.
1896 Appendix 12

Johansen G.F., 1977
The geology and mineralisation of a portion of the Drake Volcanics, south-east of Drake, NSW. B.Sc.(Hons) thesis.
University of New England. Unpublished
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1975
Gold deposits of the New England Fold Belt.
Geological Survey of New South Wales. Report
GS1975/378

Odekirk J., 1971
Unpublished reports of Newmont Exploration Ltd metallurgical department June, October 1971.
Newmont Exploration Ltd. Unpublished Report
June October 197

Odekirk J., 1972
Unpublished reports of Newmont Exploration Ltd metallurgical department 1972.
Newmont Exploration Ltd. Unpublished Report
1972 June, September

Offenberg A.C., Cochrane G.W., 1975
Drake mineral field. IN Knight C.L.(ed) - Economic geology of Australia and Papua New Guinea - 1. Metals.
AusIMM. Monograph Series
5 P721-724

Olgers F., 1972
Warwick, Queensland and New South Wales, 1:250 000 geological series map. Sheet SH 56-02, 1st edition.
Bureau Mineral Resources, Australia
1v

Olgers F., 1974
Warwick, Queensland and New South Wales, 1:250 000 geological series map and explanatory notes. Sheet SH 56-02.
Bureau Mineral Resources, Australia
1v

Olgers F., Flood P.G., Robertson A.D., 1974
Palaeozoic geology of the Warwick and Goondiwindi 1:250 000 Sheet areas, Queensland and New South Wales.
Bureau Mineral Resources, Australia. Report
164

Perkins C., 1986
The Red Rock deposit, Drake Volcanics, New South Wales, Australia - an example of a submarine epithermal system. IN Volcanism, hydrothermal systems & related mineralisation. Internat. Volcanological Cong., New Zealand, Feb 1986. Abstracts.
AusIMM and University of Auckland
Symposium 5 P307

Perkins C., 1987
Origin and provenance of submarine volcaniclastic rocks in the Late Permian Drake Volcanics, northeastern New South Wales. IN Proceedings, Pacific Rim Congress 87, Gold Coast, Queensland, August 1987.
AusIMM
1v P891-894

Perkins C., 1987
The Red Rock deposit: a Late Permian submarine epithermal precious metal system in northeastern New South Wales. IN Proceedings, Pacific Rim Congress 87, Gold Coast, Queensland, August 1987.
AusIMM
1v P895-898

Perkins C., 1988
The Red Rock deposit: Late Permian submarine epithermal Ag-Au mineralization in the Drake Volcanics. IN Kleeman J.D.(ed) - New England Orogen - tectonics and metallogenesis. Proceedings of symposium, University New England, November, 1988.
University of New England. Department of Geology and Geophysics
1v P275-P288

Raggatt H.G., 1938
Red Rock mineral field.
New South Wales. Department of Mines. Annual Report
1938 P109-114

Robertson Research (Australia), 1984
Report to Seltrust Holdings Ltd. IN Paragon Resources NL Prospectus.
Paragon Resources NL
Appendix 2

Thomson J., 1974
Geology of the Drake 1:100 000 sheet.
Geological Survey of New South Wales
1v

oooooooooooooooooooooooooooooooooooooo

DEPOSIT: 60 CORAMBA-ORARA

DEPOSIT IDENTIFICATION:

SYNONYMS: Orara, Nana Creek, Nana Creek

COMMODITIES: Au

DISTRIBUTION:
Record covers at least 45 individual reef deposits within a NNW-trending zone 40 km long x up to 25 km wide, NW of Coffs Harbour.

OREBODIES:
Coramba-Orara (D), Aurania, Coramba, Moleton, Nana Glen, Tallawudja Creek, Upper & Lower Bucca, Woolgoolga-Coffs Harbour

MINES:
Advance Australia, Advance Orara, Beacon & Reward, Black Mystery, Blue Mystery, Coramba King, Coramba Queen, Day Dawn, Eureka, Evening Staf, Evening Star, Fortune Teller, Garryowen, Golden, Golden Arrow, Golden Wattle, Hidden Treasure, Highland Mary, Homeward Bound, Illabo, Joker, Korora, Lady Belle, Lady Carrington, Lady Elsie, Laurie Bros (Sea Breeze), Lilla, McAnallys, Mountain Maid, Nanas Daughter, New Years Gift, No. 1 West Lady Belle, Queens Record Reign, Red White & Blue

GROUP: -

COMMENTS:
Record includes regional setting of Coffs Harbour Block. See Gilligan & others (1986b) for additional mining methods.

LOCATION:

LATITUDE: 30 10 — LONGITUDE: 153 0
250K SHEET: SH56 10 — 100K SHEET: 9437

ADMINISTRATIVE SUBDIVISION:

MINING DIVISION: Coffs Harbour
LOCAL GOVERNMENT AREA (LGA): Coffs Harbour

DEVELOPMENT HISTORY:

DISCOVERY YEAR	DISCOVERY METHOD	COMMENTS
1881	Prospecting	
1894		Extension To Known Mineralisation

OPERATING STATUS AT JUNE 1989

OREBODY	MINE	STATUS	MINING METHOD
Aurania	Advance Orara	Historical	Underground
Aurania	Garryowen	Historical	Underground
Coramba	Evening Star	Historical	Underground
Coramba	Coramba King	Historical	Underground
Coramba	Lady Elsie	Historical	Underground
Coramba	Coramba Queen	Historical	Underground
Coramba	Illabo	Historical	Underground
Coramba	Fortune Teller	Historical	Underground
Moleton	Highland Mary	Historical	Underground
Moleton	Lilla	Historical	Underground
Moleton	McAnallys	Historical	Underground
Nana Glen	Eureka	Historical	Underground
Nana Glen	Hidden Treasure	Historical	Underground
Nana Glen	Lady Belle	Historical	Underground
Nana Glen	No. 1 West Lady Belle	Historical	Underground
Nana Glen	Nanas Daughter	Historical	Underground
Tallawudja Creek	Day Dawn	Historical	Underground
Tallawudja Creek	Homeward Bound	Historical	Underground
Tallawudja Creek	Advance Australia	Historical	Underground
Tallawudja Creek	Red White & Blue	Historical	Underground
Tallawudja Creek	Joker	Historical	Underground
Tallawudja Creek	New Years Gift	Historical	Underground

Upper & Lower Bucca	Lady Carrington	Historical	Underground
Upper & Lower Bucca	Mountain Maid	Historical	Underground
Upper & Lower Bucca	Beacon & Reward	Historical	Underground
Upper & Lower Bucca	Queens Record Reign	Historical	Underground
Upper & Lower Bucca	Blue Mystery	Historical	Underground
Upper & Lower Bucca	Black Mystery	Historical	Underground
Upper & Lower Bucca	Golden Wattle	Historical	Underground
Woolgoolga-Coffs Harbour	Golden Arrow	Historical	Underground
Woolgoolga-Coffs Harbour	Golden	Historical	Underground
Woolgoolga-Coffs Harbour	Laurie Bros (Sea Breeze)	Historical	Underground
Woolgoolga-Coffs Harbour	Korora	Historical	Underground

COMPANIES:

PRODUCTION:

CUMULATIVE PRODUCTION TO 1964 (Au bullion, kg): 1,183
Recovered grade range 10-40 g/t Au.

ANNUAL PRODUCTION FROM 1965 (Au bullion, kg):

MAIN PRODUCTION PERIODS: (1931-1938), 1882-1914,

RESOURCES:

PRE-MINE RESOURCE SIZE: S

GEOLOGY:

PROVINCE:

BLOCK: New England Fold Belt
PROVINCE: Coffs Harbour Block
SUB-PROVINCE: -

HOST ROCKS:

FORMATION NAME & AGE: Coramba Beds - ?Late Carboniferous
LITHOLOGY: Greywacke, siltstone, siliceous siltstone, chert, jasper.
RELATIONSHIP TO MINERALISATION: Host to principal mineralisation of field in structurally controlled metasediment-hosted epigenetic quartz veins.

FORMATION NAME & AGE: Brooklana Beds - ?Late Carboniferous
LITHOLOGY: Siliceous mudstone and siltstone, chert, jasper, metabasalt.
RELATIONSHIP TO MINERALISATION: Host to minor proportion of mineralisation.

STRATIGRAPHIC ENVIRONMENT:

SIGNIFICANT: Chert, Metasedimentary, Volcanogenic Sedimentary

STRUCTURAL FEATURES:

SIGNIFICANT: Jointing, Shearing

STRUCTURAL/STRATIGRAPHIC INTERSECTIONS:

IGNEOUS ACTIVITY:

METAMORPHISM:

'Two metamorphic events have been recognised in the Coffs Harbour Block. The first (dynamothermal) metamorphism produced assemblages which increase in intensity southward from prehnite-pumpellyite to lower greenschist facies. This metamophism is considered syn-kinematic because it produced aligned micas in the S1 cleavage (Korsch, 1978). The second (static) metamorphism produced randomly orientated biotite, overprinting the higher grade dynamothermal assemblages in the southern Coffs Harbour Block. The biotite grade metamorphism produced by these events is centred S of the Coramba-Orara goldfield.' (Gilligan & others, 1986a).

DEPOSIT CHARACTERISTICS:

TYPES:

STYLE:

MAJOR: Discordant, SIGNIFICANT: Stratabound

MORPHOLOGY: Lenticular

AGE OF MINERALISATION: Mesozoic Middle Triassic

DIMENSIONS/ORIENTATION:

OREBODY: Coramba-Orara (D)

		MIN	AVE	MAX
TRUE WIDTH	(cm)			300.0

ORE TEXTURE:
Banded/Laminated, Massive

NATURE OF MINERALISATION:
PRIMARY ORE: Fault/Shear-Filling, Stockwork, Vein (Reef),
SECONDARY ORE: Supergene Enrichment

MINERALOGY:

OREBODY: Coramba-Orara (D)
Sulphide zone: quartz+-calcite, free gold, (arsenopyrite, pyrite, lesser galena, sphalerite, pyrrhotite, and/or chalcopyrite).
Veins are internallly massive, banded. or brecciated.
(Barnes & others, 1988).

CONTROLS OF MINERALISATION:
Mineralisation is broadly stratigraphically controlled but main control on localisation is structural: veins occur as fissure fillings in structural sites.

GENETIC MODELS:
Gilligan & others (1986a) and Barnes & others (1988) favoured a metamorphic hydrothermal origin in which vein deposits formed by remobilisation of stratabound gold hosted by chert lenses within the metasediments.

The concentration of deposits on the southerly projection of the axis of the Clarence-Moreton Basin may indicate a link between basin formation and gold remobilsation: the Clarence-Moreton Basin may be the product of a major Middle Triassic thermal event which may also have caused gold to be remobilised from deeper sources and deposited in structural sites to form the auriferous veins of the Coramba-Orara field (Gilligan & others, 1986a).

Barnes & others (1988, quoting from BP Minerals Australia, 1986; Gilligan & others, 1986; and Keevers & Jones, unpubl): 'Chert-hosted mineralisation in the Coffs Harbour Block may have formed by concentration of Au in favourable sites in the cherts during metamorphism and deformation. The Au may have been remobilised from trace syngenetic gold within the cherts (?exhalites derived from submarine volcanism).'

GEOLOGICAL SETTING OF MINERALISATION:

OREBODY: Coramba-Orara (D)
PRINCIPAL SOURCES: Leitch & others (1971), Markham & Basden (1974), Markham (1975), Gilligan & others (1986a,b), Barnes & others (1988).
SUMMARY

Coramba-Orara lies in the southeastern portion of the Coffs Harbour Block. Mineralisation comprised numerous small epigenetic gold-quartz veins in siliceous metasediments, that may have formed by remobilisation of chert-hosted stratabound gold (see 'GENETIC MODELS').

REGIONAL SETTING: COFFS HARBOUR BLOCK
PRINCIPAL SOURCES: Leitch & others (1971), Markham & Basden (1974), Gilligan & others (1986a).

The Coffs Harbour Block (including Demon Block) contains sequences of Ordovician-Silurian volcaniclastic sediments and Devonian-Carboniferous metasediments and oceanic crustal rocks, intruded by post-orogenic Permo-Triassic granitoids and overlain by co-magmatic felsic volcanics.

The block is largely fault-bounded: to the W by the Demon Fault, S by the Crossmaglen Fault, and possibly also to the N, against the Emu Creek Block (Markham & Basden, 1974).
To the E, the block is overlain by Mesozoic sediments of the Clarence-Moreton Basin; this boundary, along part of which the Gordonbrook Serpentinite Belt has been emplaced, is considered to be a major crustal fracture zone that may have controlled both granite (New England Batholith) emplacement and basin subsidence (Markham & Basden, 1974).

REGIONAL SUCCESSION AND ASSOCIATED MINERALISATION: COFFS HARBOUR BLOCK
PRINCIPAL SOURCES: Leitch & others (1971), Markham & Basden (1974), Olgers (1972, 1974), Brunker & others (1976), Gilligan & others (1986a,b).

1./ Unnamed metasediments (O-S, S on Grafton 1:250 000 geological map) (Ordovician-Silurian) - argillites, intermediate to mafic volcanics, limestone; quartz-veined and silicified. Occupies east-central portion of block.
2./ Moombil Siltstone (Cemf on Dorrigo-Coffs Harbour 1:250 000 metallogenic map) (?Late Carboniferous) - massive black siltstone, rare lithic wacke and granule conglomerate.
3./ Brooklana beds (Ccbf) (?Late Carboniferous) - thinly-bedded siliceous mudstone and siltstone, rare lithic wacke, lenses of chert, jasper. metabasalt, quartz-magnetite.
Host to some reefs of Coramba-Orara field.
4./ Coramba beds (Cccs) (?Late Carboniferous) - lithic and feldspathic wacke, minor siltstone, siliceous siltstone, mudstone, lenses of chert, jasper, metabasalt.
Host to majority of gold-quartz veins of Coramba-Orara field.

The Moombil Siltstone, Brooklana beds, and Coramba beds are considered to represent a deep-marine, oceanic crustal assemblage that accumulated in an accretionary prism complex (Gilligan & others, 1986a).
The coarser sediments in these units are turbidites, derived from a felsic to intermediate volcanic terrain to the W, with minor felsic plutonic, metamorphic and sedimentary contributions (Korsch, 1978, reported by Gilligan & others, 1986a).
The Carboniferous metasediments are exposed in a broad WNW-trending belt that forms the southern part of the block.

The sequence is overlain to the N by:-
5./ Drake Volcanics (Plv on Grafton, Pv on Warwick 1:250 000 geological maps) (Late Permian) - terrestrial rhyolitic to andesitic ash flow tuffs, ignimbrites, and lavas, conglomerate.
The Drake Volcanics are host to sub-volcanic epithermal gold, silver and base metal deposits, including DRAKE (Deposit No.59).
The volcanics are overlain by:-
6./ Gilgurr·· Mudstone (Pul on Warwick 1·250 000 geological map) (Late Permian) mudstone, minor sandstone.

The sediments and volcanics are intruded by:-
7./ Granitoid suites of New England Batholith (Late Permian-Early Triassic) - massive discordant post-orogenic I-type granitoids of the coastal belt, including in the Coramba region Dundurrabin Granodiorite, Emerald Beach Adamellite, Tallawudjah Leucogranite, and Kellys Creek Leucogranite, and in the northern part of the block Dumbudgery Creek Granodiorite, Towgon Granodiorite, Stanthorpe Adamellite, Undercliffe Falls Adamellite, Morgans Creek Adamellite, Burgulla Adamellite, and Bruxner Adamellite (Gilligan & others, 1986a,b).
The granites are exposed mainly in the northern part of the Coffs Harbour Block, but probably underlie much of the southern part of the block as well (Gilligan & others, 1986a).
The Permo-Triassic igneous activity produced an abundance of magmatic hydrothermal vein deposits of Sn, Mo, Bi, W, Au, Ag, As, Pb, Cu, Zn, and Sb. Major mineralising leucogranites include the Stanthorpe Adamellite, which is host to disseminated gold at TIMBARRA-POVERTY POINT (Deposit No.58).

The Carboniferous metasedimentary sequence is folded along WNW axes into upright mesoscopic folds. Cleavage slightly transects axial planes of folds (Gilligan & others, 1986a).

GEOLOGICAL SETTING: CORAMBA-ORARA
PRINCIPAL SOURCES: Markham & Basden (1974), Markham (1975), Gilligan & others (1986a), Barnes & others (1988).

The Coramba-Orara field includes at least 45 individual reefs distributed over a wide area (see 'DISTRIBUTION') in the eastern part of the Carboniferous metasedimentary belt. Most reefs occur in fine-grained siliceous claystone and tuff of the Coramba beds, but a few are hosted by Brooklana beds (Gilligan & others, 1986a).
Chert, jasper, and metabasalt lenses within the metasediments are

concentrated within a 20 km-wide zone of aeromagnetic highs, which overlaps the Brooklana beds and southern Coramba beds, and also occur sporadically to the N of the magnetic zone (Gilligan & others, 1986a). The lenses are on average 10-20 m thick, maximum thickness 150 m, and up to several km in strike length (Gilligan & others, op.cit). Some deposits lie within the magnetic zone, but most lie to the N of it. The field is localised along the southerly projection of the axis of the Clarence-Moreton Basin. (Gilligan & others, 1986a).

LOCAL SETTING: MINERALISATION
PRINCIPAL SOURCES: Markham & Basden (1974), Markham (1975), Gilligan & others (1986a), Barnes & others (1988).

Gold occurs in two main associations in the Carboniferous oceanic crustal rocks (Gilligan & others, 1986a; Barnes & others, 1988):- i) epigenetic gold-quartz veins, and ii) stratabound auriferous cherts. Veins are the predominant type and are characteristic of the Coramba-Orara field. Auriferous siliceous s ts occur elsewhere in the block (e.g. Dalmorton), and depo of this type may be the source of the vein deposits (Barnes & others, 1988 - see 'GENETIC MODELS').

Deposits show no spatial association with intrusive igneous rocks. The gold-quartz veins are apparently tension crack/fissure-filling deposits. They are lenticular, impersistent along both strike and dip, and range in width from thin stringers to bodies several metres wide. The veins occur in various orientations controlled by shear/fracture zones or bedding planes. (Markham & Basden, 1974; Barnes & others,1988).

BIBLIOGRAPHIC REFERENCES AND OTHER SOURCES:

Barnes R.G., Brown R.E., Brownlow J.W., Gilligan L.B., Krynen J., Willis I.L., 1988
A review of the mineral deposits of the New England Orogen in New South Wales. IN Kleeman J.D.(ed) - New England Orogen - tectonics and metallogenesis. Proceedings of symposium, University of New England, November, 1988.
University of New England. Department of Geology and Geophysics
1v P211-227

Olgers F., Flood P.G., Brunker R.L., Offenburg A.C., Robertson A.D., Exon N.F., Reiser R.F., Casey D.J., 1972
Warwick, Queensland and New South Wales, 1:250 000 geological series map. Sheet SH 56-02, 1st edition.
Bureau Mineral Resources, Australia
1v

Brunker R.L., Chesnut W.S., Cameron R.G., Hitchins B.L., 1976
Grafton, New South Wales 1:250 000 geological series map. Sheet SH 55-6, 1st Edition.
Geological Survey of New South Wales
1v

Clift D.S.L., 1979
Gold mines north of Cascade, County Fitzroy.
Geological Survey of New South Wales. Report
1979/163

Olgers F., Flood P.G., Brunker R.L., Offenburg A.C., Robertson A.D., Exon N.F., Reiser R.F., Casey D.J., 1972
Warwick, Queensland and New South Wales, 1:250 000 geological series map. Sheet SH 56-02, 1st edition.
Bureau Mineral Resources, Australia
1v

Gilligan L.B., Brownlow J.W., Cameron R.G., Henley H.F., Tenison Woods K.L., 1986
Excursion guide, precious metal-antimony mineralization, Dorrigo-Coffs Harbour 1:250 000 sheet area.
Geological Survey of New South Wales. Report
GS1986/023

Gilligan L.B., Brownlow J.W., Cameron R.G., Henley H.F., 1986
Dorrigo-Coffs Harbour, New South Wales, 1:250 000 metallogenic series map and metallogenic study. Sheets SH 56-10, SH 56-11.
Geological Survey of New South Wales. Report
GS1986/033

Leitch E.C., Neilson M.J., Hobson E., 1971
Dorrigo-Coffs Harbour, New South Wales, 1:250 000 geological series map. Sheets SH/56-10 & 11, 1st edition.

Geological Survey of New South Wales
1v

Markham N.L., Basden H., 1974
The mineral deposits of New South Wales.
Geological Survey of New South Wales
1v

Markham N.L., 1975
Gold deposits of the New England Fold Belt.
Geological Survey of New South Wales. Report
GS1975/378

Olgers F., Flood P.G., Brunker R.L., Offenburg A.C., Robertson A.D., Exon N.F., Reiser R.F., Casey D.J., 1972
Warwick, Queensland and New South Wales, 1:250 000 geological series map. Sheet SH 56-02, 1st edition.
Bureau Mineral Resources, Australia
1v

Olgers F., 1974
Warwick, Queensland and New South Wales, 1:250 000 geological series map and explanatory notes. Sheet SH 56-02.
Bureau Mineral Resources, Australia
1v

Scheibner E., 1976
Explanatory notes on the tectonic map of New South Wales.
Geological Survey of New South Wales
1v

oooooooooooooooooooooooooooooooooooooooooooo