DEPARTMENT OF NATIONAL DEVELOPMENT
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

BULLETIN No. 124

Regional and Economic Geology of the Herberton/Mount Garnet Area—Herberton Tinfield, North Queensland

by

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AUSTRALIAN GOVERNMENT PUBLISHING SERVICE
CANBERRA 1972

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
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Published for the Minister for National Development, the Hon. Sir Reginald Swartz, K.B.E., E.D., M.P., by the Australian Government Publishing Service

ISBN 0 642 00172 3

Printed by Graphic Services Pty. Ltd., 60 Wyatt Street, Adelaide 5000

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SUMMARY

The Herberton/Mount Garnet area is situated in North Queensland south-west of Cairns, and includes almost the whole of the productive part of the Herberton Tinfield (= Herberton Gold and Mineral Field), covering 2885 sq km. The area ranges in altitude from over 1200 m above sea level in the northeast to less than 500 m in the northwest and is crossed by the Great Dividing Range. It was mapped mostly between 1962 and 1966 by geologists of the Bureau of Mineral Resources and the Geological Survey of Queensland.

The oldest rocks cropping out are Precambrian schist, amphibolite, and gneissic granite exposed near Mount Garnet. These rocks are faulted against the Hodgkinson Formation, of Silurian to Devonian or possibly Lower Carboniferous age. The Hodgkinson Formation crops out extensively throughout the area, and consists of tightly folded and mostly steeply dipping sandstone, siltstone, shale, and minor limestone, conglomerate, chert, and basalt. These rocks were laid down in the Hodgkinson Basin, part of the Palaeozoic Tasman Geosyncline. Rocks of the Hodgkinson Formation are intruded and thermally metamorphosed by a number of upper Palaeozoic granites (*sensu lato*), including the tin-bearing Elizabeth Creek Granite, and are overlain unconformably by late Palaeozoic acid volcanics which consist mainly of flat-lying welded tuff and lava. The volcanics are associated with three cauldron subsidence areas and one ring complex. No Mesozoic rocks are known in the area; the pre-Mesozoic rocks are overlain by Cainozoic alluvium, sand, laterite, and, in the east, by olivine basalt lavas of the Atherton Basalt Province. The basalt lavas were erupted from shield volcanoes situated near the eastern margin of the area.

The Herberton Tinfield has been an important mining area since 1880, when lode tin was first found at Herberton, and to date it has yielded 15 percent of the total tin production of Australia. Most of the tin at present produced comes from alluvial deposits near Mount Garnet, but before 1938 most of the tin came from lode mines. Mines have also been worked for tungsten, copper, silver, lead, and minor bismuth, antimony, molybdenum, zinc, gold, fluxing ore, fluorite, calcite, and mica. There are over 2400 lode mines and prospects in the area, but fewer than 100 have been worked recently. Except for the Vulcan mine at Irvinebank, which produced over 13,000 tons of tin concentrates, the mines are small, and few have produced more than 100 tons of concentrates. Accompanying maps show the positions of all mines and prospects located in the area, and descriptions of the mines are given in a series of tables.

The economic mineralization took place during the emplacement of the Elizabeth Creek Granite, and only this granite, the Hodgkinson Formation, and the late Palaeozoic Featherbed Volcanics are extensively mineralized. The orebodies are mostly pipe-like, and occur in lodes which are generally associated with shears in sedimentary and volcanic rocks, where quartz, chlorite, and tourmaline are characteristic gangue minerals, and with shears and greisenized joints in granite, where quartz, mica, chlorite, fluorite, and topaz are the main gangue minerals. The mineral deposits are classified as hypothermal and mesothermal, and they occur in zones which are related spatially to the Elizabeth Creek

Granite and its metamorphic aureole: inner zones characterized by tin and tungsten mineralization pass outwards into a copper zone and then a silver and lead zone.

The major alluvial tin deposits are in Smiths, Return, Nettle, and Battle Creeks, near Mount Garnet. Minor alluvial deposits occur along most other creeks draining tin-bearing areas. Important deep leads are located near Herberton and southwards along the Wild River, where tin-bearing gravels have been buried under Cainozoic basalt lavas: the richest and most accessible parts of these deposits are now almost completely exhausted.

Many subsurface tin lodes remain to be found in the area, although most, if not all, of the rich surface deposits have been worked out. Lode tin mining should continue for many years to come, especially if the price of tin remains high. However, there seems to be little chance of finding major lode deposits. Probably the best method of working the tin lodes to achieve a reasonable level of production is for a company or syndicate to operate several small mines concurrently, and take the ore to a central treatment plant. The future of alluvial tin mining when the major known deposits near Mount Garnet have been worked out is not promising, as no further deposits of similar size and grade are likely to be found in the area.

INTRODUCTION

The Herberton/Mount Garnet area is situated in north Queensland, south-west of Cairns (Fig. 1). It is bounded by latitudes 17°15'S and 17°45'S, and by longitudes 145°00'E and 145°30'E, and comprises 2885 sq km. The area is covered by the Herberton and Mount Garnet 1-mile Military map sheets, and lies within the Atherton 1:250,000 Sheet area. Almost the whole of the productive part of the Herberton Tinfield* is covered by the two 1-mile map sheets.

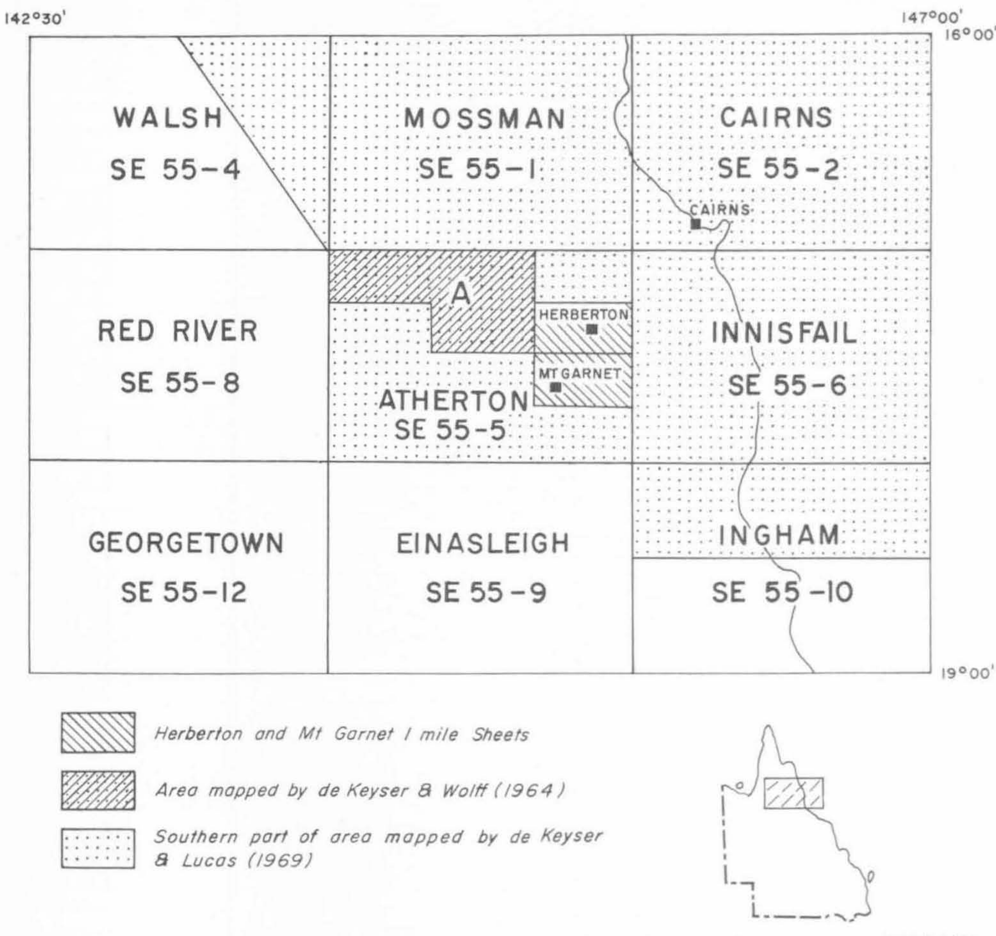

Figure 1. Locality map.

The area was mapped between 1962 and 1966 by geologists from the Bureau of Mineral Resources, and the Geological Survey of Queensland. The following geologists have taken part in the survey: D. O. Zimmerman, 1962;

* In this work the boundaries of the Herberton Tinfield are taken to be coincident with the present boundaries of the Herberton Gold and Mineral Field (Fig. 11).

TABLE 1. MAPS OF THE HERBERTON/MOUNT GARNET AREA

Type	Scale	Name of sheet and number	Published by	Date	Available from
Planimetric	1:253,440	Atherton E55/5	Aust. Army Survey Corps	1944	Dep. of National Development, Canberra
Planimetric	1:253,440	Atherton E55/5	Division of National Mapping	1959	Division of National Mapping, Canberra
Geological	1:250,000	Atherton E55/5	Bureau of Mineral Resources	1962	Bureau of Mineral Resources, Canberra
Topographical	1:63,360	Herberton, 4812 1-inch series	Aust. Army Survey Corps	1943	Division of National Mapping, Canberra
Topographical	1:63,360	Mount Garnet, 2076 1-inch series	Aust. Army Survey Corps	1944	Division of National Mapping, Canberra
Planimetric	1:25,000	Herberton (4 sheets)	Aust. Army Survey Corps	1964	Queensland Dep. of Public Lands and Geological Survey of Queensland, Brisbane
Planimetric	1:25,000	Mount Garnet (4 sheets)	Aust. Army Survey Corps	1964	Queensland Dep. of Public Lands and Geological Survey of Queensland, Brisbane
Air-photo mosaic	1:100,000	Photo Index Series; Atherton, No. 7963	Division of National Mapping	1966	Division of National Mapping, Canberra
Air-photo mosaic	1:100,000	Photo Index Series; Ravenshoe No. 7962	Division of National Mapping	1966	Division of National Mapping, Canberra

B. J. Amos, 1962; K. R. Yates, 1962-63; J. W. Smith, 1964; and D. H. Blake, 1964, 1966; all of the Bureau of Mineral Resources, and L. G. Cuttler, 1964; and R. M. Tucker, 1966; of the Geological Survey of Queensland. In addition D. H. Blake and W. B. Dallwitz (BMR) spent three weeks in 1967 and three weeks, accompanied by R. M. Tucker, in 1968, examining critical exposures and collecting specimens for future chemical analysis and age determination.

Lists of available maps and air-photographs covering the Herberton/Mount Garnet area are given in Tables 1 and 2.

TABLE 2. AIR-PHOTOGRAPHS OF THE HERBERTON/MOUNT GARNET AREA

Scale	Name	For	Date	Available from
1:50,000	Atherton	Dep. of National Development	1951	Secretary, Dep. of Air, Canberra
1:25,000	Mount Garnet	Queensland Dep. of Public Lands	1959	Queensland Dep. of Public Lands, Brisbane
1:25,000	Herberton	Queensland Dep. of Public Lands	1960	Queensland Dep. of Public Lands, Brisbane
1:85,000	Atherton	Dep. of National Development	1964	Queensland Dep. of Public Lands, Brisbane; Division of National Mapping, Canberra

The main towns are Atherton (population 2871*), Ravenshoe (1200*), Herberton (900*), Mount Garnet (800*), and Irvinebank (200*). The first four towns are connected by bitumen roads with Cairns and Innisfail on the coast, and the first three are linked to Cairns by railway. There are several partly or completely abandoned mining settlements in the area, the most important of which are Bakerville, Brownville, Coolgarra, Emuford, Glenlinedale, Montalbion, Newellton (Silver Valley), Nymbool, Stannary Hills, and Watsonville. These are connected to Herberton, Mount Garnet and Irvinebank by dirt roads. Many other roads and vehicular tracks serve individual mines and homesteads. Most of the dirt roads and tracks are suitable only for four-wheel-drive vehicles. Airstrips suitable for light aircraft are maintained at Herberton and Mount Garnet, but there is no regular air service. Railways, main towns, settlements, and roads are shown in Figure 2.

Tin mining is the chief local industry, the main centres being Mount Garnet for alluvial tin, and Irvinebank for lode tin. In 1967 four batteries were engaged in crushing and concentrating tin ore; these were the State Treatment Works at Irvinebank and privately owned batteries at Herberton and Emuford, and on the Wild River near Innot Hot Springs. In addition to tin, tungsten, copper, silver, lead, and minor antimony, bismuth, fluorite, gold, iron, mica, molybdenum and zinc have been mined in the area. Other important local industries

* Universal Business Directory, 1970. Combined Northern Queensland Business and Trade Directory.

are cattle raising, especially in the southern part of the area; dairying near Atherton and Ravenshoe; and timber near Herberton and Ravenshoe. Efforts

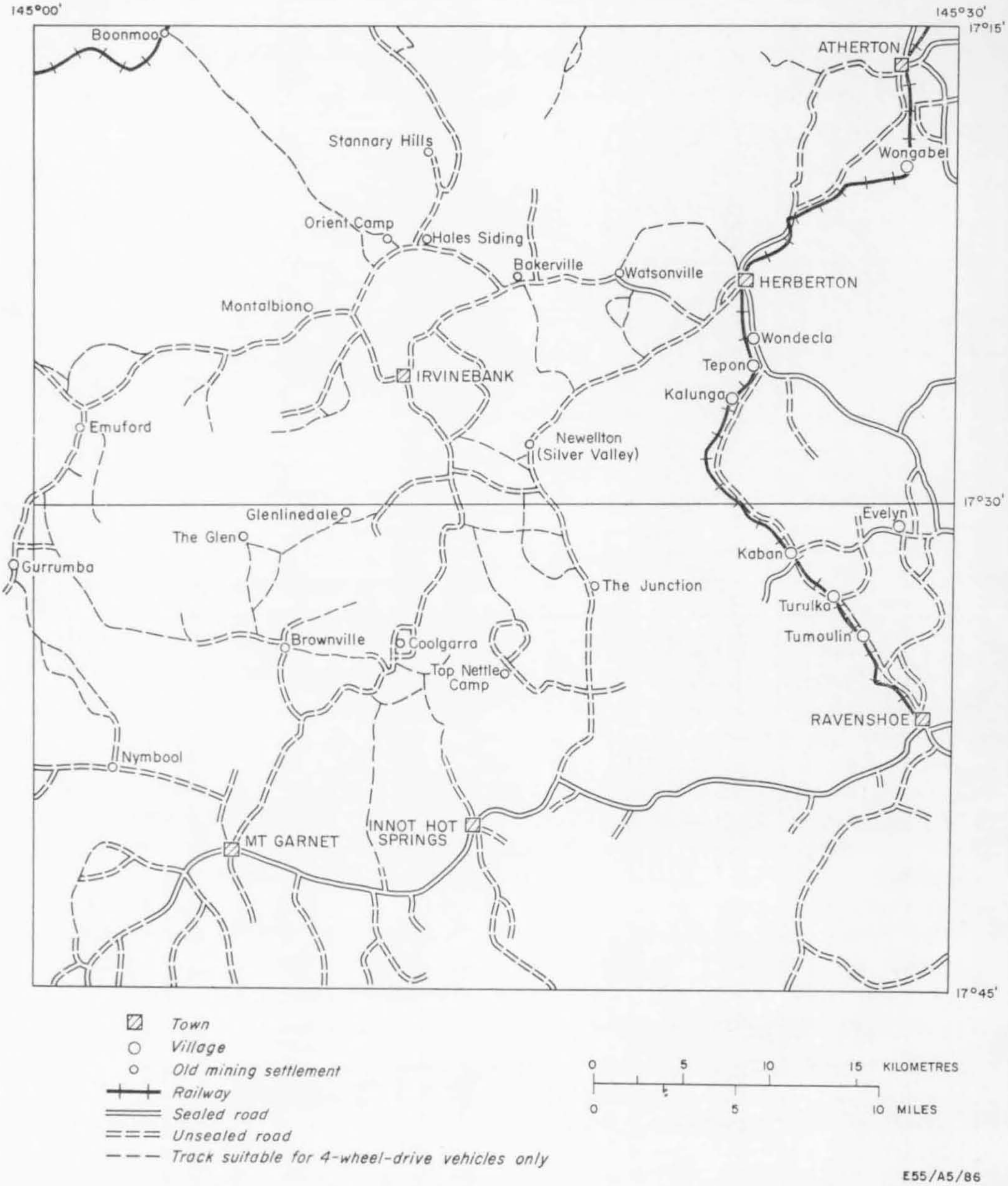

Figure 2. Towns, settlements, and communications.

are currently being made to establish a tobacco-growing industry on alluvial flats alongside the Herbert and Wild Rivers in the southeast.

TABLE 3. CLIMATIC DATA, HERBERTON/MOUNT GARNET AREA

A. *Rainfall* (in points)

Station	Period	Jan.	Feb.	Mar.	Apr.	May	Jne	Jly	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Atherton[1]	1931-1960	1942	2007	1957	742	326	275	267	245	295	220	552	793	9321
Herberton[1]	1931-1960	889	1119	808	243	182	155	89	73	68	76	308	491	4501
Irvinebank[1]	1931-1960	702	918	528	107	80	61	23	16	19	66	260	474	3254
Mount Garnet[2]	1911-1940	628	648	492	132	91	75	47	25	13	60	191	441	2843
Ravenshoe[1]	1931-1960	869	1088	1018	347	210	177	106	94	80	100	248	458	4795

B. *Temperature* (°F)

Station	No. of Years	Item	Jan.	Feb.	Mar.	Apr.	May	Jne	Jly	Aug.	Sep.	Oct.	Nov.	Dec.
Atherton[3]	17	1	83.9	82.3	80.0	76.6	74.1	71.9	70.9	73.2	77.8	81.6	84.7	85.7
		2	65.0	64.9	63.1	59.4	54.7	51.5	50.0	49.3	52.9	56.2	60.6	63.3
		3	74.4	73.6	71.5	68.0	64.4	61.7	60.5	61.3	65.3	68.9	72.7	74.5
Herberton[3]	28	1	82.5	80.7	79.3	76.3	73.0	70.7	70.2	72.2	76.5	80.9	82.8	83.8
		2	64.8	64.6	63.4	60.0	55.5	52.4	48.8	49.5	53.7	57.5	60.7	63.4
		3	73.6	72.8	71.4	68.1	64.3	61.6	59.5	60.8	65.1	69.2	71.7	73.6

Item 1: mean monthly maximum temperature
Item 2: mean monthly minimum temperature
Item 3: mean monthly temperature

[1] Bureau of Meteorology (1966): Rainfall Statistics Australia
[2] Meteorological Branch, Commonwealth of Australia: Book of Normals—No. 1 Rainfall
[3] Bureau of Meteorology (1956): Climatic averages Australia. Temperature, relative humidity, rainfall

Climate and vegetation

The Herberton/Mount Garnet area is situated in the tropical highland climatic belt. Temperature data for Atherton and Herberton, in the eastern part of the area, are shown in Table 3B. West of Herberton temperatures become more extreme, with higher summer maxima and lower winter minima. A few frosts occur in most winters.

The rainfall for the five main towns is given in Table 3A. The average annual rainfall decreases from over 90 inches in the extreme northeast to less than 30 inches in the west. The eastern part of the area lies east of the Great Dividing Range, and receives most of its rain from the Coral Sea. West of the range there is a rain-shadow area, and here most of the rain is cyclonic. The rainfall shows a marked summer maximum throughout the area.

The main natural vegetation types are tropical rain forest and savannah woodland. Tropical rain forest is restricted to the extreme east, where the average annual rainfall exceeds 60 inches, and has been partly cleared for dairying and agriculture. Savannah woodland, with eucalypts dominant, occurs throughout the remainder of the area, becoming more open westwards as the rainfall decreases.

Relief and drainage

Altitude ranges from 1296 m at Wallum Trig. in the northeast to about 470 m in the northwest. The area is crossed by the northeast-trending Great Dividing Range, and is drained by streams flowing to the Coral Sea in the east and to the Gulf of Carpentaria in the west.

Four physiographic units have been recognized in the area by Best (1962b). These are the *Herberton Highland,* which covers most of the area, the *Featherbed Range* in the northwest, the *Atherton Tableland* in the east, and the *Mount Garnet Basin* (Bik, 1962a,b), which is part of the *Gunnawarra Plain,* in the south (Fig. 3). The differences between the landscapes of the physiographic units are closely related to differences in underlying rock types.

The *Herberton Highland* (Pl. 1, fig. 1) is composed mainly of folded sedimentary rocks, acid volcanics, and granite, all of Palaeozoic age. It consists of rugged hills with up to 450 m local relief, and rocky outcrops are common. On folded sedimentary rocks steep-sided ridges with narrow rounded crests and deeply incised valleys are developed. On granite and acid volcanics ridge crests tend to be much broader, and slopes are generally less steep, although very steep slopes occur locally. The general relief decreases westwards. Some areas of lower relief and more gentle slopes occur locally within the highlands, notably on deeply weathered granite near Bakerville and Nymbool, on relatively unresistant shale and thin sandstone beds north of Emuford (Pl. 8, fig. 1), and on deeply weathered Cainozoic basalt overlying Palaeozoic rocks southeast of Herberton.

The *Featherbed Range* (Pl. 8, fig. 1) is a rugged upland region formed on upper Palaeozoic acid volcanics which are mainly massive welded tuffs. Slopes are generally less steep than those of the Herberton Highland and the maximum local relief is less than 330 m.

The *Atherton Tableland* in the east has an average altitude of about 750 m. It consists of gently undulating terrain with gentle to moderate slopes, and is developed on Cainozoic basalt. The most prominent topographic features on the tableland are extinct cones (Pl. 13, figs 1 and 2).

The *Mount Garnet Basin* lies to the south of the Herberton Highland, and consists of a flat to gently undulating plain (Pl. 16, fig. 2) which is largely covered with Cainozoic terrestrial sediments and basalt. Within the plain are some low rounded hills formed on granite and Precambrian metamorphic rocks.

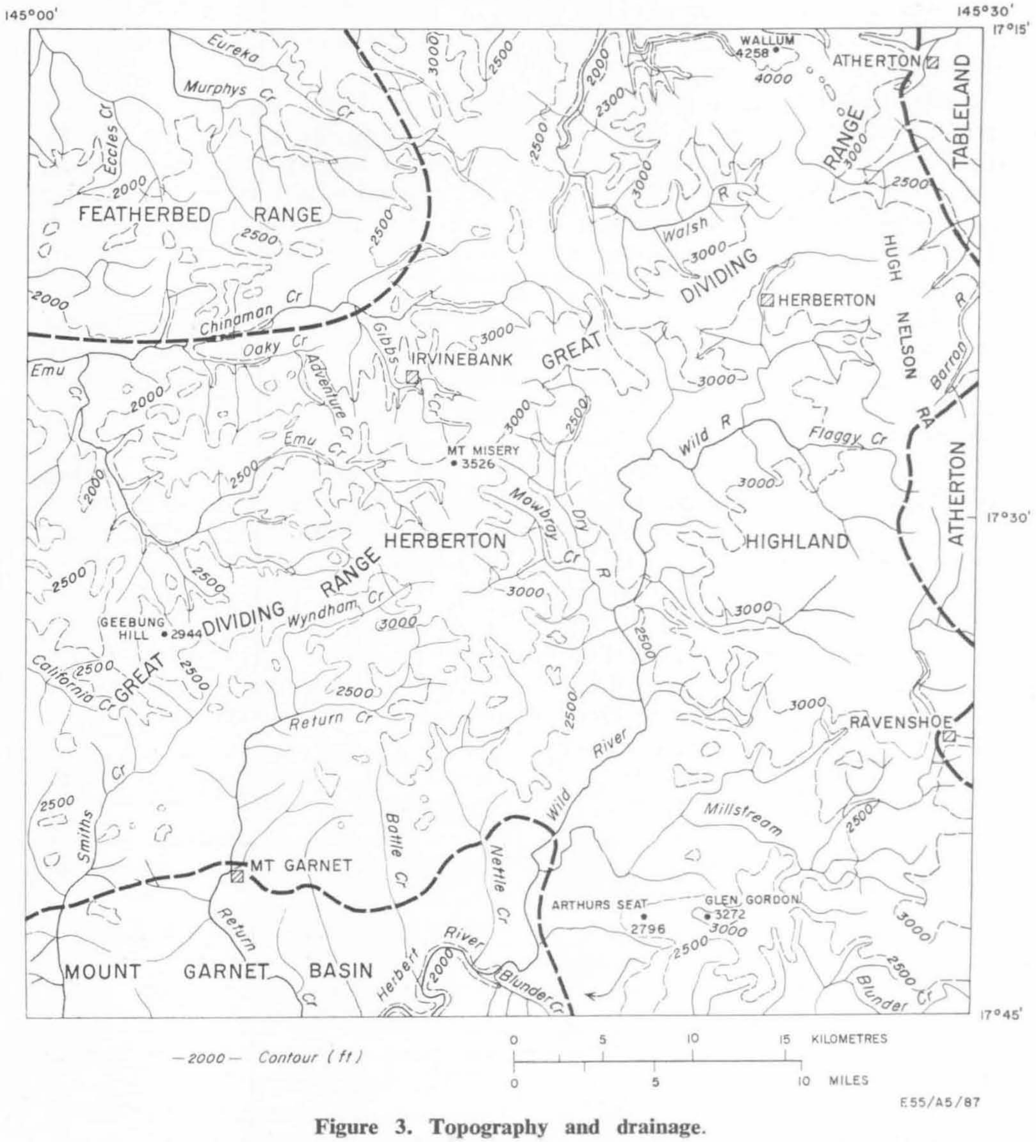

Figure 3. Topography and drainage.

The main streams draining to the Coral Sea are the Millstream and the Barron and Herberton Rivers, all of which are permanent watercourses; the Wild River, which is permanent only near its headwaters; and Smiths, Return, and Battle Creeks and the Dry River, all of which are non-permanent. The main streams draining westwards to the Gulf of Carpentaria are the Walsh River, and Emu, Eureka, and Chinaman Creeks. The only permanent watercourses occur in the headwaters of the Walsh River. However, permanent and semi-permanent waterholes and springs occur lower down the Walsh River and also along the other main westerly draining streams.

The water table commonly lies within 15 m of the surface in valleys, and even in abnormally dry seasons most boreholes strike water within 30 m of the surface.

The largest dam in the area is Collins Weir, on the Walsh River, which forms part of the Tinaroo irrigation scheme. Among the other dams are the Ibis dam at Irvinebank, which supplies water for battery and domestic use, a dam on the Wild River at Herberton, which is used by the Herberton battery, and a dam at Montalbion which is now used only for stock. Floods in March 1967 destroyed the dam on Return Creek north of Mount Garnet (Pl. 1, fig. 2).

Previous investigations

Most of the previous geological reports on the Herberton/Mount Garnet area have been concerned with mines and mineral deposits, and relatively few have dealt with regional aspects. As all available published and unpublished work on the area is given in the Bibliography, only reports of general importance are mentioned here.

The first geological reports on the area were published in 1881, following the discovery in 1880 of the first tin lode at Herberton: Jack (1881) described mines at Herberton, and Tenison Woods (1881) described mines at Herberton and Watsonville. Two years later Jack (1883) gave a more detailed account of mines at Herberton at Watsonville, and also described some of the mines in the Silver Valley area.

In a report published in 1891 Maitland described several mines in the Coolgarra area, and also noted the unconformable relationship between acid volcanics and underlying altered sedimentary rocks west of Coolgarra.

Other general reports on mines and local geology within the area have been prepared by Maclaren (1900), Cameron (1900, 1901b, 1904b,c), Stirling (1905), Lees (1907), Reid (1932e), Broadhurst (1937a,b, 1951, 1953), Wade (1937), Keid (1938), Jensen (1939), Dimmick & Cordwell (1959), and Syvret (1963b). Cameron (1904b) was the first geologist to associate the tin mineralization in the area with granite intrusion.

In 1938 the Aerial, Geological and Geophysical Survey of North Australia made the first regional geological survey of the area (Jensen, 1939), and also carried out geophysical surveys at Herberton and Watsonville (Thyer, 1939; Thyer, Rayner, & Nye, 1939a,b).

During 1956, 1958, and 1959 combined parties of the Bureau of Mineral Resources and the Geological Survey of Queensland mapped the Atherton 1:250,000 Sheet area (Best, 1962), within which is included the Herberton/ Mount Garnet area. The upper Palaeozoic acid igneous rocks in this and adjacent areas have been described by Branch (1962, 1963, 1966a,b). Detailed geological mapping in the Mount Garnet 1-mile Sheet area was begun in 1962 (Zimmerman, Amos, & Yates, 1963).

In 1967 the Bureau of Mineral Resources carried out an airborne geophysical survey of the Herberton 1-mile Sheet area to evaluate the use of airborne magnetic and radiometric methods in distinguishing different granites from one another (Waller, 1968).

Purpose of investigation

The main aims of the survey of the Herberton/Mount Garnet area were:

(a) To map the area in detail, especially the mineralized parts. Previous mapping was either on a broad regional scale or localized around mines and alluvial prospects.

(b) To locate, investigate, and catalogue all the mines in the area. Many of the mines have not previously been shown on published maps, and information on most of the mines is completely lacking.

(c) To evaluate as far as possible the mineral potential of the area in the light of the information gathered.

(d) To investigate certain alluvial prospects near Mount Garnet by detailed mapping combined with geophysical surveys and scout boring.

The Mount Garnet 1-mile Sheet area was mapped by D. O. Zimmerman, B. J. Amos, and K. R. Yates in 1962, by K. R. Yates in 1963, and by D. H. Blake and R. M. Tucker in 1966. The Herberton 1-mile Sheet area was mapped by J. W. Smith, D. H. Blake, and L. G. Cuttler in 1964, and by D. H. Blake and R. M. Tucker in 1966. Field seasons in 1962, 1963, and 1964 were of six months' duration and that of 1966 was of nine weeks.

Acknowledgements

Of the many people who provided useful information on the area, special thanks are due to Messrs G. Naumoff and G. McLennan, Inspectors of Mines at Herberton; to Carpentaria Exploration Co., Loloma Mining Corporation NL, Metals Exploration NL, and North Broken Hill Ltd; to Messrs M. A. Hay of Ravenshoe Tin Dredging Ltd and S. R. Strachan of Tableland Dredging NL; and to many private individuals who helped in the location and naming of old workings, in particular Messrs M. H. Dines, A. R. Dunmall, H. Edwards, W. M. Petersen and the late J. Young of Mount Garnet; C. McAuley of Coolgarra; J. Creen Snr and Jnr of Emuford; the late J. H. Ludlow of Innot Hot Springs; and W. Kemp of Watsonville.

Throughout the preparation of this Bulletin the author has greatly benefited from many stimulating discussions held with W. B. Dallwitz, both in the field and in Canberra. A preliminary draft for the Bulletin was prepared in 1965 by J. W. Smith and K. R. Yates.

PRECAMBRIAN

The stratigraphy of the Herberton/Mount Garnet area is summarized in Table 4. The rocks in the area range in age from Precambrian to Cainozoic. Precambrian rocks are exposed only near Mount Garnet, and the oldest rocks cropping out throughout most of the area are folded sedimentary rocks of Silurian to Devonian or possibly Lower Carboniferous age which were deposited in the Hodgkinson Basin, part of the Palaeozoic Tasman Geosyncline. These Palaeozoic sedimentary rocks are overlain and intruded by upper Palaeozoic volcanics and granites. There are no Mesozoic rocks in the area, and the youngest rocks exposed are Cainozoic terrestrial sediments and basalt flows.

TABLE 4. STRATIGRAPHY OF THE HERBERTON/MOUNT GARNET AREA

Unit and Symbol	Lithology	Distribution	Age and Palaeontology	Relationships	Remarks
Czu	Alluvial sand, silt, and gravel	Extensive outcrops in S part of area, isolated patches elsewhere	Late Tertiary to Recent	Unconformable veneer on older units	Contains alluvial tin deposits
Czl	Laterite	Scattered patches, mainly in S part of area	Cainozoic	Unconformable veneer on older units	
Czs	Sand	Extensive outcrops only in S part of area	Cainozoic	Unconformable veneer on older units	
Atherton Basalt Cza	Olivine basalt lava, minor pyroclastics	Extensive outcrops in E part of area	Cainozoic	Unconformable on older units; interlayered with and overlain by Cainozoic sediments	Overlies stanniferous gravels of the Herberton Deep Lead and tributary deep leads. Lavas derived from volcanic centres situated near eastern margin of area
		MAJOR UNCONFORMITY			
Pyd	Granophyre, olivine gabbro, and intermediate hybrid rocks	Gurrumba Ring Complex, NW of Mt Garnet	Probably Permian	Intrudes Cgz, probably also S-Dh	Unmineralized
Pd	Grey diorite	Gurrumba Ring Complex, NW of Mt Garnet; S of Watsonville	Probably Permian	Intrudes Cgz, probably also Pu	Unmineralized
Py	Pink granophyre containing abundant xenoliths	Gurrumba Ring Complex, NW of Mt Garnet; S of Geebung Hill	Probably Permian	Intrudes Cgz, Cn, S-Dh	Unmineralized
Pgy	Grey porphyritic microgranite, xenolithic; minor coarse-grained leucocratic granite	Silver Valley; SE and E of Innot Hot Springs	Probably Permian	Intrudes CuS, S-Dh	Unmineralized
Pgu	Porphyritic biotite granite; hornblende-biotite granodiorite	Bocks Cr, W of Stannary Hills; SSE of Collins Weir	Probably Permian	Biotite granite intrudes Pb	Unmineralized
Pgc	Hornblende-biotite granodiorite, quartz dolerite, diorite, intermediate hybrid rocks	Catherine Cr, N of Stannary Hills	Probably Permian	Intrudes Cga, Cgz	Generally deeply weathered and poorly exposed; unmineralized
Hales Siding Granite Pgs	Pale pink to buff medium-grained biotite adamellite	Between Irvinebank and Stannary Hills	Probably Permian	Intrudes S-Dh; probably also intrudes Pgb and Cf	Unmineralized
Bakerville Granodiorite Pgb	Grey medium to fine-grained hornblende-biotite granodiorite; commonly xenolithic; minor aplite	Around Bakerville	Probably Permian	Intrudes S-Dh, Cgz, probably also Pgw; probably intruded by Pgs	Spheroidal weathering characteristic of sporadic exposures; unmineralized
Nymbool Granite Pgn	Grey biotite adamellite, xenolithic	Near Nymbool	Probably Permian	Intrudes S-Dh, possibly also Cgz	Spheroidal weathering common; may be mineralized NW of Nymbool
Hammonds Creek Granodiorite Pgm	Grey hornblende-biotite granodiorite and biotite granodiorite, xenolithic; aplite common	W of Mt Garnet	Probably Permian	Intrudes S-Dh, possibly also Cgz	Spheroidal weathering common; minor sulphide mineralization associated with aplites

TABLE 4. STRATIGRAPHY OF THE HERBERTON/MOUNT GARNET AREA—*continued*

Unit and Symbol	Lithology	Distribution	Age and Palaeontology	Relationships	Remarks
Watsonville Granite Pgw	Pale grey and pink biotite adamellite, commonly sparsely xenolithic	Watsonville and upper Walsh R	L Permian	Intrudes S-Dh, Cgz, Pw, Pb; probably intruded by Pgb	Spheroidal weathering characteristic; unmineralized
Gurrumba Volcanics Pu	Flow-banded acid lava	Gurrumba Ring Complex, NW of Mt Garnet	Possibly Permian	Probably intruded by Pd	Unmineralized
Walsh Bluff Volcanics Pb	Acid lava, welded tuff, agglomerate, tuff	Between Atherton and Collins Weir	L Permian	Unconformable on Cgz; intruded by Pgw, Pgu	Unmineralized
Slaughter Yard Creek Volcanics Pw, Pwa, Pw?	Grey and pink intrusive acid porphyry (Pw); grey acid lava (Pwa); conglomerate (Pw?)	Between Herberton and Watsonville	L Permian	Intrudes S-Dh, Cgz, Cgk; intruded by Pgw; lava unconformable on S-Dh	Unmineralized
		MAJOR UNCONFORMITY			
Atlanta Granite Cga	Pink and pale grey leucocratic biotite adamellite	NE of Stannary Hills	Probably U Carboniferous	Intrudes Cgz; intruded by acid dykes associated with Pb, probably also intruded by Pgc	Spheroidal weathering characteristic; unmineralized
Elizabeth Creek Granite Cgz	Pink, buff, and pale grey leucocratic biotite adamellite, commonly porphyritic; aplite and greisen abundant; xenoliths very rare	Extensive outcrops throughout area	U Carboniferous	Intrudes S-Dh, Cl, Cn, Cf, Cgk; intruded by Cga, Pw, Pb, Pgw, Pgb, Pgc, Py, Pd, Pyd, and also possibly by Pgm, Pgn; unconformably overlain by Pb, and intruded by dykes associated with Pb	Spheroidal weathering uncommon; extensively mineralized and thought to be source of virtually all economic mineralization in the area
Kalunga Granodiorite Cgk	Grey hornblende-biotite granodiorite; minor biotite adamellite; commonly xenolithic	S of Herberton	U Carboniferous	Intrudes S-Dh and probably also Cl; intruded by Cgz, Pw	Spheroidal weathering common; unmineralized
Cgu	Porphyritic and xenolithic microgranite	E of Mt Garnet	Probably Carboniferous	Not known	Cut by quartz veins containing Pb and Cu mineralization
Featherbed Volcanics Cf	Acid welded tuff, lava, agglomerate, tuff	W of Stannary Hills	Carboniferous	Unconformable on S-Dh; intruded by Cgz	Host rocks for Pb, Zn, and Sb mineralization
Nanyeta Volcanics Cn	Acid and intermediate lava, welded tuff, agglomerate, tuff	Mt Garnet and NW to Iron Mountain	Carboniferous	Unconformably on pC and S-Dh; intruded by Cgz and Py	Mineralized on Mt Garnet
Glen Gordon Volcanics Cl, Cla	Acid welded tuff, lava, agglomerate, tuffaceous sandstone and siltstone (Cl); acid lava (Cla)	Extensive outcrops in SE part of area	Carboniferous	Unconformable on S-Dh; overlies, possibly conformably, Cus; intruded by Cgz and probably also Cgk	Unmineralized
Silver Valley Conglomerate Cus	Conglomerate, acid welded tuff, tuffaceous and carbonaceous sandstone and siltstone	Silver Valley	Carboniferous; plant fossils common locally	Unconformable on S-Dh; overlain, possibly conformably, by Cl; intruded by Pgy and acid dykes	Mainly flat-lying; unmineralized

TABLE 4. STRATIGRAPHY OF THE HERBERTON/MOUNT GARNET AREA—*continued*

Unit and Symbol	Lithology	Distribution	Age and Palaeontology	Relationships	Remarks
		MAJOR UNCONFORMITY			
Hodgkinson Formation S-Dh (a,b,c,d,e)	Thin-bedded greywacke, sandstone, siltstone shale, conglomerate (S-Dh); massive greywacke and sandstone, minor siltstone, shale and conglomerate (S-Dha); altered basalt (S-Dhb); limestone (S-Dhc); chert (S-Dhd); slump breccia (S-Dhe)	Extensive outcrops throughout most of area	Silurian and Devonian, possibly also L Carboniferous; poorly preserved plant fossils common locally; some corals and rare conodonts in limestone	Unconformably on pC; unconformably overlain by Cus, Cl, Cn, Cf, Pwa; intruded by CgK, Cgz, Pw, Pgm, Pgn, Pgw, Pgb, Pgs, Pgy, Py, acid dykes	Tightly folded about steeply dipping axes; extensively mineralized; thermally metamorphosed by granite intrusions; low-grade regional metamorphism near Irvinebank
		MAJOR UNCONFORMITY (?)			
pC	Mica schist, amphibolite	Between Mt Garnet and Luceys Knob	Precambrian	Unconformably overlain by Cn and S-Dh; may be intruded by pCg	Mostly belong to almandine-amphibolite facies of regional metamorphism; cut by gold-bearing quartz veins near Mt Garnet
pCg	Gneissic muscovite-albite granite	Between Mt Garnet and Luceys Knob	Precambrian	Probably intrudes pC	Unmineralized

Outcrops of Precambrian rocks are confined to the Mount Garnet 1-mile Sheet, where they occur in an area extending from Mount Garnet township southwards and southeastwards to the junction of Big Dinner and Little Dinner Creeks. Further outcrops occur just to the south of the area mapped, on the Tirrabella 1-mile Sheet (see Atherton 1:250,000 geological map). Weathered Precambrian rocks have also been identified in percussion drill holes south of Mount Garnet township in the Wurruma Swamp area. The Precambrian rocks are generally poorly exposed and deeply weathered, especially south of Wurruma Swamp, where highly altered rocks of uncertain affinities crop out.

The principal rock types are mica schist and amphibolite (pC), and gneissic granite (pCg). The schist consists of mica, albite, and quartz, of which mica, generally muscovite, rarely pale brown biotite, forms up to 25 percent of the rock. The schist shows evidence of post-crystallization deformation: twin planes of albite crystals have been distorted, and quartz crystals have been deformed and granulated along microscopic shear zones.

Amphibolite, which forms small scattered bodies within the schist, is best exposed 3 km south of Mount Garnet. The amphibolite is variable in texture, and ranges from coarse to fine-grained and from massive to banded and schistose. Green hornblende, albite, epidote, clinopyroxene (colourless or pale green in thin section), quartz, sphene, garnet, and opaque minerals are the chief minerals present, in order of decreasing abundance. However, in some rocks epidote is a major constituent, in others relict pyroxene crystals are abundant, and in one 'amphibolite', from the outcrop 3 km south of Mount Garnet, green clinopyroxene (probably salite or ferrosalite) makes up more than 50 percent of the rock.

The schistosity of the metamorphic rocks is mostly steeply dipping, and generally has a northerly or northeasterly strike. Small-scale folding of the schistosity occurs locally, especially in some amphibolite bands.

Gneissic granite crops out in two small areas, one 1 km southeast of Mount Garnet township, and the other 3 km south of Mount Garnet airstrip. In the former area the granite is surrounded by schist and amphibolite, and at the latter it is partly covered by superficial Cainozoic deposits. The granite is medium-grained and variably porphyritic. It consists of oligoclase, orthoclase (microperthitic in some specimens), quartz, and minor amounts of white mica, chlorite, and epidote. The contacts of the granite with the schist are gradational, and the marginal granite is strongly foliated parallel to the regional schistosity. W. B. Dallwitz and K. R. Yates (pers. comm.) consider that the granite is a less metamorphosed remnant of an extensive granitic body which was mostly metamorphosed to schist.

Both amphibolite and gneissic granite are exposed in isolated outcrops south of Wurruma Swamp. Here also are outcrops of highly altered rocks, consisting of quartz and fine-grained white mica, which have been mapped as probably Precambrian, (pC? and pCg?). These altered rocks are possibly schist and granite greisenized by the upper Palaeozoic Elizabeth Creek Granite.

The mineral assemblages of the schist and amphibolite indicate that they mostly belong to the almandine-amphibolite facies of regional metamorphism (Turner & Verhoogen, 1960). The occurrence of pyroxene in some amphibolite specimens may be due to metasomatism or to a local increase in a metamorphic grade to the granulite facies.

The Precambrian outcrop at Mount Garnet represents the most northeasterly exposure of the Georgetown Inlier, as defined by D. A. White (1961). The Precambrian rocks here are faulted against the Hodgkinson Formation to the west, and are unconformably overlain by Nanyeta Volcanics. Southeast of Mount Garnet they are overlain by Cainozoic superficial deposits.

Gold-bearing quartz veins occur in the Precambrian schist near Mount Garnet township.

The age of the Precambrian rocks in the Mount Garnet 1-mile Sheet area is uncertain, as no isotopic age determinations are available. However, they can probably be correlated with the Dargalong Metamorphics, which crop out in the western part of the Atherton 1:250,000 Sheet area. The Dargalong Metamorphics are considered by de Keyser & Wolff (1964) to be older than Upper Proterozoic.

SILURIAN TO DEVONIAN

Hodgkinson Formation (S-Dh)

The name Hodgkinson Formation was proposed by Best (1962b) for a Devonian to possibly Lower Carboniferous rock unit which crops out in the northeastern part of the Atherton 1:250,000 Sheet area and, more extensively, in the Hodgkinson Basin of the Mossman and Cooktown 1:250,000 Sheet areas (de Keyser & Lucas, 1969). The formation consists of highly folded beds of sandstone, siltstone, and shale, and minor conglomerate, chert, limestone, and basalt. In the type area, the Hodgkinson Goldfield, the unit was previously termed the Hodgkinson Beds (Jack, 1884) and the Hodgkinson Series (Jensen, 1920). The formation is probably several thousands of metres thick.

In the Herberton/Mount Garnet area the main outcrop of the Hodgkinson Formation lies between Emuford in the west, Hales Siding in the north, Silver Valley in the east, and Battle Creek in the south, and it includes the mining centres of Irvinebank, Brownville, and Coolgarra. This outcrop is separated by a narrow strip of granite from a large outcrop of Hodgkinson Formation at Stannary Hills. Further outcrops occur near Herberton, Watsonville, Mount Garnet, Nymbool, and Innot Hot Springs, and east of Silver Valley and west of The Glen. Except south and west of Mount Garnet, where the topography is relatively subdued, the formation typically crops out as steep-sided rugged hills with sharp ridges and narrow valleys.

The Hodgkinson Formation comprises all the Palaeozoic rocks in the Herberton/Mount Garnet area that are of pre-Carboniferous age. These rocks were previously known as the Herberton Beds (Skertchley, 1899; Levingston, 1960), the Herberton Series (Jensen, 1920), the Herbertonian Series (Jensen, 1923), and the Older and Younger Metamorphic Series (Jensen, 1939). Recently Best (1962b) subdivided the Herberton Beds into four formations, the Mount Garnet Formation, Hodgkinson Formation, Ringrose Formation, and Montalbion Sandstone. The subdivisions of Best have also been adhered to by Zimmerman, Yates, & Amos (1963) and de Keyser & Lucas (1969). However, they are now no longer considered valid, for reasons discussed below.

According to Best (1962b):

(1) The *Mount Garnet Formation* crops out in an arcuate belt extending from Almaden, in the Almaden 1-mile Sheet area, to the southern end of the

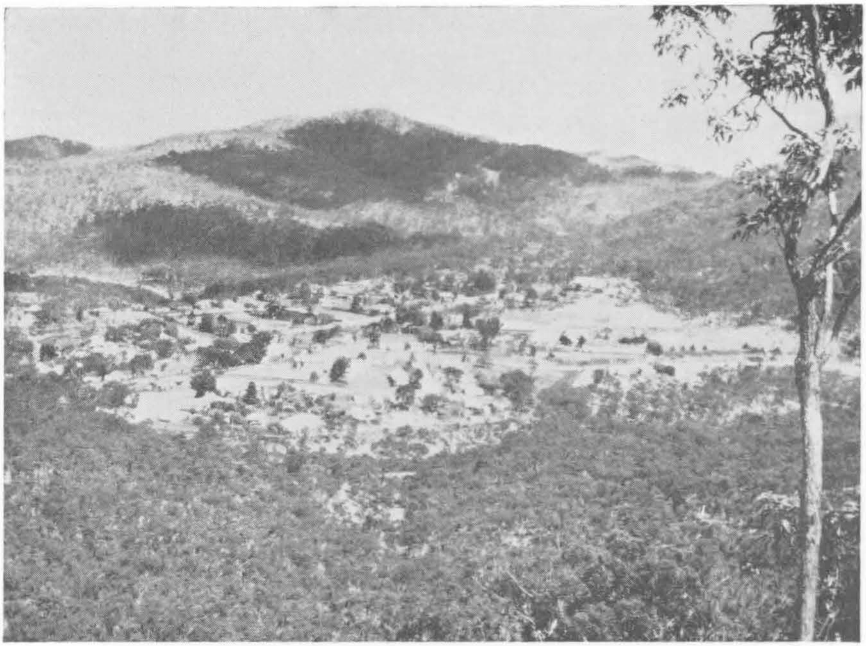

Plate 1, fig. 1. Herberton from St Patrick Hill. The highest hills behind the township (Slaughter Yard Creek Volcanics) are part of the Great Dividing Range.

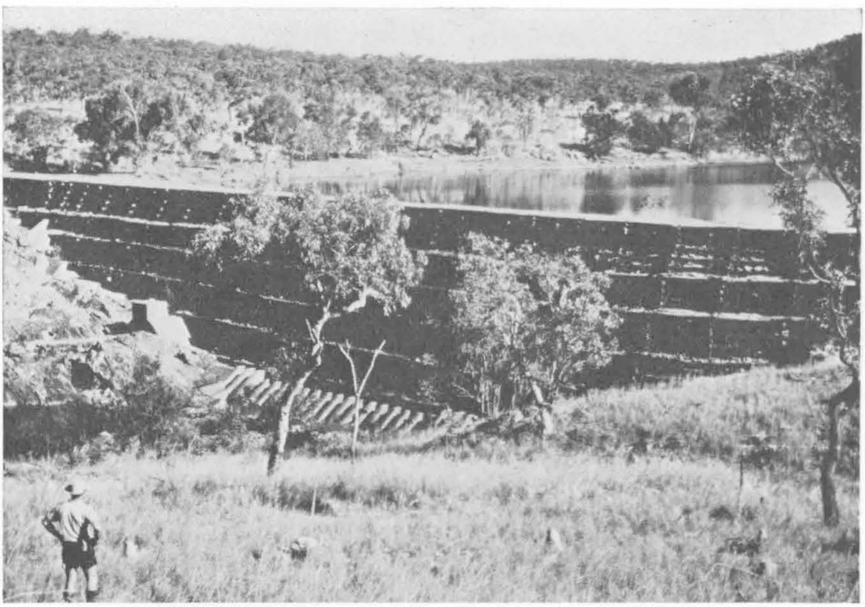

Plate 1, fig. 2. The dam on Return Creek, 5 km north of Mount Garnet, which was destroyed during floods in March 1967.

Plate 2, fig. 1. Thin-bedded sandstone, siltstone, and shale of the Hodgkinson Formation. Creek exposure 2 km southwest of Montalbion.

Plate 2, fig. 2. Irregularly folded thin-bedded siltstone and shale of the Hodgkinson Formation. Creek exposure 1 km southwest of Newellton, Silver Valley.

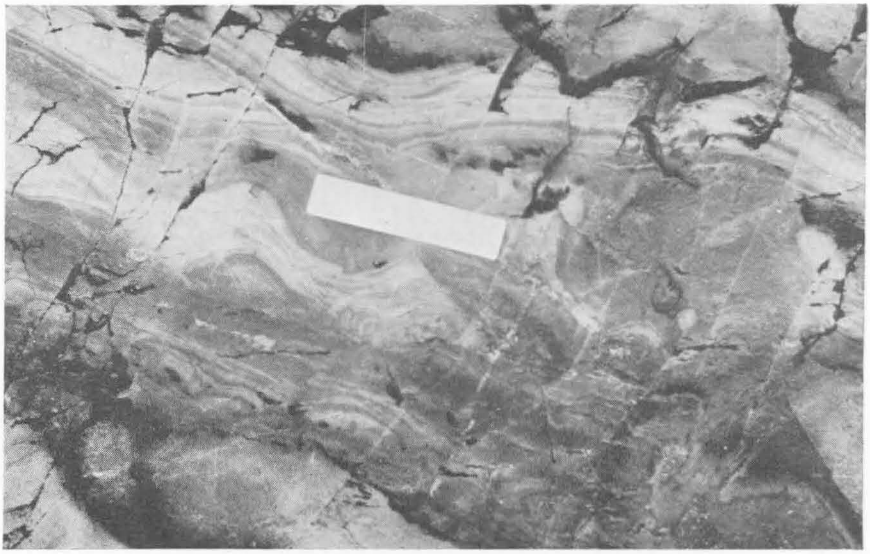

Plate 3, fig. 1. Thin-bedded sandstone, siltstone, and shale of the Hodgkinson Formation which have been thermally metamorphosed to gneissose hornfels by Elizabeth Creek Granite. Creek exposure 10 km southeast of Irvinebank.

Plate 3, fig. 2. Flat-lying unconformity breccia at the base of the Nanyeta Volcanics overlying steeply dipping beds of the Hodgkinson Formation (foreground). The breccia is composed of angular fragments of both acid volcanic rocks belonging to the Nanyeta Volcanics and sedimentary rocks derived from the underlying Hodgkinson Formation. Return Creek, 4 km south of Brownville.

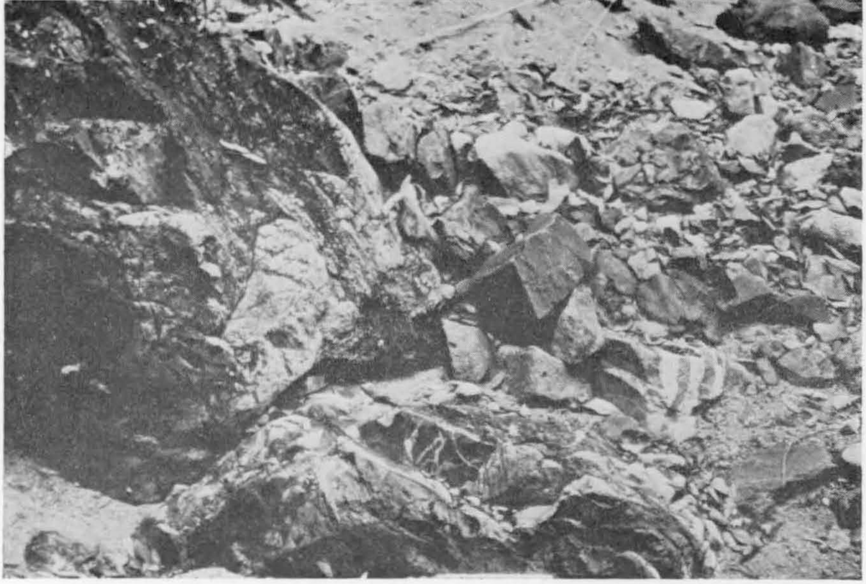

Plate 4, fig. 1. Thermally metamorphosed Hodgkinson Formation (dark) breccia-veined by Elizabeth Creek Granite (pale). Creek exposure 4 km east of Stannary Hills.

Plate 4, fig. 2. Thin-bedded siltstone and shale of the Hodgkinson Formation (dark) intruded by an irregular body of pale acid porphyry belonging to the Slaughter Yard Creek Volcanics. Road cutting 5 km west of Herberton.

Wild River, and consists of greywacke, chert, conglomerate, limestone, and dark grey fine-grained sandstone.

(2) The *Hodgkinson Formation* overlies, probably unconformably, the Mount Garnet Formation, and consists of thin-bedded sandstones and siltstones, thick greywacke beds, and minor limestone and chert.

(3) Both the Mount Garnet and Hodgkinson Formations are overlain unconformably by the *Ringrose Formation* and the *Montalbion Sandstone.*

(4) The Ringrose Formation crops out near Herberton and between Irvinebank and Coolgarra, and consists of dark to pale grey sandstone, siltstone, and quartz conglomerate.

(5) The Montalbion Sandstone consists of white to pale grey sandstone and conglomerate, and is the nearshore equivalent of the Ringrose Formation; it generally has gentle dips and overlies the Hodgkinson Formation with marked unconformity.

(6) The Mount Garnet Formation is probably of Upper Silurian to Lower Devonian age, and is correlated with the Chillagoe Formation; the Hodgkinson Formation is Middle Devonian to Lower(?) Carboniferous, and the Ringrose Formation and Montalbion Sandstone are Carboniferous.

The more recent detailed mapping in the Herberton/Mount Garnet area has shown that the rocks mapped as Hodgkinson Formation by Best (1962b), and also by de Keyser & Lucas (1969), pass laterally, with no apparent discontinuity or mappable change in lithology, into rocks mapped by the same workers as Mount Garnet Formation and Ringrose Formation. All three formations consist predominantly of pale to dark grey thin-bedded sandstone, siltstone, and shale. At Montalbion and elsewhere the rocks mapped as Montalbion Sandstone by these workers have since been found to be massive sandstone bands interbedded conformably within the Hodgkinson Formation, and the marked unconformity between the two 'formations' recorded by Best and de Keyser & Lucas does not exist. Hence the four formations of Best are here included within a single formation. This single formation continues northwards, with no marked lithological changes, into the central part of the Hodgkinson Basin, where it is known as the Hodgkinson Formation (de Keyser & Lucas, 1969). The same name is therefore used for the same formation in the Herberton/Mount Garnet area.

Lithology

The Hodgkinson Formation in the Herberton/Mount Garnet area consists of alternating thin-bedded sandstone, siltstone, and/or shale, thick-bedded to massive sandstone, conglomerate, limestone, chert, and basalt. These rocks are generally pale to dark grey or greenish grey, although the true colour is commonly masked by pink to yellowish brown ironstaining. The thin-bedded rocks are characteristically evenly stratified, although lensing and intertonguing with limestone and thick sandstone bands occur locally. No marker beds have been found in the sequence.

The lithology of thin-bedded sandstone, siltstone, and shale (S-Dh) is well developed north of Emuford, between Elizabeth Bluffs and Irvinebank (Pl. 2, fig. 1), at Stannary Hills, west of the Wild and Dry Rivers (including Silver Valley), between Brownville and Coolgarra, and near Top Nettle Camp. The individual sandstone beds have an average thickness of about 50 cm, but range from less than 2.5 cm to more than 3 m. The siltstone beds are generally thinner, and average about 20 cm. Many of the sandstone and siltstone beds show small-scale cross-bedding, convolute bedding, slump structures, and bottom structures such as sole markings and load casts. Graded bedding is discernible in some beds, and rare ripple marks also occur. Plant fossils, mostly poorly preserved, occur locally, as at Stannary Hills, near Montalbion, and in Silver Valley. The sandstones are mostly subgreywackes, but arkose and greywacke are also present. They range from coarse to fine-grained, and locally contain inclusions of shale several centimetres long.

Interbedded within the sandstone-siltstone-shale succession are beds and lenses, up to 90 m thick, of thick-bedded or massive sandstone (S-Dha). These were mapped as Montalbion Sandstone by Best (1962b) and de Keyser & Lucas (1969). They are most abundant near Emuford, Montalbion, and Irvinebank, in the Herberton 1-mile Sheet area. The thick sandstones commonly form prominent ridges, as they are more resistant to erosion than the thin-bedded rocks.

Many of the thick sandstone bands, including those at Montalbion, consist of pale grey or pale buff medium to coarse-grained arkose, whereas others, such as those exposed near Emuford and along Adventure Creek, near Montalbion, are greywackes and subgreywackes. Lenses of conglomerate and pebbly grit occur locally within the thick bands; these lenses generally have diffuse and irregular boundaries. Small fragments of shale are again common in the sandstones. Thin sequences of thin-bedded sandstone and siltstone are commonly present between successive thick sandstone bands, and indicate bedding. Vague cross-bedding is apparent in some of the sandstone bands.

The sandstones of the Hodgkinson Formation range from coarse to fine-grained, and generally contain less than 15 percent of matrix. Quartz grains mostly form 60 to 75 percent of the rock. The remaining constituents are alkali feldspar (albite, orthoclase, microcline, perthite), lithic fragments, muscovite, and minor biotite, tourmaline, zircon, and opaque and other minerals. The most abundant lithic grains are shale, chert, siltstone, granite, and acid, basic, and intermediate volcanics. The matrix of the sandstones is generally sericitic or chloritic, and probably represents altered clay material. Rarely the matrix is calcareous or siliceous.

Most of the sandstones are made up of less than 75 percent quartz and less than 15 percent matrix, and are classified as subgreywackes when they contain more lithic material than feldspar grains, and as arkoses when they contain feldspar in excess of lithic material (Pettijohn, 1957). Greywackes, defined by Pettijohn (1957) as having less than 75 percent quartz and more than 15 percent matrix, appear to be relatively rare in this area.

Conglomerate occurs as impersistent lenses, generally less than 50 cm thick, associated with both the thin-bedded sandstone-siltstone-shale sequences and with the thick sandstone bands. The conglomerate lenses consist mainly of subangular to rounded fragments of quartz, shale, chert, various sandstones, and minor, generally well rounded, fragments of acid volcanics and muscovite granite. In addition, limestone pebbles and boulders occur in a conglomerate on Bald Hill, east of Nymbool, and calcareous conglomerate, metamorphosed to calc-silicate hornfels, crops out at several localities near Mount Garnet (Fig. 4). Large chert boulders, some more than 30 cm in diameter, occur in a conglomeratic sandstone on the northwest side of Elizabeth Bluffs, east of Emuford.

Chert (S-Dhd) occurs both as probable primary beds, and as secondary masses along fault-zones. Chert also occurs as thin cappings over calc-silicate hornfels near Irvinebank. Cherts thought to be primary crop out west of Irvinebank as two massive pale grey beds each about 30 m thick. Chert which may be of primary origin also crops out 1.5 km west of Mount Garnet; the chert here is thin-

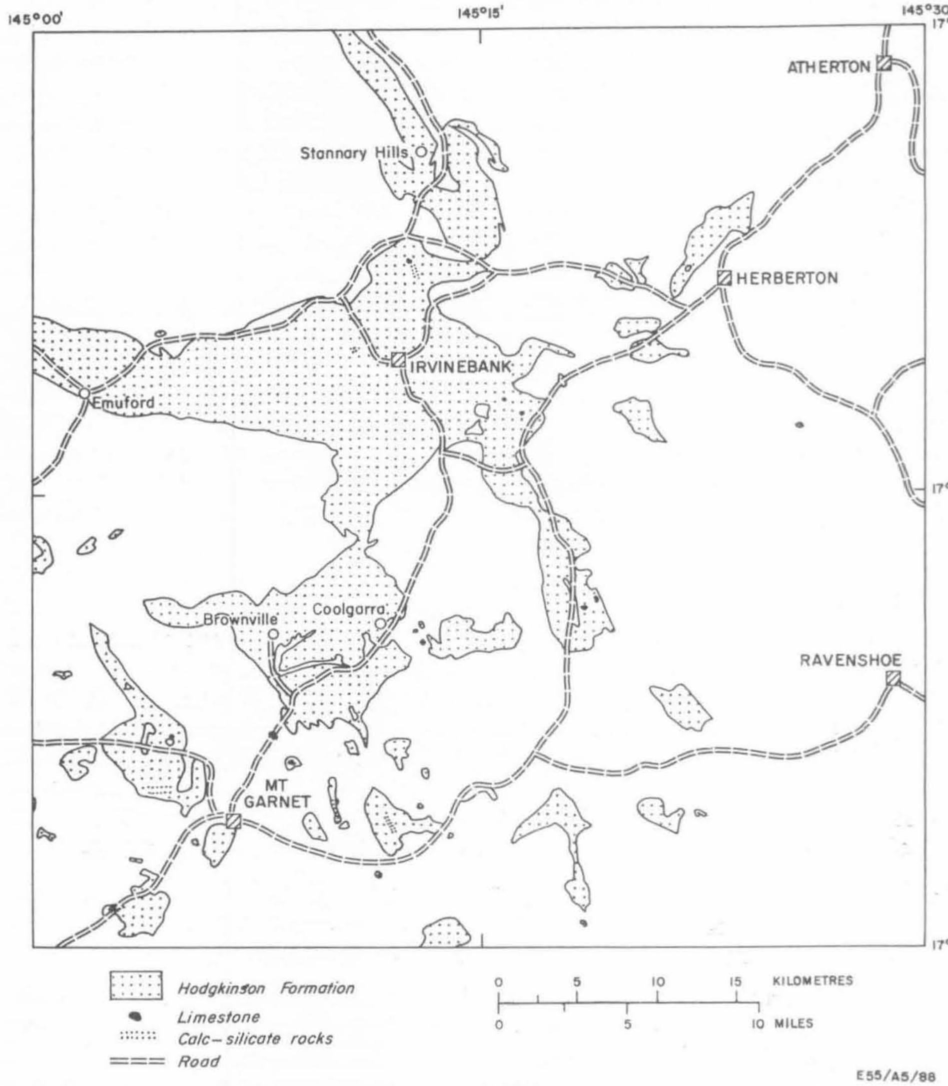

Figure 4. Hodgkinson Formation in the Herberton/Mount Garnet area, showing outcrops of limestone and calc-silicate rocks.

bedded, black and brown, and shows slump structures. In both these areas the chert appears to be unrelated to faulting. Most of the chert associated with faults consists of silicified thin-bedded sandstone and siltstone which are commonly contorted and boudinaged. Secondary chert of this type is particularly well developed at Elizabeth Bluffs, east of Emuford.

Lenses of pale grey limestone (S-Dhc), commonly metamorphosed to marble, have been found at several places in both the Herberton and Mount Garnet 1-mile Sheet areas (Fig. 4). The lenses range from 1 m to several metres in thickness. The largest limestone outcrop is 5 km northeast of Mount Garnet. Some of the least metamorphosed limestone lenses contain poorly preserved fossils, including corals, crinoids, brachiopods, and conodonts.

Dark grey fine-grained altered basalt (S-Dhb) is intercalated with sandstone, siltstone, and shale in the southwestern part of the Mount Garnet 1-mile Sheet area, but has not been recorded in the Hodgkinson Formation in the Herberton 1-mile Sheet area. The altered basalt crops out 1.5 km west of Mount Garnet, southwest of Mount Garnet between the racecourse and Smiths Creek, and west of Battle Creek. The basalt at these localities has been thermally metamorphosed, and consists mostly of sodic plagioclase and green hornblende, but the original texture is generally readily recognizable. The basalt is commonly amygdaloidal, and probably represents lava flows.

A slump breccia (S-Dhe) crops out between Bloodwood and Ragged Creeks, 8 km east of Emuford. The deposit consists of pellet-like fragments of grey shale with an average length of about 5 cm, and less abundant, larger, and more angular fragments of sandstone and siltstone, all enclosed in a shaly matrix. The matrix makes up more than 50 percent of the breccia. The shale, sandstone, and siltstone fragments are similar to the shale, sandstone, and siltstone in adjacent beds. The slump breccia has a maximum exposed thickness of about 600 m, but thins out very rapidly along strike, as it can be traced for only about 1800 m parallel to the regional strike.

Palaeontology and age

Fossils have been found in the Hodgkinson Formation at several localities in the Herberton/Mount Garnet area. Corals and crinoids occur in limestone lenses 6 km northwest of Irvinebank; in Limestone Creek, Silver Valley; near the Wild River, 2.5 km south of its junction with the Dry River; in Limestone Creek, 0.5 km north of Mount Garnet; and 5 km northeast of Mount Garnet. All limestone outcrops have been sampled for conodonts, but only one, 5 km northeast of Mount Garnet, has yielded identifiable forms. Plant fossils occur at Stannary Hills south east of Montalbion, and in Silvey Valley. The following fossils have been identified:

Corals: *Heliolites* sp., *Alveolites* sp., *Cystiphyllum* sp., and *Stringophyllum* sp., identified by Professor Dorothy Hill, occur in limestone 6 km north of Irvinebank; these forms range from Upper Silurian to Middle Devonian.

?*Dohmophyllum clarkei* Hill, identified in the field by D. L. Strusz, occurs in limestone boulders in Limestone Creek, Silver Valley, and indicates an upper Middle Devonian age.

?*Xystriphyllum dunstani* (Etheridge), and a solitary acanthophyllid coral, identified in the field by D. L. Strusz, occur in limestone 2.5 km south of the junction of the Wild and Dry Rivers; *X. dunstani* indicates a late Lower Devonian age.

Favosites sp., ?*Alveolites* sp., and *Heliolites* sp., occur in a limestone boulder in Limestone Creek, 0.5 km north of Mount Garnet (Levingston, 1960; Zimmerman et al., 1963); they indicate a Silurian or Devonian age.

Conodonts: *Spathognathodus* cf. *inclinatus posthamatus* Walliser, *Spathognathodus* cf. *inclinatus* s.s. (Rhodes), cf. *Spathognathodus ranuliformis* Walliser, *Panderodus unicostatus* Branson & Mehl, *Panderodus* sp., and *Belodella triangularis* (Stauffer), have been identified by E. C. Druce (pers. comm., 1967) in specimens from the limestone lens 5 km northeast of Mount Garnet; these forms indicate a possible range in age from Lower to Upper Silurian.

Plants: *Leptophloeum australe* occurs in thin-bedded sandstone and siltstone at Stannary Hills (Mary E. White, 1959); this form ranges from Upper Devonian to Lower Carboniferous.

The fossils indicate that the Hodgkinson Formation in the Herberton/Mount Garnet area ranges from Silurian to Upper Devonian or possibly to Lower Carboniferous.

In the northern part of the Hodgkinson Basin north of the Herberton/Mount Garnet area the only fossils found in the Hodgkinson Formation are *Leptophloeum australe* and Devonian corals, and the formation here is considered by de Keyser & Lucas (1969) to range from Middle Devonian to possibly Lower Carboniferous.

Correlation

Sedimentary rocks similar in age and lithology to the Hodgkinson Formation in the Herberton/Mount Garnet area occur in the Hodgkinson Basin to the north (de Keyser & Lucas, 1969), in the Chillagoe area to the west (de Keyser & Wolff, 1964), and in the Georgetown/Clarke River area to the south (D. A. White, 1965). In the latter area D. A. White has distinguished unconformities between the Upper and Middle Devonian, between the Middle and Lower Devonian, between the Upper and Middle Silurian, and possibly between the Middle and Lower Silurian. These unconformities have not been recognized in the Herberton/Mount Garnet area.

Relationships

The Hodgkinson Formation is presumed to overlie the Precambrian basement unconformably, although this unconformity has not been found in the field. Only at Mount Garnet is the Hodgkinson Formation seen alongside Precambrian rocks, and here the two rock units are faulted against each other.

The Carboniferous Silver Valley Conglomerate, Glen Gordon Volcanics, Nanyeta Volcanics, and Featherbed Volcanics overlie the Hodgkinson Formation with strong angular unconformity, as also do the Lower Permian Slaughter Yard Creek Volcanics and the Cainozoic Atherton Basalt. The four Carboniferous rock units are generally flat-lying, and were laid down after the rocks of the Hodgkinson Formation had been tightly folded (Pl. 2, fig. 2) and extensively eroded. In most places the contact is marked by a conglomerate or unconformity breccia (Pl. 3, fig. 2).

The Hodgkinson Formation is intruded and marginally hornfelsed (Pl. 3, fig. 1) by most of the upper Palaeozoic granites and other intrusive rocks (Pl. 4, fig. 2), including the Upper Carboniferous Elizabeth Creek Granite (Pl. 4, fig. 1) and Kalunga Granodiorite, the two oldest formally named granitic rock units in the area. The Elizabeth Creek Granite is considered responsible for the widespread mineralization in the Hodgkinson Formation.

Depositional environment

The greater part of the Hodgkinson Formation in the Herberton/Mount Garnet area is thought to represent geosynclinal deposits laid down in the southern part of the Hodgkinson Basin, near the northern end of the Palaeozoic Tasman geosynclinal zone. The Hodgkinson Basin was bordered to the southwest by a Precambrian landmass, now represented by the Georgetown Inlier (D. A. White, 1961), which was probably the source area for the Palaeozoic sediments. During the Silurian and Devonian periods the edge of this landmass probably trended northwestwards through the southwestern part of the Mount Garnet 1-mile Sheet area. In this part of the area some shelf deposits may be included within the Hodgkinson Formation.

Most of the features of the thin-bedded sandstone-siltstone-shale sequences within the Hodgkinson Formation are similar to those found in deposits formed by turbidity currents, and hence these beds are interpreted as turbidites. They show such features as graded bedding, small-scale cross-bedding, convolute bedding, bottom structures, and slump structures. The thick massive sandstone bands which are interbedded with the turbidites may be fluxoturbidites, which are probably formed by a combination of sliding and turbidity currents (Dzulynski et al., 1959). However, many of the thick bands show cross-bedding, and may have been deposited by traction currents.

The presence of turbidites and of limestone lenses containing marine fossils indicates that most of the Hodgkinson Formation is probably marine, and that both deep and shallow water deposits are represented.

The great thickness and areal extent of the formation, the uniform nature of the rocks, the presence of turbidites, and the lack of marker beds indicate that the Hodgkinson Formation is probably a flysch type of deposit (de Keyser & Wolff, 1964; de Keyser & Lucas, 1969).

UPPER PALAEOZOIC VOLCANIC FORMATIONS

Acid volcanic rocks of upper Palaeozoic age cover nearly one-third of the Herberton/Mount Garnet area (Fig. 6). They consist mostly of sub-aerial welded tuff sheets, but also include lava flows, agglomerate, air-fall tuff, tuffaceous sediments, and minor intrusions. The extrusive rocks were laid down on an irregular land surface formed very largely of tightly folded rocks of the Hodgkinson Formation.

The majority of the volcanic rocks are rhyodacites (Branch, 1966b) but rhyolites, andesites, and trachyandesites are also present. They contain phenocrysts of quartz (originally β quartz), alkali feldspar, sodic plagioclase, and ferromagnesian minerals. The phenocrysts of quartz and alkali feldspar are commonly partly resorbed.

The ages of the volcanic rocks are based partly on their relationships to the Upper Carboniferous Elizabeth Creek Granite and the Lower Permian Watsonville Granite, and partly on palaeontological evidence. The oldest upper Palaeozoic acid volcanics are probably those within the fossiliferous Silver Valley Conglomerate, which is probably of Middle Carboniferous age. This formation is overlain by the Glen Gordon Volcanics, which are intruded by Elizabeth Creek Granite. The Nanyeta and Featherbed Volcanics are also intruded by Elizabeth Creek Granite, and are correlated with the Glen Gordon Volcanics. The Walsh Bluff and Slaughter

Yard Creek Volcanics are younger than the Elizabeth Creek Granite, but are intruded by the Watsonville Granite, and are probably Lower Permian, as also are the Gurrumba Volcanics. Only the Nanyeta and Featherbed Volcanics are mineralized.

The acid volcanics and granites of the Herberton/Mount Garnet area form part of a suite of upper Palaeozoic acid igneous rocks which crop out over large areas of the Georgetown Inlier (D. A. White, 1961). The suite has been described by Branch (1961, 1962, 1963, 1966a,b, 1967a,b), who has divided the acid rocks on genetic grounds into two groups. The first group consists of volcanics and granite which are considered to be derived by fractional melting of basic rocks in the lower crust, and the second consists of contemporaneous granite thought to be derived by anatexis of sialic crustal material. Most of the volcanic rocks are considered by Branch to be associated with volcanic cauldrons, three of which occur in the Herberton/Mount Garnet area; these are the Featherbed, Nanyeta, and Glen Gordon cauldron subsidence areas. Most of the extrusive volcanic rocks within the cauldrons, especially the welded tuff sheets, may have been erupted from fissures situated near the margins of the cauldrons (Branch, 1967a).

Silver Valley Conglomerate (Cus)

The Silver Valley Conglomerate crops out over 8 sq km in the Silver Valley area, in the Herberton 1-mile Sheet area (Fig. 5). The main outcrop consists of rounded hills on which a dendritic drainage pattern has been developed. Before being named the Silver Valley Conglomerate (Best, 1962b), the formation was known as the *Rhacopteris* Beds (Jensen, 1923), *Aneimites* beds (Reid, 1930), and Silver Valley Beds (Reid, 1930; Hill & Denmead, 1960). Stirling (1905) first described the formation, and subsequent accounts have been given by Reid (1930, 1933g), Hill & Denmead (1960), Best (1962b), and Lucas (de Keyser & Lucas, 1969). The maximum known thickness of the formation is about 90 m, on Breccia Hill.

The dominant rock type is a coarse polymictic conglomerate containing thin sandstone lenses. In addition welded tuff sheets, air-fall tuff, and tuffaceous and carbonaceous sandstone and siltstone are present in subordinate amounts. Good exposures occur along the Dry River and Clotten Creek.

The conglomerate is a massive poorly sorted deposit (Pl. 5, figs 1 and 2; Pl. 6, fig. 1) in which bedding is indicated by sandstone lenses and the orientation of the megaclasts. No imbricate structures of pebbles have been recognized. The conglomerate is weakly cemented, and the megaclasts weather out readily from the matrix. Purplish brown staining is characteristic of both megaclasts and matrix. The megaclasts are mostly less than 15 cm in diameter, although boulders up to 30 cm across are common, and some are over 2 m across. The megaclasts over 2.5 cm in diameter are typically well rounded, but the smaller megaclasts are mostly angular to subangular. Reid (1933g) reported that some boulders are soled and faceted, but no such boulders were found during the present survey. Many of the megaclasts are obviously derived from the Hodgkinson Formation, and consist of greywacke, feldspathic sandstone, shale, and chert. The abundant pale grey quartzite megaclasts may also be derived from the Hodgkinson Formation. Other megaclasts are of volcanic rocks, including soft friable purplish brown dacitic welded tuff, which is particularly characteristic, and rather rare massive grey

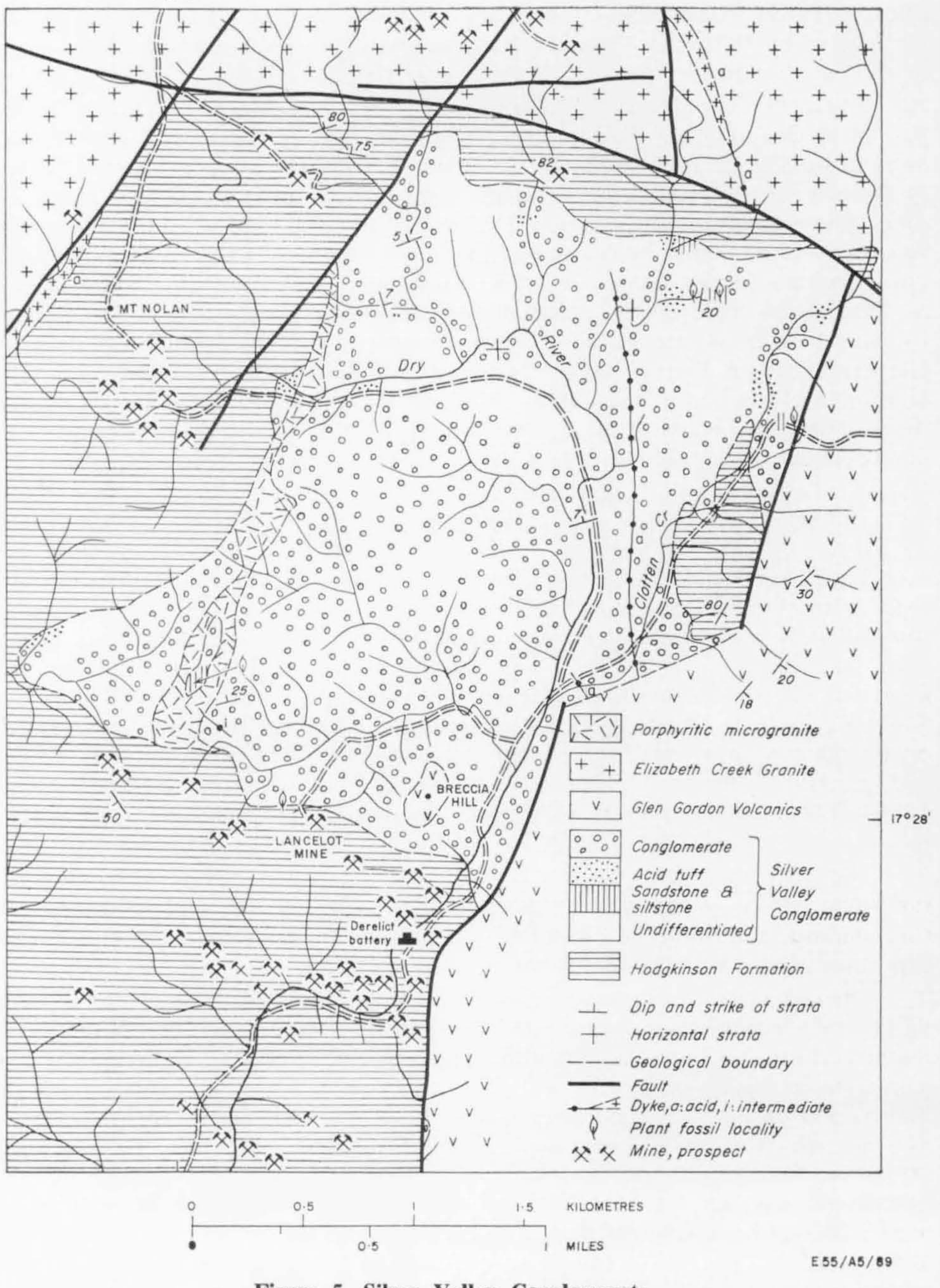

Figure 5. Silver Valley Conglomerate.

rhyolite and rhyodacite. The welded tuff megaclasts were probably derived locally from contemporaneous welded tuffs (see below). No limestone or granite megaclasts have been found.

The conglomerate closely resembles the Recent river gravels in the Silver Valley area, but the latter contain pebbles of Elizabeth Creek Granite and Glen Gordon Volcanics, and do not show purplish brown staining.

The sandstone lenses within the conglomerate and the matrix of the conglomerate itself consist of purplish brown or green medium to coarse-grained tuffaceous sand. The tuffaceous character of the sand is indicated by the presence of abundant altered glass shards readily recognizable under the microscope. The sandstone lenses commonly show cross-bedding.

Welded tuff and air-fall tuff occur locally within the conglomerate, and are present at the base of the formation in the western part of the outcrop, unconformably overlying the Hodgkinson Formation. They range in colour from purplish brown to buff and green. The tuffs contain small phenocrysts of quartz and altered feldspar, and commonly also contain small fragments of shale and sandstone derived from the Hodgkinson Formation: eutaxitic textures are preserved in many specimens.

Thin-bedded and laminated buff to dark grey tuffaceous and carbonaceous sandstone and siltstone, containing poorly preserved plant fossils, are present at a number of localities within the outcrop area (Fig. 5), the most accessible of which is on the Herberton/Silver Valley road 3 km northeast of the disused Silver Valley battery.

Throughout most of its outcrop, the Silver Valley Conglomerate is flat-lying, and dips are generally less than 10°. However, minor contortions occur in the northeast, where there are dips up to 50°. These contortions may be due to the proximity of faults at or near the margin of the Glen Gordon cauldron subsidence area.

The purplish brown staining of much of the Silver Valley Conglomerate is thought to be essentially diagenetic, and to be due to oxidation and devitrification of acid to intermediate volcanic material during and shortly after the deposition of the conglomerate and tuffs. The purplish colour does not appear to be related to either present day or pre-Cainozoic weathering.

The welded tuff megaclasts, although now soft and friable, must have been hard solid rock when incorporated within the conglomerate. The change in state of the megaclasts is attributed to post-depositional devitrification of acid glass, a major constituent of the welded tuff.

Palaeontology and age

Carbonaceous sandstone and siltstone containing plant fossils have been found at several localities (Fig. 5). Two of these localities, 1 km northeast of the Lancelot mine, and on the Herberton/Silver Valley road northeast of the Silver Valley battery, were recorded by Stirling in 1905. The fossiliferous beds appear to occur near the top of the formation. The following fossils have been recorded:

Rhacopteris inequilatera (Goess) (Etheridge, *in* Stirling, 1905; Best, 1962b); *Rhacopteris* sp. (Jensen, 1923; Reid, 1933g; Hill & Denmead, 1960); *Cardiocarpus* sp. (Etheridge, *in* Stirling, 1905); *Aneimites ovata* M'Coy (Reid, 1930, 1933g); *Pitys* sp. (Reid, 1933g).

The presence of *Rhacopteris* indicates a Carboniferous age (Mary E. White, *in* Mollan et al., 1964). As the Silver Valley Conglomerate is overlain by the Glen Gordon Volcanics, which are intruded by the Upper Carboniferous Elizabeth Creek Granite, it is considered to be probably Middle Carboniferous.

Relationships

The Silver Valley Conglomerate unconformably overlies the Hodgkinson Formation, and is overlain, possibly conformably, by Glen Gordon Volcanics.

The unconformity with the Hodgkinson Formation is well exposed in Clotten Creek, where flat-lying conglomerate lies on steeply dipping interbedded greywacke and siltstone. Other exposures occur in the northwest and southwest, where the unconformity surface dips steeply and irregularly eastwards. Contacts between the Silver Valley Conglomerate and the Glen Gordon Volcanics can be seen on the Silver Valley/Herberton road, and in small creeks to the south, east of the Dry River. Here pebble conglomerate passes up, apparently gradationally, into gently dipping tuffs which are the basal beds of the Glen Gordon Volcanics. The tuffs contain pebbles similar to those in the underlying conglomerate.

Although deposited before the intrusion of the Elizabeth Creek Granite, the Silver Valley Conglomerate is neither mineralized nor hornfelsed. This is in marked contrast to the underlying Hodgkinson Formation. For instance, the lode at the Lancelot mine, the largest mine in the Silver Valley area (Fig. 5), lies in steeply dipping rocks of the Hodgkinson Formation less than 200 m from the nearest exposures of Silver Valley Conglomerate. To account for the lack of mineralization, it is suggested that the conglomerate, being massive and unjointed, was impervious to the mineralizing solutions emanating from the Elizabeth Creek Granite.

Depositional environment

Some previous workers have suggested that the Silver Valley Conglomerate is a glacigene deposit (Reid, 1933h; Bryan & Jones, 1946). This interpretation is largely based on the presence of thin-bedded siltstone and sandstone near the top of the formation, which have been interpreted as varves. Reid (1933h) also considered the soled and faceted boulders which he found as further evidence of glacial origin, although none of the boulders showed glacial striae. However, the nature of the matrix of the conglomerate, which is tuffaceous and not clayey, is incompatible with a glacial deposit.

An alternative explanation is offered here, based on the close association of massive polymictic conglomerate and thin-bedded sandstone and siltstone, which are waterlaid deposits, with contemporaneous subaerial welded tuff and air-fall tuff. The conglomerate is considered to be a fanglomerate deposited in alluvial fans in a narrow valley or basin bounded by hills formed of contemporaneous acid volcanics and older sedimentary rocks of the Hodgkinson Formation. The volcanics consisted mostly of pyroclastics, some of which were deposited directly onto the alluvial fans as air-fall tuff and welded tuff sheets. The thin-bedded sandstone and siltstone are thought to be lacustrine deposits formed in temporary lakes associated with the alluvial fans.

Glen Gordon Volcanics (Cl)

Extensive outcrops of Glen Gordon Volcanics occur in the southeast quadrant of the Herberton 1-mile Sheet area and the eastern half of the Mount Garnet 1-mile Sheet area. The outcrops consist mainly of rugged hills, bounded in places by steep scarps. The volcanics are generally very well exposed, especially in the western part of the area of outcrop. Their maximum thickness is not known, but is probably well over 300 m. The formation is named after Glen Gordon Trig.

Station, in the Mount Garnet 1-mile Sheet area 16 km southwest of Ravenshoe. Previous descriptions of the formation have been given by Best (1962b) and Branch (1962, 1966b).

The outcrop of Sunday Creek Volcanics distinguished by Branch (1966b) and Best (1962b) in the southeast corner of the Mount Garnet Sheet area was examined. The rocks here appear to be indistinguishable from the adjacent Glen Gordon Volcanics, and have therefore been mapped as Glen Gordon Volcanics, as also have exposures of acid volcanics 1.5 km south of Newellton, Silver Valley, which were mapped as Nanyeta Volcanics by Branch (1966b). Similarly the outcrops of Glen Gordon Volcanics mapped by Branch (1966b) and Best (1962b) near Mount Garnet have now been included within the Nanyeta Volcanics. In both areas there is evidence of possible minor unconformities within the acid volcanics, but these can be expected where subaerial lava flows and pyroclastic deposits overlie one another, and there is no good evidence of any major unconformity.

The Glen Gordon Volcanics are made up of welded tuff sheets, acid lava flows, agglomerate, tuff, and tuffaceous sandstone and siltstone. The tuffaceous sandstone and siltstone are thin-bedded and commonly silicified to chert. The rocks are various shades of buff, pink, green, grey, and blue. They are particularly well exposed near Silver Valley (Pl. 6, fig. 2; Pl. 7, fig. 1), where easterly dipping welded tuff sheets in the north form a steep scarp about 150 m high; these sheets pass up into bedded tuffaceous sandstone and siltstone, up to 15 m thick, which are overlain by flow-banded and locally autobrecciated acid lava (Cla). To the southwest a massive agglomerate composed of acid volcanic material crops out along the Dry River. Branch (1966b) considers that this agglomerate marks the sites of several explosive vents situated along the western boundary fault of the Glen Gordon cauldron. Numerous exposures of laminated and silicified tuffaceous siltstone, probably lacustrine deposits, occur along the Wild River and its tributaries (Pl. 7, fig. 2). Jensen (1939) found plant fossils in siltstone exposed near the junction of Evelyn Creek and the Wild River.

The lavas and pyroclastic rocks contain small phenocrysts, up to 3 mm in diameter, of quartz, alkali feldspar, and sodic plagioclase. The phenocrysts of alkali feldspar are generally pink, whereas those of plagioclase are generally white. Ferromagnesian phenocrysts, entirely pseudomorphed mostly by celadonite and chlorite, are also commonly present. The pyroclastic deposits in addition to quartz, feldspar, and ferromagnesian phenocrysts, contain rock fragments and devitrified glass shards. The rock fragments are mostly rhyolitic, although rare fragments of dark grey trachyandesite also occur. The groundmasses of the lavas and pyroclastic rocks have been recrystallized, but the original textures are commonly partly preserved. Green celadonite is a characteristic secondary mineral at many localities.

In the west, the Glen Gordon Volcanics appear to be gently folded about north-south axes. The folds are indicated by dips of generally less than 35° in waterlaid tuffaceous sediments. However, only one distinct structure has been mapped, a northerly plunging syncline near the junction of the Wild and Dry Rivers. The folding is probably of volcano-tectonic origin, and may be related to the formation of the Glen Gordon cauldron postulated by Branch (1966b), as also may some of the faults at or near the western margin of the area occupied by the volcanics. No dips have been measured in the eastern part of the outcrop.

Jointing is prominently displayed in a number of areas, especially at The Bluff and Arthurs Seat. Many of the joints may be minor faults.

The Glen Gordon Volcanics are probably of Middle or Upper Carboniferous age. They overlie the Hodgkinson Formation unconformably, and the Middle Carboniferous Silver Valley Conglomerate possibly conformably, and they are intruded by the Upper Carboniferous Elizabeth Creek Granite. They are also thought to be intruded by the Kalunga Granodiorite, although no contact relationships were seen in the field. Contacts with the Silver Valley Conglomerate are exposed in the Silver Valley area, where flat-lying conglomerate passes gradationally upwards into pyroclastic deposits at the base of the Glen Gordon Volcanics. An exposed contact with Elizabeth Creek Granite was found southwest of Glen Gordon Trig. At this locality the granite becomes finer in grain towards a fused contact with hornfelsed acid volcanics. Hornfelsic acid volcanics also occur on the western margin of the Glen Gordon Volcanics in the Wild River and within 10 m of Elizabeth Creek Granite 10 km southeast of Herberton, and greisenized acid volcanics occur between Glen Gordon Trig. and Arthurs Seat. The metamorphism was probably caused by the Elizabeth Creek Granite. The hornfelsic acid volcanics southeast of Herberton contain fine-grained aggregates of reddish brown biotite.

The Glen Gordon cauldron subsidence area postulated by Branch (1966b) includes all the mapped outcrops of Glen Gordon Volcanics. According to Branch, the western boundary of the cauldron is defined by a zone of intersecting faults, whereas the eastern boundary is covered by Tertiary basalts. The western boundary is complicated in the Herberton and Mount Garnet 1-mile Sheet areas by later granite intrusions, but may be represented by faults west and south of Silver Valley.

Nanyeta Volcanics (Cn)

The Nanyeta Volcanics comprise the acid volcanic rocks cropping out in a belt 19 km long and up to 7 km wide trending northwest from Mount Garnet, and they also include an isolated outcrop of acid volcanics capping Mount Garnet itself. The formation is named after Nanyeta Creek, better known as Return Creek, and the type section is along the headwaters of the East Branch of Smiths Creek (Branch, 1966b). The maximum thickness of the formation is over 150 m.

The outcrop of Nanyeta Volcanics includes areas north of Mount Garnet previously mapped as Glen Gordon Volcanics (Best, 1962b; Branch, 1966b), but does not include a small area south of Newellton, Silver Valley, mapped as Nanyeta Volcanics by Branch (1966b), as in this work the latter area is mapped as Glen Gordon Volcanics.

The main rock types are welded tuff, lava, agglomerate, tuff, and tuffaceous sediments, all of which are present in the type section (Branch, 1966b). The rocks are of andesitic to rhyolitic composition, and are cream, buff, pink, red, purple, brown, green, or grey. The volcanic rocks are sparsely to richly porphyritic. The phenocrysts are generally less than 2 mm in diameter, although some up to 2.5 cm occur locally, as on Bald Hill. Most of the phenocrysts are of sodic plagioclase, alkali feldspar, and, in the rhyolitic rocks only, quartz. Quartz and alkali feldspar phenocrysts are only rarely partly resorbed. The plagioclase phenocrysts are white, and the alkali feldspar phenocrysts white or pink. Many rocks also contain secondary green minerals pseudomorphing ferromagnesian phenocrysts. In the andesitic lavas the groundmass is very fine-grained and trachytic to subtrachytic: in the rhyolitic lavas it is very fine-grained and felsitic.

Plate 5, fig. 1. Silver Valley Conglomerate exposed along the Dry River, 3 km north-northeast of Newellton, Silver Valley.

Plate 5, fig. 2. Thin flat-lying lens of sandstone (just above and to left of hammer head) in massive conglomerate, Silver Valley Conglomerate. Dry River, 3 km northeast of Newellton, Silver Valley.

Plate 6, fig. 1. Coarse polymictic conglomerate, Silver Valley Conglomerate. Pale weathered-out megaclasts are of sedimentary rocks derived from the Hodgkinson Formation; also present are many dark friable megaclasts of welded tuff derived from volcanics thought to be contemporaneous with the conglomerate. Dry River, 3 km northeast of Newellton, Silver Valley.

Plate 6, fig. 2. Massive welded tuff of the Glen Gordon Volcanics along the Wild River, 6 km southeast of Newellton, Silver Valley.

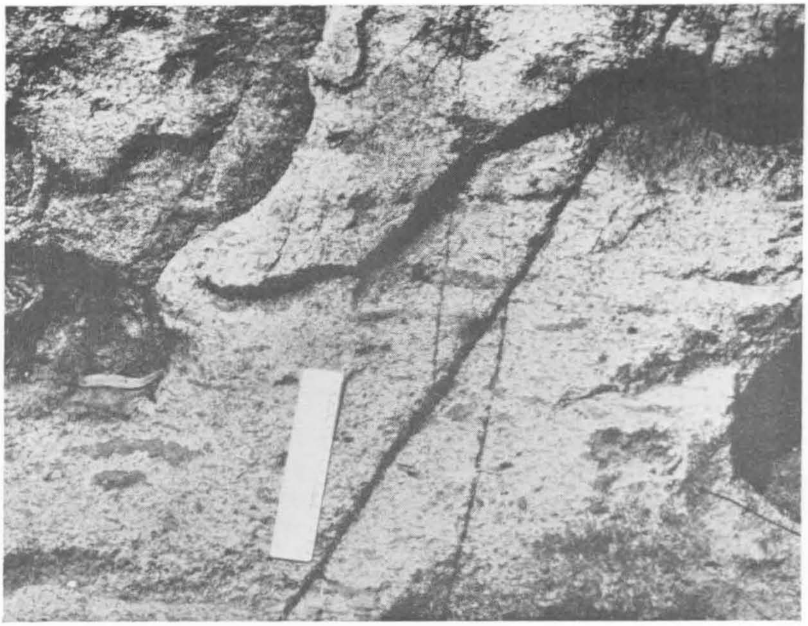

Plate 7, fig. 1. Welded tuff showing megascopic eutaxitic texture, Glen Gordon Volcanics. Creek exposure 2 km south-southeast of Newellton, Silver Valley.

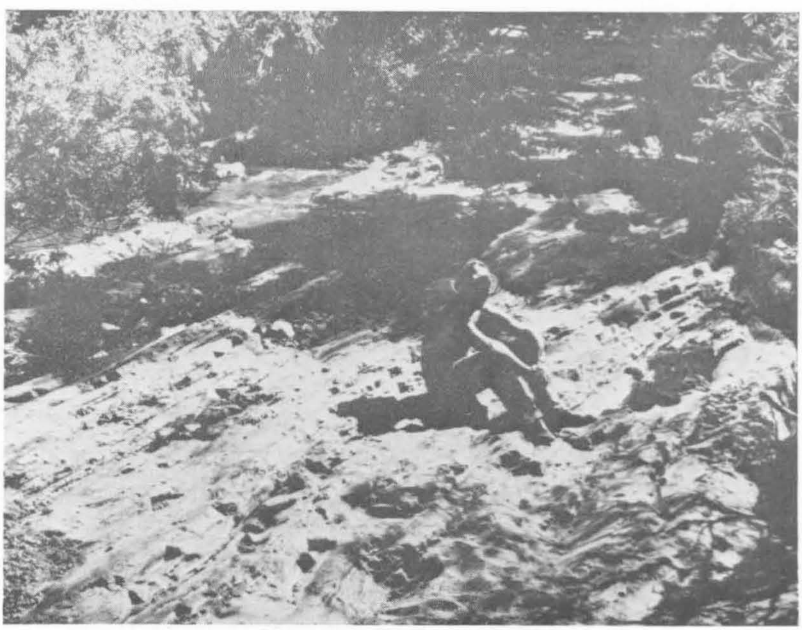

Plate 7, fig. 2. Gently dipping thin-bedded tuffaceous sandstone and siltstone of the Glen Gordon Volcanics. Wild River, 5 km east-southeast of Newellton, Silver Valley.

Plate 8, fig. 1. The southern side of the Featherbed Range, formed of acid volcanics, viewed from granite hills near Emuford. The low-lying area in the middle distance consists of relatively unresistant shale, siltstone, and thin sandstone beds of the Hodgkinson Formation.

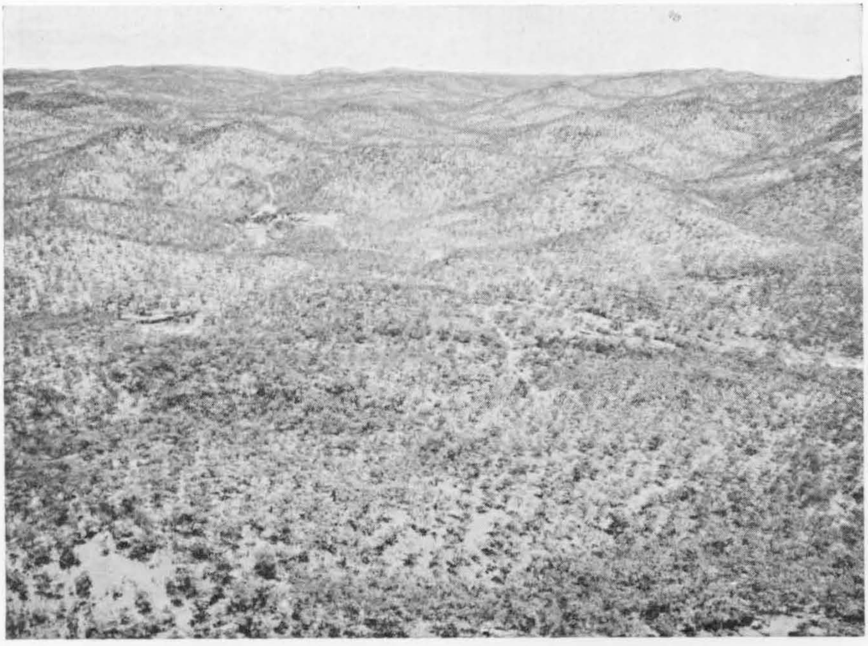

Plate 8, fig. 2. Hills of Elizabeth Creek Granite near Emuford, looking southwest. In the foreground Emu Creek traverses an area of subdued relief on Hodgkinson Formation.

Plate 9, fig. 1. Typical exposure of Elizabeth Creek Granite, 8 km south-southeast of Irvinebank.

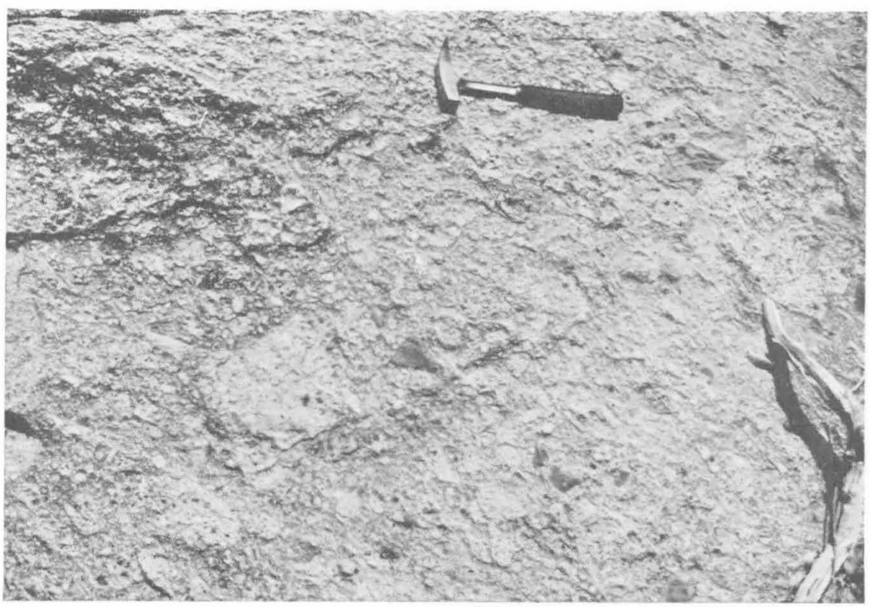

Plate 9, fig. 2. Vent breccia associated with a large acid dyke, 8 km east-northeast of Stannary Hills. The breccia is made up mainly of angular fragments of Elizabeth Greek Granite (pale) but also contains scattered fragments of acid volcanics (dark); it occupies a vent which may have been one of the eruptive sites for the Walsh Bluff Volcanics.

Plate 10, fig. 1. Flow-banded acid lava of the Walsh Bluff Volcanics (lower part of photograph) intruded and thermally metamorphosed by Watsonville Granite (upper part), 9 km east-northeast of Stannary Hills.

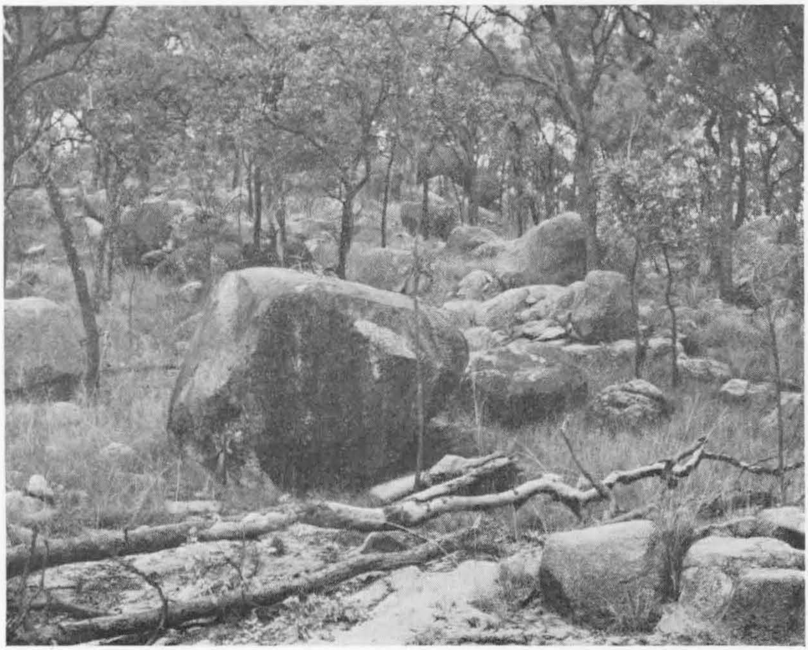

Plate 10, fig. 2. Typical exposure of Watsonville Granite, showing spheroidal weathering, 3 km west of Watsonville.

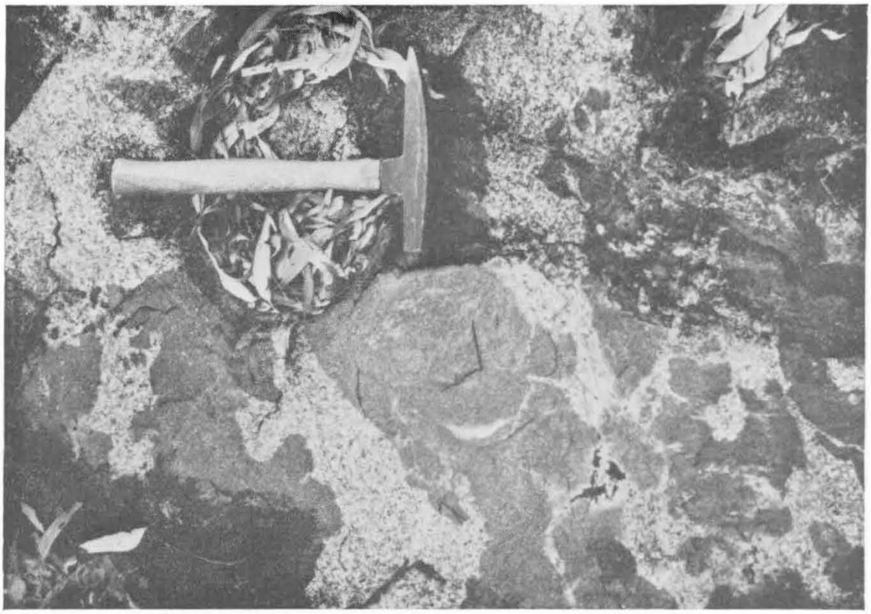

Plate 11, figs 1 and 2. Irregular pillow-like inclusions of dark dioritic hybrid rock in pale granophyre. Net-veined complex of the composite ring dyke, Gurrumba Ring Complex, 5 km west of Iron Mountain.

Plate 12, fig. 1. Irregular inclusions of dark dioritic hybrid rocks in contaminated granophyre. Net-veined complex of the composite ring dyke, Gurrumba Ring Complex, 5 km west-southwest of Iron Mountain.

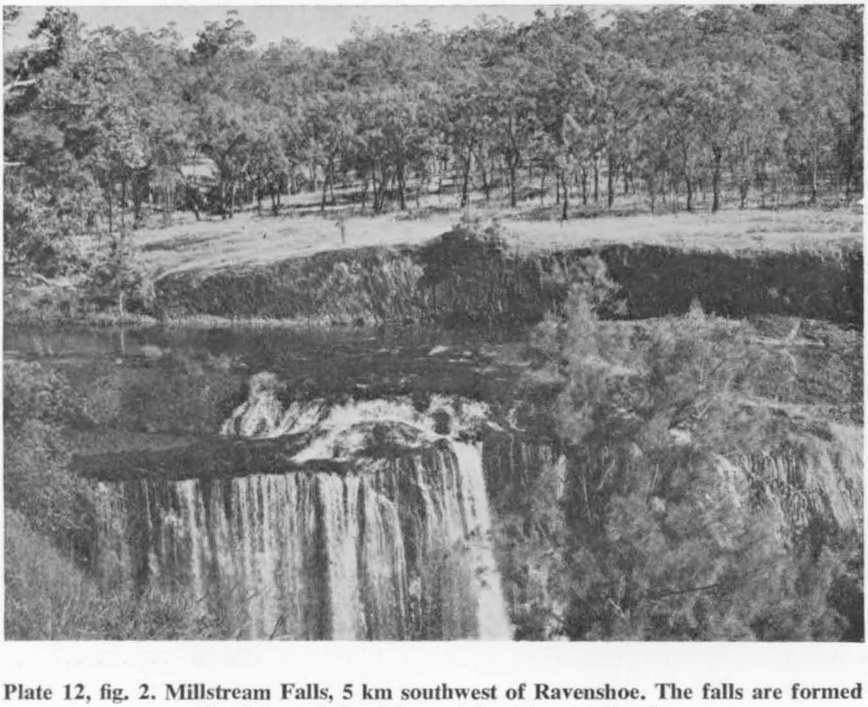

Plate 12, fig. 2. Millstream Falls, 5 km southwest of Ravenshoe. The falls are formed of columnar-jointed lava of the Atherton Basalt.

The Nanyeta Volcanics unconformably overlie the Precambrian and the Hodgkinson Formation, and are intruded by Upper Carboniferous Elizabeth Creek Granite and by granophyre. The contact relationships are generally poorly exposed, and only contacts with the Hodgkinson Formation were seen in the field. The unconformable contact of the Nanyeta Volcanics with the Hodgkinson Formation, first recorded by Maitland (1891), is exposed in Return Creek 3 km south of Brownville (Pl. 3, fig. 2), and in Rankin Creek 2.5 km west of Brownville; at these localities steeply dipping beds of the Hodgkinson Formation are overlain by a flat-lying breccia or agglomerate, up to 15 m thick, which is succeeded by acid lavas and pyroclastic deposits. The breccia bed contains angular fragments of greywacke, siltstone, and shale up to 1.5 m or more across, and smaller and less numerous fragments of porphyritic acid volcanics, all enclosed in a tuffaceous matrix.

The contacts of the Nanyeta Volcanics with inliers of Hodgkinson Formation north of Mount Garnet are not exposed. The inliers, which consist mostly of limestone, may represent partly exhumed fossil hills buried beneath the acid volcanics.

It is inferred that the Elizabeth Creek Granite intruded the Nanyeta Volcanics north of California Creek, where acid lavas close to the granite contact are sericitized (greisenized?) and contain tourmaline. No contacts between the two rock units were found in the field. Granophyre intrudes the acid volcanics west of Geebung Hill.

Tin mineralization related to the Elizabeth Creek Granite occurs within the Nanyeta Volcanics on Mount Garnet. Elsewhere the volcanics are unmineralized.

The Nanyeta Volcanics are probably Middle or Upper Carboniferous, and are correlated with the Glen Gordon and Featherbed Volcanics.

Branch (1966b) considers that the Nanyeta Volcanics lie in a remnant cauldron, which he has named the Nanyeta cauldron subsidence area. Its southwestern boundary is marked by a prominent fault which may continue northwards and join an arcuate fault near Iron Mountain. However, a corresponding fault has not been identified along the northern part of the northeast boundary of the cauldron, although its presence here is postulated by Branch (1966b, p. 45). Although the cauldron subsidence presumably took place during the deposition of the Nanyeta Volcanics, and hence before the intrusion of the Elizabeth Creek Granite, the southwestern boundary fault has displaced the granite; so, if it does mark the edge of the cauldron, the fault must still have been active after the granite was emplaced.

Featherbed Volcanics (Cf)

Acid rocks of the Featherbed Volcanics cover most of the northwest part of the Herberton Sheet area. The main outcrop lies west of Stannary Hills and north of Emuford (Pl. 8, fig. 1), and covers about 360 sq km. East of Stannary Hills some small outcrops with a total area of about 5 sq km have also been mapped as Featherbed Volcanics. The formation was named Featherbed Range Porphyries by Jensen (1920), after the Featherbed Range between Almaden and Mount Mulligan, on the Atherton and Mossman 1:250,000 Sheets, and was later renamed Featherbed Volcanics (Best, 1962b). The formation has been described recently by de Keyser & Wolff (1964) and Branch (1966b).

The main outcrop of Featherbed Volcanics in the Herberton Sheet area consists largely of strongly jointed welded tuff sheets, although acid lava, agglomerate, bedded tuff, and dykes of rhyolitic and andesitic composition also occur. The rocks are pink, buff, green, blue, pale grey, or dark grey. No stratigraphical succession has been mapped, and the succession recognized by de Keyser & Wolff (1964) and Branch (1966b) in the Featherbed Range to the northwest, which consists of a basal grey unit, a middle pink or buff unit, and an upper grey unit, has not been traced into the Herberton Sheet area.

The acid volcanics are porphyritic, and commonly contain over 20 percent of phenocrysts of quartz, alkali feldspar, sodic plagioclase, and ferromagnesian minerals. The phenocrysts range from less than 2 mm to more than 2.5 cm across, and are generally larger than the phenocrysts in the other upper Palaeozoic acid volcanics. In the pyroclastic rocks the phenocrysts are commonly fragmented. Phenocrysts of quartz are clear and colourless. Those of alkali feldspar are generally pink in hand specimen, and highly turbid in thin section. Plagioclase phenocrysts are mostly white in hand specimen. The ferromagnesian phenocrysts are generally pseudomorphed by chlorite, calcite, and iron oxide, although unaltered biotite, hornblende, and pyroxene phenocrysts are present locally, as for instance in massive rhyodacite north of Emuford. In addition to phenocrysts the pyroclastic rocks contain small angular rock fragments, mostly of very fine-grained acid rock, and devitrified glass shards (not always readily recognizable). The groundmass of the acid rocks generally consists of very fine-grained quartzofeldspathic material, much of which is devitrified acid glass; eutaxitic textures are commonly preserved in the welded tuff sheets.

The largest of the small outcrops mapped as Featherbed Volcanics east of Stannary Hills is probably intrusive. It consists of quartz-feldspar porphyry in which both the phenocrysts and the microgranitic groundmass decrease in grainsize towards the margins of the outcrop. At the margins the rock is flow-banded parallel to unexposed contacts with the Hodgkinson Formation. In contrast, the easternmost small outcrop consists at least partly of subaerial porphyritic tuff containing shale and siltstone fragments derived from the underlying Hodgkinson Formation. The southwestern boundary of this outcrop is probably faulted.

The Featherbed Volcanics unconformably overlie the Hodgkinson Formation, and angular unconformities are well exposed northeast of Emuford and in Chinaman and Gibbs Creeks northwest of Irvinebank. At these localities a breccia or conglomerate bed, containing fragments derived from the underlying steeply dipping Hodgkinson Formation, is succeeded by gently dipping acid tuff. An apparent unconformable contact is also exposed in an old railway cutting in Eureka Creek, west of Stannary Hills. Here sandstone and siltstone of the Hodgkinson Formation, dipping 56° to 080°, are separated from massive porphyritic acid tuff by a slightly sheared breccia 1 m thick, which is composed of fragments derived from the Hodgkinson Formation. Twenty metres west of the contact bedded tuff dips 70° to 260°, parallel to the breccia, and similar dips occur in welded tuff sheets farther down Eureka Creek. The contact was mapped as a fault by Branch (1966b), but is considered to be an unconformity breccia by R. M. Tucker (GSQ). However, the breccia shows evidence of some shearing, and it seems probable that a fault movement took place along the plane of unconformity. The steep dips of the tuff adjacent to the contact could have been caused by drag along either this or a nearby fault, as suggested by Branch (1966b).

The age of the Featherbed Volcanics is probably Middle or Upper Carboniferous, comparable to that of the Glen Gordon and Nanyeta Volcanics. At Weinert and Orient Camp, southwest of Stannary Hills, the Featherbed Volcanics are extensively mineralized, and the mineralization is considered to be related to the Upper Carboniferous Elizabeth Creek Granite. The acid volcanics are therefore thought to be older than the granite. This age relationship is supported by evidence from the Bamford Hill area, in the Almaden 1-mile Sheet area, where Featherbed Volcanics are intruded and mineralized by Elizabeth Creek Granite (Best, 1962b; de Keyser & Wolff, 1964; Branch, 1966b). The Featherbed Volcanics are also considered to be older than the Hales Siding Granite: however, these two rock units were not seen in contact in the field, and it is not known whether the Hales Siding Granite intrudes or is faulted against the acid volcanics.

Although the Featherbed Volcanics are described here as being older than the Elizabeth Creek Granite, age determinations recently made by L. P. Black (1969) indicate that this may not be so. Black has dated samples of Featherbed Volcanics at 298 m.y. $\pm$ 12 m.y. by the Rb/Sr method (using a decay constant for Rb_{87} of 1.39 x $10^{-11}y^{-1}$), and specimens of Elizabeth Creek Granite from the large outcrops between Emuford, Silver Valley, and Mount Garnet at 326 m.y. $\pm$ 7 m.y. by the same method. These age determinations indicate that the Featherbed Volcanics dated are uppermost Carboniferous or lowermost Permian, and are significantly younger than the dated samples of Elizabeth Creek Granite. From this it follows that the mineralization in the Featherbed Volcanics can hardly be due to the Elizabeth Creek Granite unless (a) the Featherbed Volcanics dated are younger than the Featherbed Volcanics that are mineralized, or (b) the mineralization in the Featherbed Volcanics is related to a younger and as yet undated intrusion of Elizabeth Creek Granite.

The Featherbed Volcanics west of Stannary Hills are described by Branch (1966b) as occupying part of a cauldron named the Featherbed cauldron subsidence area. This view is supported by the general shape of the area of outcrop, and by the inward dip of the volcanics near the eastern boundary. However, the boundaries of the postulated cauldron in the Herberton 1-mile Sheet area do not appear to be marked by major faults or collapse structures. This may be because such structures have been hidden beneath overlapping younger members of the Featherbed Volcanics which were laid down after the main subsidence movement had taken place, or because the boundary of the cauldron lies inside the present outcrop of Featherbed Volcanics and hence is not readily recognizable.

Slaughter Yard Creek Volcanics (Pw)
(new name)

An irregular outcrop of acid volcanic rocks covers an area of about 15 sq km between Herberton and Watsonville, in the Herberton 1-mile Sheet area. These acid rocks are the Slaughter Yard Creek Volcanics, named after a creek which flows across the eastern part of the outcrop. They were previously mapped as Glen Gordon Volcanics (Best, 1962b; Branch, 1966b). The type area of the formation is the headwaters of Slaughter Yard Creek.

The volcanics consist of pale grey acid lava in the northern and most rugged part of the outcrop, and pink and grey intrusive rocks in the central and southern parts. The acid lava is over 100 m thick, and shows contorted flow banding. It is made up of sparse small phenocrysts of quartz and feldspar, averaging 1 mm in diameter, enclosed in a very fine-grained quartzofeldspathic groundmass containing minute flakes of biotite.

The intrusive acid rocks, which are thought to be contemporaneous with the acid lava, form dykes, inclined sheets, and larger and more irregular bodies. They intrude the Hodgkinson Formation, Elizabeth Creek Granite, and Kalunga Granodiorite. In contrast to the acid lava the intrusive rocks are richly porphyritic; the phenocrysts make up to 30 percent of the rock, and range up to 1 cm in diameter. The phenocrysts are of quartz, alkali feldspar (commonly sanidine), sodic plagioclase, and pseudomorphs after biotite. They lie in a fine to very fine-grained quartzofeldspathic groundmass which shows felsitic, granophyric, and devitrified spherulitic textures. The groundmass also contains small opaque granules and minute flakes of altered biotite. Secondary minerals present are chlorite, sericite, calcite, and iron oxide.

One dyke-like body, exposed in a ford on the Silver Valley/Herberton road 1 km north of the Stella mine, is probably a composite intrusion. It consists of pink porphyritic granophyre containing irregular pillow-like inclusions of 'andesite', many over 30 cm across. Highly irregular crenulate contacts between the andesite inclusions and the surrounding granophyre indicate that the inclusions were probably in a liquid state when they were incorporated in the granophyre magma (cf. Blake et al., 1965). The inclusions contain sparse plagioclase phenocrysts set in a fine-grained subvariolitic groundmass formed of elongate crystals of turbid feldspar and greenish brown hornblende, minor biotite, opaque granules, and interstitial quartz.

Intrusive relationships of Slaughter Yard Creek Volcanics with Hodgkinson Formation are well exposed along the new road between Watsonville and Herberton (Pl. 4, fig. 2), and an intrusive contact with Elizabeth Creek Granite is exposed in a creek 2.5 km northeast of the Stella mine. At the latter locality the granite is sheared, and appears to be partly recrystallized at a fused contact with flow-banded porphyritic acid rock: the groundmass of the porphyritic rock becomes coarser in grain away from the granite contact. No contacts were seen between undoubted Slaughter Yard Creek Volcanics and Kalunga Granodiorite. However, the many porphyritic acid dykes which cut both the Kalunga Granodiorite and the Elizabeth Creek Granite in the Herberton-Watsonville area are considered to be related to the Slaughter Yard Creek Volcanics.

East of Watsonville, the Slaughter Yard Creek Volcanics are intruded and hornfelsed by the Lower Permian Watsonville Granite, and, as they are younger than the Upper Carboniferous Elizabeth Creek Granite, which they intrude, they are probably lowermost Permian in age.

A small outcrop of massive unbedded conglomerate or breccia on Specimen Hill, 1.5 km west of Herberton, has been mapped as possible Slaughter Yard Creek Volcanics (Pw?). The conglomerate, which was first described by Ringrose (1897), overlies Elizabeth Creek Granite and Hodgkinson Formation. It is made up mostly of angular to subangular fragments of sandstone, greywacke, siltstone, and shale derived from the Hodgkinson Formation, but it also includes fragments of 'greisen', possibly altered granite, of unknown derivation. The conglomerate is cut by quartz veins, and is highly indurated, and it is therefore probably pre-Cainozoic. Its relationship to the underlying Elizabeth Creek Granite and the nearby Watsonville Granite is not known.

Walsh Bluff Volcanics (Pb)

The rugged hills in the north between Atherton and Collins Weir, and including Wallum Trig. (1295 m), the highest point in the area, are formed of Walsh Bluff Volcanics (Best, 1962b; Branch, 1966b). The volcanics cover 80 sq km in the Herberton 1-mile Sheet area, and extends northwards into the adjacent Dimbulah 1-mile Sheet area, where Walsh Bluff, which gives its name to the formation, is located.

The Walsh Bluff Volcanics consist of subaerial acid lavas, welded tuff sheets, and minor agglomerate and tuff. They probably have a maximum thicknes of well over 600 m. The rocks range from pale buff to greenish, greyish, and dark bluish grey, and contain phenocrysts up to 3 mm in diameter of euhedral sodic plagioclase and partly resorbed quartz and alkali feldspar. The feldspar phenocrysts are generally white, and are only rarely pink. Pseudomorphed ferromagnesian phenocrysts also occur.

Throughout most of their outcrop the Walsh Bluff Volcanics are flat-lying, as is apparent from the prominent subhorizontal layering visible west of Wallum Trig. on the air-photographs. Easterly dips occur on the western edge of the outcrop, and these may be depositional dips.

East of Collins Weir bedded tuff at the base of the formation rests unconformably on Elizabeth Creek Granite. The tuff, which is loosely consolidated, crops out on a steep scarp; it is mostly less than 6 m thick, and dips eastwards at 20° to 50°. The bedded tuff is overlain by massive welded pyroclastic flow deposits, over 100 m thick, which pass up into flow-banded and autobrecciated acid lava.

A large acid dyke on the west side of the Walsh River between Collins Weir and the disused Rocky Bluff Battery may have been one of the feeders for the Walsh Bluff Volcanics. The dyke is over 5 km long and locally more than 50 m wide. It is bordered to the east by a zone of vent breccia (Pl. 9, fig. 2) up to 450 m wide, and a similar but much more restricted zone appears to be developed on the west side of the dyke. The wider zone of vent breccia consists mainly of angular fragments of Elizabeth Creek Granite, but also includes, in the immediate vicinity of the dyke, fragments of acid volcanics.

Numerous other acid dykes occur in the Collins Weir area, intruding both the Elizabeth Creek and Atlanta Granites, but have not been found intruding either the Walsh Bluff Volcanics or the Watsonville Granite. Most, if not all, of these dykes may also be related to the Walsh Bluff Volcanics. The dyke rocks contain small phenocrysts of quartz and feldspar and appear to be petrographically similar to the extrusive rocks.

The only dykes known to intrude the Walsh Bluff Volcanics in the Herberton Sheet area belong to the Parada Dyke Swarm mapped in 1959 by Lucas (Branch, 1966b). The dykes, which are reported to consist of rhyodacite or trachyandesite, occur 5.5 km east-northeast of Collins Weir.

The Walsh Bluff Volcanics are probably Lower Permian. They unconformably overlie Upper Carboniferous Elizabeth Creek Granite, and are intruded by Lower Permian Watsonville Granite and an unnamed granite (Pgu). The intrusive relationships are well exposed in creeks east of the disused Rocky Bluff Battery, where flow-banded acid lava is veined and hornfelsed by both granites (Pl. 10, fig. 1). Immediately adjacent to fused contacts with granite the acid lava is recrystallized, and contains porphyroblastic biotite, muscovite, and tourmaline.

Gurrumba Volcanics (Pu)
(new name)

The Gurrumba Volcanics crop out near the abandoned township of Gurrumba (Fig. 8), in the central part of the Gurrumba Ring Complex (called the Gurrumba Volcanic Neck by Branch, 1966b). They occur in two small outcrops covering less than 3 sq km, one of which lies off the western edge of the Mount Garnet Sheet area. Both outcrops form prominent hills. The maximum exposed thickness of the formation is about 150 m.

The formation consists of a pale grey flow-banded and autobrecciated 'rhyolite' which contains small white phenocrysts of turbid feldspar averaging 1 mm in diameter. Sericite and pyrite are abundant, and the rock appears to have been propylitized. The contact of the rhyolite with the adjacent Hodgkinson Formation is marked by a zone of breccia formed of angular fragments derived from both rock units. No contacts with other rock types within the Gurrumba Ring Complex were seen in the field.

The age of the Gurrumba Volcanics is uncertain. They are tentatively regarded as Lower Permian as the ring structure in which they lie was formed after the emplacement of the Upper Carboniferous Elizabeth Creek Granite.

UPPER PALAEOZOIC GRANITES

Outcrops of granite (*sensu lato*) cover almost half the Herberton/Mount Garnet area (Fig. 6), and much of the remainder is underlain by granite at shallow depths. The two main rock types present are adamellite and granodiorite. Except for two very small areas of Precambrian granite, covering a total area of less than 2 sq km, all the granites are considered to be upper Palaeozoic.

During the regional mapping of the Georgetown Inlier in 1956-59, geologists from the Bureau of Mineral Resources and the Geological Survey of Queensland divided the granites into two main units, the Herbert River Granite and the Elizabeth Creek Granite (D. A. White, 1961; Best, 1962b; Branch, 1966b). Branch (1966b, 1967b) considers that the two granites have two distinct origins: that the Elizabeth Creek Granite was derived from fractionated sima magma, and is genetically related to the upper Palaeozoic acid volcanic rocks, whereas the Herbert River Granite was formed from anatectic magma.

The recent detailed work in the Herberton/Mount Garnet area has shown that, as in the Chillagoe area (de Keyser & Wolff, 1964), the relationship of the granites is more complicated than was indicated by the earlier mapping, and at least 10 granitic units have now been recognized. These are, in approximate order of intrusion:

Permian(?)	10. Hales Siding Granite (Pgs): previously mapped as Elizabeth Creek Granite (Best, 1962b)
	9. Bakerville Granodiorite (Pgb): previously mapped as Herbert River Granite (Best, 1962b)
	8. Unnamed granodiorite and quartz dolerite (Pgc) cropping out in Catherine Creek northeast of Stannary Hills: previously mapped as undifferentiated dolerite, rhyolite, and diorite (Best, 1962b)
	7. Nymbool Granite (Pgn): previously mapped as Herbert River Granite (Zimmerman et al., 1963)
	6. Hammonds Creek Granodiorite (Pgm): previously mapped as Herbert River Granite (Zimmerman et al., 1963)
Lower Permian	5. Watsonville Granite (Pgw): previously mapped as Herbert River Granite (Best, 1962b)
Upper Carboniferous	4. Atlanta Granite (Cga): previously mapped as Herbert River Granite (Best, 1962b)
Upper Carboniferous	3. Elizabeth Creek Granite (Cgz): essentially as mapped by earlier workers (Best, 1962b; Branch, 1966b)
Carboniferous	2. Unnamed granite (Cgu) cropping out 5 km east of Mount Garnet: previously mapped as Elizabeth Creek Granite (Best, 1962b; Zimmerman et al., 1963)
	1. Kalunga Granodiorite (Cgk): previously mapped as Herbert River Granite (Best, 1962b)

In addition there are several other small isolated bodies of unnamed granitic rocks (Pgu, Pgy) which are also probably of upper Palaeozoic age.

Some of the characteristic features of the granites are summarized in Tables 5 and 6. Chemical analyses of the Elizabeth Creek and Watsonville Granites are given in Table 7.

The Elizabeth Creek Granite, which is considered to be responsible for the mineralization in the Herberton Tinfield, intrudes the Kalunga Granodiorite and is intruded by the Watsonville Granite and probably also by the Atlanta, Nymbool, and Hales Siding Granites, the Hammonds Creek and Bakerville Granodiorites, and the unnamed granodiorite and quartz diorite cropping out in Catherine Creek. The Atlanta and Watsonville Granites appear to be intruded by the Catherine Creek rocks and the Bakerville Granodiorite respectively, and the latter granodiorite may be intruded by the Hales Siding Granite.

Kalunga Granodiorite (Cgk)
(new name)

The Kalunga Granodiorite crops out in the southeast quadrant of the Herberton Sheet area, where it covers about 50 sq km. It is named after a small settlement situated near the centre of the granodiorite outcrop. The topography of the outcrop area is relatively subdued, and consists of shallow valleys in deeply weathered granite separated by rounded hills strewn with granite boulders. Spheroidal weathering is characteristically well developed. Good exposures occur on either side of the Silver Valley to Herberton road west of Cassowary Creek, and this has been selected as the type area.

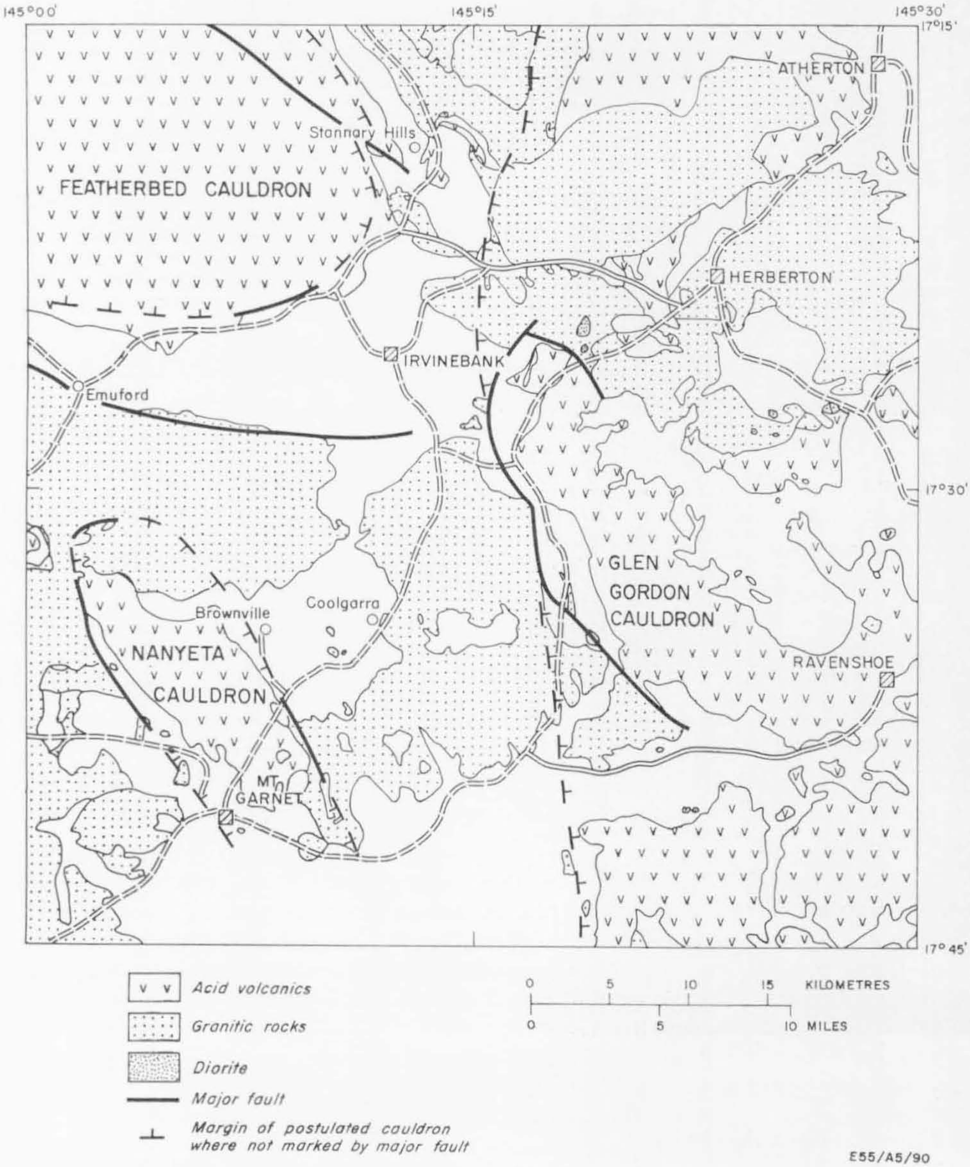

Figure 6. Distribution of upper Palaeozoic igneous rocks.

The Kalunga Granodiorite shows a considerable range in composition and texture, and may represent more than one intrusion. The most common rock type is a grey medium-grained non-porphyritic hornblende-biotite granodiorite in which hornblende is generally much subordinate to biotite. With an increase in alkali feldspar content, the granodiorite grades into adamellite, which generally does not contain hornblende. The colour ranges from very pale to dark grey, depending on the percentage of dark minerals present, and the grainsize ranges from less than 1 mm to over 5 mm. Some of the finer-grained varieties contain plagioclase phenocrysts up to 1 cm long, and others have poikilitic alkali feldspar crystals of similar

TABLE 5. GRANITES OF THE HERBERTON/MOUNT GARNET AREA: FIELD AND HAND SPECIMEN CHARACTERISTICS

Granite	Colour	Spheroidal weathering	Aplite	Greisens	Chloritization	Sericitization	Xenoliths	Texture	Average grainsize (mm)	Ferromagnesian minerals	% Quartz	% Dark minerals (colour index)	Cross-cutting acid dykes
Hales Siding Granite (Pgs)	Pale pink	a	r	a	a	a	r	NP	1-2	Biotite	>35	<5	a
Bakerville Granodiorite (Pgb)	Grey	c	c	a	a	a	c	NP	1-2	Biotite Hornblende Augite r	<35	10-15	a
Watsonville Granite (Pgw)	Pale grey	c	r	a	a	a	c	NP	1-5	Biotite	>35	5-10	a
Hammonds Creek Granodiorite (Pgm)	Grey	c	c	a	a	r*	c	NP	1-2	Biotite Hornblende vc Augite r Hypersthene r	<35	10-15	c
Nymbool Granite (Pgn)	Grey	c	r	a	a	a	c	rP	1-5	Biotite	>35	5-10	a
Atlanta Granite (Cga)	Pale pink	c	a	a	a	a	a	cP	1-10	Biotite	>35	<5	c
Elizabeth Creek Granite (Cgz)	Pink to pale grey	r	vc	vc	c	c	r	cP	1-10	Biotite	>35	<5	c
Kalunga Granodiorite (Cgk)	Grey	c	r	a	a	a	c	NP	1-2	Biotite Hornblende vc Augite r Hypersthene r	<35	10-15	c

KEY

vc	very common	cP	phenocrysts commonly present
c	common	rP	phenocrysts rarely present
r	rare	NP	essentially non-porphyritic
a	absent	*	of associated aplites only

size. Dark grey fine-grained xenoliths, generally less than 10 cm in diameter, are common, and cross-cutting veins of pale pink or white aplite occur locally. Some of the granitic rocks are markedly heterogeneous, and are probably hybrids.

The granodiorite shows little secondary alteration, other than surface weathering, and it appears to be unmineralized.

Petrography

Texture: granitic, coarse to fine-grained, but mostly medium-grained; rarely porphyritic; small xenoliths common.

Composition: quartz, plagioclase, orthoclase, biotite, and hornblende as major constituents; allanite, apatite, sphene, zircon, and opaque minerals as minor constituents and secondary chlorite, epidote, and sericite: some specimens also contain

TABLE 6. GRANITES OF THE HERBERTON/MOUNT GARNET AREA: MICROSCOPIC CHARACTERISTICS

Granite	Alkali Feldspar	Plagioclase	Ratio Alk. Feld.:Plag.	Characteristic Minor Constituents
Hales Siding Granite (Pgs)	Mostly orthoclase, rarely microcline, perthitic	Oligoclase and oligoclase-andesine, normal zoning common	5:4 - 3:2	—
Bakerville Granodiorite (Pgb)	Orthoclase, rarely perthitic	Oligoclase-labradorite, normal zoning	2:3 - 1:8	Opaque minerals
Watsonville Granite (Pgw)	Orthoclase, commonly perthitic, also poikilitic	Oligoclase-andesine, normal zoning	2:1 - 1:1	Zircon
Hammonds Creek Granodiorite (Pgm)	Orthoclase, microcline, commonly perthitic	Oligoclase-labradorite	2:3 - 1:6	Opaque sulphides
Nymbool Granite (Pgn)	Orthoclase, microcline, commonly perthitic	Oligoclase-andesine, normal zoning	4:5 - 2:3	Apatite, zircon
Atlanta Granite (Cga)	Orthoclase, microcline, perthitic	Oligoclase, oligoclase-andesine, normal zoning	5:4 - 3:2	—
Elizabeth Creek Granite (Cgz)	Microcline, orthoclase, generally perthitic	Oligoclase and oligoclase-andesine, normal zoning	5:2 - 1:1	Fluorite
Kalunga Granodiorite (Cgk)	Orthoclase, commonly perthitic, also poikilitic	Oligoclase-labradorite, normal zoning	1:4 - 1:1	Apatite, zircon

augite and, in one example, hypersthene: most of the pyroxene occurs in the cores of hornblende crystals.

Quartz is anhedral, interstitial.

Plagioclase generally occurs as subhedral crystals which show normal zoning ranging from labradorite or andesine in the cores to oligoclase or albite at the crystal margins: secondary sericite is patchily developed: very fine-grained myrmekite is present in many specimens.

Orthoclase is turbid and commonly microperthitic; it forms anhedral interstitial crystals, and also larger crystals poikilitically enclosing other minerals.

Biotite is brown and strongly pleochroic; it shows some alteration to chlorite.

Hornblende generally forms subhedral crystals, and is pleochroic from green to brown.

TABLE 7. CHEMICAL ANALYSES OF UPPER PALAEOZOIC GRANITES
(after Branch, 1966b)

	1	2	3	4
SiO_2	77.47	74.5	75.56	75.2
Al_2O_3	12.38	13.1	12.89	12.73
Fe_2O_3	0.92	0.36	0.37	0.07
FeO	0.67	1.33	1.60	1.48
MgO	0.03	0.23	0.29	0.60
CaO	0.36	1.59	0.88	1.34
Na_2O	3.25	3.40	2.76	3.39
K_2O	4.61	4.80	4.95	4.42
H_2O+	0.52	0.29	0.53	0.44
H_2O-	0.09	0.14	0.19	0.05
CO_2	n.d.	0.12	n.d.	n.d.
TiO_2	0.03	0.19	0.12	0.05
P_2O_5	0.03	0.05	0.07	0.10
MnO	0.02	0.02	0.01	0.04
Total	100.38	100.22	100.22	99.91

Elizabeth Creek Granite

1. Biotite granite, Elizabeth Creek at Cumbana homestead, the type area of Elizabeth Creek Granite. Analyst, A. McClure, BMR. E55/9/3.
2. Biotite adamellite, 26 km SW of Mount Garnet. Analyst, H. W. Sears, AMDL. E55/5/25.
3. Biotite granite, 1.5 km S of Herberton. Analysts, A. McClure and S. Baker, BMR. E55/5/13 (GA447 in Richards et al., 1966b).

Watsonville Granite

4. Biotite adamellite, 3 km E of Bakerville. Analysts, A. McClure and S. Baker. E55/5/12 (GA446 in Richards et al., 1966b).

Relationships and age

The relationship of the Kalunga Granodiorite to most of the adjacent rock units has been fairly well established. The granodiorite intrudes and marginally hornfelses rocks of the Hodgkinson Formation, and probably also intrudes the Glen Gordon Volcanics. It is intruded by the Elizabeth Creek Granite and by numerous acid minor intrusions which are correlated with the Slaughter Yard Creek Volcanics. The contact with the Elizabeth Creek Granite is exposed 2.5 km northwest of the Stella mine, northeast of Silver Valley. Here the Kalunga Granodiorite is toughened and has a streaky appearance at the contact, and microscopic examination shows that it has been partly melted and recrystallized, whereas the immediately adjacent Elizabeth Creek Granite is coarse-grained, and appears to be relatively unaltered.

The Kalunga Granodiorite is overlain by the Atherton Basalt, of Cainozoic age, and underlies most of the Herberton and Bradlaugh Deep Leads. Its age is probably Carboniferous.

Elizabeth Creek Granite (Cgz)

The Elizabeth Creek Granite is typically a pale pink to orange or pale grey leucocratic adamellite, with up to 5 percent mafic minerals. It has an aggregate outcrop area in the Georgetown Inlier of 5000 sq km (Branch, 1966b). The type area is Elizabeth Creek, near Cumbana homestead, in the Einasleigh 1:250,000 Sheet area (D. A. White, 1959).

Outcrops of Elizabeth Creek Granite cover more than a quarter of the Herberton/Mount Garnet area, and extensive areas of mineralized and thermally metamorphosed sedimentary rocks at, for example, Irvinebank, Brownville, and Coolgarra, are underlain by the Elizabeth Creek Granite at shallow depth. Most of the granite contacts are gently dipping, commonly as low as 15°, and the outcrops evidently represent the exposed upper parts of one or more granite batholiths. Roof pendants of country rocks are exposed near Glenlinedale, between Gurrumba and The Glen, and near Top Nettle Camp.

Branch (1966a,b) has estimated that the granite was emplaced under a cover only 150 to 600 m thick.

The Elizabeth Creek Granite generally forms rugged hills (Pl. 8, fig. 2) with rough boulder-strewn surfaces (Pl. 9, fig. 1). The boulders are generally subangular, unlike the rounded boulders characteristic of most of the other granitic rocks of the area. However, well rounded boulders occur locally, as south of Emuford, west of Nymbool, north of Brownville, and 6 km east of Mount Garnet.

The intrusive contacts of the granite are sharp and commonly irregular in detail, although some contacts are smooth and probably fault-controlled. In many places, porphyritic fine-grained granite occurs near the intrusive contacts, and may represent marginal chilling of the granite magma.

The Elizabeth Creek Granite is strongly jointed, and joints are conspicuous both in the field and on air-photographs. The jointing has been studied in detail in the Mount Garnet Sheet area by Zimmerman, Yates, & Amos (1963), and the results of their work are generally applicable to the other outcrops of Elizabeth Creek Granite. Their study has shown that the predominant trends of the major joints are northwest and northeast.

In some areas prominent closely spaced jointing gives the granite a foliated appearance, which is evident on air-photographs. The well jointed areas lie to the north of Stannary Hills, where the joints have a northwesterly trend; south of Bakerville, where the joints dip steeply to the northeast; and southwest of Emuford, where the joints are flat-lying and are possibly parallel to the postulated roof of the granite batholith (Branch, 1966b).

In the Herberton/Mount Garnet area the Elizabeth Creek Granite is mostly a leucocratic biotite adamellite with an average grainsize of 2 to 5 mm. However, the granite is quite variable: the colour ranges from salmon pink to pale pink, pale orange, white, or pale grey; the average grainsize ranges from less than 1 mm to over 5 mm; porphyritic varieties are common; and in places adamellite grades into alkali granite. Veins and sheet-like bodies of aplite and porphyritic microgranite occur at many localities. Pegmatites are rare, and xenoliths are uncommon, even in the contact zones. Greisens are widespread, and are especially abundant where the granite is mineralized.

The finer-grained varieties of Elizabeth Creek Granite are generally porphyritic. They characteristically contain rounded bleb-like phenocrysts of quartz and variable amounts of pink or white feldspar phenocrysts or both. Some of the medium and coarse-grained varieties are also porphyritic, and contain phenocrysts of quartz and feldspar: the feldspar phenocrysts in such rocks range up to more than 6 cm in length. Coarsely porphyritic varieties crop out north of Stannary Hills, southeast of The Glen, west of Nymbool, and between Innot Hot Springs and the Wild River.

Xenoliths have been found in Elizabeth Creek Granite at only a few localities: these are the headwaters of Bloodwood Creek, east of Emuford, where the granite contains numerous large angular stoped blocks, many feet in length, of hornfelsed sedimentary rocks; on Skinner Hill, northeast of Herberton, where contaminated Elizabeth Creek Granite is exposed in a new road cutting; and west and south of Nymbool, where dark grey fine-grained xenoliths up to 50 cm long occur in porphyritic fine-grained granite and aphyric medium grained granite, respectively. On Skinner Hill a pale grey heterogeneous granite, mostly medium-grained, contains swirl-like inclusions of darker grey and finer-grained granite: both granitic rocks here contain prominent quartz blebs and white euhedral phenocrysts up to 5 cm long of perthite and sodic plagioclase.

The granite is commonly partly sericitized or chloritized, biotite being altered to green chlorite, and some of the feldspar (plagioclase only?) being replaced by pale greenish sericite.

Petrography

Texture: mostly medium-grained, granitic; also fine and coarse-grained; commonly porphyritic; aplite common, pegmatite and xenoliths rare.

Alteration: greisenization, sericitization, and chloritization common.

Composition: main constituents are quartz (35-45%), alkali feldspar (25-55%), plagioclase (10-40%), and biotite (1-5%): minor constituents are allanite, apatite, fluorite, muscovite, topaz, tourmaline, zircon, and opaque and metamict minerals; fluorite is almost invariably present. In addition small amounts of green hornblende occur in biotite adamellite mapped as Elizabeth Creek Granite cropping out between Ravenshoe and Evelyn.

Quartz is anhedral and mostly interstitial; it also forms bleb-like phenocrysts, each of which is generally made up of more than one crystal: myrmekitic and granophyric textures are locally common.

Alkali feldspar occurs as anhedral interstitial crystals and subhedral phenocrysts of microline and, less commonly, orthoclase: it is generally perthitic and is nearly always turbid.

Plagioclase forms euhedral to subhedral phenocrysts and subhedral crystals in the groundmass; it is mostly oligoclase, and rarely shows much zoning; many crystals show incipient alteration to sericite; rare xenocrysts of labradorite-bytownite have been recorded by Branch (1966b).

Biotite is commonly yellowish brown to reddish brown, rarely greenish, and is intensely pleochroic; pleochroic haloes, mostly around zircon inclusions, are common; many crystals are partly altered to chlorite and iron oxide: in some localities the biotite does not form distinct tabular crystals, but occurs instead as fine-grained aggregates.

Greisenization

The widespread development of greisen is a characteristic feature of the Elizabeth Creek Granite, and greisenization has affected most, if not all, of the different varieties of the granite, including aplite and porphyritic microgranite. Greisens are particularly abundant between Emuford, Gurrumba, and Geebung Hill in the west, and Thompson Creek, near Glenlinedale, in the east, and they are also prominent near Stannary Hills, Watsonville, and Herberton, north of Innot Hot Springs, and southwest of Mount Garnet.

The greisens are mostly more resistant to erosion than the unaltered granite, and typically form sharp ridges or pinnacle-like hills flanked by slopes covered with greisen rubble. The rubble tends to conceal unaltered granite, and may give a false impression of the extent of the greisen. In the western part of the area the greisens are more densely vegetated than the unaltered granite, and show up as darker areas on air-photographs.

The greisens form both well defined veins and massive irregular bodies. The vein greisens, which are the most common, range in width from less than 2 cm to more than 10 m, and in length from a few metres to over 1.5 km. The majority of the veins are developed along vertical or steeply dipping joints, most of which have a northwesterly trend, but narrow flat-lying or gently dipping greisen veins are also common. Some of the veins have inner cores of highly siliceous greisen or massive vein quartz. Massive greisens are well developed near Emuford and Gurrumba, where they cap pinnacle-like hills, and also near Geebung Hill, Battle Creek, and Mount Gibson, and southeast of Glenlinedale. The massive greisens range up to 1 sq km in area, and have exposed thickness of up to 90 m.

The contacts between unaltered granite and greisen are either sharp or gradational over a width of generally less than 15 cm.

Most of the greisens are pale grey to greyish green in hand specimen, and consist predominantly of quartz and pale mica. The quartz is coarse to fine-grained, and at many localities occurs as rounded bleb-like megacrysts similar to those in the unaltered granite. The mica is generally finer-grained than the quartz, and is only rarely coarse-grained. At some localities, as on St Patrick Hill, Herberton, the mica is extremely fine-grained, and resembles pale yellow-green serpentine in hand specimen. In thin section, some of the mica is slightly pleochroic from very pale green to colourless or very pale yellow. Most of the mica is probably muscovite, although variable amounts of protolithionite or lepidolite or both are probably also present, as is indicated by the amount of lithium in some of the partial chemical analyses of greisens shown in Table 8, and by the range in Li/K ratios. The very fine-grained mica on Herberton Hill and elsewhere has been identified as sericite (G. Greaves, pers. comm.). Green biotite occurs in a 'greisen' at the Globe mine, southeast of Gurrumba, and at the Smiths Creek mine, Nymbool.

Accessory minerals found in the greisens are, in approximate order of decreasing abundance, fluorite, topaz, cassiterite, wolframite, arsenopyrite, iron oxides, molybdenite, monazite, siderite, galena, bismuthinite, stibnite, copper minerals, and chalcedony. Dumortierite and zeunerite have also been identified (Zimmerman et al., 1963), and beryl is present in massive dark mica at the John Bull tungsten mine, west-southwest of Top Nettle Camp, and in a quartz reef at the Fingertown mine, southeast of Geebung Hill. The nature and economic significance of the mineralization associated with the greisens is discussed later.

Most of the greisens have probably been formed by pneumatolytic alteration of granite in situ in the roof zones of the granite intrusions during the final stages of crystallization of the granite magma. The principal change in the granite during greisenization was the replacement of feldspar by mica. The joints in the granite provided the channels for late-magmatic fluids. Some of the greisens may have been formed, not by alteration of the granite, but by the intrusion as dykes and veins of a volatile-rich material which crystallized as a primary quartz-mica rock or 'esmeraldite' (Hatch, Wells, & Wells, 1961; and others).

TABLE 8. PARTIAL ANALYSES OF GREISENS, ELIZABETH CREEK GRANITE, MOUNT GARNET 1-MILE SHEET AREA
(from Zimmerman et al., 1963)

Sample No.	Locality	K_2O	Na_2O	Li_2O	SrO
R13717	Geebung Hill	3.66	0.10	0.04—	0.01
R13718	" "	3.54	0.05—	0.04—	0.01
R14242	S of Mt Gibson	10.32	1.20	0.19	0.02
R14243	" "	8.65	0.20	0.15	0.03
R14244	Gibsons Gully	8.08	0.10	0.11	0.02
R14245	Clarrie Smiths lode	7.07	0.05—	0.06	0.02
J60C	Wild River area	3.38	0.05—	0.04—	0.01—
J118A	Dingo mine	5.66	2.12	0.09	0.02
J187	2.5 km WSW of Top Nettle Camp	7.90	0.05—	0.25	0.02
J189	Devon mine	8.88	0.05—	0.19	0.03
R14247	Tuckers Gully	4.12	0.05—	0.04	0.01

Analyst, S. Baker, BMR.

Relationships

The relationships of the Elizabeth Creek Granite to many of the other rock units in the Herberton/Mount Garnet area have now been established. The Elizabeth Creek Granite intrudes the Hodgkinson Formation, the Glen Gordon, Nanyeta, and Featherbed Volcanics, and the Kalunga Granodiorite; it is unconformably overlain by the Walsh Bluff Volcanics and the Cainozoic Atherton Basalt, and is intruded by the Atlanta and Watsonville Granites, the Bakerville Granodiorite, an unnamed granodiorite and associated diorite northeast of Stannary Hills, and by acid dykes and other minor intrusions. The relationships with the Hammonds Creek Granodiorite and the Nymbool Granite are not clear as no exposures of the contacts were found: both these rock units are tentatively considered to be younger than the Elizabeth Creek Granite.

The intrusive contacts of the Elizabeth Creek Granite with the Hodgkinson Formation are exposed at several localities. The contacts are welded, and veins and apophyses of granite penetrate the sedimentary rocks. In places, such as 5 km east of Stannary Hills, the sedimentary rocks have been breccia-veined by the granite (Pl. 4, fig. 1).

The Elizabeth Creek Granite is seen to intrude the Glen Gordon Volcanics 5 km south-southwest of Glen Gordon Trig., in the Mount Garnet Sheet area. The granite becomes markedly finer in grain towards the contact, which is welded, and the adjacent acid volcanics have a hornfelsic appearance. No exposed contacts with the Nanyeta Volcanics were found, but the occurrence of greisenized volcanics 10 km north of Nymbool and of tin lodes in volcanics on Mount Garnet indicate that the Nanyeta Volcanics are older than the granite. The Featherbed Volcanics are intruded by Elizabeth Creek Granite near Bamford Hill (Branch, 1966b), in the Almaden 1-mile Sheet area, and the same relationship is inferred in the Herberton Sheet area. In both areas, the Featherbed Volcanics are mineralized, and the mineralization is considered to be genetically associated with the Elizabeth Creek Granite.

The contact between Elizabeth Creek Granite and Kalunga Granodiorite is exposed south of Watsonville. The Kalunga Granodiorite has been partly recrystallized immediately adjacent to deeply weathered, but otherwise unaltered, Elizabeth Creek Granite.

The unconformable relationship of the Walsh Bluff Volcanics with the Elizabeth Creek Granite can be seen east of Collins Weir, where the Elizabeth Creek Granite is overlain by loosely consolidated bedded acid tuffs. The granite here is cut by numerous acid dykes which were intruded after the emplacement of the granite, and before the acid tuffs were deposited.

The intrusive contact of the Watsonville Granite can be seen in Gorge Creek, east of Stannary Hills, where partly recrystallized Elizabeth Creek Granite has a welded contact with slightly contaminated Watsonville Granite. Recrystallization of the Elizabeth Creek Granite is indicated by the presence of fine-grained decussate aggregates of biotite and of plagioclase with highly irregular, instead of smooth, crystal edges. The Elizabeth Creek Granite near the contact is cut by streaky veins of a porphyritic acid rock which may have been formed by partial melting of the Elizabeth Creek Granite by the younger Watsonville Granite. The veins, which do not cut Watsonville Granite, consist of phenocrysts of partly resorbed quartz and turbid feldspar set in a fine-grained granulitic groundmass of quartz, feldspar, and biotite.

The intrusive relationships of the Atlanta Granite and the Bakerville Granodiorite with the Elizabeth Creek Granite are evident from the air-photographs, where the outcrops of the younger units show a cross-cutting relationship to the prominent northwest-trending joints of the Elizabeth Creek Granite. However, no contacts were observed in the field.

Acid dykes cutting Elizabeth Creek Granite are most common in the Herberton Sheet area, especially near Collins Weir, and at Watsonville and Herberton. The largest acid dyke occurs on the west side of Collins Weir, where it is bounded to the east by a zone of brecciated Elizabeth Creek Granite (Pl. 9, fig. 2), up to 400 m wide; this zone is interpreted as vent breccia and the dyke is thought to be one of the feeders for the Walsh Bluff Volcanics. The other acid dykes in the same general area are also probably related to the Walsh Bluff Volcanics. The dykes at Herberton and Watsonville are thought to be related to the Slaughter Yard Creek Volcanics. The Elizabeth Creek Granite has also been intruded by two granophyre ring dykes, one at Gurrumba and the other 1.5 km west of Geebung Hill, and by small bodies of quartz dolerite south of Watsonville.

The emplacement of the Elizabeth Creek Granite was accompanied by thermal metamorphism of the country rocks. The effects of this metamorphism are most noticeable in the Hodgkinson Formation, which has been hornfelsed for up to 5 km from the nearest granite exposure. In contrast hornfelsing of the acid volcanics is only readily apparent within a few metres of the granite contact.

Age, mineralization, and distinguishing features

Numerous specimens of Elizabeth Creek Granite outside the Herberton/Mount Garnet area have been isotopically dated by the K/Ar method (Richards et al., 1966a,b).

According to Branch (1966b), the ages range from Middle Carboniferous to Lower Permian. In the Herberton/Mount Garnet area the granite is probably Upper Carboniferous, as it intrudes the Glen Gordon Volcanics, which overlie the Middle Carboniferous Silver Valley Conglomerate, and it is intruded by the Lower Permian Watsonville Granite. However even in this area the Elizabeth Creek Granite probably represents several separate intrusions of slightly different age, some of which may be younger or older than Upper Carboniferous. Only one specimen of Elizabeth Creek Granite from the area was dated by Richards et al. (1966a,b). The specimen (GA447), from 1.7 km south of Herberton on the main road to Ravenshoe, has given a biotite age, by the K/Ar method, of 280 m.y. (The location of specimen GA447 is incorrectly given in Richards et al., 1966a,b, and is also misidentified as 'Herbert River Granite'.) Samples of Elizabeth Creek Granite from Emuford, Silver Valley, and Mount Garnet have been dated recently by L. P. Black (1969) at 326 m.y. $\pm$ 7 m.y. by the Rb/Sr method (using a decay constant for Rb_{87} of 1.39 x $10^{-11}y^{-1}$).

The Elizabeth Creek Granite is richly mineralized, and is considered to be responsible for most, if not all, of the mineralization in the Herberton Tinfield. The main metals associated with the granite, in approximate order of economic importance, are tin, silver, lead, copper, tungsten, antimony, molybdenum, bismuth, iron, and arsenic. The gold found at Mount Garnet and Gurrumba may also be derived from this granite.

Features which serve to distinguish the Elizabeth Creek Granite from other granitic rocks in the area are the rarity of spheroidal weathering, the pale pink, buff, or very pale grey colour, the relative scarcity of mafic minerals, the presence of quartz blebs in the finer-grained varieties, the abundance of greisens, and the local sericitization and chloritization.

Atlanta Granite (Cga)
(new name)

The Atlanta Granite crops out north of Stannary Hills and west of Collins Weir, in the Herberton Sheet area. There are two outcrops separated from each other by an outcrop of granodiorite and diorite. The granite is named after the Atlanta mine (lat. 17°15′40″S, long. 145°12′30″E), which is situated 1.5 km west of the western outcrop. The main rock type is a leucocratic biotite adamellite which is difficult to distinguish in the field from the adjacent Elizabeth Creek Granite. In the western outcrop the adamellite is porphyritic, but phenocrysts are generally absent in the eastern outcrop. On its western margin, the Atlanta Granite appears to pass imperceptibly into porphyritic Elizabeth Creek Granite, whereas its eastern margin follows a thick acid dyke: an indurated granite breccia is developed locally on the west side of the acid dyke, and this is taken as evidence that the dyke was intruded after the emplacement of the Atlanta Granite. The type area of the granite is 1.5 km southwest of Collins Weir.

Unlike the Elizabeth Creek Granite, the Atlanta Granite is characterized by spheroidal weathering, and both its outcrops consist of numerous small hills surmounted by granite tors. Also, the Atlanta Granite does not show the prominent northwesterly joints found in the adjacent Elizabeth Creek Granite, and the contacts between the two granites can be fairly accurately delineated on the air-photographs.

The Atlanta Granite consists mostly of medium to coarse-grained biotite adamellite. In the western outcrop, the adamellite is pale grey to white, and contains abundant plagioclase phenocrysts up to 2 cm long, and quartz blebs up to 1 cm across. In the eastern outcrop it is generally pink, and phenocrysts are absent except in the extreme northeast, where contaminated varieties contain plagioclase phenocrysts up to 6 cm long. The contaminated varieties also contain aplite veins, pegmatitic and melanocratic patches, and small dark grey xenoliths. No mineralization has been found associated with the Atlanta Granite.

Petrography

Texture: medium to coarse-grained, granitic; mostly aphyric in east, porphyritic in west; aplite, pegmatite, and xenoliths rare; no associated greisen.

Composition: major constituents are quartz (30-50%), alkali feldspar (15-40%), plagioclase (15-40%), and biotite (5%); magnetite is present as a minor accessory.

Quartz is anhedral and generally interstitial, although it locally occurs as distinct blebs; very fine-grained myrmekite is common.

Alkali feldspar is either orthoclase or microcline microperthite, and is generally anhedral and turbid.

Plagioclase is subhedral, and is mostly albite or oligoclase, although andesine occurs in the cores of some phenocrysts; minor alteration to sericite is common.

Biotite is brown and strongly pleochroic, and is commonly partly altered to green chlorite.

Relationships and age

On the air-photographs the Atlanta Granite outcrop shows a cross-cutting relationship to the prominent jointing in the adjacent Elizabeth Creek Granite, and hence the Atlanta Granite is considered to be younger. Both granites are cut by acid dykes which can probably be correlated with the Lower Permian Walsh Bluff Volcanics. The Atlanta Granite is therefore considered to be Upper Carboniferous, and to have been emplaced shortly after the adjacent Elizabeth Creek Granite, and before the eruption of the Walsh Bluff Volcanics. The petrographic similarity indicates that the Atlanta and Elizabeth Creek Granites may have been derived from the same granitic magma.

Watsonville Granite (Pgw)
(new name)

The Watsonville Granite crops out over about 130 sq km in the northeastern part of the Herberton Sheet area. It is named after an old and partly deserted mining township 6 km west of Herberton. The elliptical outcrop area rises to over 1200 m near Wallum Trig. and mostly consists of rugged boulder-strewn hills surmounted by tors. The natural vegetation on the granite is tree savannah in the west and tropical rain forest in the east. Surface drainage is joint-controlled except near Bakerville, where irregularly meandering creeks are incised in gently sloping surfaces developed on deeply weathered granite.

The granite is generally well exposed, except where covered by rain forest in the east, and characteristically shows well developed spheroidal weathering (Pl. 10, fig. 2). The Walsh River north of Watsonville has been chosen as the type area.

The Watsonville Granite shows little variation throughout the area of outcrop. It is generally a homogeneous, pale pinkish or greyish, medium to coarse-grained biotite adamellite commonly containing feldspar phenocrysts. Dark grey xenoliths, up to 50 cm in diameter, are widespread, although nowhere very abundant, and veins of aplite, microgranite, and quartz-feldspar pegmatite occur at a few localities. The adamellite is very little altered, no greisens are present, and there is no associated mineralization.

Petrography

Texture: medium to coarse-grained, granitic; aphyric or with plagioclase phenocrysts; small xenoliths common; veins of aplite and microgranite and patches of pegmatite locally present.

Composition: major constituents are quartz (30-50%), orthoclase microperthite (25-40%), plagioclase (20-30%), and biotite (5-10%); minor constituents are zircon, which is relatively abundant, allanite, apatite, muscovite, and opaque minerals.

Quartz is anhedral, and unlike that in the Elizabeth Creek Granite, it does not form bleb-like phenocrysts.

Orthoclase microperthite forms patchily turbid anhedral crystals which are generally similar in size to those of quartz, although it also forms larger crystals poikilitically enclosing the other constituents.

Plagioclase occurs as subhedral to anhedral crystals which generally show normal zoning from andesine to oligoclase; slight alteration to sericite and 'kaolinite' is prevalent.

Biotite is brown or reddish brown, and contains pleochroic haloes; the margins of some crystals are altered to pale green chlorite.

Relationships and age

The relationships of the Watsonville Granite to adjacent rocks have been established from field observations. The granite intrudes the Hodgkinson Formation, Elizabeth Creek Granite, Walsh Bluff Volcanics (Pl. 10, fig. 1), and Slaughter Yard Creek Volcanics, and is probably intruded by the Bakerville Granodiorite. The observed intrusive contacts are steeply dipping. That between the Watsonville Granite and the Elizabeth Creek Granite is well exposed in Gorge Creek north of Bakerville: at this contact, the Watsonville Granite is streaky and appears contaminated, and the Elizabeth Creek Granite is partly recrystallized; neither granite becomes finer in grain towards the contact. The approximate contact of the Watsonville Granite and the Bakerville Granodiorite is seen on the road between Bakerville and Watsonville, where foliated and recrystallized adamellite is exposed within a few metres of apparently unaltered Bakerville Granodiorite; this evidence indicates that the Watsonville Granite is probably intruded by the granodiorite, although the possibility of a fault along the contact, which may have obscured the true age relationships, cannot be discounted.

No dykes have been observed to cut the Watsonville Granite, and the granite is considered to be younger than the acid dykes in the area.

A sample from the main road 3 km west of Watsonville has given a K/Ar age of 265 m.y. for biotite (specimen GA446 *in* Richards et al., 1966b). This age is in agreement with the other geological evidence, and indicates that the Watsonville Granite is Lower Permian, comparable in age to the petrographically similar Mareeba Granite (Best, 1962b; de Keyser & Lucas, 1969).

Distinguishing features

The Watsonville Granite is distinguished from the Elizabeth Creek Granite by the well developed spheroidal weathering, and by the absence of quartz blebs, cross-cutting dykes, and greisens.

Hammonds Creek Granodiorite (Pgm)
(new name)

The main outcrop of Hammonds Creek Granodiorite lies 3 km west of Mount Garnet township, where it covers an area of about 30 sq km. A few small isolated outcrops also occur south of Mount Garnet in and near Return Creek and west of the Mount Garnet to Gunnawarra road. Hammonds Creek (Fig. 7), is the type area of the granodiorite.

The granodiorite forms gently undulating hills, in contrast to the prominent rocky hills characteristic of the Elizabeth Creek Granite, and has a thicker soil and vegetation cover. Exposures are generally poor, and mostly consist of rounded residual boulders.

The dominant rock type is a medium-grained grey to greenish grey granodiorite containing both biotite and hornblende. Small amounts of adamellite and quartz diorite also occur. The granodiorite is generally aphyric, although some varieties contain sparse feldspar phenocrysts. Small dark xenoliths occur locally, and are especially abundant in the granodiorite close to outcrops of Hodgkinson Formation. At many exposures the granodiorite is cut by thin veins of aplite, the product of late-stage crystallization. Both the granodiorite and, in particular, the aplite veins, contain variable amounts of pyrite. No economic mineralization has been recorded from the granodiorite, although the outcrop area shows a weak copper geochemical anomaly (Zimmerman et al., 1963).

Within the Hammonds Creek Granodiorite outcrop are some areas of iron-stained gossanous rocks which are locally brecciated and quartz-veined. These rocks are fine-grained and equigranular, and are composed of quartz, sericite, pyrite, and kaolinite. They are interpreted as altered aplite, as all gradations are seen between unaltered aplite and the gossanous rocks. The alteration is probably a late-stage feature of the Hammonds Creek Granodiorite.

Petrography

Texture: medium-grained, granitic; aphyric or sparsely porphyritic; xenoliths and aplite veins common.

Composition: major constituents are quartz (10-35%), plagioclase (40-55%), alkali feldspar (5-15%), biotite (5-15%), and hornblende (5-15%); diopsidic augite, mostly partly uralitized, occurs in some specimens and hypersthene has also been identified; other minor constituents are actinolite (as an alteration product of hornblende), allanite, apatite, calcite, epidote, magnetite, pyrite, sericite, sphene, and zircon.

Quartz is interstitial, and does not form prominent blebs.

Plagioclase forms subhedral crystals which show normal zoning from cores of andesine (rarely sodic labradorite) to margins of oligoclase: sericite and epidote are common alteration products.

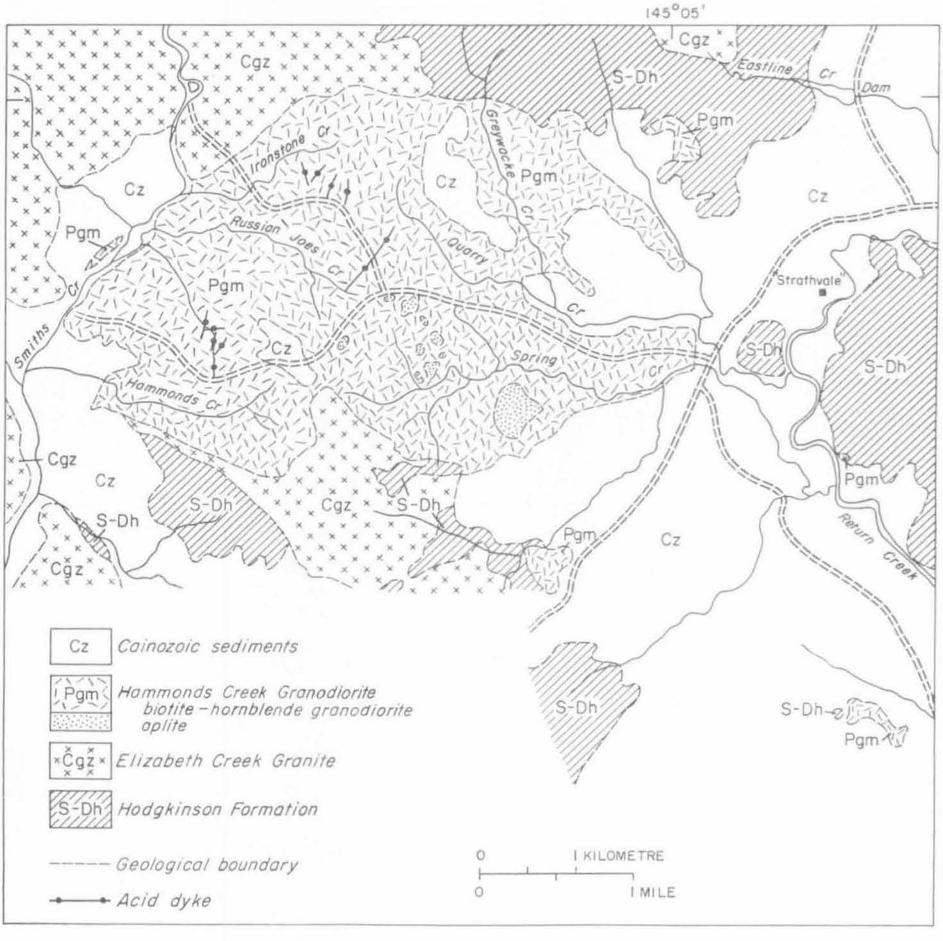

Figure 7. Hammonds Creek Granodiorite, showing distribution of aplite.

Alkali feldspar is turbid orthoclase and microcline microperthite; it generally occurs as anhedral crystals, some of which form micrographic intergrowths with quartz.

Biotite is brown, and shows alteration to chlorite, epidote, and calcite.

Hornblende, a pale brownish green variety, is commonly little altered, although actinolite occurs as a minor alteration product.

Origin

The granodiorite was mapped as Herbert River Granite by Zimmerman et al. (1963), and was compared with the hornblende-bearing Almaden Granite in the Almaden 1-mile Sheet area (de Keyser & Wolff, 1964). The Almaden Granite has been interpreted as having been formed by the assimilation of limestone by Herbert River Granite (Branch, 1962), or by the mixing of Herbert River Granite with basic magma (Branch, 1966b). However, there is little evidence to suggest that the Hammonds Creek Granodiorite is a hybrid rock, and it is considered more likely that the granodiorite crystallized directly from a granodioritic magma.

Relationships and age

The age of the Hammonds Creek Granodiorite is not certain. The granodiorite intrudes the Hodgkinson Formation, and is in contact with the Elizabeth Creek Granite, but the contacts between the two granitic rock units are very poorly exposed and their relationships are obscure. However, as the Hammonds Creek Granodiorite is essentially unmineralized, it is probably younger than the Elizabeth Creek Granite. This interpretation is supported by the granodiorite outcrop having an elliptical shape and being partly surrounded by Elizabeth Creek Granite.

Nymbool Granite (Pgm)
(new name)

Near Nymbool, a partly deserted settlement 9 km west-northwest of Mount Garnet township, two outcrops of a grey biotite granite, here named the Nymbool Granite, cover a total area of about 10 sq km. The granite gives rise to gently undulating country and, as it tends to be deeply weathered, exposures are generally poor. The type area of the granite is California Creek, 4.5 km due north of Nymbool.

The Nymbool Granite is a medium to coarse-grained adamellite containing up to 10 percent of biotite. Small biotite-rich xenoliths are abundant, and thin cross-cutting veins of late-stage aplite are common.

Petrography

Texture: medium to fine-grained, generally sparsely porphyritic; xenoliths and aplite veins common.

Composition: major constituents are quartz (35-45%), orthoclase microperthite (20-45%), plagioclase (12-40%), and brown biotite (5-10%); accessory minerals are allanite, apatite, magnetite, and zircon; small amounts of chlorite, epidote, and sericite are also present.

Quartz occurs as interstitial crystals and as blebs up to 1 cm in diameter.

Orthoclase microperthite forms turbid anhedral crystals.

Plagioclase is present as subhedral crystals in the groundmass and also occurs as scattered phenocrysts; it shows normal and weakly oscillatory zoning, the zones ranging from andesine to oligoclase.

The Nymbool Granite is distinguished from the Hammonds Creek Granodiorite to the south by a higher ratio of alkali feldspar to plagioclase, and by the absence of hornblende.

Possible mineralization

No genetic association has been proved between mineralization and the Nymbool Granite, although it occurs near several tin and tungsten mines in the Nymbool area, including the Smiths Creek mine. At this mine a small area of Elizabeth Creek Granite containing tin and sulphide mineralization is surrounded by Nymbool Granite, and both granites are chloritized: however, it is not known if the Nymbool Granite here, as well as the Elizabeth Creek Granite, is mineralized. One and a half kilometres north of the Smiths Creek mine unaltered Nymbool Granite crops out within a few metres of some small tungsten mines situated in greisenized Elizabeth Creek Granite.

Relationships and age

Contacts of the Nymbool Granite with the surrounding rocks have been observed only in California Creek, where the granite has intruded and hornfelsed greywackes of the Hodgkinson Formation: the contact between the two rock types is welded, and the granite appears unchilled. Near the same locality an acid dyke, 2 m thick, occurs at the contact between the Nymbool and Elizabeth Creek Granites: both granites become finer in grain towards each other, and their relative ages could not be ascertained. The field relationships between the two are also ambiguous at the Smiths Creek mine, where the Elizabeth Creek Granite may intrude the Nymbool Granite or occur as large inclusions or roof pendants within it. At present the latter explanation is preferred, and the Nymbool Granite is tentatively considered to be Lower Permian.

Bakerville Granodiorite (Pgb)
(new name)

A small body of granodiorite, here named the Bakerville Granodiorite, crops out at Bakerville, 13 km west of Herberton. The granodiorite has an irregular outcrop of about 8 sq km, and forms a flat area between rugged hills. Exposures are mostly restricted to isolated groups of rounded residual boulders, as the granodiorite is generally deeply weathered. Probably the best exposure is on the north side of the Herberton-Irvinebank road, 700 m west of Bakerville, and this has been selected as the type locality.

The predominant rock type is a dark grey medium to fine-grained hornblende-biotite granodiorite containing small dark fine-grained xenoliths. Thin veins of aplite, mostly less than 2.5 cm thick, occur locally. The granodiorite is generally even-grained, although some hornblende and plagioclase crystals show a tendency to form phenocrysts. Except for surface weathering, the granodiorite has suffered little alteration, and there are no associated greisens. The granodiorite is unmineralized.

Petrography

Texture: medium-grained, granitic; small fine-grained xenoliths common; aplite veins present locally.

Composition: major constituents are quartz (30-40%), plagioclase (40-50%), orthoclase (less than 10%), biotite (up to 10%), and hornblende (up to 5%): minor constituents are apatite, chlorite, epidote, magnetite, sericite, and zircon.

Quartz occurs as interstitial anhedral crystals, and also as larger crystals in ophitic-type relationships to the other constituents.

Plagioclase mostly forms subhedral crystals zoned from sodic labradorite in the cores to oligoclase at the margins; sericite is irregularly developed.

Orthoclase occurs as small interstitial faintly turbid crystals.

Biotite is brown and strongly pleochroic; some crystals show minor alteration to chlorite.

Hornblende forms green, markedly pleochroic, subhedral crystals up to 5 mm long.

Associated aplite: a leucocratic rock with an average grainsize of about 1 mm; it consists of quartz (35%), microcline microperthite (40%), oligoclase (25%), and biotite (trace).

Relationships and age

Because of poor exposures the contacts of the Bakerville Granodiorite with adjacent rocks were not observed in the field. However, the granodiorite is considered to be younger than the Elizabeth Creek Granite as it is unmineralized, even though it intrudes richly mineralized rocks of the Hodgkinson Formation, and it has an irregular outcrop which cuts across prominent jointing in the Elizabeth Creek Granite. It is also thought to be younger than the Watsonville Granite, as Bakerville Granodiorite, apparently unaltered except for deep weathering, occurs within a few metres of sheared and recrystallized Watsonville Granite on the Herberton road east of Bakerville; it is inferred that the modifications to the Watsonville Granite were produced during the emplacement of the granodiorite, although they may have been caused by later faulting.

The age of the Bakerville Granodiorite is most likely to be Lower Permian, closely comparable to the Watsonville Granite.

Hales Siding Granite (Pgs)
(new name)

The Hales Siding Granite crops out between Bocks Creek and Chinaman Creek, south of Stannary Hills, and is named after Hales Siding, on the abandoned Irvinebank/Stannary Hills tramway, 7 km north of Irvinebank. The main outcrop covers an area of about 8 sq km, and lies north and east of Hales Siding. To the north of this outcrop are some much smaller outcrops of the same granite. The outcrops probably represent the partly exposed roof zone of an irregular stock-like body. The type area of the granite is 1.5 km northeast of Hales Siding.

The granite mostly forms rocky slopes and hillocks and has a thin soil cover supporting a sparser vegetation than that on the adjacent sedimentary and volcanic rocks; hence the granite outcrops show up as pale areas on the air-photographs.

The Hales Siding Granite is generally a closely jointed leucocratic pale pinkish medium to fine-grained aphyric biotite adamellite. There are no associated greisens.

Petrography

Texture: medium to fine-grained, granitic to aplitic, generally aphyric, although some of the feldspar locally has a porphyritic tendency; myrmekite is commonly present; small xenoliths are common in places.

Composition: main minerals present are quartz (35%), perthitic orthoclase or less commonly microcline (30-40%), weakly zoned oligoclase and oligoclase-andesine (20-35%), and brown biotite (up to 5%); minor minerals are allanite, apatite, epidote, magnetite, and zircon: the biotite commonly occurs in fine-grained crystal aggregates.

Relationships and age

The Hales Siding Granite is tentatively considered to be the youngest granitic rock in the area, although, as no isotopic ages are available, and as the geological relationships are uncertain, there is little evidence to support this conclusion. The granite intrudes the Hodgkinson Formation, which has been thermally metamorphosed and cut by granitic veins and apophyses near the granite contact, and probably also intrudes the Featherbed Volcanics, although the contact was not observed in the field. The granite is unmineralized, although it is in contact with mineralized rocks of the Hodgkinson Formation, and it is therefore probably younger than the Elizabeth Creek Granite. The Hales Siding Granite may be younger than the adjacent Bakerville Granodiorite as the latter is cut by veins of aplitic granite which are possibly related to the Hales Siding Granite.

Unnamed Granitic Rocks (Cgu, Pgc, Pgu, Pgy)

Several small granitic bodies cropping out in the Herberton/Mount Garnet area cannot be definitely related to any of the named granites and granodiorites, and not enough is known about them to give them formal names.

One small body (Cgu), which was mapped as Elizabeth Creek Granite by Zimmerman, Yates, & Amos (1963), crops out 5 km east of Mount Garnet. The outcrop of just over 3 sq km straddles the Palmerston Highway, and is crossed by both Big Dinner and Little Dinner Creeks. The body consists of grey highly heterogeneous rocks which are mostly adamellite to granodiorite in composition. The texture ranges from coarse to fine-grained, granitic to micrographic, and porphyritic to aphyric. Xenoliths are very common, and many are over 1 m in diameter. Large phenocrysts, up to 4 cm across, of quartz, plagioclase, and orthoclase are prominent in most exposures. Variable amounts of brown biotite and brownish green hornblende are commonly present, and both tend to be concentrated immediately adjacent to xenoliths. The xenoliths are fine-grained, and are generally of dioritic composition; some may be altered sedimentary rocks, possibly derived from the Hodgkinson Formation. Many of the xenoliths have been partly digested by the host rock. The age of the granite is not known, and its relationships to the adjacent Hodgkinson Formation and Elizabeth Creek Granite are uncertain. However, as copper and lead minerals occur in a quartz vein cutting the unnamed granite on the north side of the Palmerston Highway, it is probably older than the Elizabeth Creek Granite. Alternatively, it may represent a contaminated phase of Elizabeth Creek Granite. Its age is probably Carboniferous.

Another body (Pgc) crops out in a relatively inaccessible area north of Stannary Hills. The outcrop area consists of a steep-sided flat-bottomed valley system, the headwaters of Catherine Creek, flanked by high ridges formed of Elizabeth Creek and Atlanta Granites. Exposures are generally poor and consist mostly of residual boulders. The main rock type appears to be a hornblende-biotite granodiorite very similar in appearance to that of the Bakerville Granodiorite, but quartz dolerite and intermediate hybrid rocks are also present. This granitic body is probably younger than the Elizabeth Creek Granite, and is thought to be probably Permian. It is unmineralized, and its outcrop appears to cut across the prominent northwest-striking joints of the Elizabeth Creek Granite. Its relationship to the adjacent Atlanta Granite is not known.

An unnamed granite (Pgu) crops out 9 km east of Stannary Hills. It is a pale grey coarse-grained biotite granite containing euhedral phenocrysts of white feldspar. It intrudes and thermally metamorphoses Walsh Bluff Volcanics, blocks of which occur as xenoliths. It is very different in appearance from the nearby Watsonville Granite, which also intrudes Walsh Bluff Volcanics, but its relationship to this granite is not known. It is possibly of Permian age.

In Bocks Creek, west of Stannary Hills, granodiorite (Pgu) occurs along a major fault. Because of its locally sheared and foliated appearance, the granodiorite was previously mapped as Precambrian (Branch, 1962, 1966b), but is considered to be more probably upper Palaeozoic, possibly Permian. Its relationships to adjacent rock units are not known. The granodiorite consists of quartz (25%), strongly zoned oligoclase-andesine (45%), orthoclase (10%), brown biotite (10%), and green hornblende (10%).

In the Silver Valley area an irregular body of porphyritic microgranite (Pgy) of possible Permian age intrudes the Silver Valley Conglomerate. Included within the microgranite are irregular patches several feet across of leucocratic richly and coarsely porphyritic microgranite resembling in hand specimen some of the coarse-grained varieties of Elizabeth Creek Granite. At its margins the intrusion is flanked by conglomerate which appears to be weakly hornfelsed close to the contact, and in the southern part of its outcrop the intrusion is capped by hornfelsic siltstones containing Carboniferous plant fossils. Three kilometres south of this intrusion a small body of a similar type of rock intrudes the Hodgkinson Formation. The microgranite of both intrusions contains phenocrysts of white plagioclase, pale pink alkali feldspar, quartz, and chloritic pseudomorphs (probably mostly after biotite and augite), microphenocrysts of magnetite, and numerous small 'microdiorite' xenoliths. The phenocrysts are mostly less than 5 mm in diameter, but range up to 2 cm locally. Quartz and alkali feldspar are much subordinate to plagioclase. The groundmass is quartzofeldspathic, and is generally partly microgranitic and partly very fine-grained micrographic.

At the Three Sisters, northeast of Arthurs Seat and south of the Millstream, two small granitic bodies (Pgy) mapped as Permian have been intruded into siltstone of the Hodgkinson Formation. In the only thin section of the granitic rock examined phenocrysts of quartz and turbid feldspar and fine-grained aggregates of green hornblende are set in a fine-grained and mostly micrographic groundmass; secondary chlorite and epidote are abundant.

Granitic rocks (Pgy) mapped as Permian also crop out in Dingo Creek and its tributaries, southeast of Innot Hot Springs. They intrude the Hodgkinson Formation, and appear to be similar in rock type to the granitic rocks at the Three Sisters. Three specimens have been examined in thin section: they contain phenocrysts of zoned plagioclase, quartz, augite, and hornblende set in a fine-grained, partly micrographic groundmass consisting of the same minerals plus opaque minerals and apatite. Both augite and hornblende are commonly pseudomorphed. The main secondary minerals are chlorite, epidote, and calcite.

Gurrumba Ring Complex

The eastern half of a small ring complex, here called the Gurrumba Ring Complex (Fig. 8), occurs in the northwest part of the Mount Garnet Sheet area. The western half lies in the adjoining Munderra 1-mile Sheet area. The ring complex, which was named the Gurrumba Volcanic Neck by Branch (1966b), has an elliptical outcrop 5 km long by 2.8 km wide, and is completely surrounded by Elizabeth Creek Granite.

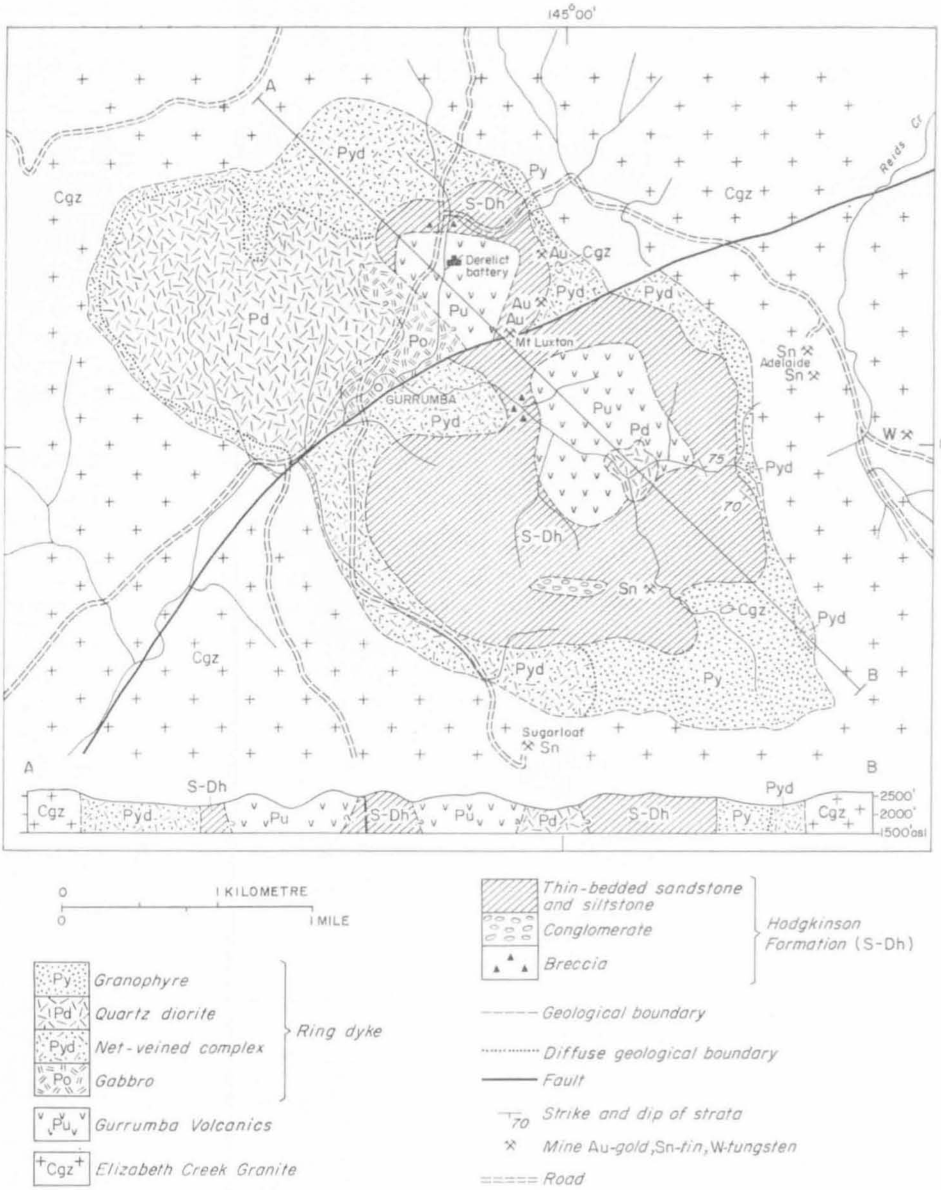

Figure 8. Gurrumba Ring Complex.

The Gurrumba Ring Complex consists of an outer ring of acid, intermediate, and basic igneous rocks surrounding greywacke and siltstone of the Hodgkinson Formation, which in turn partly surrounded two bodies of acid lava, named the Gurrumba Volcanics, and a smaller mass of quartz diorite. Throughout most of its outcrop, the outer ring, which is presumed to be a composite ring dyke, forms a topographical depression between hills of Elizabeth Creek Granite and prominent hills of Gurrumba Volcanics and Hodgkinson Formation. A fault striking east-northeast, marked in places by a massive quartz vein up to 3 m wide, cuts across the ring complex, and along this fault the northwest part of the ring structure shows a relative horizontal displacement of about 180 m.

Ring dyke (Pd, Po, Py, Pyd, Cgz)

The ring dyke ranges in width from less than 10 m to over 1.5 km. It is made up of pink granophyre (Py), grey olivine gabbro (Po), a variety of pale to dark grey intermediate hybrid rocks mostly of quartz diorite composition (Pd) and, at two localities only, small masses of Elizabeth Creek-type granite (Cgz) (Fig. 8). Over a large part of the outcrop these rocks are intimately associated, and form a net-veined complex (Pyd), in which the basic and intermediate hybrid rocks occur as angular to rounded inclusions, mostly less than 50 cm across, within the granophyre (Pl. 11, figs 1 and 2; Pl. 12, fig. 1). Where the net-veined complex is not developed the ring dyke consists of either granophyre containing sparse inclusions, or quartz diorite cut by minor granophyre veins.

Many of the inclusions in the net-veined complex have irregular pillow-like forms, and are strikingly similar to pillow-like inclusions described from other net-veined complexes (Blake et al., 1965; Blake, 1966). The contacts of the pillows and the enclosing granophyre range from sharp to diffuse, and are commonly highly irregular and crenulate. Some of the pillows become finer in grain towards their margins, and some are cut by thin veins of granophyre. Many of the other inclusions within the net-veined complex are probably pieces of fragmented pillows.

The granophyre contains small phenocrysts, generally less than 2 mm long, of white or pink sodic plagioclase and green chlorite pseudomorphing biotite, and also contains partly digested inclusions. The phenocrysts are set in a fine-grained micrographic to microgranitic groundmass of quartz and turbid alkali feldspar. Minor constituents are allanite, apatite, magnetite, pyrite, zircon, and secondary calcite, chlorite, epidote, and leucoxene.

The olivine gabbro is medium-grained and consists of bytownite-anorthite (about An_{90}), augite, hypersthene, olivine, and opaque iron oxide; pale green uralitic hornblende after pyroxene, and serpentine and talc after olivine occur as secondary minerals.

The hybrid rocks are medium to fine-grained, and commonly contain xenocrysts of quartz and small rounded inclusions of coarse-grained pink granophyre. The more basic hybrids, including quartz diorite, are generally aphyric, and consist of subhedral plagioclase, ferromagnesian crystals, and interstitial, commonly micrographic, quartz and alkali feldspar. The plagioclase is generally strongly zoned from cores of andesine or labradorite to margins of albite or oligoclase; however, in some specimens the plagioclase is completely replaced by alkali feldspar. The ferromagnesian minerals are augite, green to greenish brown hornblende, and chlorite pseudomorphs after biotite, olivine, and pyroxene. The acid hybrids commonly contain unevenly distributed phenocrysts of alkali feldspar and strongly zoned plagioclase enclosed in an irregularly micrographic to granitic groundmass of quartz and alkali feldspar; most of the ferromagnesian minerals have been altered to chlorite. In the hybrid rocks, calcite, chlorite, epidote, and sericite are characteristic secondary minerals, and apatite, magnetite, pyrite, and sphene are common accessories.

The contacts of the ring dyke and the surrounding Elizabeth Creek Granite are approximately vertical, and are irregular in detail, as veins and apophyses of granophyre intrude the marginal granite. Where quartz diorite occurs close to the granite the contact is commonly gradational over a few centimetres, and the marginal granite appears to have been partly melted and recrystallized. In such places the modified granite contains large sieve-like crystals of alkali feldspar and sodic plagioclase enclosed in a relatively coarse-grained micrographic groundmass of quartz and alkali feldspar, and decussate aggregates of brown biotite. The contacts between the ring dyke and the Hodgkinson Formation are concealed, and their attitudes are not known.

Hodgkinson Formation (S-Dh)

The Hodgkinson Formation forms a zone, ranging from 100 m to 1 km wide, bordering the two outcrops of Gurrumba Volcanics. The main rock types are pale grey ironstained feldspathic sandstone, siltstone, and a quartz conglomerate containing scattered fragments of siltstone and sandstone up to 50 cm in diameter. In the wider parts of the zone the sedimentary rocks dip steeply, and the thin-bedded siltstones commonly show minor contortions. In the narrower parts of the zone, near the abandoned township of Gurrumba, the sedimentary rocks form an irregular breccia. Two disused mines and one prospect occur within the zone, the Mount Luxton gold mine and MacGregors gold prospect on the north side of the cross-cutting fault, and an old tin mine 1.5 km south of the fault. The Hodgkinson Formation within the complex shows no evidence of strong hornfelsing, unlike the roof pendants of Hodgkinson Formation in the Elizabeth Creek Granite a few kilometres to the east.

The contacts between the Hodgkinson Formation and the Gurrumba Volcanics are marked by a breccia which is locally more than 100 m wide. The breccia consists mostly of angular fragments of Hodgkinson Formation, but also includes, in the immediate vicinity of the Gurrumba Volcanics, fragments of volcanic rocks.

Gurrumba Volcanics (Pu)

The Gurrumba Volcanics, which form two prominent hills in the centre of the ring complex, consist of pale grey autobrecciated and flow-banded acid lava, possibly rhyolite, containing small phenocrysts of altered feldspar and much secondary pyrite and sericite. The relationship of this rock to the small body of quartz diorite 1.5 km east-southeast of Gurrumba is uncertain, as no contacts were found.

Conclusions

The field and petrographic evidence indicate that (a) the ring dyke intrudes, and is therefore younger than, the Elizabeth Creek Granite, and (b) that the breccia between the Hodgkinson Formation and Gurrumba Volcanics is probably an explosion breccia (Branch, 1966b), formed during the emplacement of the Gurrumba Volcanics in two adjacent vents or pipes.

The ring dyke is interpreted as a composite intrusion, and the net-veined complex within the ring dyke, like many other net-veined complexes (Blake et al., 1965; Blake, 1966), is considered to have been formed by the commingling of acid and basic magmas: the granophyre and olivine gabbro in the ring dyke crystallized from uncontaminated acid and basic magmas respectively, and the hybrid rocks were formed from contaminated magmas. In this interpretation the pillows in the net-veined complex represent small bodies of basic and hybrid magma intruded into acid magma, and they are considered to be comparable to pillows of pillow lavas intruded into water or soft mud.

Branch (1966b) has suggested that the Hodgkinson Formation and Gurrumba Volcanics in the Gurrumba Ring Complex represent a roof pendant in Elizabeth Creek Granite, and that the roof pendant was later intruded around its margins by granophyre. However, it seems unlikely that the occurrence of the Gurrumba Volcanics within the ring complex is entirely fortuitous, as implied by Branch, and it seems more probable that both the volcanic and intrusive rocks of the complex were formed during a phase of local igneous activity after the intrusion of the Elizabeth Creek Granite batholith, possibly during the Permian.

A possible sequence of events which could have led to the formation of the Gurrumba Ring Complex is:

1. Explosive volcanic activity took place, and the Gurrumba Volcanics were emplaced in two vents blasted through sediments of the Hodgkinson Formation capping Elizabeth Creek Granite.
2. A period of intrusion followed, during which the ring dyke was emplaced.
3. Major collapse took place inside the ring dyke, possibly due to withdrawal of magma at depth (Williams, 1941), and the central part of the ring structure subsided at least 300 m relative to the surrounding granite (the lowest exposures of the Hodgkinson Formation within the ring complex are over 300 m below the granite hills surrounding the complex).

Alternatively the displacement of the central part of the ring structure may have taken place simultaneously with the intrusion of the ring dyke.

It is possible that the acid magmas which formed the Gurrumba Volcanics and the granophyre of the ring dyke may have resulted from melting and remobilization of Elizabeth Creek Granite by olivine gabbro magma at depth.

Minor Intrusions

Granophyre (Py)

Although granophyre occurs within the Slaughter Yard Creek Volcanics and within some of the bodies mapped as unnamed granite, it has been mapped separately in only two areas, both in the Mount Garnet Sheet area. These two areas are the Gurrumba Ring Complex (see p. 56) and a small outcrop 1.5 km west of Geebung Hill. At the latter locality a semicircular dyke-like body of pink granophyre intrudes Elizabeth Creek Granite, Nanyeta Volcanics, and Hodgkinson Formation. The granophyre contains numerous rounded pillow-like inclusions of fine-grained quartz diorite and granodiorite, and is very similar to the granophyre of the Gurrumba Ring Complex. The granophyre itself is made up of phenocrysts of plagioclase and greenish brown hornblende and microphenocrysts of magnetite enclosed in a micrographic groundmass of quartz and turbid alkali feldspar; calcite, chlorite, and epidote occur as secondary minerals. The intrusion is possibly of Permian age.

Quartz diorite (Pd)

Three small outcrops of quartz diorite lie within the large outcrop of Elizabeth Creek Granite between Silver Valley and Watsonville. The quartz diorite is deeply weathered, and forms depressions bounded by granite hills. It is a grey medium-grained rock consisting of subhedral crystals of plagioclase, pale green hornblende, brown biotite, augite, and magnetite, and interstitial quartz and alkali feldspar showing ophitic relationships to the other minerals; also present are secondary chlorite and sericite. The quartz diorite probably intrudes the Elizabeth Creek Granite, although this could not be confirmed in the field, and it is thought most likely to be Permian.

Dykes (a—acid; i—intermediate; b—basic; c—composite)

Dykes are widespread throughout the area, and intrude most of the pre-Mesozoic rocks. Acid dykes are the most common, and are especially abundant in the mineralized areas at Herberton and Watsonville, but intermediate, basic, and composite dykes also occur. Most of the dykes are probably related to the upper Palaeozoic volcanic formations, and some, such as the larger acid dyke west of Collins Weir (p. 33), may have been feeders for extrusive volcanics. Many of the dykes have been intruded along faults.

The acid dykes are mostly rhyodacitic, and are almost invariably porphyritic. They contain phenocrysts, generally averaging about 2 mm in diameter, of quartz, alkali feldspar, plagioclase, and, in some cases, biotite. The quartz and alkali feldspar phenocrysts are generally partly resorbed. The phenocrysts lie in a felsitic, micrographic, or very fine-grained micrographic groundmass in which spherulitic textures are common.

Andesite dykes occur within the Featherbed cauldron subsidence area, and near Montalbion, Watsonville, and Newellton. They are dark grey very fine-grained rocks containing sparse plagioclase phenocrysts.

Dolerite dykes have been mapped within the Featherbed cauldron subsidence area and near Geebung Hill, and similar dykes have been recorded (Zimmerman et al. 1963) near Innot Hot Springs and Top Nettle Camp. These dykes do not contain olivine and are not likely to be related to the Cainozoic Atherton Basalt.

Composite dykes occur 2 km south of the abandoned township of Newellton (Silver Valley), and within the area of outcrop of the Slaughter Yard Creek Volcanics, north of the Stella mine. At both localities the dykes consist of pink porphyritic granophyre containing rounded pillow-like inclusions of andesite.

The longest dyke mapped crops out on the west side of Silver Valley. This dyke, which has been traced for over 8 km, ranges in width from less than 1 m to more than 150 m. It dips eastward at about 75°, and was intruded along a major fault which has displaced both the Hodgkinson Formation and the Elizabeth Creek Granite. The dyke does not appear to be related to the Glen Gordon Volcanics cropping out to the east, as these are older than the Elizabeth Creek Granite. The dyke rock is a rhyodacite containing small phenocrysts, mostly less than 2 mm across, of quartz, plagioclase, alkali feldspar, and biotite set in a very fine-grained felsitic matrix. Small inclusions of pale greenish grey tuff are common. In the northern part of its outcrop the dyke forms an intrusive breccia consisting mostly of angular fragments of rhyodacite but also including streaky fragments of greenish grey tuff oriented parallel to the dyke margins. This breccia is thought to be vent or pipe breccia, and the dyke probably occupies the site of an eruptive fissure.

Other large acid dykes occur between Silver Valley and Watsonville and east of Brownville. In the former area some of the dykes contain large sieved xenocrysts of alkali feldspar and small xenoliths of graphic granite, both of which may be partly melted inclusions derived from the adjacent Elizabeth Creek Granite.

CAINOZOIC

The Cainozoic rocks comprise sediments in various stages of consolidation and, in the eastern part of the area, lava flows and pyroclastic deposits of the Atherton Basalt Province. Sediments underlie, overlie, and are interbedded with the basalt flows.

Laterite (Czl), *Sand* (Czs), *and Alluvium* (Czu)

The Cainozoic sediments consist of laterite, residual sand, and alluvial clay, silt, sand, and gravel derived from the adjacent upland areas. The sediments cover large areas in the Mount Garnet Sheet area, but are much less extensive in the Herberton Sheet area. They have been distinguished on the geological maps only where they are sufficiently thick to conceal the nature of the underlying bedrock. At several localities the sediments contain economically important alluvial tin deposits, some of which are overlain by basalt flows.

Sediments are best developed in the Mount Garnet Basin, where they reach a maximum thickness of over 85 m (Zimmerman et al., 1963). This basin is an erosional feature which was filled with sediments during Cainozoic times. Bik (1962a,b) has recognized five phases of sedimentation in the basin, ranging in age from possibly early Tertiary to Recent, and he believes that erosion and deposition occurred as alternating processes related to climatic cycles. The following account of the sediments is based on Bik's notes (as reported in Zimmerman et al., 1963).

The oldest sediments in the Mount Garnet Basin are characterized by a dark brown to grey lateritic duricrust formed by the irreversible drying out of a zone of lateritized sediments during a dry climatic phase. The duricrust is typically strongly cemented, and is generally mottled by iron oxide.

The second phase of sedimentation is now represented by deeply weathered sediments containing bands with iron and manganese nodules. The sediments are characteristically red, but yellow, brown, and leached grey and white types are also present. This phase probably accounts for most of the sediments dredged in Smiths and Return Creeks. At least some of these sediments are Pleistocene, as a specimen of carbonized wood from them has been dated at 36,000 $\pm$ 1900 to 2400 years by the C^{14} method (Zimmerman et al., 1963; Zimmerman, 1965): the carbonized wood came from a depth of 18 to 21 m in a drill hole 1 km south of the dredged area in Smiths Creek. The age determination was carried out by the Institute of Nuclear Sciences, DSIR, Lower Hutt, New Zealand.

Next followed two or more phases of sedimentation, also probably during the Pleistocene, consisting mainly of alluvium characterized by yellow or yellow-brown soil profiles.

The youngest sediments in the basin are sandy channel deposits and heavy-textured backswamp deposits which are found adjacent to the larger stream channels. As yet no soil profiles have been developed on these sediments.

Atherton Basalt (Cza)

Extensive outcrops of Atherton Basalt occur in the eastern part of the Herberton/Mount Garnet area (Fig. 9). In addition the basalt is buried under a few metres of alluvium in most of the alluvial flats along the Wild River, and has also been located in boreholes near Innot Hot Springs (Zimmerman et al., 1963). The basalt is part of the Atherton Basalt Province (Best, 1960) of the Atherton Tableland, also called the Mount Quincan Province (Best et al., 1960) and

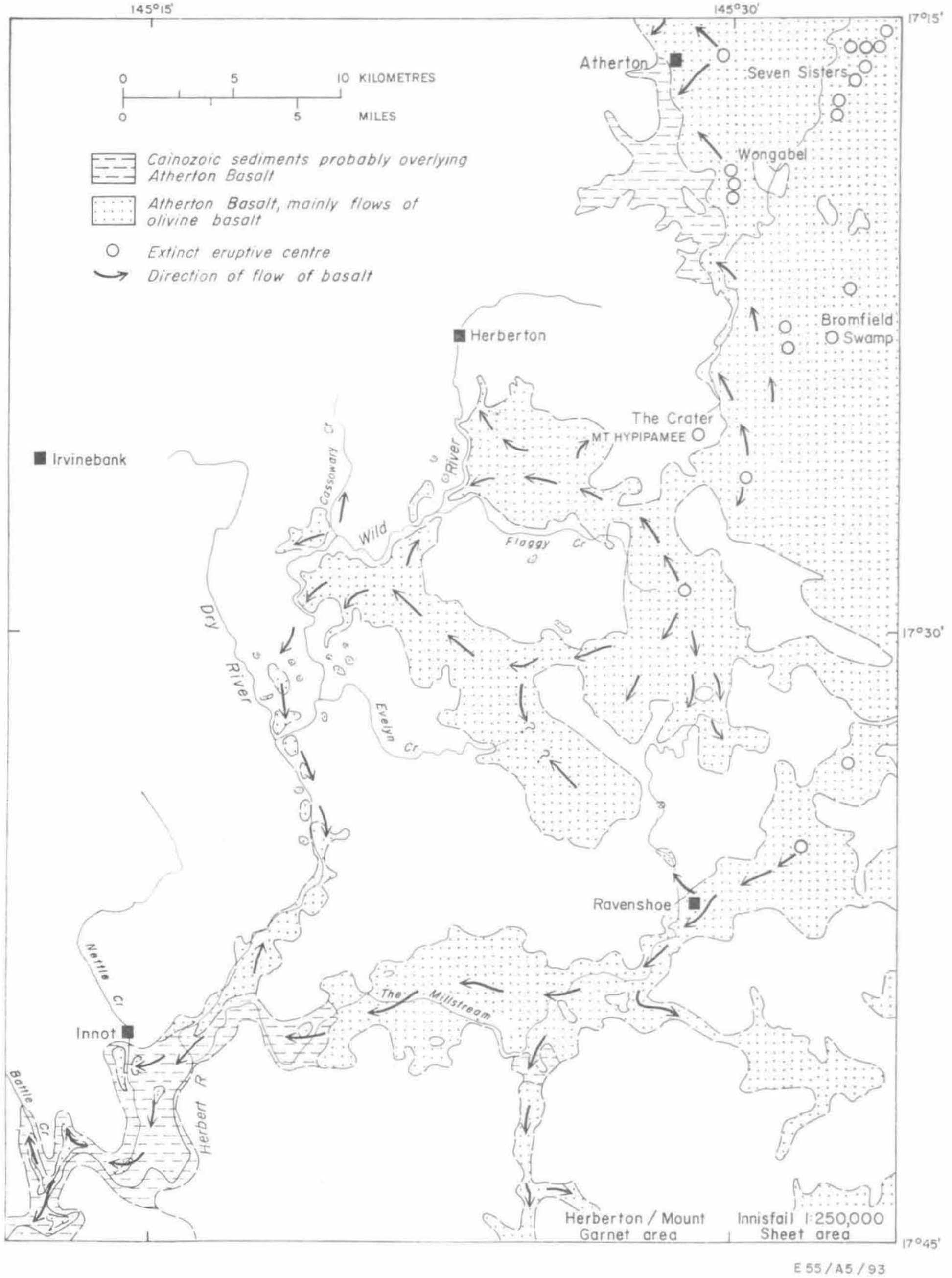

Figure 9. Lava flows and eruptive centres of the Cainozoic Atherton Basalt Province in the Herberton/Mount Garnet area and part of the adjoining Innisfail 1:250,000 Sheet area.

Quincan Province (Morgan, 1968), after Mount Quincan, near Yungaburra. The Atherton Basalt Province covers a total area of about 2000 sq km, most of which is in the Innisfail 1:250,000 Sheet area (de Keyser, 1964).

The Atherton Basalt Province lies mostly within the tropical rain forest zone, where a dendritic drainage pattern has been developed on gently to steeply undulating surfaces (Best, 1960). In this zone deeply weathered basaltic material forms a characteristic dark reddish brown fertile soil. However, outside the tropical rain forest zone, west of a line joining Atherton and Ravenshoe, the Atherton Basalt is much less deeply weathered, and forms flat or gently sloping and commonly bouldery surfaces with little surface drainage (cf. the McBride Basalt Province, described by Best, 1960).

The Atherton Basalt in the Innisfail and Atherton 1:250,000 Sheet areas consists of basaltic pyroclastic material and subaerial basalt lavas derived from more than 40 known eruptive centres, including both explosion craters and shield volcanoes (Best, 1960; de Keyser, 1964). Only six of the eruptive centres occur in the Herberton/Mount Garnet area (Table 9). The pyroclastic deposits are made up of bombs, lapilli, ash, and agglomerate, mostly of basaltic composition, although abundant bombs and lapilli of peridotite occur locally (de Keyser, 1964).

TABLE 9. DETAILS OF EXTINCT VOLCANOES SHOWN IN FIGURE 9

No.*	Name	Latitude	Longitude	Type of Volcano	Height above Sea Level (m)	Height of Edifice (m)
1	Unnamed	17°16′10″S	145°29′45″E	Shield volcano	850	90
2	"	17°18′25″S	145°29′55″E	Cinder cone	820	90
3	"	17°19′05″S	145°30′00″E	"	800	80
4	"	17°19′25″S	145°30′05″E	"	790	60
5	Mt Hypipamee	17°25′40″S	145°29′20″E	Diatreme	960	—
6	Unnamed	17°26′05″S	145°30′15″E	Shield volcano	1000	210
7	"	17°28′50″S	145°29′05″E	"	1150	60
8	"	17°35′15″S	145°32′00″E	"	1060	Not known

* Refers to numbers shown in Figure 9.

Basalt lavas predominate in the Herberton/Mount Garnet area, and pyroclastic material is mostly restricted to the immediate vicinity of Wongabel (Pl. 13, fig. 2) and two other cinder cones 5 km southeast of Atherton. The lavas were erupted from shield volcanoes near the eastern margin of the area, and flowed down major valleys, diverting streams, filling old river channels, and backing up tributary valleys.

Most of the extinct shield volcanoes can be identified on air-photographs, in spite of being modified by erosion, as they are centres of radial drainage. The basalt lava near Atherton is derived mainly from a volcanic centre 2 km east of the town (Pl. 13, fig. 1), the lava southeast of Herberton is derived from a volcano 14 km southeast of Herberton, and the lava of the Millstream and Herbert River valleys west of Ravenshoe came from a volcano 5 km east-northeast of Ravenshoe. However, the source of one group of lavas is less certain. This group, which comprises the lavas cropping out between Tumoulin and the Wild River downstream from Kalunga, may be derived from the volcano east-northeast of

Ravenshoe, or perhaps more likely, from an unidentified centre situated near Tumoulin. The locations of the eruptive centres and the probable flow directions of the lavas are shown in Figure 9.

The maximum known thickness of the Atherton Basalt in the area is at the Millstream Falls (Pl. 12, fig. 2), where over 45 m of columnar-jointed basalt lava are exposed.

TABLE 10. CHEMICAL ANALYSES AND CIPW NORMS OF OLIVINE BASALTS, ATHERTON BASALT PROVINCE
(after Morgan, 1968)

	Analyses					CIPW Norms			
	1	2	3	4		1	2	3	4
SiO_2	48.30	47.10	48.90	46.80	or	12.41	13.59	8.27	10.63
Al_2O_3	13.40	12.80	14.40	13.40	ab	22.40	18.29	28.33	21.99
Fe_2O_3	2.24	2.41	4.47	2.51	an	14.88	15.35	20.13	19.58
FeO	8.42	8.60	5.75	8.83	ne	3.67	3.15	—	—
MgO	9.64	9.98	6.93	8.83	di wo	9.39	10.25	7.72	8.83
CaO	8.59	9.11	8.87	9.08	di en	6.07	6.70	5.73	5.48
Na_2O	3.45	2.85	3.35	2.60	di fs	2.69	2.83	1.23	2.83
K_2O	2.10	2.30	1.40	1.80	hy en	—	—	9.73	0.80
H_2O+	0.54	0.99	1.49	2.42	hy fs	—	—	2.09	0.41
H_2O-	0.38	0.62	1.44	0.82	ol fo	12.57	12.72	1.26	11.00
CO_2	0.26	0.24	0.16	0.04	ol fa	6.15	5.92	0.30	6.25
TiO_2	1.97	2.19	2.06	1.89	mt	3.25	3.49	6.48	3.64
P_2O_5	0.55	0.58	0.67	0.62	il	3.74	4.16	3.91	3.59
MnO	0.16	0.17	0.13	0.17	ap	1.30	1.38	1.59	1.47
					cc	0.59	0.55	0.36	0.09
					water	0.92	1.61	2.93	3.24
Total	100.00	99.94	100.02	99.81	Total	100.03	99.97	100.06	99.85

1. Olivine basalt, Tumoulin/Kazan road, 10 km NNW of Ravenshoe.
2. Olivine basalt, 1.5 km ENE of Kaban, 11 km NNW of Ravenshoe.
3. Olivine basalt, near Vine Creek, off the Ravenshoe/Wooroora road, 7(?) km SSW of Ravenshoe.
4. Olivine basalt, Mount Ronald homestead, 8 km SW of Ravenshoe.

Analysts: D. K. Rowley and H. W. Sears, AMDL.

The crater at Mount Hypipamee (Pl. 13, fig. 3), situated 12 km east-southeast of Herberton, is a diatreme formed during a single violent volcanic explosion (Ringrose, 1913; Ball, 1931; Best, 1960). The vent is an almost vertical-sided hole 60 m wide at the top, 120 m deep, partly filled by water, and tapering slightly downwards. Around the vent are scattered basalt lapilli and small fragments of Elizabeth Creek Granite which were erupted during the explosion. The well preserved diatreme has been little modified by erosion since its formation and may have been formed since the Pleistocene.

According to Morgan (1961, 1968) the lavas of the Atherton Province are potash-rich alkali olivine basalts that belong to the continental non-orogenic olivine basalt association of Turner & Verhoogen (1960). The predominant rock type is a dark grey vesicular basalt containing microphenocrysts of olivine and titaniferous augite enclosed in a groundmass of plagioclase microlites, granules of olivine, titaniferous augite, and opaque minerals, and variable amounts of interstitial clear brown basic glass; analcite, alkali feldspar, apatite, nontronite, and thomsonite(?) have been recorded as accessory minerals (Morgan, 1961, 1968). Most of the olivine is partly or completely altered to orange iddingsite. The plagioclase microlites have an average composition of An_{70}. Calcite and zeolites occur in many vesicles.

Chemical analyses and CIPW norms of four basalt specimens from the Atherton Basalt Province are given in Table 10 (after Morgan, 1968).

The Atherton Basalt probably ranges in age from upper Miocene to Recent (Best, 1960; de Keyser, 1964). Most of the lavas in the Herberton and Mount Garnet Sheet areas are little weathered or eroded and are probably not older than Pleistocene. At least two distinct ages are indicated in the Herberton Deep Lead, where river gravels separate an older lava from a younger lava.

The Atherton Basalt overlies the Hodgkinson Formation, Glen Gordon Volcanics, Elizabeth Creek Granite, and Kalunga Granodiorite. It also overlies, and is interbedded with, Cainozoic sediments.

METAMORPHISM

The three main types of metamorphism recognized by Turner & Verhoogen (1960)—regional, contact, and dislocation metamorphism—are represented in the area. Most of the metamorphism is of the contact type, and is associated with granite intrusions. Very commonly metasomatism accompanied the contact metamorphism. Regional metamorphism is generally very low grade, and in most areas is partly or completely masked by contact metamorphism. Dislocation metamorphism is restricted to the immediate vicinity of faults.

The metamorphic terminology used in this account is defined by Turner & Verhoogen (1960).

Regional Metamorphism

Regional metamorphism is restricted to Precambrian rocks and to an area of Hodgkinson Formation near Irvinebank. The Precambrian rocks mostly belong to either the almandine-amphibolite or the granulite facies of regional metamorphism. Rocks of the Hodgkinson Formation show low-grade regional metamorphism 3 km north-northeast of Irvinebank, where fine-grained sediments fall into the quartz-albite-biotite subfacies of the greenschist facies. These rocks have a poorly developed cleavage and consist of very fine-grained quartz, white mica, and pale brown biotite. Elsewhere, except near some faults, rocks of the Hodgkinson Formation are uncleaved.

Contact Metamorphism

The effects of contact metamorphism are shown by most of the pre-Mesozoic rock units (Fig. 10), and are best displayed by rocks of the Hodgkinson Formation. The metamorphosed rocks lie within thermal aureoles associated with the upper Palaeozoic granites, in particular the Elizabeth Creek Granite. In the aureoles around this granite, metasomatism, commonly accompanied by tin and sulphide mineralization, is generally intimately associated with the contact metamorphism. The aureoles are widest near Irvinebank, where thermally metamorphosed rocks crop out more than 5 km from the nearest granite exposure. The rocks affected belong to the albite-epidote facies and hornblende facies of contact metamorphism.

In the outer parts of the metamorphic aureoles calcareous rocks and the fine-grained components of non-calcareous rocks of the Hodgkinson Formation are

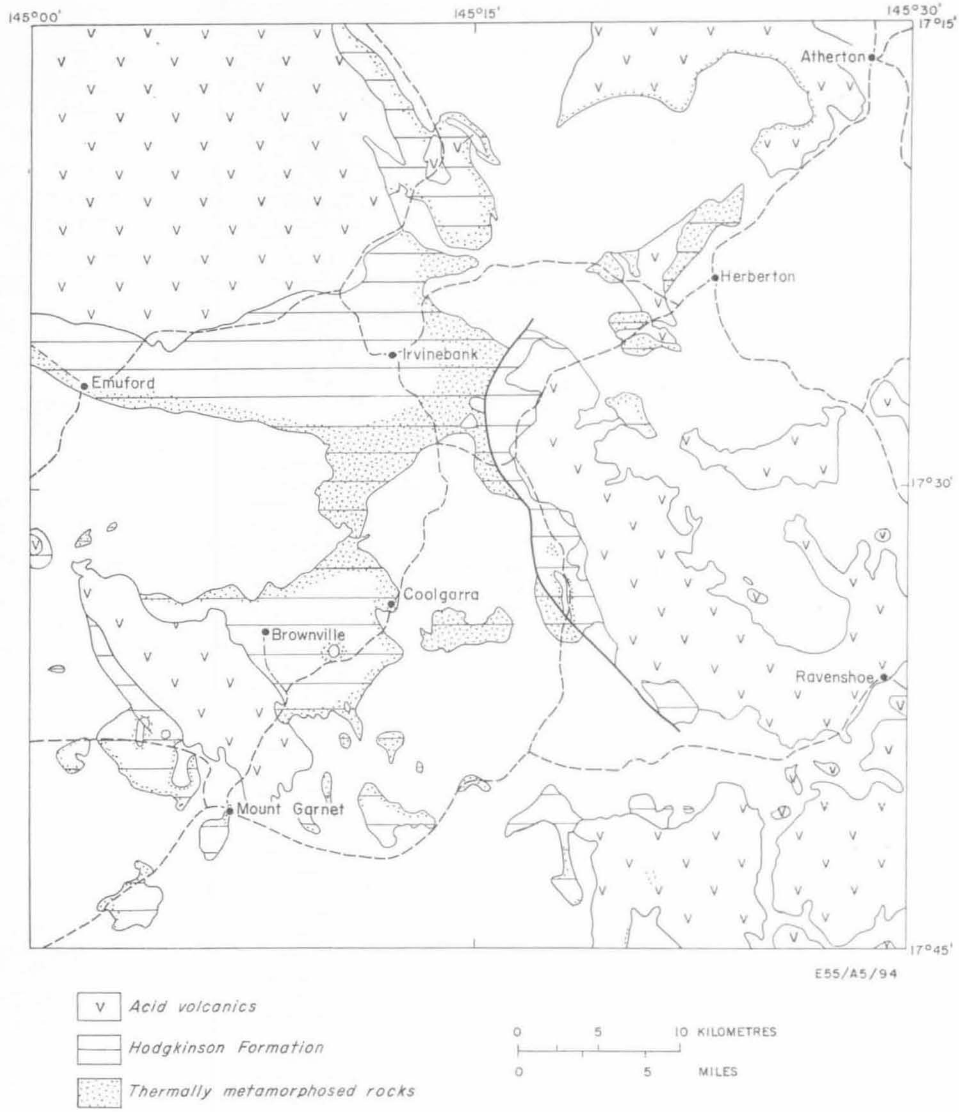

Figure 10. Distribution of thermally metamorphosed rocks.

partly or completely recrystallized, but coarse-grained non-calcareous rocks are recrystallized only in the innermost parts. Recrystallized rocks are well developed north of Herberton, between Emuford and Mount Misery, and along the Dargo Range, in the Herberton Sheet area, and in the vicinity of Glenlinedale in the Mount Garnet Sheet area. Many of the completely recrystallized rocks have a banded gneissose appearance (Pl. 3, fig. 1), and some of them were previously regarded as Archaean (Jensen, 1939). Other recrystallized rocks, for example 3 km northwest of Bakerville and 3 km southeast of Glenlinedale, have been extensively greisenized.

Most of the limestone and calcareous sediments, except the limestone cropping out in Silver Valley and northeast of Mount Garnet, have been affected by both contact metamorphism and metasomatism, and now consist of marble, calc-silicate hornfels, and skarn. The following minerals, in various proportions, have been identified in these rocks: actinolite, albite, calcite, chlorite, diopside, epidote, garnet (probably grossularite and andradite), idocrase, hedenbergite, hornblende, prehnite, pyrite, quartz, salite, sphene, wollastonite, and zoisite. Skarn minerals are probably best developed in the limestone outcrop 4 km east of Mount Garnet, where diopside, garnet, idocrase, hornblende, prehnite, and wollastonite are abundant. The same skarn minerals are also present in metamorphosed calcareous conglomerates and greywackes in the Hodgkinson Formation northwest and southwest of Mount Garnet.

The hornfelsed non-calcareous sediments of the Hodgkinson Formation, where least affected by metasomatism, mostly consist of quartz, albite, and, in the innermost zones of the metamorphic aureoles, decussate aggregates of foxy red biotite and rare pale green hornblende. Metasomatism has resulted in the local development of chlorite, white mica, tourmaline, and, more rarely, andalusite, cordierite, and pink garnet (almandine). Chlorite, commonly associated with white mica, occurs in most of the hornfelsed rocks in the mineralized areas. White mica is a main constituent of greisenized sedimentary rocks, such as those that crop out northwest of Bakerville and west of Nymbool. Tourmaline, which has a more restricted distribution than chlorite or white mica, is characteristic of hornfelsed rocks near Emuford, on the western fall of the Dargo Range, and northwest of Bakerville; it is rare in the Mount Garnet Sheet area (Zimmerman et al., 1963), where the only known occurrences are near Brownsville and Geebung Hill. Andalusite occurs in pelitic hornfels close to contacts of Elizabeth Creek Granite at Watsonville and southwest of Silver Valley. Cordierite has been found only at Watsonville. Pink garnet is associated with chlorite 2 km northwest of Bakerville, and at Watsonville.

Hornfelsed basalt northwest and southwest of Mount Garnet is made up of hornblende, sodic plagioclase, and minor amounts of brown biotite, chlorite, epidote (as thin veins), and opaque material. The original basaltic texture is commonly preserved. The hornblende forms green to bluish or brownish green crystals replacing augite, and, in more intensely hornfelsed basalt, minute pale brown granules. In weakly hornfelsed basalt some augite is preserved in the cores of partly uralitized phenocrysts.

Acid volcanic rocks are generally little affected by contact metamorphism and metasomatism except within a few metres of granite contacts. Here the volcanic rocks become recrystallized and minerals such as biotite, white mica, tourmaline, and epidote are formed. However, more widespread alteration of acid volcanics is seen north of Nymbool, where acid lava belonging to the Nanyeta Volcanics is greisenized for more than 100 m from the nearest granite exposure, and south of Stannary Hills, where the Featherbed Volcanics have been extensively mineralized.

At intrusive contacts between two granites, the older granite generally shows evidence of partial recrystallization, such as the development of fine-grained decussate aggregates of biotite, but appears unaltered when more than a few inches away from the actual contact.

Dislocation Metamorphism

Rocks in the immediate vicinity of faults are generally sheared, and under the microscope show such features as a microbreccia texture, strained and granulated quartz, and plagioclase with bent twin lamellae. Commonly the sheared rocks are partly silicified.

STRUCTURE

Since the Precambrian the Herberton/Mount Garnet area has been involved in one major orogeny. This occurred during Upper Devonian/Lower Carboniferous times, when the Hodgkinson Formation was strongly folded and faulted. Later, widespread faulting accompanied the upper Palaeozoic acid igneous activity in the area. The Palmerville Fault (de Keyser, 1963), a major structure which has been traced intermittently from the Cape York Peninsula to Townsville, has not been identified in the area.

Folding

No attempt has been made to analyse the structure of the Precambrian rocks near Mount Garnet. The rocks are strongly foliated, and the foliation planes are generally steep to vertical. Some minor folds and crenulations occur locally.

The folding of the Hodgkinson Formation has been studied in detail by Amos (1961, 1962, 1968; de Keyser & Lucas, 1969) in the Mossman and Cooktown 1:250,000 Sheet areas. Amos recognized four fold systems. The oldest consists of large tightly compressed folds with approximately horizontal axes. The next oldest consists of large open folds that have broad hinge areas and vertical fold axes. The most widespread folds are the second youngest; they are tight similar folds with small hinge areas, steep fold axes, and an associated axial plane cleavage. The youngest folds have a much more restricted distribution; they consist of small right-angled kink folds with subhorizontal fold axes.

In the Herberton/Mount Garnet area, which lies south of the area studied by Amos, the Hodgkinson Formation is strongly folded, mostly about steeply dipping axial planes, and fold limbs, which generally dip at 60° to 90°, are commonly overturned. This folding, although not associated with an axial-plane cleavage, probably corresponds to the second youngest fold system of Amos. Rapid local alterations across strike of upturned and overturned beds indicate that some of the folding in the area is probably isoclinal, although, as no marker beds have been identified, this is difficult to prove.

Large folds have been mapped in the Hodgkinson Formation near Irvinebank, Emuford, and Mount Garnet. The large fold near Irvinebank is a syncline which shows a major swing in strike northwards from northeast to northwest. The northwest trend continues northwards into the adjoining Dimbulah 1-mile Sheet area. The axes of minor folds on the limbs of the major fold plunge at 30° south. In the same area some rare minor folds have irregularly oriented subhorizontal axial planes; these are probably slump features.

The Hodgkinson Formation at Emuford, between the Elizabeth Creek Granite in the south and the Featherbed Volcanics to the north, has been folded into a broad overturned syncline with a nearly vertical fold axis. This fold may be related to the major swing in strike of the Hodgkinson Formation near the Irvinebank fold, and is possibly younger than the Irvinebank fold.

The other large fold mapped in the Hodgkinson Formation is a southerly plunging anticline 3 km northwest of Mount Garnet (Zimmerman et al., 1963). The approximately vertical axis strikes at about 025°.

In the Silver Valley area southwest of Herberton and locally in the Mount Garnet Sheet area, thin-bedded greywacke, siltstone, and shale show irregular small-scale folds (Pl. 2, fig. 2) which have not been related to any major structure.

The only gentle dips recorded in the Hodgkinson Formation occur in the inlier east of Watsonville. Graded bedding and cross-bedding in thin-bedded siltstone suggest that at least some of the beds here are overturned.

The Silver Valley Conglomerate, which unconformably overlies steeply dipping Hodgkinson Formation, is mostly flat-lying. However, dips greater than 20° have been recorded near the northern and eastern margins of the area of outcrop. These dips are most probably due partly to slumping and partly to drag along faults. The Silver Valley Conglomerate does not appear to lie in the trough of a syncline, as has been suggested by de Keyser & Lucas (1969).

The upper Palaeozoic acid volcanic formations also appear to be mostly flat-lying, although dips of more than 50° have been measured at several localities. Only one fold has been mapped, a northerly plunging syncline in the Glen Gordon Volcanics between the Wild and Dry Rivers. On the limbs of the syncline waterlaid bedded tuffs have an average dip of 35°. This fold and the steep dips recorded elsewhere may be related to volcano-tectonic activity localized within the Featherbed, Nanyeta, and Glen Gordon cauldron subsidence areas postulated by Branch (1966a,b).

The Cainozoic rocks are subhorizontal, and have not been affected by folding.

Faulting

The pre-Tertiary rocks have been extensively faulted, and probably many more faults are present than are shown on the geological maps. Most of the faulting is of upper Palaeozoic age, and was associated with the strong folding of the Hodgkinson Formation, the emplacement of the upper Palaeozoic granites, and the formation of the postulated Featherbed, Glen Gordon, and Nanyeta cauldron subsidence areas. No faults have been found that displace Cainozoic rocks, although according to Best (1962a,b) and de Keyser & Lucas (1969), faulting continued into the Cainozoic on the Atherton Tableland and in parts of the Hodgkinson and Laura Basins.

Two main fault trends are apparent: a northwest trend, which is the more pronounced, and a northeast trend. The faults are mostly high-angle normal faults dipping at 60° to 90°, although low-angle faults, dipping at about 45°, occur locally. Many have acted as loci for the mineralization associated with the Elizabeth Creek Granite. Silicification along faults is common, leading in many places, as at Elizabeth Bluffs, east of Emuford, to the formation of secondary chert. Many of the acid dykes are intruded along faults.

Some of the more important faults are noted below. The displacements are probably of the order of several thousand metres.

1. A large fault traced westwards from Mount Misery to Emuford, and into the adjoining Almaden 1-mile Sheet area. This is a normal fault, downthrown to

the north, which displaces the Hodgkinson Formation, Featherbed Volcanics, and Elizabeth Creek Granite. It may have been initiated during the formation of the Featherbed cauldron subsidence area (Branch, 1966b), before the emplacement of the Elizabeth Creek Granite.

2. The Elizabeth Bluffs fault, east of Emuford. This is a northeast-striking fault, downthrown to the southeast, which has displaced Hodgkinson Formation and Featherbed Volcanics.

3. A northwesterly trending fault along Eureka and Bocks Creeks, near Stannary Hills. The direction of movement is not known; it may be a right lateral transcurrent fault or a high-angle normal or reverse fault downthrown to the north.

4. A possible fault or group of faults bounding the Featherbed cauldron subsidence area (Branch, 1966b) east of Stannary Hills. Parts of the bounding fault or faults may be represented by the faults near Montalbion and Stannary Hills.

5. A large fault on the west side of Silver Valley. It has been traced from 3 km southeast of Bakerville to near the Palmerston Highway 11 km west of Ravenshoe, where it disappears under the Atherton Basalt. It is a normal fault downthrown to the east. The fault plane dips eastwards at 70° to 90°. A vertical displacement of at least 300 m is indicated on the east side of the Dargo Range, where Elizabeth Creek Granite and strongly hornfelsed Hodgkinson Formation have been faulted alongside unmetamorphosed Hodgkinson Formation. The fault was active after the emplacement of the Elizabeth Creek Granite, and may also have been active earlier, during the formation of the Glen Gordon cauldron subsidence area. Along much of its length the fault has been intruded by an acid dyke.

6. A major fault, downthrown to the southeast, traced from the Dargo Range, north of Silver Valley, eastwards and southeastwards to the Wild River southwest of Kalunga; south of the Wild River the fault is concealed beneath the Atherton Basalt. The fault postdates the Elizabeth Creek Granite, although movement along it may have been initiated during the formation of the Glen Gordon cauldron subsidence area.

7. A north-northeasterly fault at Mount Garnet between downfaulted Hodgkinson Formation to the west and Precambrian to the east. It apparently predates the Nanyeta Volcanics.

8. Northwest-striking faults on either side of the outcrop of Nanyeta Volcanics. These faults may represent the margins of the Nanyeta cauldron subsidence area.

GEOLOGICAL HISTORY

The following account of the geological history of the Herberton/Mount Garnet area is partly based on the descriptions of the Cairns-Townsville hinterland by D. A. White (1961), the Atherton 1:250,000 Sheet area by Best (1962b), and the Hodgkinson Basin by de Keyser & Lucas (1969).

The oldest rocks in the area are schist, amphibolite, and granite of Precambrian age which crop out near Mount Garnet; these rocks occur on the northeastern edge of a large basement complex termed the Georgetown Inlier by D. A. White (1961). Most of the schist and amphibolite of the basement complex may represent sediments and intercalated basic lavas laid down early in the Precambrian. These rocks were regionally metamorphosed to amphibolite and possibly locally to granulite grade during a Precambrian orogeny, and were later in the Precambrian intruded by granitic, basic, and ultrabasic rocks. However, the schist at Mount

Garnet may represent regionally metamorphosed granite, in which case the amphibolite may represent metamorphosed basic dykes.

Towards the end of the Precambrian the region was uplifted to form an extensive landmass, and a long period of subaerial erosion set in, continuing into the lower Palaeozoic.

The history of the Tasman Geosyncline commenced in the area in the Upper Ordovician or Lower Silurian (D. A. White, 1961). The geosyncline was formed to the east of the Georgetown Inlier, whose eastern margin was determined by major faults. Greywacke, subgreywacke, siltstone, shale, and minor conglomerate, limestone, chert, and basic volcanics were deposited in the geosyncline and on narrow bordering continental shelves. Many of the geosynclinal sediments were deposited by turbidity currents. Most of the detrital material was probably derived from a Precambrian landmass (the Georgetown Inlier) to the west. In the late Silurian the geosyncline began to be deformed, and the early Palaeozoic sediments in the central part of the geosyncline were uplifted, dividing the geosyncline into two parts, the Broken River Embayment to the south, and the Hodgkinson Basin to the north. The southwestern margin of the Hodgkinson Basin probably lay close to Mount Garnet.

In the Herberton/Mount Garnet area, deposition of the Hodgkinson Formation possibly continued throughout the Silurian and Devonian periods, as there is no evidence of any break in sedimentation. However, several changes in sea level or local uplifts occurred during this time, as is indicated by the occurrence of turbidites, which are probably mostly deep-water deposits, and of shallow-water coralline limestones. Most of the sediments are interpreted as flysch deposits laid down partly by turbidity currents, although near Mount Garnet, on the margin of the Hodgkinson Basin, a narrow shelf may have been present. This shelf has been termed the Mount Garnet Shelf (D. A. White, 1961). Some basic lavas were intercalated with the sediments in the vicinity of Mount Garnet. By the end of the Devonian the several tens of thousands of metres of sediments which make up the Hodgkinson Formation in the area had been deposited.

In the Lower Carboniferous or possibly earlier the geosynclinal deposits, including those of the Hodgkinson Formation, were involved in a major orogeny. They were folded and faulted, and uplifted above sea level to form a mountainous landmass. A period of extensive erosion followed. The mountains were worn down, and probably by the end of the Lower Carboniferous the landmass became an area of relatively low relief.

Acid volcanic activity and granite intrusion began in the area during the Middle or Upper Carboniferous, and continued through into the Permian. Widespread faulting accompanied the igneous activity, and several cauldron subsidence areas and one ring complex were formed. The acid magma generated at this time is attributed by Branch (1966a, 1966b, 1967b) partly to fractional melting of basic rocks in the lower crust, due to an increase in heat flow from the mantle during the orogenic phase of geosynclinal development, and partly to anatexis of sialic crustal material.

The oldest volcanic rocks, consisting mainly of welded tuff sheets but also including some acid lavas, are those of the Silver Valley Conglomerate, Glen Gordon Volcanics, Nanyeta Volcanics, and Featherbed Volcanics. They were erupted onto a gently undulating land surface developed on tightly folded rocks of Hodgkinson Formation and, in the southwest, on Precambrian basement. The conglomeratic deposits of the Silver Valley Conglomerate were laid down as fanglomerates in a basin flanked by hills formed of rocks of the Hodgkinson Formation. Most of the volcanic rocks may have been erupted from fissures developed along faults at the margins of the Glen Gordon, Nanyeta, and Featherbed cauldrons.

Shortly after the older acid volcanics were erupted, or possibly at the same time, the Kalunga Granodiorite, Elizabeth Creek Granite, and Atlanta Granite were emplaced at shallow depths. These granitic rocks were intruded into the Hodgkinson Formation and the overlying acid volcanics. The emplacement of the Elizabeth Creek Granite was accompanied by widespread tin, tungsten, and base-metal sulphide mineralization in the Hodgkinson Formation and the Featherbed Volcanics, as well as in the Elizabeth Creek Granite itself.

Early in the Lower Permian acid lavas and welded tuff sheets of the Walsh Bluff Volcanics and acid lavas of the Slaughter Yard Creek Volcanics were erupted. These volcanics were laid down on a land surface developed on rocks of the Hodgkinson Formation and, near Collins Weir, on Elizabeth Creek Granite laid bare by erosion. The extrusive volcanics were fed by dykes and irregular bodies which were intruded through the older rocks. Later in the Lower Permian the Watsonville Granite was emplaced, intruding both the Walsh Bluff Volcanics and Slaughter Yard Creek Volcanics, as well as the Elizabeth Creek Granite and Hodgkinson Formation.

Other events which probably occurred during the Permian were the emplacement of the Nymbool and Hales Siding Granites, the Bakerville and Hammonds Creek Granodiorites, and several unnamed bodies of granite, granodiorite, granophyre, diorite, and dolerite, and also the formation of the Gurrumba Ring Complex. Acid igneous activity probably ceased in the area before the end of the Permian.

Throughout the Mesozoic the region appears to have formed a stable landmass which was gradually worn down to an area of low relief. In the Cretaceous a marine transgression from the west extended into the western part of the Chillagoe area (de Keyser & Wolff, 1964), but did not reach the Herberton/Mount Garnet area.

Early in the Tertiary the region was uplifted. Rates of erosion increased, and streams were rejuvenated, becoming incised into the old landscape. Towards the end of the Tertiary, and continuing into the Quaternary, eruptions of olivine basalt took place in the eastern part of the area, and several shield volcanoes were formed, as also was the Mount Hypipamee diatreme. Basalt lavas from the volcanoes flowed down some of the valleys, including those of the Millstream and the Wild River, and caused the diversion of streams and the burial of stanniferous gravels.

ECONOMIC GEOLOGY

The Herberton Tinfield has been an important mining area since 1880, when lode tin was discovered at Herberton, and to date it has yielded 15 percent of Australia's total tin production. The tinfield, also known as the Herberton Gold and Mineral Field, covers parts of several 1-mile Sheet areas (Fig. 11), but all the old mining centres in the field lie within the Herberton and Mount Garnet 1-mile Sheet areas, where over 2400 lode mines and prospects have been located (Pls 17 and 18). Most of the mines are now disused, and most workings are collapsed and inaccessible. Two disused mines and one working mine are shown in Plate 14, figure 2 and Plate 15, figures 1 and 2. The majority of the mines have been worked for tin, but there are also many tungsten, copper, and silver-lead mines, and some mines have been worked for bismuth, antimony, molybdenum, zinc, gold, fluxing ore, fluorite, calcite, and mica. As well as lode deposits there are extensive deposits of alluvial cassiterite, and currently most of the tin produced in the area comes from alluvial deposits near Mount Garnet. Important deep lead deposits occur near Herberton, where cassiterite-bearing gravels of the ancestral Wild River have been buried under Cainozoic basalt flows.

A list of ore and associated minerals found in the area is given in Table 11.

Figure 11. Mineral fields of northeastern Queensland.

History of Mining

Tin was first discovered in the area in 1874, when J. V. Mulligan found tin in the headwaters of the Wild River. Five years later J. Atherton found alluvial tin in Prospectors Gully, Herberton, and reported his find to J. Jack at Cairns. The following year, 1880, J. Jack, J. Newell, T. Brandon, and J. Brown found the first lode tin in the area, at the site of the future Great Northern mine, Herber-

TABLE 11. ORE MINERALS AND ASSOCIATES FOUND IN THE HERBERTON/ MOUNT GARNET AREA

Anglesite	$PbSO_4$	Linarite[1]	$(Pb,Cu)SO_4$
Aragonite[1]	$CaCO_3$		$(Pb,Cu)(OH)_2$
Arsenolite[1]	As_2O_3	Magnetite	Fe_3O_4
Arsenopyrite	FeAsS	MALACHITE	$CuCO_3.Cu(OH)_2$
AZURITE	$2CuCO_3.Cu(OH)_2$	*Marcasite*	FeS_2
Barytes	$BaSO_4$	Melanterite[1]	$FeSO_4.7H_2O$
Beryl	$Be_3Al_2Si_6O_{18}$	Mimetite[1]	$(PbCl)Pb_4(AsO_4)_3$
Beudantite[3]	phosphate or arsenate	Minium[1]	Pb_3O_4
	with sulphate of Fe and	MOLYBDENITE	MoS_2
	Pb	Monazite	$(Ce,La,Yt)PO_4$ with
Biotite	$K(Mg,Fe)_3(Al,Si_3)O_{10}$		ThO_2 and SiO_2
	$(OH,F)_2$	MUSCOVITE	$KAl_2(Al,Si)_3O_{10}$
BISMUTHINITE	Bi_2S_3		$(OH,F)_2$
Bismutite	$Bi_2CO_5.H_2O$	Native arsenic	As
BORNITE	Cu_5FeS_4	Native bismuth	Bi
Bournonite[1]	$CuPbSbS_3$	Native copper	Cu
Bravoite	$(Fe,Ni)S_2$	NATIVE GOLD	Au
Calcite	$CaCO_3$	NATIVE SILVER	Ag
CASSITERITE	SnO_2	*Pyrite*	FeS_2
CERAGYRITE	(Horn silver) AgCl	Pyromorphite	$(PbCl)Pb_4(PO_4)_3$
Cervantite	$Sb_2O_3.Sb_2O_5$	Pyrrhotite	$Fe_{1-n}S$
CERUSSITE	$PbCO_3$	*Quartz*	SiO_2
Chalcanthite[1]	$CuSO_4.5H_2O$	Realgar[1]	AsS
CHALCOCITE	Cu_2S	Rutile[1]	TiO_2
CHALCOPYRITE	$CuFeS_2$	Scheelite	$CaWO_4$
Chlorite	Hydrous silicate of	*Scorodite*	$FeAsO_4.2H_2O$
	Al, Fe, Mg	*Sericite*	similar to muscovite
Cinnabar[1]	HgS	Serpentine	hydrous magnesium
Clinozoisite	$Ca_2Al_3(SiO_4)_3(OH)$		silicate
Cosalite	$2PbS.Bi_2S_3$	*Siderite*	$FeCO_3$
COVELLITE	Cus	Smithsonite[1]	$ZnCO_3$
CUPRITE	Cu_2O	SPHALERITE	
Dumortierite[3]	borosilicate of Al	(Blende)	ZnS
Dyscrasite	Ag_3Sb	Stannite	Cu_2SnFeS_4
Epidote	$Ca_2(Al,Fe)_3(SiO_4)_3$	STIBNITE	
	(OH)	(Antimonite)	Sb_2S_3
Feldspars	aluminous silicates of K,	Talc	hydrous magnesium
	Ca, or Na		silicate
FLUORITE		TENORITE	CuO
(Fluospar)	CaF_2	Tetrahedrite[1]	$(Cu,Fe)_{12}Sb_4S_{13}$
GALENA	PbS	*Topaz*	$Al_2F_2SiO_4$
Garnet	silicates of Ca, Al,	*Tourmaline*	complex borosilicate of
	Mg, Fe, Mn		Al, with K, Na, Fe, Mg
Goethite[1]	Fe(OH)	Tungstite	
Goslarite[1]	$ZnSO_4.7H_2O$	(Tungstic ochre)	$WO_3.H_2O$
Graphite[1]	C	Vivianite[1]	$Fe_3P_2O_8.8H_2O$
Gypsum	$CaSO_4.2H_2O$	Willemite[1]	Zn_2SiO_4
Hematite	Fe_2O_3	WOLFRAMITE	$(Fe,Mn)WO_4$
Hemimorphite[1]	$Zn_4Si_2O_7(OH)_2.H_2O$	Zeunerite[3]	$Cu(UO_2)_2As_2O_8.8H_2O$
Ilmenite	$FeO.TiO_2$	Zircon	$ZrSiO_4$
Jamesonite[2]	$Pb_4FeSb_6S_{14}$		
Kaolinite	$Al_4Si_4O_{10}(OH)_8$	LEGEND	
Lepidolite	$K(Li,Al)_3(Si,Al)_4O_{10}$	Anglesite	uncommon
	$(OH,F)_2$	*Arsenopyrite*	common
Limonite	$2Fe_2O_3.3H_2O$	BORNITE	ore mineral

[1] Berge, Brownlee, & Ringrose (1899); [2] Edwards (1951); [3] Zimmerman et al. (1963); all other minerals are mentioned elsewhere in this Bulletin.

TABLE 12. MAJOR HISTORICAL EVENTS IN THE HERBERTON/MOUNT GARNET AREA

1874	Alluvial cassiterite found in the headwaters of the Wild River by J. V. Mulligan.
1877	Alluvial cassiterite found in Prospectors Gully, Herberton, by J. Atherton.
1880	Lode cassiterite found at the Great Northern mine, Herberton, by J. Jack, J. Newell, T. Brandon, and J. Brown. Silver-lead deposits discovered at Silver Valley by J. V. Mulligan, J. Newell, and W. Stenhouse. Cassiterite found in the Return Creek area, near Mount Garnet.
1881	Alluvial cassiterite found in Nettle Creek, and lode cassiterite found at the North Australian and Great Western mines, Watsonville.
1882	Cassiterite found by Gibbs, Thompson, and McDonald at Irvinebank. Cassiterite also found at Coolgarra.
1883	Cassiterite found in the Herberton Deep Lead by J. McDonald. Shafts sunk on copper-silver ore at Mount Garnet. A smelting plant was erected at Newellton, Silver Valley. At about this time the Bischoff Battery, situated on the Walsh River north of Watsonville, began operating.
1884	Cassiterite deposits discovered at Stannary Hills. Battery opened at Coolgarra, and a battery and dam built at Irvinebank.
1885	Silver-lead ore found at Montalbion. Irvinebank battery began crushing ore.
1886	Cassiterite deposits discovered at Glenlinedale, and silver-lead ore found at Orient Camp. Smelter at Newellton closed.
1888	Cassiterite found at the Vulcan mine, Irvinebank. Batteries at Stannary Hills and Glenlinedale began crushing ore.
1891	Batteries closed at Glenlinedale and Coolgarra.
1893	Lancelot lode discovered in Silver Valley.
1898	Mount Garnet copper mine opened up, and construction of a smelter commenced.
1900	Smelter completed at Mount Garnet.
1901	Cassiterite discovered at Smiths Creek mine, Nymbool. New battery erected at Coolgarra by the Coolgarra Tin Co.
1902	Smiths Creek mine opened up at Nymbool. Completion of the railway connecting Mount Garnet with the Chillagoe line at Lappa Junction, and of the tramway between Stannary Hills and Boonmoo.
1903	Rocky Bluff Battery, on the Walsh River east of Stannary Hills, began crushing ore. Battery erected at Nymbool to crush ore from Smiths Creek mine. Mount Garnet copper mine and smelter closed.
1907	Tramway between Irvinebank and Stannary Hills completed.
1909	Smiths Creek mine stopped work.
1910	Tungsten and bismuth mined at The Glen.
1920	Battery at Emuford began crushing ore.
1929	The Oakey Creek Tin Mines NL formed to work a number of small mines near Brownville and Coolgarra. Nettle Creek Company formed to sluice alluvial cassiterite deposits in Nettle Creek.
1930	Vulcan mine, Irvinebank, closed.
1931	Dam and battery built at Brownville by the Oakey Creek Co.
1933	Coolgarra Sluicing Co. formed.
1933-1934	Small amounts of gold mined at Mount Garnet.
1935	Broken Hill Pty Co. Ltd began test drilling in Nettle and Battle Creeks.
1937	Tableland Tin Dredging NL formed. Oakey Creek Co. liquidated, but Brownville Battery remained in operation.
1938	First systematic geological mapping of the Herberton Mineral Field, undertaken by AGGSNA (Jensen, 1939).
1939	Tableland Tin Dredging NL commenced drilling in Return Creek, and constructed a 1500 KW powerhouse at Mount Garnet.
1940	Coolgarra Sluicing Co. stopped work.

TABLE 12—*continued*

1941	Nettle Creek Co. taken over by Broken Hill Pty Co. Ltd.
1942	New dredge completed by Tableland Tin, replacing dredge capsized in a flood earlier in year.
1943	Smelters at Chillagoe closed down, and copper production in the area virtually ceased.
1946	Broken Hill Pty Co. Ltd sluicing plant on Nettle Creek closed down.
1952	Tableland Tin dredge in Return Creek dismantled and re-erected on Smiths Creek.
1953	Ravenshoe Tin Dredging Ltd formed.
1957	Ravenshoe Tin commenced operations in Battle Creek.
1962	Battery at Brownville ceased working.
1965	Ravenshoe Tin dredge moved from Battle Creek to Nettle Creek. Stannary Hills alluvial plant opened by Loloma Mining Corporation NL.
1967	Alluvial plant at Stannary Hills closed down. Only four batteries working in the area, at Irvinebank, Herberton, Emuford, and near Innot Hot Springs. Tableland Tin and Ravenshoe Tin dredging alluvial deposits in Smiths Creek and Nettle Creek respectively.

ton. This last find triggered off a rush to the area which led to the development of the local mining industry. These and other events in the mining history are summarized in Table 12. Further details of the early history can be found in the Annual Reports of the Queensland Department of Mines, and in reports by Jack (1881), Tenison Woods (1881), Skertchley (1897), Cameron (1904b), and Lees (1907). General historical accounts are also given by Zimmerman, Amos, & Yates (1963), and de Keyser & Lucas (1969).

Mineral Exploration

During the early days of the field attention was focused on rich lodes cropping out on the surface, and little systematic exploration was attempted. However, within a short time many of the rich exposed lodes were worked out, and, as soon as the grade of ore fell off, many mines were abandoned. For profitable mining operations it became necessary to spend more time and effort prospecting. This was encouraged by the success of J. Newell in finding new lodes and continuations of old lodes at the Great Northern mine, Herberton, and by J. Moffat at Irvinebank. Moffat was largely responsible for the development of Irvinebank, where he stimulated mining for nearly 30 years. Added impetus at Irvinebank was given by the success of the Vulcan tin mine, which was opened up in 1888.

Since 1880 many of the mines have been examined by geologists of the Geological Survey of Queensland, notably R. L. Jack, S. B. J. Skertchley, W. E. Cameron, L. C. Ball, E. C. Saint-Smith, C. C. Morton, J. H. Reid, A. K. Denmead, and, most recently, K. R. Levingston. However, none of the Herberton Tinfield was systematically mapped until 1938, when part of the area was mapped by an AGGSNA party led by H. I. Jensen (Jensen, 1939). In 1958 and 1959 the area was remapped, mostly on a reconnaissance scale, during the mapping of the Atherton 1:250,000 Sheet area by combined geological parties from the Bureau of Mineral Resources and the Geological Survey of Queensland. The present more detailed survey was begun in 1962, and field work was essentially completed in 1966. During this latest survey most of the mine workings were located and briefly examined.

Several mining companies have undertaken prospecting and development work in the area. Since 1953 the companies most concerned have been New

Consolidated Goldfields (A'asia) Pty Ltd, Carpentaria Exploration Co. Pty Ltd, Noranda Australia Pty Ltd, North Broken Hill Ltd, Metal Exploration NL, and Loloma Mining Corporation NL.

Geophysical exploration methods have been tried out on several occasions. The first attempts were in 1938, when AGGSNA staff carried out magnetic and electrical resistivity methods on the Herberton Deep Lead (Thyer, 1939), electromagnetic and potential ratio methods on the tin lodes at Herberton (Thyer et al., 1939a), and electromagnetic, self potential, and potential ratio methods on the United North Australian group of mines, Watsonville (Thyer et al., 1939b). In 1955 an airborne scintillograph survey covering most of the Herberton/Mount Garnet area was undertaken by the Bureau of Mineral Resources (BMR, 1956). The United North Australian group of mines was later investigated by Carpentaria Exploration Co. in 1961, using electromagnetic and magnetic methods (Syvret, 1963a) and by the Bureau of Mineral Resources in 1964, using electromagnetic, self potential, induced polarization, and magnetic methods, followed by diamond drilling (Sedmik, 1967). Seismic refraction surveys and a gravity survey were carried out near Mount Garnet in 1962 by the Bureau in a search for alluvial cassiterite deposits (Horvath & Hussin, 1966; Sedmik & Williams, 1967): these surveys were followed by a programme of percussion drilling. None of these surveys has found any significant new ore deposits.

Some geochemical surveys, mostly based on stream sediment sampling, have also been carried out in the area (e.g., Zimmerman et al., 1963). Perhaps the most interesting result of this work has been the detection of appreciable amounts of beryllium in some areas of greisenized Elizabeth Creek Granite.

PRODUCTION

Recorded production figures for the Herberton Tinfield (Herberton Gold and Mineral Field) are shown in Table 13. These are based on production figures given in the Annual Reports of the Queensland Department of Mines, and have been adjusted to exclude, as far as possible, production from areas outside the present boundaries of the tinfield. Probably over 95 percent of the production of the Herberton Tinfield has come from within the Herberton and Mount Garnet 1-mile Sheet areas. The Herberton Gold and Mineral Field originally formed part of the Walsh and Tinaroo Mineral Field, which also included the areas now covered by the Chillagoe and Mareeba Gold and Mineral Fields. In 1908 the Chillagoe Gold and Mineral Field was proclaimed, and the remainder of the Walsh and Tinaroo Mineral Field was renamed the Herberton Gold and Mineral Field. In 1949 the northern part of this field was included in the newly formed Mareeba Gold and Mineral Field, and the present boundaries of the Herberton Gold and Mineral Field were created.

Tin is by far the most important product of the Herberton Tinfield, and at present the field contributes one-third of Australia's annual tin production. The three products next in importance are silver, lead, and copper, but the total production of these metals is much less than in the adjacent Chillagoe Gold and Mineral Field (de Keyser & Wolff, 1964). Tin producton was greatest between 1883 and 1913, and reached a peak of over 4000 tons SnO_2 in 1907. Maximum silver, lead, and copper production occurred during the same period. At this time several thousand people lived in the mining area, mostly at Herberton and Irvinebank, but also in many smaller centres, including Bakerville, Coolgarra, The Junction (of the Dry and Wild Rivers), Emuford, Glenlinedale, Gurrumba, Mont-

TABLE 13. PRODUCTION OF ORE FROM THE HERBERTON TINFIELD

Year	Cassiterite			Wolframite	W/Sn Ore	W/Bi Ore	Bi	Cu	Pb	Ag	F	Sb	Mo	Scheelite	Au
	Lode	Alluvial	Total												
1879	31	100	131												
1880	93	100	193												
1881	1,084	100	1,184												
1882	1,610	200	1,810												
1883	2,646	450	3,096												
1884	1,902	250	2,152												
1885	2,095	100	2,195							187,203					
1886	2,198	100	2,298						340	110,454					
1887	1,507	200	1,707						1,041	272,863					
1888	1,390	100	1,490						1,083	229,308					
1889	1,560	100	1,660					100	896	318,192					
1890	1,689	226	1,915					100	888	230,995					
1891	1,063	193	1,256						218	109,376					
1892	1,180	100	1,280					19		198,492					
1893	1,214	166	1,380					56	99	100,094					
1894	1,250	378	1,628					16	314	64,013					
1895	1,260	200	1,460	21				22	219	50,971					
1896	747	143	990					84	37	16,184					
1897	749	96	845					6	2	515					
1898	509	107	616					14	95	12,040					
1899	682	93	775					17	38	11,090					
1900	493	55	548					21	47	5,249					
1901	910	120	1,030					1,885	213	391,037					
1902	1,524	80	1,604					2,057	73	486,651					
1903	2,268	540	2,808					474		72,303					
1904	2,171	600	2,771	800			1								
1905	2,291	600	2,891	500			2								
1906	2,855	800	3,755	200			1		83	12,000			13		
1907	3,432	650	4,082	130					471	62,809			3		
1908	3,013	700	3,713	13				30	200	20,000					
1909	1,449	439	1,888	208				218	38	50,829					
1910	1,116	419	1,535	291		16	2	157	433	57,624			1	1	
1911	1,585	445	2,030	293		31		154	124	26,973					
1912	1,626	301	1,927	159		13		189	689	85,614					

TABLE 13—*continued*

Year	Cassiterite Lode	Cassiterite Alluvial	Cassiterite Total	Wolframite	W/Sn Ore	W/Bi Ore	Bi	Cu	Pb	Ag	F	Sb	Mo	Scheelite	Au
1913	1,508	353	1,861	42				163	447	60,722					
1914	899	242	1,141	30		3		44	132	18,446					
1915	915	249	1,164	53		9		192	129	22,507		17			
1916	654	167	821	88		8		566	60	48,725		10			
1917	374	167	541	102		8		565	93	66,620	71			9	
1918	546	169	715	50		2		206	11	33,464				10	
1919	409	115	524	50		6		94	1	20,031				7	
1920	698	130	828	20			1	409	318	70,496	603	3		2	
1921	373	93	466					98	60	22,570	536				
1922	385	100	485	4				40	137	17,099					
1923	419	110	529					156	97	25,295					
1924	720	84	804					83	450	61,619					14
1925	524	116	640					91	614	80,084					3
1926	496	75	571					21	1,080	98,524					1
1927	378	116	494						81	8,701					
1928	411	189	600												
1929	425	215	640	11				86	78	15,115					
1930	272	132	404	15				350	52	34,626					10
1931	151	177	328	1				596	25	53,339					10
1932	216	210	426	1				430	39	42,474					12
1933	298	207	505					359	46	44,775					25
1934	407	275	682	6				211	14	25,253					120
1935	546	254	800	2				148	5	20,172					10
1936	407	270	677					132		19,072					
1937	374	284	658		3	1	1	146	8	17,879	51	1	3		
1938	324	277	601		5	1		169	5	20,390	5	1	1		
1939	340	410	750		1	2		133	2	13,355			1	1	
1940	289	465	754	30	2			169		14,191					
1941	200	407	607	45	1			269		20,395				1	131
1942	205	191	396	79				273		22,252					1
1943	190	392	582	52				50		3,967		9		1	1
1944	137	947	1,084	54				5		353		2		1	
1945	84	734	818	29	1									5	
1946	107	759	866	24					5	365					

TABLE 13—*continued*

Year	Lode	Cassiterite Alluvial	Total	Wolfram-ite	W/Sn Ore	W/Bi Ore	Bi	Cu	Pb	Ag	F	Sb	Mo	Scheelite	Au
1947	170	1,113	1,283	25					13	856		6		8	
1948	181	370	551	50			1	4	2	45		8	1		
1949	174	748	922	10			1					11	1		
1950	149	544	693	5								37	1		
1951	103	272	375	65	4			1				19			
1952	115	232	347	96	8							5			
1953	133	123	256	49		1					38	6			
1954	163	686	849	11	1										
1955	150	791	941	29	3			3							
1956	121	672	793	11				7							
1957	138	820	958	1											
1958	155	1,062	1,217					2		71					
1959	138	1,165	1,303												
1960	102	928	1,030												
1961	143	1,496	1,639					2		10					
1962	182	992	1,174					1							
1963	198	1,063	1,261					7		43					
1964	140	1,593	1,733												
1965	204	1,220	1,424												
1966	256	1,650	1,906												
1967	266	1,554	1,820	2											
1968	303	1,048	1,351												
1969	362	1,036	1,398									7			
Totals	69,919	39,610	109,529	3,885	29	101	10	11,900	11,645	4,206,780	1,304	142	25	46	338

Mica. 10 tons in 1958
Cu/Ag ore. 89 tons in 1894
Pb/Ag ore. 19 tons in 1883, 8 tons in 1950
W/Bi/Sn ore. 1 ton in 1948
Sn/Pb slag. 15 tons in 1952
Sn/Pb ore. 3 tons in 1965
Sn slag. 312 tons in 1948, 5 tons in 1952
Ironstone. 1,760 tons in 1932

albion, Mount Garnet, Nymbool, Orient Camp, Silver Valley, Stannary Hills, and Watsonville. Many of the smaller centres have been abandoned and the others have greatly reduced populations. Past and present population figures for some mining centres are given in Table 14. After 1913 tin production declined, and it was not until 1957 that the annual production again regularly exceeded 1000 tons of cassiterite.

TABLE 14. POPULATION OF MINING CENTRES

	1893[1]	1896[1]	1900[1]	1906[1]	1910[1]	1969
Bakerville	—	—	—	157	44	10*
Coolgarra	93	30	232	245	107	5*
Dry River Junction	—	—	—	32	79	10*
Emuford	—	—	—	54	90	15*
Glenlinedale	7	—	—	—	51	0
Gurrumba	—	—	—	211	97	1
Herberton	920	712	587	562	991	900[2]
Irvinebank	347	410	599	1,707	1,256	200[2]
Montalbion	203	109	176	19	26	0
Mount Garnet	—	19	523	226	104	800[2]
Nymbool	—	—	—	222	70	10*
Orient Camp	35	—	—	25	40	0
Silver Valley	—	—	30	116	77	0
Stannary Hills	—	—	—	724	466	0
Watsonville	200	262	248	264	277	10*

[1] Annual Reports, Queensland Department of Mines.

[2] Bureau of Census and Statistics.

* Universal Business Directory 1970, Combined Northern Queensland Business and Trade Directory.

Before 1939 most of the tin produced was lode tin, but since Tableland Tin Dredging, NL, and later Ravenshoe Tin Dredging Ltd commenced dredging operations near Mount Garnet alluvial tin has become much more important, and currently makes up over 80 percent of the field's annual production. This is shown graphically in Figure 12. Variations in annual production appear to be unrelated to fluctuations in the world price of tin (Figs 12 and 13).

Production of copper, silver, and lead, although insignificant compared with the present annual production of these metals from the mines at Mount Isa, was an important factor in the prosperity of the field up to 1943. However, in this year production virtually ceased owing to the closing down of the smelter at Chillagoe.

Tungsten is the only other metal produced in the area in relatively large quantities. Maximum production was between 1904 and 1917, after which there was a marked drop, with minor revivals during World War II and the Korean War. No tungsten production was recorded in the years 1957 to 1966.

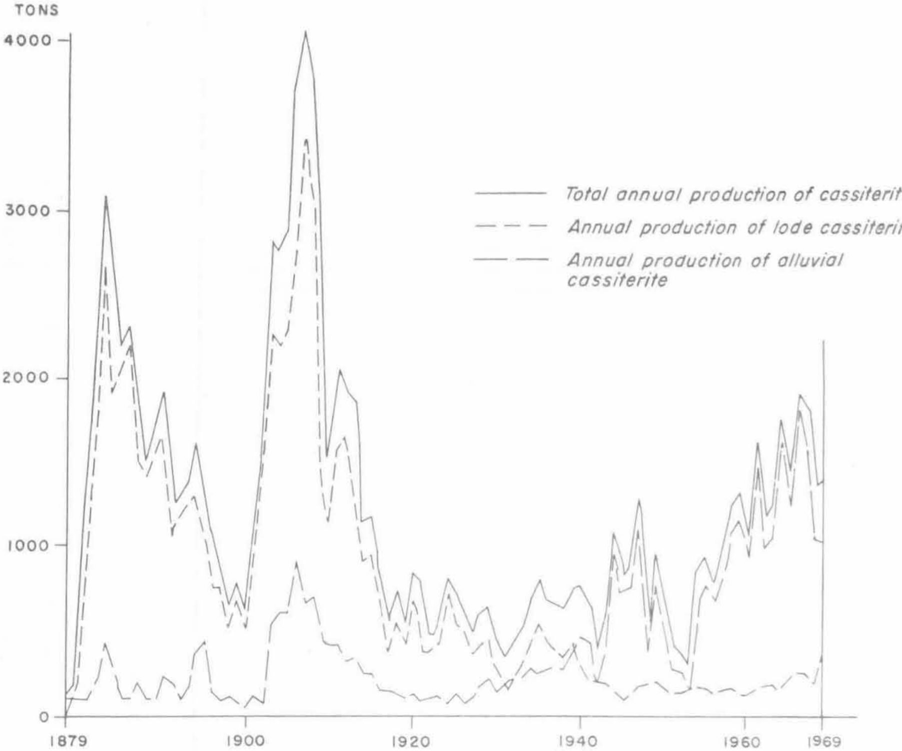

Figure 12. Tin production, Herberton Tinfield.

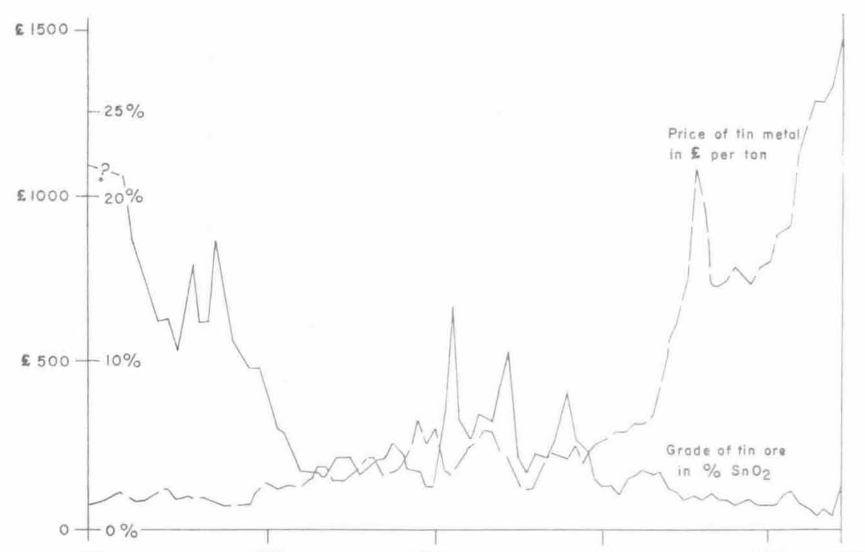

Figure 13. Grade of tin ore mined in the Herberton Tinfield and price of tin metal at the London Metal Exchange (annual averages).

ORE DEPOSITS

Distribution and Origin of Mineralization

In the Herberton Tinfield economic mineralization is widespread in rocks of the Hodgkinson Formation and in the Elizabeth Creek Granite, and also occurs in Precambrian rocks at Mount Garnet, in Featherbed Volcanics near Stannary Hills, in Nanyeta Volcanics on Mount Garnet and in an unnamed granite cropping out between Mount Garnet and Innot Hot Springs. The extent of the mineralization is indicated by the mines and prospects shown on the Herberton and Mount Garnet 1-mile geological maps. Some economic mineralization may also occur in Nymbool Granite north of Nymbool; this occurrence is discussed later.

The mineralization is considered to be associated with the intrusion of the Elizabeth Creek Granite. Evidence for this conclusion is given by the restriction of mineralization to within the Elizabeth Creek Granite and rocks intruded by it, and as will be described later, by the zonal arrangement of mineralization around the granite. However, not all the rocks intruded by the Elizabeth Creek Granite are mineralized, the exceptions being the Kalunga Granodiorite and Glen Gordon Volcanics. Also the Silver Valley Conglomerate, although considered to be older than the Elizabeth Creek Granite, is not mineralized. These unmineralized rocks are presumed to have been impervious to the mineralizing solutions.

Previously the mineralization was attributed to basic dykes, to granite (unspecified), to aplite dykes, and to two different granites. Both Jack (1883) and Skertchley (1897) considered that the mineralization was related to the intrusion of basic dykes, as the ore minerals commonly occur in quartz-chlorite bodies which were interpreted by these two workers as altered basic dykes. Cameron (1904b) and Stirling (1905) were the first to suggest that the mineralization was related to granite. Most later workers have also attributed the mineralization to granite although Jensen (1926) considered that aplite dykes intruded shortly after the emplacement of the granite were responsible. Recently, Best (1962b) and Branch (1962, 1966b) subdivided the granite in the area into the Elizabeth Creek Granite and the Herbert River Granite; they considered that the tin-tungsten-molybdenum mineralization was due to the Elizabeth Creek Granite and that the copper-silver-lead-zinc mineralization was due to the Herberton River Granite. The present work, however, shows that the granites mapped as Herbert River Granite by Best and Branch are not responsible for any economic mineralization, and all the mineralization is now attributed to the Elizabeth Creek Granite.

In the mineralized areas many of the mineral deposits consist of ore shoots irregularly distributed within steeply dipping pipe-like orebodies (Blanchard, 1947a). These orebodies are generally associated with narrow shear zones in sedimentary and volcanic rocks and with narrow shears and greisen zones in Elizabeth Creek Granite. In most places where they are associated with shear zones, the pipes occur at the intersection of two or more shears. The pipes associated with greisenized granite may have been formed by the upward migration of hydrothermal solutions during the solidification of the granitic magma (Douglas, 1957).

Zoning

Many mineral deposits, including those of the Herberton Tinfield, are arranged in zones around a magmatic source. This zoning is of three main types (Park & MacDiarmid, 1964), namely regional zoning, district zoning, and orebody zoning.

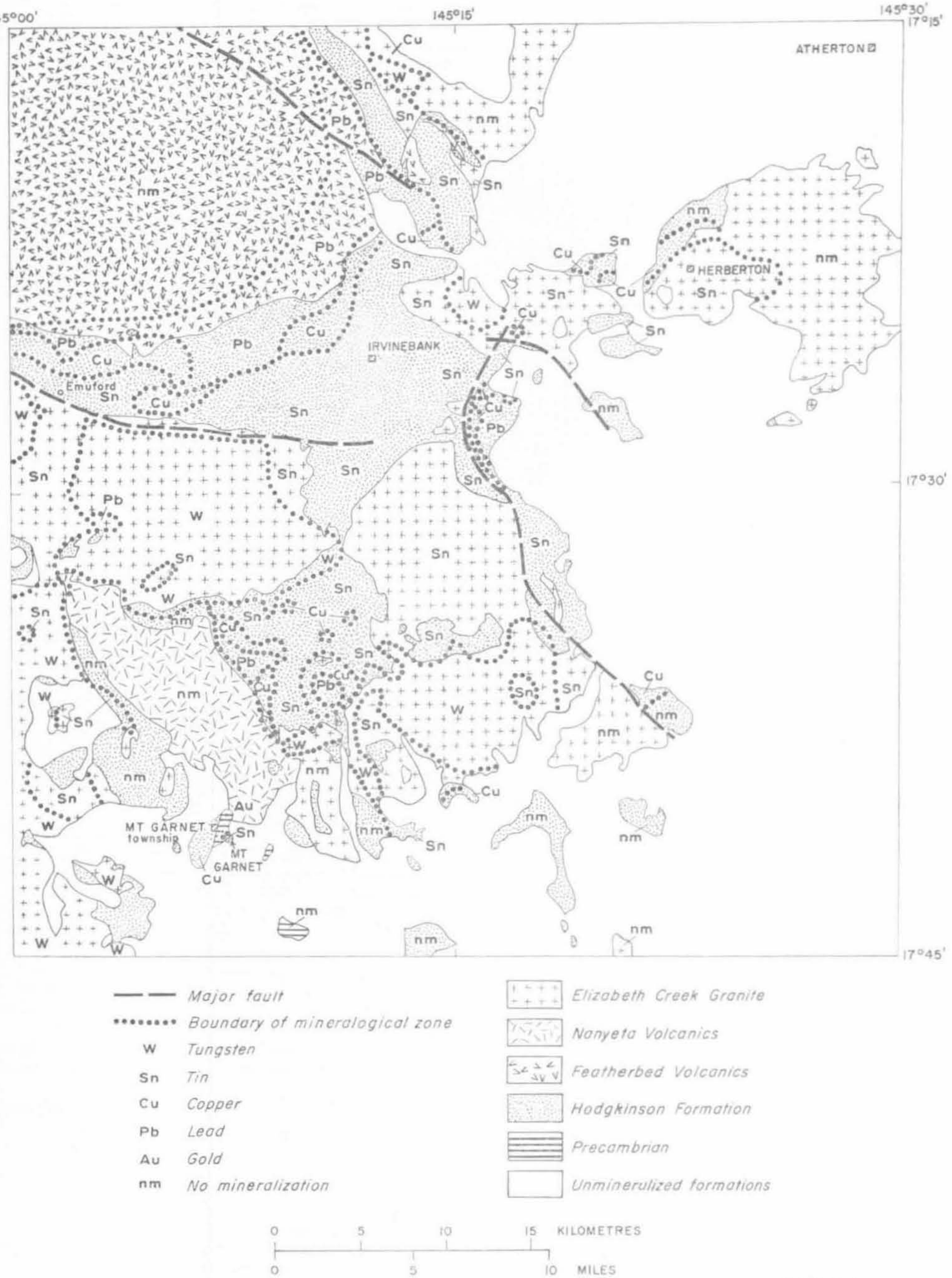

Figure 14. District mineral zoning in the Herberton/Mount Garnet area.

Regional zoning is zoning on a very large scale, and is not discussed here. *District zoning* is zoning shown by closely grouped mines, and is the type of zoning that is particularly well displayed in the Herberton/Mount Garnet area, where it was

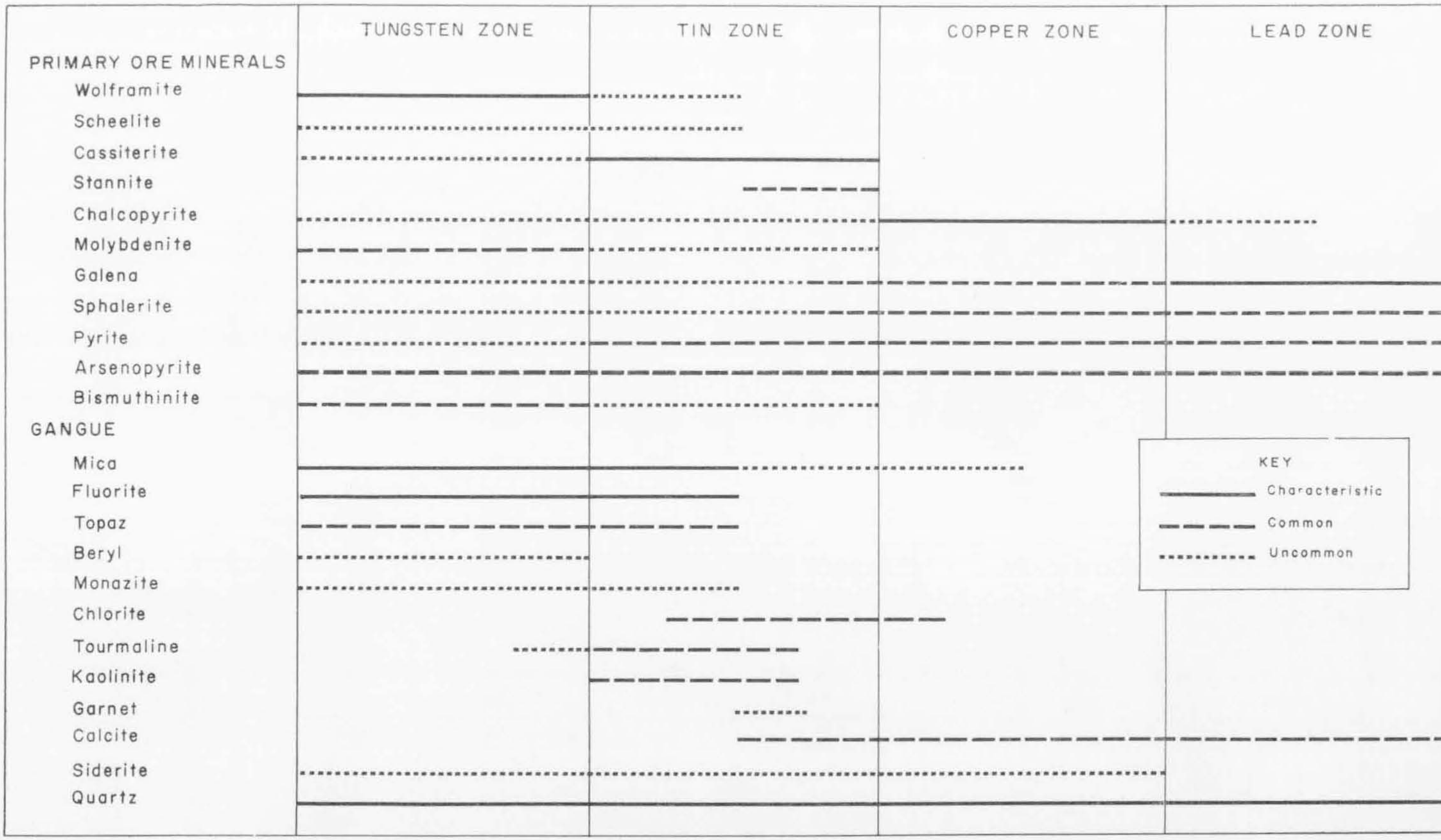

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Figure 15. Zonal distribution of primary ore and gangue minerals.

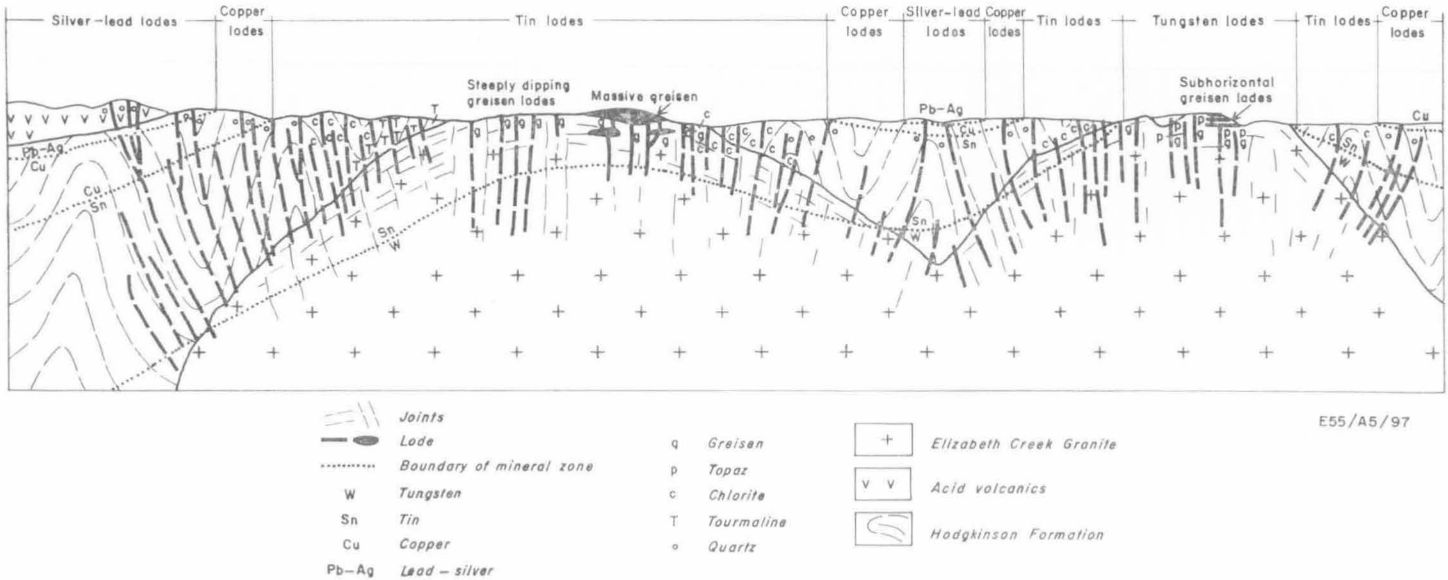

Figure 16. Diagrammatic section showing relationships between lode types, district mineral zones, and country rocks.

first recognized by J. W. Smith in 1964 (Blake & Smith, 1970). *Orebody zoning*, as the name implies, is zoning within a single orebody, and it also is represented in the area.

District zoning

District zoning in the Herberton/Mount Garnet area became apparent in 1964 as a result of detailed geological mapping, the examination of ore material on mine dumps, and a study of previous literature. The zoning is related to the Elizabeth Creek Granite and its associated metamorphic aureole. Four zones have been distinguished in the area, characterized by (1) tungsten, (2) tin, (3) copper, and (4) lead mineralization. The geographical distribution of the zones is shown in Figure 14, and the ore minerals and associates found within each zone are shown in Figure 15. The diagrammatic cross-section of Figure 16 shows the relationships between mineral zones, country rocks, and main lode types.

1. *Tungsten zone*. This is the innermost zone, and is mainly confined to the Elizabeth Creek Granite. Wolframite is the main ore mineral, and associated with it are arsenopyrite, molybdenite, bismuthinite, and, less commonly, other sulphides. Some cassiterite is present locally. The chief gangue minerals are quartz, mica, fluorite, and topaz.

2. *Tin zone*. The tungsten zone passes outwards into the tin zone, in which cassiterite is the main ore mineral. The mineral deposits of the tin zone occur in Elizabeth Creek Granite, hornfelsed Hodgkinson Formation, and Nanyeta Volcanics. In the inner part of the zone cassiterite is commonly the only ore mineral present, but towards the outer part of the zone sulphides, especially those of copper, become increasingly important and several mines near the outer margin of the zone have been worked for both tin and copper. Some of the cassiterite associated with sulphides is possibly secondary after stannite. The main gangue minerals are quartz, mica, and fluorite in the Elizabeth Creek Granite, and quartz, chlorite, tourmaline, and sericite in the Hodgkinson Formation.

3. *Copper zone*. Chalcopyrite characterizes this zone, commonly associated with minor quantities of arsenopyrite, pyrite, galena, and sphalerite. Quartz is the main gangue mineral. The majority of the mineral deposits in the zone occur within unmetamorphosed rocks of the Hodgkinson Formation, although some occur within the Elizabeth Creek Granite.

4. *Lead zone*. This is the outermost zone, and is generally the farthest away from the Elizabeth Creek Granite. Galena and sphalerite are the characteristic ore minerals, and quartz occurs as gangue. The country rocks are generally unmetamorphosed Hodgkinson Formation and Featherbed Volcanics.

Because of their sporadic occurrences, gold and antimony have not been placed within the zonal sequence. Gold has been obtained only from lodes in Precambrian rocks at Mount Garnet, and in the Hodgkinson Formation within the Gurrumba Ring Complex. Antimony occurs at widely separated localities in Elizabeth Creek Granite, Hodgkinson Formation, and Featherbed Volcanics.

Orebody zoning

Ideally the zonal sequence within a zoned orebody should be similar to that of the larger-scale district zoning. Hence in the Herberton/Mount Garnet area lead mineralization in an orebody would be expected to grade into copper and possibly tin mineralization as the granite contact was approached. However, this

Plate 13, fig. 1. Unnamed basaltic shield volcano of Atherton Basalt Province (looking north from Atherton). Dark forested hills in the left background are formed of Walsh Bluff Volcanics.

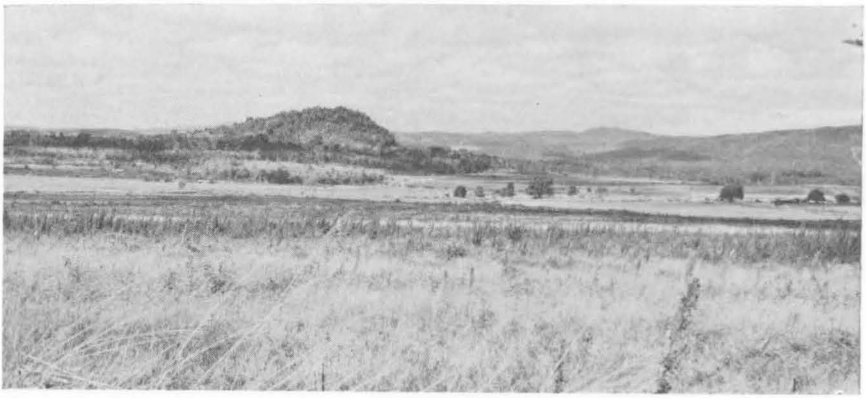

Plate 13, fig. 2. Wongabel, a basaltic volcano 5 km south-southeast of Atherton. Atherton Basalt Province.

Plate 13, fig. 3. The Crater, Mount Hypipamee, 18 km south of Atherton. The Crater is a diatreme formed in Elizabeth Creek Granite. It is 123 m deep and is filled with water to a depth of 67 m; its top is 960 m above sea level.

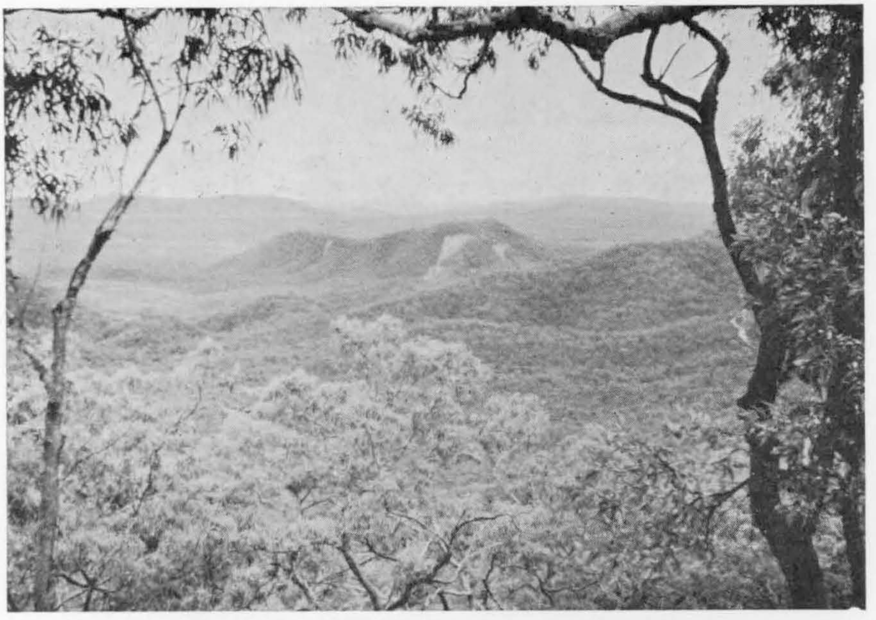

Plate 14, fig. 1. View northwards to Montalbion from near Omeo, west of Irvinebank. Montalbion is the prominent hill in the middle distance, on the sides of which are light-coloured mine dumps.

Plate 14, fig. 2. Pride of the Valley mine, situated on a deep hill slope in Silver Valley. The mine was worked for copper, silver, and lead, and lies on the Lancelot line of lode. In the foreground are the ruins of the long disused Silver Valley battery, on the east bank of the Dry River.

Plate 15, fig. 1. The Rover tin mine, South Coolgarra, a typical example of one of the smaller mines in the Herberton Tinfield. In June 1968, when the photograph was taken, the main shaft was 23 m deep. The mine is in Elizabeth Creek Granite.

Plate 15, fig. 2. Poppet legs over the main shaft of the North Australian tin and copper mine, Jamie Creek, Watsonville, 1958.

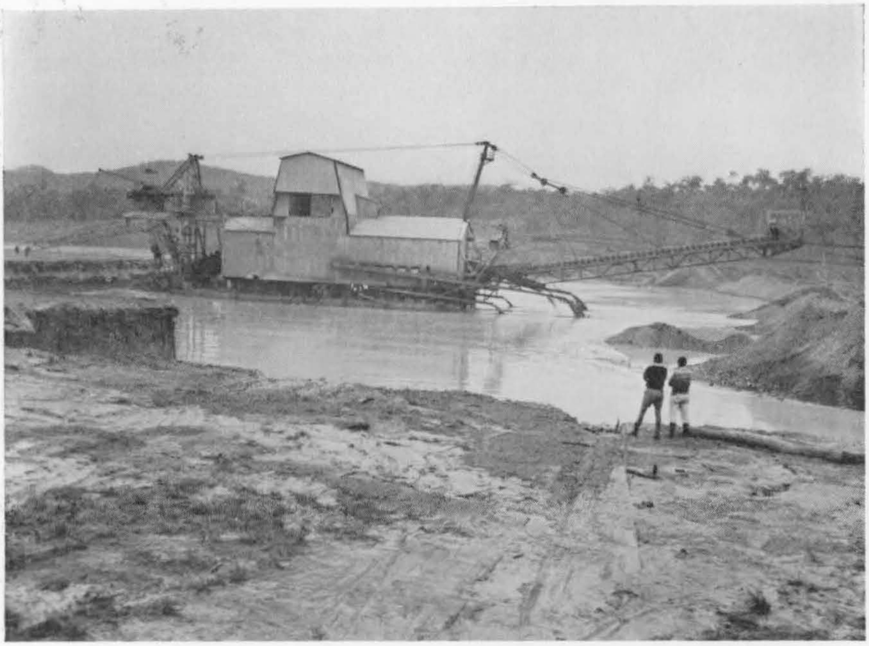

Plate 16, fig. 1. Dredge operated by Tableland Tin Dredging NL in Smiths Creek, west of Mount Garnet.

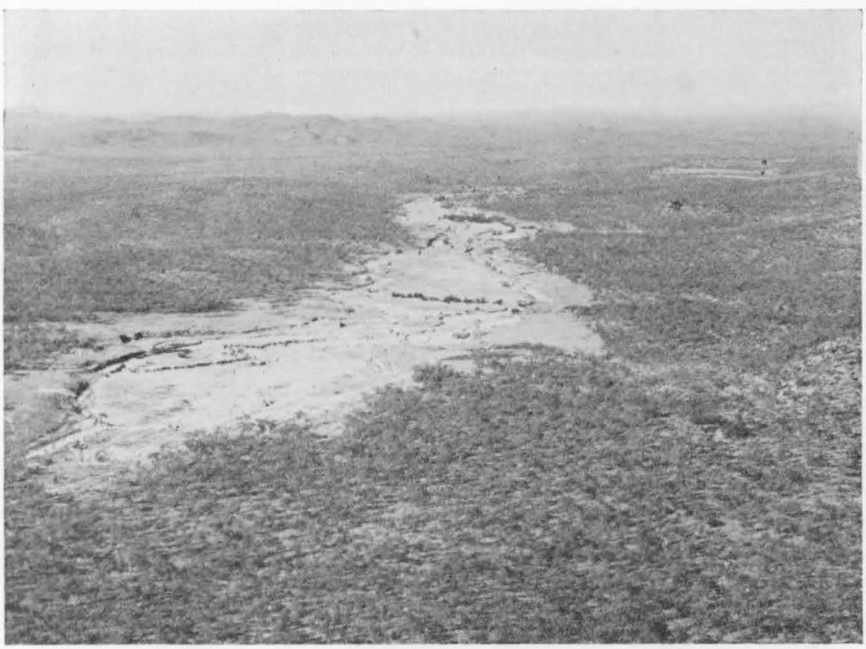

Plate 16, fig. 2. Dredging area of Battle Creek, looking southeast, in June 1968. Hills in the left background are formed of Glen Gordon Volcanics and mark the eastern edge of the Mount Garnet Basin.

sequence has rarely been observed, and reverse zoning appears to be more typical, the most common example being cassiterite mineralization passing downwards into complex sulphide mineralization, as at the Ivy mine, Emuford, and the Shasta mine, Stannary Hills. It has been suggested by some workers (A. K. Denmead, pers. comm.) that in such instances the clean cassiterite occurs in the leached oxidized zone, above the permanent watertable, and is partly or entirely secondary after stannite which is confined to unaltered primary complex sulphide ores situated below the watertable. Hence the reverse zoning may be more apparent than real.

The district zoning is closely comparable to that in the tin-mining districts of Cornwall (Davison, 1921; Dewey, 1925, 1948; Hosking, 1951) and Bolivia (Ahlfeld, 1941). In all three areas the zoning is attributed to ore deposition from a mineralizing granitic body, the zonal sequence being largely controlled by decreasing temperature and pressure away from the granite (Blanchard, 1947b).

The characteristic spatial distribution of tin and tungsten near the source of mineralization, passing outwards into copper and finally lead, probably corresponds to the general paragenetic sequence of mineral deposition: in any one area cassiterite and wolframite were deposited first, followed by chalcopyrite, sphalerite, and galena. The zonal and paragenetic sequence may be related to densities of fluids, atomic weights of metals, mineral hardnesses, free energies of mineral formation, volatiles, metal-sulphur ratios, electrode potentials, and other properties (Park & MacDiarmid, 1964, p. 176).

Classification of Ore Deposits

The mineral deposits of the Herberton/Mount Garnet area can be classified according to temperature and pressure of formation into hypothermal deposits, formed at high temperatures and pressures, and mesothermal deposits, formed at moderate temperatures and pressures (Park & MacDiarmid, 1964, p. 210). The hypothermal deposits include the deposits of the tungsten and tin zones, which were probably formed at temperatures between 300° and 500°C. The copper deposits within the Elizabeth Creek Granite south of Watsonville, northwest of Herberton, and north of Stannary Hills are also probably hypothermal deposits. The deposits of the copper and lead zones away from the Elizabeth Creek Granite were formed at lower temperatures, probably 200° to 300°C, and at lower pressures, as indicated by the unmetamorphosed nature of the country rocks, and these deposits are classified as mesothermal.

Distribution and Details of Mines and Prospects

The positions of most of the main mines in the area are shown on the accompanying geological maps and all mines and prospects are shown in Plates 17 and 18. Descriptions of the works are given in tabular form in Tables 17 to 50. Of over 2400 mines and prospects examined, fewer than 100 have been worked since 1960, and fewer than 50 were being worked in 1966.

The descriptions of the mines and prospects given in Tables 17 to 50 are based on brief field examinations of surface workings, mine dumps, and, in a few cases, underground workings, and on published and unpublished reports. Most of the underground workings are collapsed or flooded, and therefore inaccessible. Except in a very few cases production records of the mines are either incomplete or lacking.

Tin Deposits

Tin occurs in the Elizabeth Creek Granite, in sedimentary rocks of the Hodgkinson Formation close to the granite contact, and in the Nanyeta Volcanics on Mount Garnet hill. It is confined to the tungsten and tin mineral zones (Fig. 14). The tin is present principally as the oxide, cassiterite, but the tin-copper-iron sulphide, stannite, has been recorded at several mines, and is probably more common than generally thought. No other tin-bearing minerals have been recorded. In the Elizabeth Creek Granite the cassiterite occurs in pipe-like lodes along joints and shears, in quartz veins, and in disseminated deposits, all of which are commonly associated with greisen. Where not greisenized the granite in the tin mineral zone is generally a pale pink coarse-grained non-porphyritic variety. In the Hodgkinson Formation the cassiterite mostly occurs in lenticular or pipe-like lodes situated along shear zones. No obvious lithological preference of the tin mineralization was found within the Hodgkinson Formation, although some previous workers have suggested that the cassiterite is concentrated within the thicker arenite bands (Cameron, 1904b; Dimmick & Cordwell, 1959). On Mount Garnet hill the cassiterite appears to be associated with thin quartz veins cutting acid volcanic rocks.

The cassiterite is generally dark brown, reddish brown, or black in hand specimen, and rarely light brown, amber, or ruby. In thin section the cassiterite is brown or reddish brown to colourless, and very commonly shows colour zoning. Much of the cassiterite is magnetic, particularly that in the Elizabeth Creek Granite. G. F. J. Greaves (pers. comm.) has made a detailed study of the mineralogy, magnetic susceptibility, coercive forces, curie temperatures, trace-element abundances, and X-ray diffraction patterns of magnetic cassiterite from several mines in the area, and came to the conclusion that the magnetism is caused by microscopic to submicroscopic inclusions of magnetite, average diameter 0.7μ, which are probably exsolved from the host cassiterite: the amount of magnetite in the cassiterite ranges from 0.04 to 1.7 percent. Greaves has also studied the trace-element compositions of cassiterite from the area; the most important trace elements found by him are indium, which is concentrated in low-temperature cassiterite associated with sulphides, and niobium, which is concentrated in high-temperature cassiterite associated with greisens.

Most of the tin mines in the area are less than 30 m deep. However, the area does include the deepest tin mine in Australia. This is the Vulcan mine, Irvinebank, which has been worked to a depth of 453 m: the mine is situated in thermally metamorphosed rocks belonging to the Hodgkinson Formation. The deepest mine in Elizabeth Creek Granite is the Great Northern mine, Herberton, which was worked to a depth of 198 m.

The great majority of tin mines in the area are small producers, and only ten have produced more than 1000 tons of tin concentrates. These are listed in Table 5.

The annual production of lode cassiterite in the Herberton/Mount Garnet area, and the grade of ore mined are shown graphically in Figures 12 and 13. The average grade of ore mined has ranged from over 10 percent of tin oxide, when the area was first opened, to less than 1.5 percent at the present time. During the early days of the field most of the ore had to be transported many kilometres to the nearest battery by mule trains, pack horses, and manual labour, and ores containing less than 10 percent tin oxide were commonly unprofitable. However, it was not long before batteries were erected at most of the local mining centres, enabling lower-grade ores to be worked. Although many of the batteries were closed down before 1900, improved transport facilities in the area enabled the mining of lower-grade ores to continue. With the trend to lower-grade ores, many of the old mine dumps were reworked, in some instances more than once, and some dumps have been entirely removed to batteries for crushing. Many of these dumps probably bulked over 2 percent tin oxide.

In 1966 only four batteries were engaged in crushing ore. These were the Great Northern Battery at Herberton, the State Battery at Irvinebank (described by Herman, 1914, and Elford, 1945), Greens Battery at Emuford, and the Dead Finish Battery on the Wild River south of the Dry River Junction. The latter two batteries are closed for part of the year because of lack of water. The Dead Finish Battery is the smallest of the four, and is suitable for crushing only soft ores. A battery was working at Brownville up to the end of 1962. The other batteries in the area have been disused for many years, and are now in various stages of disintegration (Pl. 14, fig. 2).

The different types of tin deposits that occur in the area are briefly described below.

TABLE 15. MAIN TIN MINES IN THE HERBERTON/MOUNT GARNET AREA

Mine	*Cassiterite Concentrates Produced up to* 1969 (tons)	*Average Recovery Grade* (%)
Vulcan, Irvinebank	13,712	7.6
Great Northern, Herberton	5,000	—
Wild Irishman, Herberton	2,300	—
Smiths Creek, Nymbool	1,561	2.4
Old Bradlaugh, Herberton	1,400	—
Great Southern, Irvinebank	1,352	8.2
Arbouin, North Bakerville	1,182	1.9
Lancelot, Silver Valley	1,173	7.5
Governor Norman, Irvinebank	1,100	1.55
Old Monarch, Herberton	1,000	—

1. *Disseminated deposits in granite.* Although cassiterite occurs as an accessory mineral in Elizabeth Creek Granite, it is rarely present in sufficient quantities to form a workable disseminated deposit. Such deposits as do exist are invariably closely associated with cassiterite-bearing quartz veins, as at the Ruby Anne mine, Bakerville; Elsie mine, Upper Emu Creek; and the Sugar Bag mine, Emuford. The host rock at these mines is a pale pink leucocratic medium-grained granite in which the feldspar is partly altered to kaolin and the biotite is altered to chlorite. The cassiterite occurs as reddish brown to black crystals averaging about 1 mm in diameter.

2. *Greisen deposits.* These deposits are mainly confined to the Elizabeth Creek Granite, although some occur in Hodgkinson Formation close to the granite contact. Two types are distinguished.

(a) *Disseminated deposits.* Low-grade deposits of disseminated cassiterite in massive greisen have been worked in the Emuford, Gurrumba, and Mount Gibson areas. The largest known deposit of this type is at the Boulder West mine, Gurrumba. The cassiterite is generally fine-grained, and occurs in very small quartz veins as well as disseminated through the greisen. Small quantities of sulphide minerals, particularly arsenopyrite and pyrite, are occasionally present.

(b) *Greisen lodes.* Most of the tin deposits within the Elizabeth Creek Granite are lenticular and pipe-like orebodies formed in narrow and generally steeply dipping greisen lodes. Many of these lodes can be traced for over 1 km along strike, and they show up prominently on air-photographs as lines of darker vegetation. The greisen lodes consist essentially of quartz and white mica, and commonly have cores of either massive quartz, as at the Croesus mine, Mowbray Creek, or quartz-mica pegmatite, as at the Black Prince mine, Glenlinedale. The cassiterite is generally fine-grained, although crystals up to 7 mm across have been recorded, and commonly occurs in small granular aggregates. The mica locally forms crystals up to 10 cm across but is mostly fine to very fine-grained, and at many localities, as on Herberton Hill, has a talcose appearance: most of the coarse mica is probably lithium-bearing. Fluorite is a very common accessory mineral in the greisen lodes. Less common are wolframite, monazite, topaz, kaolinite, chlorite, and minor sulphides.

3. *Biotite lodes.* This type of lode occurs at the Globe mine, Gurrumba, and Smiths Creek mine, Nymbool. The lode material consists dominantly of dark green biotite, with quartz, brown biotite, chlorite, fine-grained cassiterite, pyrite, chalcopyrite, and arsenopyrite. The country rock is Elizabeth Creek Granite.

4. *Chlorite lodes.* Chlorite lodes are the most common type of tin lode in the Herberton/Mount Garnet area, and occur in both the Hodgkinson Formation and Elizabeth Creek Granite. The cassiterite in the chlorite lodes is generally fine-grained, averaging about 0.1 mm in diameter, but is occasionally much coarser, especially where associated with quartz veins, as at the Extended mine, Coolgarra. The chlorite in the lodes is dark green in hand specimen, and characteristically weathers reddish brown. Very fine-grained sericite, which alters to kaolinitic material on weathering, is commonly present, and may be as abundant as the chlorite. Four main types of chlorite lodes have been recognized.

Chlorite-quartz lodes in granite. These are common on Herberton Hill and at Watsonville. The lode material, known locally as 'black rock', consists of chlorite, blebs and small veins of quartz, cassiterite, sericite, sulphide minerals, fluorite and, in some instances, tourmaline.

Chlorite-topaz lodes. The only known occurrence is at the Sullivan mine, Watsonville. Here the cassiterite occurs with sulphide minerals in 'black rock' consisting of dark green chlorite, colourless topaz, sericite, and minor fluorite. The country rock is Elizabeth Creek Granite.

Chlorite-quartz lodes in sedimentary rocks. These account for more than half the total lode tin produced in the area. They occur in steeply dipping shear zones, many of which, like the greisen lodes, show up on air-photographs as dark lines representing relatively dense vegetation. The cassiterite is generally fine to very fine-grained, and is disseminated in chlorite and sericite and also in thin quartz veins which are very commonly associated with the chlorite. Pyrite is commonly present, but other sulphides are generally rare. Kaolinite, probably secondary after sericite, occurs in the oxidized zones of many lodes, as at the Summer Hill mine, Brownville. Other minerals in these lodes are calcite, tourmaline, fluorite, and brown biotite.

Chlorite-garnet lodes. Reddish brown garnet up to 5 mm in diameter is associated with chlorite, minor quartz, and cassiterite in lodes in sedimentary rocks in the Bakerville and Watsonville areas. Good examples were noted at the Vesuvius mine, Bakerville, and the Irish Girl mine, Watsonville.

5. *Quartz-tourmaline lodes.* Cassiterite-bearing quartz-tourmaline lodes are common in the Herberton 1-mile Sheet area, especially northwest of Bakerville, east of Irvinebank, and northeast of Emuford, but are rare in the Mount Garnet 1-mile Sheet area. They are almost entirely confined to sedimentary rocks. The tourmaline is dark greyish blue in thin section, and occurs either massive or in stellate clusters. This type of lode includes the 'streaky' lodes of Wyatts lease, Irvinebank, in which the lode material consists of thin alternating bands or streaks of quartz, tourmaline, and cassiterite. Pyrite and other sulphide minerals are generally absent in quartz-tourmaline lodes.

6. *Quartz lodes.* These lodes occur in both Elizabeth Creek Granite and Hodgkinson Formation, and consist of cassiterite-bearing quartz veins. The quartz is generally coarse-grained and vuggy, and the cassiterite commonly forms euhedral crystals which may be 5 mm or more in diameter. Small quantities of sulphide minerals are present in places. The largest mines developed on quartz lodes are the Peacemaker mine, Bakerville, which is in granite, and the Captain mine, Dry River, which is in sedimentary rocks. Most other quartz lodes have been only small producers. Many of the quartz lodes grade imperceptibly into chlorite-quartz and quartz-tourmaline lodes.

7. *Complex sulphide lodes.* In complex sulphide lodes the cassiterite is associated with pyrite, chalcopyrite, and other sulphide minerals, including stannite. Quartz is the main gangue mineral, but chlorite, fluorite, epidote, calcite, siderite, and sericite may also be present. The complex sulphide lodes are found in both granite and sedimentary rocks. Typical examples occur at the De Wett mine, Emuford, the Elizabeth and Bloodwood mines, Bloodwood Creek, the Brass Bottle mine, Hales Siding, and the North Australian mine, Watsonville.

8. *Calc-silicate(?) lodes.* At the Magnum Bonum mine, Silver Valley, cassiterite occurs in a lode consisting mostly of magnetite and hematite, with minor calcite, epidote, and fluorite. The lode occupies a shear zone. Dimmick & Cordwell (1959) suggested that the country rocks at the mine were altered basic and ultrabasic rocks, but it seems more probable that they are calc-silicate hornfelses.

Tungsten Deposits

Tungsten is common in many parts of the area, but has been mined in only small quantities. The most important occurrences are in the Geebung Hill, Glenlinedale, The Glen, and Nettle Creek areas of the Mount Garnet 1-mile Sheet area, and in the Bakerville, Emuford, and Watsonville areas of the Herberton 1-mile Sheet area.

Wolframite is the main tungsten ore mineral in the area, although scheelite has been recorded at several localities. Both minerals are mainly confined to the tungsten and tin mineral zones. Tungstite occurs as an alteration product of wolframite. Most of the tungsten lodes are in Elizabeth Creek Granite, although some occur in the Hodgkinson Formation close to the granite contacts. Many of the lodes are associated with a pale grey porphyritic variety of Elizabeth Creek Granite, in contrast to the pale pink non-porphyritic granite typically associated with the tin lodes.

The recorded production of wolframite in the area is about 3900 tons. However, this can be regarded as only an approximate figure, as production records are incomplete.

Five main types of wolframite lodes occur in the area.

Vertical to steeply dipping zoned greisen lodes in Elizabeth Creek Granite. These are the most common type of wolframite lode. The zoned greisens consist of outer zones of barren quartz-mica greisen, intermediate zones of mostly coarse lithium-bearing mica, and central cores of quartz and fluorite with only minor mica. Wolframite is most abundant in the central core, where it occurs as large crystals (over 1 cm across) commonly associated with small amounts of molybdenite, but it may also occur in the innermost part of the intermediate zone. Other minerals associated with wolframite are sulphide minerals, cassiterite, monazite, tourmaline, beryl, and uranium minerals. A typical example of a greisen lode worked for wolframite occurs at the Devon mine, Top Nettle Camp.

Flat-lying topaz greisen lodes. This type is mainly restricted to The Glen area, where the wolframite occurs with topaz in lodes up to 1.5 m wide formed along subhorizontal greisenized joints in Elizabeth Creek Granite. Associated with the topaz and wolframite are arsenopyrite, bismuthinite, chalcopyrite, fluorite, and quartz.

Quartz veins and pipes. These occur in greisenized Elizabeth Creek Granite and in shear zones cutting hornfelsed sedimentary rocks close to granite contacts. Associated minerals include arsenopyrite, beryl, cassiterite, fluorite, molybdenite, pyrite, and topaz. The largest deposit of this type in the area is probably at the Fingertown tungsten mine, Geebung Hill, where a quartz vein up to 6 m wide occurs at the contact of the granite and sedimentary rocks.

Chlorite lodes. Chlorite lodes containing wolframite are not common in this area, and the most important is probably that in hornfelsed sedimentary rocks of the Hodgkinson Formation at the Great Southern tin mine, Irvinebank. Here the wolframite forms scattered bladed crystals in a chlorite lode which has been worked primarily for cassiterite.

Copper Deposits

Copper minerals are widely distributed in the Herberton/Mount Garnet area, occurring in the Elizabeth Creek Granite, Hodgkinson Formation, and Featherbed Volcanics, and in all mineral zones. Some probably also occur in the Hammonds Creek Granodiorite. However, the only economic copper deposits are found in the copper mineral zone and in the outer part of the tin mineral zone. The principal copper minerals present in the area (Table 11) are chalcopyrite, bornite, covellite, chalcocite, cuprite, tenorite, malachite, and azurite. Native copper has been recorded at the Lancelot mine, Silver Valley. Silver is probably a significant impurity in many of the copper minerals, and most of the copper mines have produced silver as an important by-product.

Before production virtually ceased with the closing down of the Chillagoe smelters in 1943, copper had been produced from several parts of the area, the most important of which were the mining areas of Mount Garnet (notably the Mount Garnet copper mine), Herberton Dividing Range (e.g., Captain, Empress, Anniversary, and Yellow Jacket mines), Watsonville (e.g., United North Australian group of mines and the Consolation mine), Emuford (e.g., Mount Babinda mine), Bloodwood Creek (e.g., mines on the Siberia lode), Silver Valley (e.g., Westward Ho and Mulligan mines), and Hales Siding (e.g., Humbug mine).

None of the copper mines in the area was a large producer. The largest single mine is the Mount Garnet copper mine, which produced 4415 tons of copper between 1901 and 1903. This amount is less than the average monthly production at Mount Isa in 1964. Collectively the copper mines north of Herberton, which are known as the Copper Firing Line, were probably the greatest producers of copper, although production records are incomplete.

Three main types of economic copper lodes have been distinguished.

Complex sulphide lodes formed perhaps the most important economic copper deposits in the area. They occur along shears cutting sedimentary rocks and granite in the copper and outer part of the tin mineral zones. In the complex sulphide lodes copper sulphides are associated with other base-metal sulphides in a gangue of mostly quartz and chlorite. Good examples of this type of lode occur at the mines on the Copper Firing Line north of Herberton.

Calc-silicate lodes occur in the copper mineral zone at the intersection of faults with calc-silicate lenses within the Hodgkinson Formation. In addition to various copper minerals, such lodes also contain lead and zinc sulphides. The main calc-silicate lode in the area is at the Mount Garnet copper mine, Mount Garnet.

Quartz lodes containing economic deposits of copper minerals are confined to the copper mineral zone. The lodes occur in shear zones cutting Elizabeth Creek Granite and, more commonly, sedimentary rocks of the Hodgkinson Formation. Arsenopyrite, pyrite, galena, and sphalerite are common associates. Many lodes of this type have been worked in the area, examples including the Mount Babinda mine, Emuford, and the Atlanta mine, Stannary Hills.

SILVER-LEAD DEPOSITS

Economic deposits of silver-lead ore are confined to the lead mineral zone, although galena, the principal silver-lead ore mineral, has a wide distribution, and is found in all mineral zones. Almost all the silver-lead production has come from the Herberton 1-mile Sheet area, mostly from the Montalbion and Silver Valley areas, where the lodes occur in the Hodgkinson Formation, and the Weinert area, where the country rocks are Featherbed Volcanics.

The deposits that have been worked economically are pipe or lens-like bodies associated with quartz veins in shear zones. The lodes consist of argentiferous galena and, in oxidized zones, anglesite, ceragyrite, cerussite, native silver, and pyromorphite. These minerals are associated with sphalerite and secondary zinc minerals. Accessory minerals commonly include pyrite, chalcopyrite, and secondary copper minerals. Quartz is generally the only gangue mineral present.

In addition some small silver-lead deposits are associated with calc-silicate lenses in the Hodgkinson Formation. None of these deposits has proved economic.

OTHER DEPOSITS

Antimony: Small quantities of stibnite have been mined at several widely scattered localities in the area, the lodes occurring in Elizabeth Creek Granite, Featherbed Volcanics, and Hodgkinson Formation. The main occurrences are northeast of

Herberton, northwest of Emuford, and northeast of Top Nettle Camp. The ores consist of long bladed crystals of stibnite, partly oxidized to cervantite, in a gangue of massive quartz. The lodes occupy shear zones.

Bismuth: Bismuthinite, bismutite, and native bismuth occur at several mines in the tungsten and tin mineral zones, especially in Elizabeth Creek Granite. The main occurrence is probably at The Glen. Most of the bismuth produced in the area has been recovered as a by-product from tungsten ores.

Diatomite: An occurrence of diatomite associated with basalt near Innot Hot Springs was recorded by Crespin (1947), who stated that the diatomite was of fairly good grade for filtration purposes. This occurrence was not found during the present survey.

Fluorite: Fluorite is a ubiquitous accessory mineral in Elizabeth Creek Granite, and is a common gangue mineral in many tungsten and tin lodes, both in granite and sedimentary rocks. However, it has been produced in large amounts at only one mine in the area, the Mistake mine, Emuford. Here it occurs with wolframite and minor quartz in a vertical shear zone cutting Elizabeth Creek Granite. Fluorite has also been mined at Stannary Hills (in 1917) and near Brownville.

Gold: Gold has been mined at Gurrumba and Mount Garnet. At Gurrumba gold was recovered from the Mount Luxton mine, where it occurs in quartz veins associated with a northeast-striking fault separating fine-grained sandstone of the Hodgkinson Formation from intrusive diorite. At Mount Garnet gold occurs in quartz veins cutting Precambrian quartzite and schist: here the main occurrence is at the Golden Prospect mine, where 185 oz of gold and 217 oz of silver were produced from 247 tons of ore in the period 1932 to 1934 (Zimmerman et al., 1963).

Limestone and calcite: Several lenses of limestone occur within the Hodgkinson Formation (Fig. 4), but are probably too small to be of economic importance at present. Some of the limestone in the Silver Valley area has been worked for use as a flux. Minor amounts of calcite have been mined northwest of Weinert, where the calcite forms veins cutting Featherbed Volcanics.

Iron: Small deposits of hematite and magnetite are associated with some of the calc-silicate rocks of the Hodgkinson Formation close to the contact of the Elizabeth Creek Granite. Some of these deposits have been worked for fluxing ore, as at the Glencoe and Magnum Bonum mines, Silver Valley. Hematite has also been mined by Tableland Tin Dredging NL for jigging alluvial cassiterite.

Mica: The only recorded production of mica was in 1958, when 10 tons were mined, probably from a mine near the headwaters of Bloodwood Creek. Although mica is a major constituent of the greisens that are associated with the Elizabeth Creek Granite, very little appears to be suitable for commercial purposes.

Molybdenum: Molybdenite occurs as an accessory mineral in many tungsten and some tin lodes in Elizabeth Creek Granite, but has not been found in sufficient quantities to warrant mining on a commercial scale. The molybdenum production shown in Table 13 was probably obtained as a by-product from tungsten ores.

Monazite: Some lodes in Elizabeth Creek Granite contain accessory monazite (e.g., Devon mine, Top Nettle Camp), and monazite is recovered by the tin dredges at Mount Garnet. However, quantities appear to be too small to be economically important.

Zinc: Sphalerite is common at most mines in the lead mineral zone, and also occurs as an accessory mineral in many lodes in other mineral zones. It has been mined recently at the Isobel mine, north of Herberton, but no production figures are available: the sphalerite at this mine is probably too rich in iron to be of value (46% FeS found in one sample by K. R. Walker, BMR).

DESCRIPTION OF MINING AREAS

The mines and prospects in the Herberton/Mount Garnet area have been grouped into 34 mining areas, each of which has been given a name. Of these areas 18, labelled A to R, occur in the Herberton 1-mile Sheet area, and 16, labelled I to XVI, occur in the Mount Garnet 1-mile Sheet area. The mining areas and the most important mines within them are shown on the 1 inch to 1 mile geological maps, and the locations of all mines and prospects found are shown on Plates 17 and 18. Some mines lying just outside the 1-mile Sheet areas have been included within the mining areas.

The mines and prospects within each mining area have been allotted reference numbers, the keys to which are given in Tables 17 to 50, in which the descriptions of the mines and prospects are tabulated. Abbreviations used in these tables are explained in Table 16. Production figures, where quoted, have been obtained from the returns published in the Annual Reports of the Queensland Department of Mines. Unfortunately, the returns are not always related to individual mines, and in some cases these returns are also complicated because some of the mines were known by more than one name, or different mines were known by the same name.

Brief accounts of the mining areas are given in the following pages. Individual mines, when first mentioned, are followed by their reference numbers as suffixes.

Emuford area (Table 17, p. 140; area A, Pl. 17)

Mines in the Emuford area have produced tin, tungsten, copper, and fluorite. The mineral deposits occur in the Elizabeth Creek Granite and in rocks of the Hodgkinson Formation, and lie within the tungsten, tin, and copper zones.

The Elizabeth Creek Granite crops out in the hilly southern part of the area, where bouldery and rocky outcrops are the rule. The granite is generally a pale pink coarse-grained variety, with abundant aplite and greisen. The abundance of greisen indicates that the granite exposed here probably represents the roof zone of the granite batholith. The intrusive contact of the granite dips gently northward under steeply dipping sedimentary rocks of the Hodgkinson Formation to the north and east. However, for most of its length the contact of the granite and the Hodgkinson Formation is marked by a fault downthrown to the north and east. An acid dyke has been intruded along this fault.

The Hodgkinson Formation, which consists of greywacke, sandstone, siltstone, shale, and minor conglomerate, has been thermally metamorphosed for up to 1.5 km from the nearest granite outcrop. Chlorite, tourmaline, and quartz are the characteristic minerals within the thermal aureole. The sedimentary rocks are cut by acid dykes, most of which are extensively chloritized; the chloritization is due to thermal metamorphism and metasomatism and indicates that the dykes are probably older than the granite. The dykes may be related to the Featherbed Volcanics which unconformably overlie the Hodgkinson Formation to the north.

The mineralization in the granite occurs in greisen and quartz lodes and in massive greisens. In the sedimentary rocks the mineralization is associated with shear zones, some of which can be traced for 1.5 km. The longest shears are those of the A1 and Johnny Walker lines. Four types of lode have been recognized: chlorite, quartz-tourmaline, quartz, and complex sulphide lodes. Most of the lodes, both in the granite and sedimentary rocks, strike between west-northwest and north and dip steeply westwards. The ore minerals are generally concentrated in small irregular pipe-like bodies located within the lodes.

Tin was discovered in the Emuford area in the 1880s, and most of the mines were opened up before 1890. However, within a few years the rich near-surface deposits were worked out, and few of the mines appear to have been worked after 1910. Since 1960 mining activity has increased, and some mines have been re-opened, the most important being the *De Wett*[7].

As records are incomplete the total tin production of the area can only be roughly estimated. It is probably about 1250 tons of tin oxide, the main producing mines being the *Brown Snake*[10], *Denford*[187], *De Wett, Gem*[40], *Ivy*[50], and *Royal Standard*[150-1] (one of the oldest mines in the area). At the Ivy mine, which has been worked to a depth of 35 m, a quartz-chlorite lode passes downwards at 32 m into a complex sulphide lode consisting of stannite, pyrite, pyrrhotite, marcasite, arsenopyrite, chalcopyrite, covellite, galena, sphalerite, bismuthinite, cassiterite, and bismuth (Edwards, 1951). Tungsten and copper production in the area is very much subordinate to tin. The main tungsten mine is the *Mystery*[28], which was worked to a depth of 55 m. Most of the copper produced has come from the *Mount Babinda*[1-4] mines, also known as *Copper Hill, Morefield, Copperfield,* and *Combination,* at which oxidized ores in shear zones were worked sporadically up to 1937: no production figures are available. Fluorite has been produced only at the *Mistake*[14] mine: the lode at this mine is 150 m long on the surface and up to 3 m wide; it has been worked to a depth of over 45 m for fluorite and wolframite.

Bloodwood Creek area (Table 18, p. 148; area B, Pl. 17)

In the Bloodwood Creek area tin, copper, lead, antimony, and mica mines are situated in the tin, copper, and lead mineral zones. The mines occur in Elizabeth Creek Granite, in sedimentary rocks of the Hodgkinson Formation, and in Featherbed Volcanics. Lode tin production for the area is estimated at 150 tons of tin oxide.

Elizabeth Creek Granite in the southern part of the area passes northwards under steeply dipping rocks of the Hodgkinson Formation which have been thermally metamorphosed for up to 1 km from the granite contact. A near-vertical northeast-striking fault, marked by a line of prominent hills, the Elizabeth Bluffs, crosses the outcrop of the Hodgkinson Formation; it separates thin-bedded sandstone, siltstone, and shale to the southeast from massive greywacke and sandstone to the northwest. The thin-bedded rocks immediately adjacent to the fault have been silicified, and now consist of chert. In the north the sedimentary rocks are overlain unconformably by the Featherbed Volcanics.

The mineralization in the Elizabeth Creek Granite occurs in greisen lodes, and that in the sedimentary rocks in quartz-chlorite, quartz, and complex sulphide lodes. The only mine in the Featherbed Volcanics is the *Antimony Reward*[1], which is probably the largest antimony mine in the Herberton/Mount Garnet area: the lode consists of stibnite and quartz filling a shear zone that dips 35° north-northwest. The main tin mines are the *Bloodwood*[11] and *Elizabeth*[10], both of which are on complex sulphide lodes. Most of the copper produced (amount unknown) has come from the Siberia lode[28-35] (Jensen, 1939): this lode, which is over 2 km long, consists of two east-west shears dipping 25° to 40°N; clean copper ore in the upper part of the lode gives way below the watertable to complex ore consisting of copper, arsenic, iron, lead, and zinc sulphides.

Montalbion area (Table 19, p. 150; area C, Pl. 17)

Mines in the Montalbion area were worked for silver and lead. They occur in steeply dipping pale grey sandstone and minor interbedded shale of the Hodgkinson Formation and in Featherbed Volcanics.

The Montalbion mines have been described by Skertchley (1897), Lees (1907), Saint-Smith (1916c), Jensen (1939), Dimmick & Cordwell (1959), and Syvret (1963b). The lodes were discovered in 1885, and by 1895 1,583,693 oz of silver had been recovered from 39,170 tons of ore (Skertchley, 1897). The ores consist of a variety of lead, silver, copper, and zinc minerals, associated with quartz veins, and they form lenticular and pipe-like bodies situated along breccia zones. Cinnabar has also been recorded (Berge et al., 1900). Most of the silver came from the zone of secondary enrichment which bottomed at 15 to 20 m. The main mines are the *Albion*[4], *Barossa*[6], *Lady Jane* No. 1[1] and No. 2[2], and *Rio Tinto*[5], all of which are situated on Montalbion itself (Pl. 14, fig. 1).

Adventure Creek area (Table 20, p. 152; area D, Pl. 17)

Tin, silver, lead, and minor copper have been won in the Adventure Creek area. Most of the mines occur in steeply dipping and much faulted greywacke, sandstone, siltstone, and shale of the Hodgkinson Formation, and only a few occur in Elizabeth Creek Granite, which intrudes the Hodgkinson Formation in the southern part of the area.

The lodes are situated in the tin and lead mineral zones. The copper mineral zone appears to be very narrow and poorly developed, and very little copper has been produced in the area. Lead minerals are common in many of the tin lodes, and one mine, the *Silver Queen*[9], has been worked for tin, silver, and lead: at this mine tin ore at shallow depth passed downwards into silver-lead ore. The majority of the orebodies occur in quartz-chlorite and quartz lodes associated with steeply dipping shear zones, most of which have a west-northwest to north strike.

Total tin production for the Adventure Creek area is estimated at 2000 tons of tin oxide, the largest producer probably being the *Rainbow*[24] mine, which has produced more tin since 1950 than any other mine in the Herberton Tinfield.

Stannary Hills area (Table 21, p. 156; area E, Pl. 17)

Mines in the Stannary Hills area occur in the tungsten, tin, copper, and lead mineral zones, and have been worked for tin, tungsten, copper, silver, lead, and, in 1917, fluorite. Only tin has been produced in large quantities, the total production being estimated at 5000 tons of tin oxide. Three mines, the *Ivanhoe*[56], *Lass O'Gowrie*[30] and *Kitchener*[44,45], have each produced over 400 tons of cassiterite.

In this area steeply dipping greywacke, sandstone, siltstone, and shale of the Hodgkinson Formation are unconformably overlain in the west by bedded tuff and welded tuff of the Featherbed Volcanics, and are intruded in the northeast by the Elizabeth Creek Granite, in the south by Hales Siding Granite, and in the east by quartz-feldspar porphyry mapped as Featherbed Volcanics. Atlanta Granite and unnamed dioritic rocks crop out in the northeast, where they appear to intrude

Elizabeth Creek Granite, and unnamed granitic rocks crop out in Bocks Creek. Several large and innumerable small faults occur in the area.

Mineralization is confined to the Elizabeth Creek Granite, the Hodgkinson Formation, and the Featherbed Volcanics. Greisen and quartz lodes occur in the Elizabeth Creek Granite, and quartz, quartz-chlorite, and complex sulphide lodes occur in the Hodgkinson Formation. Only two lodes, both with quartz gangue, are present in the Featherbed Volcanics. Stannite has been recorded at the *Ivanhoe* and *Lass O'Gowrie* mines (Edwards, 1951).

Tin deposits were discovered at Stannary Hills in 1884, and a battery erected on Eureka Creek began crushing ore in 1888. The boom period for the area was between 1900 and 1910, when Stannary Hills had a population of several hundred people (Table 14). During this period tramways of 60 cm gauge connected Stannary Hills with Boonmoo (completed 1902) on the Mareeba-Chillagoe railway, and with Irvinebank (completed 1907). The battery on Eureka Creek ceased working in 1893, and another battery, the Rocky Bluff battery (Cleland, 1907; Herman, 1914), was built on the Walsh River, and operated between 1903 and 1925. A small battery also operated near the *You and Me*[41] mine between 1921 and 1924. After a period during which little mining was carried out, activity has recently increased, and prospecting and exploratory diamond drilling have been carried out at several mines by Metals Exploration NL and North Broken Hill Ltd.

Weinert area (Table 22, p. 162; area F, Pl. 17)

The lodes in the Weinert area are in the lead mineral zones, and occur in porphyritic acid pyroclastics belonging to the Featherbed Volcanics. Two small mines in the northwest have been worked for calcite, but elsewhere only silver-lead ores have been mined. The lodes are associated with shear zones, most of which strike between northeast and east-southeast and dip 35° to 90° south. The ore-bodies consist of high-grade silver-lead ores, mostly galena and lead carbonates, down to water level, and complex sulphide ores below water level (Morton, 1936b).

The silver-lead ores were discovered in 1886 and a small mining settlement was established at Orient Camp. Production ceased about 1924, and now most of the mine workings are collapsed and partly flooded. The area probably produced less silver and lead than the mines at Montalbion, but no production figures are available.

The main mines in the area are *Weinert*[9,10], *East Orient*[31], and *Nannum Amalgamated*[35].

Hales Siding area (Table 23, p. 164; area G, Pl. 17)

In the Hales Siding area there are tin and copper mines, situated in the tin and copper mineral zones. Total tin production is estimated at 1000 tons tin oxide. The oldest mine is probably the *Star of the South*[39], which was being worked in 1893. A battery erected at this mine in 1894 closed down in 1902. The main mines are the *Brass Bottle*[14], *Consolidated*[16], *Perseverence*[10], and *Star of the South.*

Some of the mines occur in the Elizabeth Creek Granite, but most are in Hodgkinson Formation, which here consists of steeply dipping greywacke, sandstone, siltstone, shale, and interbedded limestone lenses. In the southwest these rocks have been folded about a northerly striking anticlinal axis, in the east they are intruded and thermally metamorphosed by the Elizabeth Creek Granite, and in the north they are intruded by the unmineralized Hales Siding Granite. In the west the Hodgkinson Formation is unconformably overlain by the Featherbed Volcanics, which in this area are unmineralized.

The orebodies occur in chlorite, quartz, quartz-tourmaline and complex sulphide lodes associated with shear zones. Complex sulphide lodes occur at the *Brass Bottle* and *Consolidated* mines. At the *Brass Bottle* pipe-like orebodies consist of cassiterite, arsenopyrite, chalcopyrite, galena, jamesonite, marcasite, pyrite, native bismuth, pyrrhotite, sphalerite, stannite, and secondary ore minerals in a gangue of siderite, calcite, quartz and 'muscovite' (Edwards, 1951). The complex ore at the *Consolidated* consists of cassiterite and sulphides and carbonates of copper, iron, and zinc in a gangue of quartz and calcite (Edwards, 1951).

Irvinebank area (Table 24, p. 166; area H, Pl. 17)

Almost all the mines in the Irvinebank area, the main lode-tin producing area in the Herberton Tinfield, have been worked for tin. The only exceptions are two copper mines in the northwest, some lead prospects in the west, and an antimony prospect in the south; in addition small quantities of tungsten have been recovered from tin lodes at the *Vulcan*[83], *Great Southern*[164], and *Red King*[165] mines. The total production of lode tin from the area is estimated at 25,000 tons tin oxide, of which over 13,000 tons came from the *Vulcan* mine, the largest mine in the Herberton Tinfield. The other main mines are the *Governor Norman*[109], and *Great Southern*[164], both of which have produced over 1000 tons of tin oxide, and the *Tornado*[65], the oldest large mine in the area, which has produced over 500 tons of tin oxide.

The rocks cropping out in the area consist of steeply dipping and much faulted greywacke, sandstone, siltstone, shale, and minor calc-silicate hornfelses belonging to the Hodgkinson Formation. These rocks have been tightly folded about a north to north-northeast trending syncline, the axis of which passes just west of Irvinebank. The Elizabeth Creek Granite does not crop out in the area, but underlies the sedimentary rocks at shallow depth in the south and east, where the sedimentary rocks are extensively thermally metamorphosed. Tourmaline is the characteristic mineral of the thermal aureole.

The orebodies are mostly pipe-like and are associated with shear zones. They occur in quartz-tourmaline, quartz, chlorite, and minor complex sulphide lodes. Some of the lodes, such as those of *Wyatts Lease*[95-98], consist of banded streaky ores in which cassiterite is associated with quartz and tourmaline. The orebody at the *Vulcan* mine occurs in a chlorite-quartz lode and is pipe-like with an irregular left-hand spiral plunging steeply southwest; it consists of cassiterite, magnetite, and minor galena, chalcopyrite, bismuthinite, pyrite, and wolframite (Mason, 1953).

A complex sulphide lode occurs at the *Gordon*[23] mine, where the ore consists of arsenopyrite, bismuthinite, cassiterite, chalcopyrite, marcasite, pyrrhotite, pyrite, stannite, and secondary carbonates in chlorite gangue (Edwards, 1951).

Tin deposits were discovered at Irvinebank by Gibbs, Thompson, and McDonald in 1882 and immediately attracted many miners to the area. Shortly before this discovery, lode tin had been found at the *Jumna*[7] mine. By 1890 Irvinebank had taken over from Herberton as the main lode-tin mining centre of the Herberton Tinfield, a position it has maintained to the present day. Between 1905 and 1910 over 1000 people lived at Irvinebank; the population reached a maximum of 1918 in 1907. A battery began crushing ore in the town in 1885, a tin smelter was erected in 1894, and a tramway connecting Irvinebank with Stannary Hills, and hence with Boonmoo and the Mareeba-Chillagoe railway, was completed in 1907, all under the supervision of John Moffat. Part of the successful development of Irvinebank was undoubtedly due to the success of the *Vulcan* mine, which began working in 1891, after the discovery of the lode in 1888.

Upper Emu Creek area (Table 25, p. 174; area I, Pl. 17)

Mines in the Upper Emu Creek area have mostly been worked for tin, although small amounts of tungsten have also been obtained. The mines occur in the tin mineral zone, the only zone recognized here. The total production of lode tin in the area is estimated at 500 tons tin oxide. The largest mine is probably the *Fanny Parnell*[14].

The tin deposits were discovered in 1883, and tin lodes were first worked the same year. Alluvial tin deposits also occur in the area, and have been worked intermittently since 1888.

The lodes occur in thermally metamorphosed sedimentary rocks of the Hodgkinson Formation, which crop out over most of the area, and in Elizabeth Creek Granite, which crops out in the east. The granite underlies the metamorphosed sedimentary rocks at shallow depth. Quartz-chlorite, quartz, quartz-tourmaline, and greisen lodes are present.

Arbouin area (Table 26, p. 176; area J, Pl. 17)

Tin and minor silver, lead, and antimony have been mined in the Arbouin area from quartz and chlorite lodes in the Hodgkinson Formation and Elizabeth Creek Granite. All but one of the mines occur in the southwest, the exception being an antimony mine on the east side of the Walsh River north of Collins Weir. The area has produced about 1500 tons of tin oxide, most of which has come from the *Arbouin*[4] mine. At this mine a low-grade chloritic lode, discovered in 1900, is associated with a series of shears.

In the southwest, sedimentary rocks of the Hodgkinson Formation are unconformably overlain by, and faulted against, bedded and massive tuffs belonging to the Featherbed Volcanics. The sedimentary rocks are intruded and thermally metamorphosed by the Elizabeth Creek Granite, which in turn is intruded by the Watsonville Granite in the southeast and east, and by the Atlanta Granite in the northwest. The Walsh Bluff Volcanics in the northeast unconformably overlie the Elizabeth Creek Granite and are intruded by the Watsonville Granite.

Bakerville area (Table 27, p. 178; area K, Pl. 17)

Tin and small amounts of tungsten, copper, silver, and lead have been mined in the Bakerville area. The mineralization occurs in steeply dipping greywacke, siltstone, and shale of the Hodgkinson Formation and in Elizabeth Creek Granite, in the tungsten, tin, copper, and lead mineral zones. Both the Hodgkinson Formation and Elizabeth Creek Granite are intruded by the Watsonville and Hales Siding Granites and the Bakerville Granodiorite. Several large faults have been mapped in the area.

The orebodies occur in quartz-tourmaline, chlorite-garnet, quartz, and greisen lodes, most of which are associated with shear zones.

Lodes in the Bakerville area have been worked since 1883, and to date about 2000 tons of tin oxide have been produced. A battery was built in 1891 at Redmont, near the *Reliance*[40] mine, and another battery was built at the *New Era*[53] mine in 1904; both are now in ruins. The main mines in the area, all tin mines, are *Bakers*[48], *Etna*[37], *New Era*[53], *Peacemaker*[22], *Pompeii*[43], *Reliance,* and *Vesuvius*[44].

Dargo Range area (Table 28, p. 182; area L, Pl. 17)

All but one of the mines in the Dargo Range area occur in hornfelsed sedimentary rocks of the Hodgkinson Formation (mapped as gneisses by Jensen, 1939), in the tin mineral zone, and have been worked for tin. The exception is a small tungsten mine situated in Elizabeth Creek Granite in the northeast. The sedimentary rocks are hornfelsed by the Elizabeth Creek Granite, which crops out in the north and south and underlies the sedimentary rocks at shallow depth throughout the rest of the area. Quartz-tourmaline lodes predominate, although chlorite and quartz lodes are also present.

The Dargo Range has produced an estimated 500 tons of tin oxide. The earliest record of tin production was in 1897. The main mines in the area are the *Alexandra*[27], *Endeavour*[29], *Native Bee*[36], and *Sailor Boy*[8].

Mount Nolan area (Table 29, p. 184; area M, Pl. 17)

Tin and copper mines occur in the Mount Nolan area in sedimentary rocks of the Hodgkinson Formation and in Elizabeth Creek Granite, in the tin and copper mineral zones. Total production of lode tin is estimated at 1000 tons tin oxide. The main mines are *Hadleigh Castle*[3], which was working in 1895, and *Mount Nolan*[18-20].

Tightly folded greywacke, sandstone, siltstone, and shale of the Hodgkinson Formation are overlain unconformably by the mostly flat-lying Silver Valley Conglomerate, which is overlain in turn, possibly conformably, by the Glen Gordon Volcanics. Elizabeth Creek Granite crops out in the north, where it intrudes the the Hodgkinson Formation, and is itself intruded by some irregular dioritic bodies. Several acid dykes that occur are probably related to the Glen Gordon and Slaughter Yard Creek Volcanics. Three steeply dipping major faults have been mapped, two trending north-northeast to northeast, and one east to southeast; they displace the Hodgkinson Formation, Silver Valley Conglomerate, Glen Gordon Volcanics, and Elizabeth Creek Granite.

Four main types of lode are present: quartz-chlorite, quartz, greisen, and complex sulphide lodes.

Silver Valley area (Table 30, p. 186; area N, Pl. 17)

Silver, lead, copper, tin, limestone, and ironstone have been mined in the Silver Valley area, from lodes situated in the Hodgkinson Formation and Elizabeth Creek Granite, in the tin, copper, and lead mineral zones.

In 1880 rich silver-bearing copper and lead ores were found in the Silver Valley area by J. V. Mulligan. This discovery attracted many miners to the area, and led to the establishment of the now deserted township of Newellton. A smelter to process the ores was erected in 1883 on the Dry River southeast of the township, but ceased operating in 1886, when most of the rich near-surface ores were worked out. One of the old mines probably working at this time is shown in Plate 14, figure 2. In 1893 the Lancelot tin lode was discovered by G. Harrod, and two years later the *Lancelot*[14,15] mine was opened. This led to a revival of interest in the area. However, the *Lancelot* mine closed in 1915, and most of the local miners left the area. After World War I several copper mines were opened up, the most important being the *Agnes*[55], *Lanette*[37], and *Westward Ho*[69-71], but these had ceased operating by 1941. In 1966 there were no working mines in the area. Total tin production is estimated at 1300 tons tin oxide, most of which has come from the *Lancelot* mine.

The geology of the area was first described in detail by Stirling (1905). Later accounts have been given by Reid (1932e), Jensen (1939), Dimmick & Cordwell (1959), and Syvret (1963b).

The Silver Valley area is divided into two parts by a major north-south fault downthrown to the east. Elizabeth Creek Granite and hornfelsed sedimentary rocks of the Hodgkinson Formation occur on the west side of the fault, whereas on the east side unmetamorphosed interbedded greywacke, siltstone, shale, and minor limestone lenses of the Hodgkinson Formation, crop out. The unmetamorphosed rocks are tightly but irregularly folded (Pl. 2, fig. 2), and are generally steeply dipping. They are unconformably overlain by the Silver Valley Conglomerate in the northeast. The Glen Gordon Volcanics crop out in the east. They unconformably overlie the Hodgkinson Formation and overlie, possibly conformably, the Silver Valley Conglomerate, but the contacts are generally obscured by faulting. Irregular bodies of grey porphyritic microgranite intrude the Silver Valley Conglomerate and Hodgkinson Formation, and numerous acid dykes occur throughout the area. Some of these dykes are cut by, and hence predate, the lodes (Reid, 1932), and are probably related to the Glen Gordon Volcanics.

The orebodies occur in quartz, quartz-chlorite, greisen, complex sulphide, and calc-silicate lodes associated with shear zones, most of which are steeply dipping and strike between 090° and 180°.

The ore at the *Lancelot* mine occurs in a complex sulphide lode, and consists of cassiterite, arsenopyrite, native bismuth, chalcopyrite, galena, pyrite, sphalerite, stannite (Edwards, 1951), and wolframite in a gangue of quartz and chlorite.

Watsonville area (Table 31, p. 190; area O, Pl. 17)

The lodes in the Watsonville area have produced tin, copper, and silver, and occur in the Hodgkinson Formation and Elizabeth Creek Granite, in the tin and copper mineral zones. Total tin production was estimated by Wade (1937) as at least 6000 tons of tin oxide, although only about 4500 tons can be accounted for from production records. The main mines are the *North Australian*[17] (Pl. 15, fig. 2), *Stewarts T. Claim*[55], *Great Western*[81], *Boundary*[86], and *King of the Ranges*[53], each of which has probably produced over 500 tons of tin oxide. A number of mines, including most of the *United North Australian* group, have been worked for both tin and copper.

The area was opened up about 1881 by R. Watson, R. Dougherty, and C. Conley (Lees, 1907), and by 1883 two batteries were operating—the Bischoff battery on the Walsh River and a battery at the *Great Western* mine. In 1909 a battery and dam were constructed on Jamie Creek at the *North Australian* mine. All three batteries have long been disused: the last battery to be worked, that on Jamie Creek, ceased operating in 1929. Most of the tin won in the area was obtained before 1900. Two important new lodes were discovered in the 1940s—the *Elaine Mary*[85] in 1946, and the *Little Western*[83] in 1947. Geophysical surveys followed by diamond drilling were carried out at the *United North Australian* group of mines by AGGSNA in 1938 (Thyer et al., 1939b), by Carpentaria Exploration Co. in 1961 (Syvret, 1963a) and by the Bureau of Mineral Resources in 1964 (Sedmik, 1967). These surveys, which used electromagnetic, self potential, electrical potential, magnetic, and induced polarization methods, failed to find any new areas of significant mineralization.

Several geologists, in particular Jack (1883), Skertchley (1897), Wade (1937), Jensen (1939), and Syvret (1963a), have worked in the area, and have described the geology and most of the mines.

Interbedded greywacke and siltstone crop out in the central part of the Watsonville area. These rocks are folded and much faulted, and have been intruded by acid porphyries belonging to the Slaughter Yard Creek Volcanics and by the Elizabeth Creek and Watsonville Granites. The Elizabeth Creek Granite, which is responsible for the mineralization, crops out in the south, and the Watsonville Granite, which is unmineralized, in the north. A massive rhyolite flow belonging to the Slaughter Yard Creek Volcanics occurs in the northeast. Acid porphyries of the Slaughter Yard Creek Volcanics intrude the Elizabeth Creek Granite, and are themselves intruded by the Watsonville Granite, the youngest rock in the area. The Elizabeth Creek Granite is extensively chloritized and sericitized in the mineralized area, and this alteration, which does not affect the Slaughter Yard Creek Volcanics and Watsonville Granite, is probably related to the mineralization. Both the Hodgkinson Formation and Elizabeth Creek Granite are cut by numerous acid dykes which are also unaffected by the alteration, and are thought to be related to the Slaughter Yard Creek Volcanics, and hence to be later than the mineralization. Although many lodes are cut off by dykes, the dykes were previously considered to predate or overlap with the period of mineralization (Wade, 1937; Jensen, 1939; Syvret, 1963a,b), because at the *Stewarts T. Claim* mine a thin streak of ore passes through a dyke, and at the *Irish Girl*[49], and also possibly at the *Elaine Mary* (Ridgway, 1946), tin occurs within a dyke. However, the presence of tin in some of the dykes could be due to local remobilization of lode material during the period of dyke intrusion.

Five main types of lode are present—quartz, quartz-chlorite, chlorite, and complex sulphide—all of which commonly contain abundant sericite. The lodes are typically pipe-like and most, if not all, are associated with shear zones. Complex sulphide lodes at the *United North Australian* group of mines appear to have kaolinite, possibly as an alteration product of sericite, as the main gangue mineral. Copper and iron sulphides are common throughout the mineralized area, but galena and sphalerite are rare. Many of the 'clean' tin lodes grade into complex sulphide lodes at depth. Copper generally shows secondary enrichment at the watertable. At the *Consolation*[2] mine, for instance, copper carbonates and cassiterite occur near the surface and sulphides occur at depth (Edwards, 1951).

Stella area (Table 32, 194; area P, Pl. 17)

Mines in the Stella area have produced about 500 tons of tin concentrate and small quantities of copper and silver. The main producer has been the *Stella*[8], from which nearly 400 tons of tin oxide have been won.

Most of the mines are situated in the Hodgkinson Formation, which crops out as two partly fault-bound inliers surrounded by Kalunga Granodiorite, Elizabeth Creek Granite, and Slaughter Yard Creek Volcanics. In the southwest two mines occur in Elizabeth Creek Granite, one of which was worked for tin, and the other, to the south, for copper and silver.

The lodes occur in the tin mineral zone, and are of two main types, quartz and quartz-tourmaline. The lode at the *Stella* mine, which was discovered in 1910, has been worked to a depth of 58 m; from 0 to 40 m for tin, and from 40 to 58 m for copper and silver.

Herberton Dividing Range area (Table 33, p. 196; area Q, Pl. 17)

Tin, copper, silver, and small amounts of tungsten, lead, zinc, and antimony have been mined in the Herberton Dividing Range area, from lodes in the tin, copper, and lead mineral zones.

The lodes occur in thermally metamorphosed sandstone, siltstone, and shale of the Hodgkinson Formation and in Elizabeth Creek Granite. Also cropping out are Kalunga Granodiorite, Slaughter Yard Creek Volcanics, and Watsonville Granite, all of which are unmineralized. Conglomerate exposed on top of Specimen Hill west of Herberton has been included tentatively within the Slaughter Yard Creek Volcanics. The Elizabeth Creek Granite intrudes the Hodgkinson Formation, and is itself intruded by the Slaughter Yard Creek Volcanics and Watsonville Granite.

The tin mines occur in the southern part of the area, west of Herberton and south of the Copper Firing Line. Many of the mines were worked when the Herberton Tinfield was first opened up, and were described in 1883 by R. L. Jack. Probably none of the mines has produced more than 50 tons of tin oxide, and the total tin production is estimated at only 300 tons of cassiterite concentrate. Most of the orebodies occur in quartz and quartz-chlorite lodes.

Most of the copper and silver has come from the mines of the Copper Firing Line, situated north of Herberton. Collectively these mines are probably the main copper producers in the Herberton Tinfield, producing several thousands of tons of copper between 1909 and 1943, when production ceased owing to the closing down of the smelters at Chillagoe. The copper occurs in narrow quartz lodes, the upper and richest parts of which are now largely worked out. Several of the copper mines have been described by Jensen (1939) and Syvret (1963b). Production figures for individual mines are either incomplete or not available. The largest producers of copper were probably the *Anniversary*[58], *Captain*[19], *Empress*[35], and *Yellow Jacket*[41] mines.

Tungsten has been won from mines at the northern end of the Copper Firing Line; lead, zinc, and silver have been obtained from the *Isabel*[77] mine; and antimony has been mined in the northeast corner of the area.

Herberton Hill area (Table 34, p. 200; area R, Pl. 17)

The mines in the Herberton Hill area have produced tin and small amounts of tungsten. The lodes occur in Elizabeth Creek Granite, in the tin mineral zone. The total tin production is estimated at 15,000 tons of tin oxide, the main producers being the *Great Northern Gully*[5] and *Great Northern East*[6] lodes, each of which has produced about 2500 tons tin oxide; the *Wild Irishman*[93], 2300 tons tin oxide; the *Old Bradlaugh*[103], 1400 tons tin oxide; and the *Old Monarch,* 1000 tons tin oxide. Several other mines in the area have produced more than 100 tons tin oxide. Most of the tin was produced before 1900.

The *Great Northern Gully* lode, discovered in 1880 by J. Jack, J. Newell, T. Brandon, and J. Brown, was the first tin lode found in the Herberton Tinfield. By

1883 most of the mines in the area had been opened up and were described in a report by R. L. Jack (1883). In this year three batteries existed at Herberton: the Great Northern Battery on the Wild River, operated by the Herberton Tin Co., a battery on Nigger Creek operated by the Monarch Co., and a smaller battery operated by Co-operative Tin Crushing Co. However, the initial boom was short-lived, and few of the mines have been worked since 1900. More recent descriptions of many of the mines have been given by Broadhurst (1937a,b, 1951), who also described the geology of the area, and Syvret (1963b). A geophysical survey carried out by AGGSNA in 1938 (Thyer et al., 1939), using electromagnetic and potential ratio methods, was found to be of no value in assisting mineral prospecting in the area.

The Elizabeth Creek Granite in the mineralized area is extensively chloritized and sericitized, and the original biotite is pseudomorphed by chlorite. No hornblende was found in the granite, although Broadhurst (1937b, 1951) and Dimmick & Cordwell (1959) described the country rock as hornblende granite. The granite is cut by innumerable porphyritic acid dykes, which notably are younger than the mineralization and related to the Slaughter Yard Creek Volcanics, like the dykes in the Watsonville area. However Broadhurst (1951) considered that the period of dyke intrusion overlapped with the period of mineralization.

Two major shear zones occur in the mineralized area. These are the St Patrick and Canberra shears (Broadhurst, 1951), both of which are steeply dipping, and strike east-northeast. In addition there are many other shears with a variety of trends, including some horizontal shears. Many of the shears are occupied by acid dykes.

The tin lodes are associated with the shears and typically form steeply plunging irregular pipe-like bodies which in horizontal cross-section are elongated parallel to the shears. Three main types of lode are present: chlorite-quartz, quartz, and greisen. In the chlorite-quartz lodes sericite is commonly as abundant as chlorite, but is less prominent in hand specimens. The greisen lodes consist of aggregates of quartz and very fine-grained sericite, the sericite giving the rock a serpentinous appearance. 'Black rock' is the local name given mainly to chlorite-quartz lodes consisting of quartz blebs and fine-grained chlorite-sericite aggregates. An exception is the 'black rock' lode at the *Black King*[86-89], which is made up of quartz and tourmaline. Many of the lodes contain fluorite and minor sulphides, and some also contain wolframite.

Gurrumba area (Table 35, p. 206; area I, Pl. 18)

Mines in the Gurrumba area have been worked for tin, tungsten, and minor amounts of gold, silver, and lead. They occur in Elizabeth Creek Granite and Hodgkinson Formation, in the tin and tungsten mineral zones. The total production of lode tin in the area is estimated at about 500 tons of tin oxide. Gold production has amounted to only a few ounces.

Gold was discovered in the area in 1896, and in the following year lode tin was found at the *Village Blacksmith*[1] mine. A battery to treat tin ore was erected at Gurrumba in 1906, and closed down in 1921.

The oldest rocks exposed are interbedded greywacke, siltstone, shale, and conglomerate of the Hodgkinson Formation, which crop out on Iron Mountain and Lead Hill, where they occur as thermally metamorphosed roof pendants overlying

Elizabeth Creek Granite, and in the Gurrumba Ring Complex, where they are mostly unmetamorphosed. Next oldest are acid lavas and pyroclastics of the Nanyeta Volcanics, which crop out in the southeast. Both the Hodgkinson Formation and Nanyeta Volcanics are intruded by the Elizabeth Creek Granite, which crops out over most of the area. The granite is mostly a coarse-grained leucocratic pale pink to pale grey biotite adamellite, with abundant associated aplite and greisen. The Gurrumba Ring Complex in the west, which has been emplaced within the Elizabeth Creek Granite, consists of a ring dyke of granophyre, gabbro, and a variety of intermediate hybrid rocks enclosing outcrops of Hodgkinson Formation, acid lavas of the Gurrumba Volcanics, and diorite.

Most of the mines are situated in Elizabeth Creek Granite, where cassiterite and wolframite, commonly associated with small amounts of sulphide minerals, mostly occur in greisen lodes located along joints and shears. These lodes consist essentially of quartz, white mica, and fluorite. Cassiterite also forms low-grade disseminated deposits in massive greisen, as at the *Great Boulder*[33] mine. Quartz lodes predominate in the Hodgkinson Formation.

The Glen area (Table 36, p. 210; area II, Pl. 18)

Tungsten, bismuth, and minor tin have been mined in The Glen area from mines situated in Elizabeth Creek Granite, the only rock exposed, in the tungsten mineral zone. Total production is about 100 tons of mixed wolframite-bismuthinite concentrates.

The lodes at The Glen, an abandoned mining settlement, were discovered in 1910. They are up to 1.5 m thick, and occur along flat-lying joints in the granite at levels 3 to 6 m apart. The flat lodes are connected by vertical pipes averaging 0.5 m in diameter. The orebodies consist of wolframite, bismuthinite, arsenopyrite, chalcopyrite, pyrite, and sphalerite in a gangue of topaz, quartz, and fluorite (Zimmerman et al., 1963). Some steeply dipping greisen lodes also occur; the most notable example forms the axis of a prominent northwest-trending ridge west of The Glen.

Glenlinedale area (Table 37, p. 212; area III, Pl. 18)

In the Glenlinedale area tin and tungsten lodes occur in the Elizabeth Creek Granite and the Hodgkinson Formation, in the tin and tungsten mineral zones. Total tin production is estimated at 600 tons tin oxide, most of which has come from the *General Gordon*[4,5] mine.

Lode tin was discovered in the area in 1886, and in the following year a dam and battery were constructed at Glenlinedale. The battery closed down in 1890, and was not reopened.

The Hodgkinson Formation consists of sandstone, siltstone, and shale which have been thermally metamorphosed to hornfels by the Elizabeth Creek Granite. The granite crops out in the east and west and in the central part it underlies the sedimentary rocks at shallow depth.

Four main types of lodes are present: quartz and greisen lodes, which occur in both sedimentary rocks and granite, and quartz-chlorite and quartz-tourmaline lodes, which are confined to sedimentary rocks. Many of the lodes contain some sulphide minerals.

Mowbray Creek area (Table 38, p. 214; area IV, Pl. 18)

The lodes in the Mowbray Creek area have been worked for tin and small amounts of tungsten. All are greisen lodes in Elizabeth Creek Granite. Total tin production for the area is probably about 600 tons of tin oxide.

The tin lodes were discovered about 1881, and in 1883 a battery was erected on Thompsons Creek, but was removed later in the same year.

Dry River area (Table 39, p. 220; area V, Pl. 18)

Lodes in the Dry River area have been worked only for tin. They are quartz and quartz-chlorite lodes situated in sedimentary rocks of the Hodgkinson Formation. About 125 tons of tin oxide concentrates have been obtained in the area, mostly from the *Captain*[4] mine.

The Hodgkinson Formation consists of interbedded greywacke, sandstone, siltstone, shale, and conglomerate. These rocks are overlain unconformably by acid lavas and pyroclastics of the Glen Gordon Volcanics in the east, and are faulted against Elizabeth Creek Granite in the west. Tertiary olivine basalt occurs in the valley of the Wild River.

Geebung Hill area (Table 40, p. 222; area VI, Pl. 18)

Most of the mines in the Geebung Hill area have been worked for tungsten, although small amounts of tin and copper have also been obtained. However, probably less than 10 tons of cassiterite concentrates have been produced. The lodes occur in Elizabeth Creek Granite and in hornfelsed sedimentary rocks of the Hodgkinson Formation close to the granite contact, in the tungsten mineral zone. They are mostly greisen lodes in which wolframite, cassiterite, and chalcopyrite are associated with quartz, mica, and minor fluorite, topaz, molybdenite, and arsenopyrite; in addition beryl occurs at the *Fingertown*[31] mine.

The largest mine in the area is probably the *Fingertown* (Jensen, 1939; Knight, 1949; Zimmerman et al., 1963), from which 22 tons of wolframite concentrate were obtained between 1942 and 1955, mainly from dump material. The mine was first mentioned in the Queensland Department of Mines Annual Report for 1914. The wolframite occurs as crystals up to 2.5 cm long in a gangue consisting mostly of quartz and fluorite. Total production from the mine is probably rather more than 50 tons of wolframite concentrate.

Brownville area (Table 41, p. 224; area VII, Pl. 18)

Tin and minor tungsten, copper, silver, and lead have been obtained from lodes in the Brownville area. Some of the lodes have been known since 1883. The total production of lode tin in the area is estimated at 500 tons of tin oxide, of which over 150 tons have come from the *Excelsior*[29] mine. A battery and dam were built at Brownville in 1931 by the Oakey Creek Co. and the battery was working up to December, 1962.

The lodes occur in interbedded greywacke, siltstone, and shale of the Hodgkinson Formation and in Elizabeth Creek Granite, in the tungsten, tin, copper, and lead mineral zones. The sedimentary rocks are unconformably overlain by Nanyeta Volcanics in the southwest, and are intruded and thermally metamorphosed by the Elizabeth Creek Granite in the north. Quartz and quartz-chlorite lodes occur in the sedimentary rocks, where they are associated with steeply dipping shear zones. The chloritic lodes commonly contain abundant sericite. The lode at the *Excelsior* mine consists of low-grade chloritic ore containing small amounts of scheelite and also tourmaline. At the *Mount Fairy*[49] copper and tungsten mine the lode consists of malachite and azurite associated with wolframite and some scheelite in a gangue of quartz. The main lead mine in the Brownville area, the *Koh-in-oor*[103], has a lode consisting of cerussite, pyromorphite, anglesite, galena, and quartz located in a nearly vertical shear zone. The lodes in granite are greisen lodes located along prominent joints.

Coolgarra area (Table 42, p. 230; area VIII, Pl. 18)

Lodes in the Coolgarra area have been worked for tin and minor copper, silver, tungsten, and bismuth. The lodes occur in the Hodgkinson Formation and Elizabeth Creek Granite, in the tin, tungsten, and copper mineral zones. As in the Brownville area, the Hodgkinson Formation consists of steeply dipping interbedded greywacke, siltstone, and shale which have been intruded and thermally metamorphosed by Elizabeth Creek Granite.

The total lode tin production is estimated at about 1700 tons tin oxide, the main producers being the *Alhambra*[115,116] and *Extended*[130] mines, which between them probably produced about 1000 tons tin oxide.

Lode tin was discovered in 1883, and a battery, the Victoria Mill, was opened at Coolgarra in 1884. It closed down in 1889, but a new and larger battery was erected in 1901, and continued operating until 1908. Another battery was built at Coolgarra in 1918 and worked up to 1931. Only a small amount of lode tin has been produced in the area since then. Several of the mines were described in 1891 by Maitland.

The tin lodes are of two main types, quartz lodes and quartz-chlorite lodes, both of which occur in granite and in sedimentary rocks. Sericite is generally abundant in the chloritic lodes. The tungsten comes almost entirely from greisen lodes in granite.

Top Nettle Camp area (Table 43, p. 238; area IX, Pl. 18)

In the Top Nettle Camp area, lodes have been worked for tin, tungsten, and at two mines antimony. The lodes occur in Elizabeth Creek Granite and in thermally metamorphosed greywacke, siltstone, and shale of the Hodgkinson Formation, in the tin and tungsten mineral zones. The Hodgkinson Formation forms roof pendants overlying Elizabeth Creek Granite. Most of the lodes in granite are greisen lodes, whereas those in the sedimentary rocks are quartz lodes. The total production of lode tin is probably about 50 tons tin oxide.

Alluvial tin was discovered in Nettle Creek in 1881, but the first lode deposits were probably not found until about 1908, when wolframite was obtained from lodes at the *Devon*[71-75] and *Griffin*[41] mines.

The main mines are the *Devon, Griffin* and *John Bull*[58] tungsten mines, each of which probably produced over 100 tons of wolframite. At the *Devon* mine a pegmatitic greisen lode consists of mica (probably lithium-bearing), quartz, fluorite, wolframite, siderite, molybdenite, monazite, cassiterite, and minor tourmaline and pyrite. At the *Griffin* mine wolframite is associated with quartz, fluorite, coarse mica, and in deeper parts of the mine, scheelite, molybdenite, native bismuth, pyrite, copper minerals, arsenopyrite, and small amounts of coarse cassiterite; the mine is reputed to have produced 140 tons of wolframite, but the recorded production is only 14 tons between 1908 and 1953.

Wild River area (Table 44, p. 244; area X, Pl. 18)

Most of the lodes in the Wild River area occur west of the Wild River in Elizabeth Creek Granite and Hodgkinson Formation, in the tin and tungsten mineral zones. These lodes have been worked for tin, tungsten, and at one mine antimony. Only two lodes are known east of the Wild River, and both have been worked for copper. The Hodgkinson Formation consists of interbedded greywacke, siltstone, shale, and rare limestone lenses, and has been intruded and thermally metamorphosed by the Elizabeth Creek Granite.

The lodes in granite are mostly greisen lodes, whereas those in sedimentary rocks are mostly quartz lodes. An exception is the lode at the *Mount Ruby*[17-19], which consists of hematite, magnetite, and copper carbonates.

Nymbool area (Table 45, p. 248; area XI, Pl. 18)

Lodes in the Nymbool area have produced tin, tungsten, copper, and lead, of which tin is by far the most important. The lodes occur in the Hodgkinson Formation and Elizabeth Creek Granite, in the tin, tungsten, copper, and lead mineral zones. The total production of lode tin is estimated at 1700 tons tin oxide, of which over 1500 tons came from the *Smiths Creek*[13] mine between 1903 and 1909.

The main outcrop of the Hodgkinson Formation is in the east, where interbedded greywacke, siltstone, shale, and minor calcareous conglomerate and limestone are unconformably overlain by the Nanyeta Volcanics. Elsewhere isolated outcrops of Hodgkinson Formation occur as roof pendants in granite. The formation is intruded by the Elizabeth Creek and Nymbool Granites and by the Hammonds Creek Granodiorite.

The Elizabeth Creek Granite is generally a pale pink medium to coarse-grained biotite adamellite, but is locally represented by greisenized micrograniite with quartz blebs; microgranite of this type forms a prominent hill 3 km northwest of Nymbool. The Elizabeth Creek Granite is thought to be intruded by the Nymbool Granite and the Hammonds Creek Granodiorite, but the contact relationships are not clear.

At the *Smiths Creek* mine, and also probably at the *Adelaide*[12], *Lucey*[14], and *April Fool*[24] mines, the lodes occur at or very close to the contact of the Elizabeth Creek and Nymbool Granites, and it is possible that here both granites are mineralized. Most of the lode material at the *Smiths Creek* mine is altered coarse-grained granitic rock, thought to be altered Elizabeth Creek Granite, which consists essentially of green biotite and chlorite studded with quartz blebs and cut by calcite veins. The Nymbool Granite adjacent to the lode is a medium to fine-grained biotite adamellite which is only slightly chloritized. The lode may be part of a roof pendant or large inclusion of Elizabeth Creek Granite surrounded by Nymbool Granite.

Most of the other lodes in the Nymbool area are quartz and greisen lodes. However, at the *Bald Hill*[22] lead mine the lode consists of sphalerite, galena, and minor chalcopyrite and pyrite which have selectively replaced coarse calcareous conglomerate and limestone of the Hodgkinson Formation; the lode here appears to have no structural control.

Five Mile Creek area (Table 46, p. 250; area XII, Pl. 18)

Lodes in the Five Mile Creek area have mostly been worked for tin, although small amounts of tungsten, copper, silver, and lead have also been obtained. Total lode tin production for the area is estimated at about 125 tons tin oxide.

The lodes occur in the Hodgkinson Formation and Elizabeth Creek Granite, in the tin, tungsten, copper, and lead mineral zones. Three main types of lodes are present: greisen lodes in granite, and quartz and quartz-chlorite lodes in sedimentary rocks. In addition calc-silicate lodes occur at two mines in the southwest. The chloritic lodes commonly contain abundant sericite.

The Hodgkinson Formation consists of interbedded greywacke, siltstone, and shale, with some limestone in the southwest. It is overlain unconformably by Nanyeta Volcanics in the west, and is intruded and hornfelsed by the Elizabeth Creek Granite in the east and southeast.

South Coolgarra area (Table 47, p. 254; area XIII, Pl. 18)

In the South Coolgarra area tin and tungsten have been mined from lodes in interbedded greywacke, siltstone, and shale of the Hodgkinson Formation, and in Elizabeth Creek Granite, which has intruded and thermally metamorphosed the sedimentary rocks. The lodes are in the tin and tungsten mineral zones. Greisen lodes predominate, but quartz lodes also occur.

Although over 60 individual mines and prospects have been identified, none of them has produced more than about 10 tons of cassiterite or wolframite, and the total lode tin production for the area is estimated at less than 50 tons of tin oxide.

The only mine for which some official production figures are available is the *Jack Johnson*[4,5] from which 2 tons of tin oxide were recorded in 1912 and 1935. One mine, the *Rover*[58], was working in 1966 (Pl. 15, fig. 1).

Mount Garnet area (Table 48, p. 258; area XIV, Pl. 18)

Lodes in the Mount Garnet area have been worked for copper, silver, lead, gold, and tin. The lodes occur in Precambrian rocks, in sedimentary rocks of the Hodgkinson Formation, in Nanyeta Volcanics, and in an unnamed granite cropping out east of Mount Garnet township.

Copper, silver, and lead ores are economically the most important. These ores occur in a calc-silicate lode at the *Mount Garnet* copper mine[9-11], by far the largest mine in the area, and also in quartz lodes nearby and at the *Chinaman*[30-1] mine, which is situated in unnamed granite 5 km east-southeast of the township. Copper ores were first found in the area in 1883, but were not worked on a large scale until 1898, when the *Mount Garnet* copper mine was opened up by the Mount Garnet Freehold Copper and Silver Mining Co. The company erected a smelter at Mount Garnet in 1900, which operated until 1903.

The *Mount Garnet* copper mine was worked to a depth of 67 m. At least three distinct lenses of ore, consisting of copper, lead, and zinc minerals, are associated with vertical shears striking roughly north-south; the shears cut garnetiferous calc-silicate hornfels of the Hodgkinson Formation. Oxidized ores were worked from open cuts, the largest of which is 18 m deep. The underlying primary ore is predominantly sphalerite containing very low copper values, and diamond drilling carried out by Enterprise Exploration Co. Pty Ltd in 1948 and by Metals Exploration NL in 1956 does not appear to have found ore of economic grade.

Recorded production is 4415 tons Cu and 948,651 oz Ag in 1901-03, the recovery grade of ore mined being 4.9 percent Cu and 10.7 oz Ag per ton; in addition 1924 tons of unspecified ore in 1904 and 966 tons silver-lead ore in 1926 were sent to the Chillagoe smelters.

Gold has been mined northeast of Mount Garnet township, where it occurs in narrow quartz veins cutting Precambrian schist and quartzite. The main mine is the *Golden Prospect*[3], where the lode consists of narrow quartz veins containing gold, pyrite, and arsenopyrite: the main shaft at the mine is 46 m deep, but no gold appears to have been found below 27 m. Total production of gold in the area is probably under 200 oz.

The main occurrence of lode tin is on Mount Garnet hill, where the lodes occur in acid lava and tuff of the Nanyeta Volcanics and in Precambrian metamorphic rocks. Total production is probably less than 10 tons of tin oxide. A slug of almost pure cassiterite weighing nearly 200 kg was found lying on the surface on Mount Garnet many years ago, but the lode from which it was shed has never been found, possibly because it was completely eroded away.

Mount Gibson area (Table 49, p. 260; area XV, Pl. 18)

Tin, tungsten, and copper have been obtained from lodes in the Mount Gibson area, but total production is insignificant—probably less than 20 tons each of cassiterite, wolframite, and copper concentrate. Most of the lodes are greisen lodes in Elizabeth Creek Granite and only a few lodes occur in sedimentary rocks of the Hodgkinson Formation; the sedimentary rocks are intruded and thermally metamorphosed by the granite.

Seven Mile Hill area (Table 50, p. 264; area XVI, Pl. 18)

No mines of any consequence occur in the Seven Mile hill area, although several small lodes have been worked for tungsten, tin, and copper. Total lode tin production is probably less than 5 tons tin oxide. The lodes occur in Elizabeth Creek Granite and greywacke, siltstone, shale, limestone lenses, and basalt lavas of the Hodgkinson Formation. The Hodgkinson Formation is intruded and thermally metamorphosed by both the Elizabeth Creek Granite and Hammonds Creek Granodiorite.

ALLUVIAL CASSITERITE DEPOSITS

Alluvial deposits of both cassiterite and wolframite occur in the Herberton/Mount Garnet area, but only those of cassiterite are of present economic importance. No alluvial deposits of wolframite have been worked during the last ten years: the deposits are small and localized, and occur mainly in small creeks on Elizabeth Creek Granite close to wolframite lodes.

The deposits of alluvial cassiterite range from large deposits worked by dredging or hydraulicking to deposits in small creeks mostly worked by individual miners during the wet season. Large deposits occur in the valleys of Smiths Creek, Return Creek, Battle Creek, Nettle Creek, and the Wild River. Small deposits occur along most of the small creeks draining tin-bearing areas, especially along creeks on Elizabeth Creek Granite. The alluvial deposits recently worked at Stannary Hills by Loloma Mining Corporation NL are of intermediate size.

Most of the alluvial deposits in the Wild River valley underlie olivine basalt lavas belonging to the Cainozoic Atherton Basalt Province. These deposits are known as the Herberton Deep Lead, and are described separately (see p. 116).

The production of alluvial cassiterite in the Herberton Gold and Mineral Field is given in Table 13, and is shown graphically in Figure 12. The production figures for the years 1879-1908 have been derived by subtracting the approximate production of alluvial cassiterite from areas outside the present boundaries of the field from the figures quoted for these years in the Annual Reports of the Queensland Department of Mines. The marked increase in production since 1940 is due to the dredging operations near Mount Garnet of Tableland Tin Dredging NL, and later of Ravenshoe Tin Dredging Ltd.

The dredge operated by Tableland Tin (Pl. 16, fig. 1) can dig to 19 m below and 9 m above pond level. It has an average annual throughput of about 2,700,000 cu m. Barren overburden has in recent years mostly been stripped by earthmoving equipment, as overburden stripped by the dredge cannot bypass the treatment plant. The dredge used by Ravenshoe Tin is smaller; it can dig to 12 m below and 6 m above pond level, and has the advantage of being able to remove barren overburden by dry stripping, as the overburden bypasses the treatment plant of the dredge; this minimizes pollution of the dredge pond. The dredge has an average annual throughput of about 1,900,000 cu m.

Mount Garnet 1-mile Sheet Area

The deposits which have yielded most of the tin produced in the Herberton Tinfield during the last 30 years occur near Mount Garnet, in Smiths, Return, Battle, and Nettle Creeks. They have been described by Zimmerman et al. (1963), K. R. Yates (unpublished notes written in 1963), and Zimmerman (1965). Geophysical investigations, followed by drilling, were carried out in 1962 by the Bureau of Mineral Resources (Horvath & Hussin, 1966; Sedmik & Williams, 1967) to test the 'Ancestral River Tate' hypothesis of Best (1962a).

The cassiterite in the main alluvial deposits near Mount Garnet occurs in lenses of sand and fine to coarse gravel within Cainozoic alluvial sediments on the northern margin of the Mount Garnet Basin, a deeply alluviated area sloping gently southeastwards. The cassiterite-bearing lenses are scattered haphazardly through the alluvial sequence, a feature of which is the occurence of 'false bottoms' or cemented layers that are overlain and underlain by cassiterite-bearing gravels. The alluvium also contains interbedded layers of basalt at various levels in the eastern part of the basin.

The main alluvial deposits occur just before the valleys of Smiths, Return, Battle (Pl. 16, fig. 2), and Nettle Creeks emerge southwards from the hills on the north side of the Mount Garnet Basin. Downstream in the basin itself the valleys are less confined, and the alluvium brought down by the creeks is dispersed over a wide area. In addition, the cassiterite content of the alluvium decreases southwards as the distance from the tin lodes from which the cassiterite is derived increases, and at the same time the cassiterite generally becomes finer in grain, assisting its dispersion. Hence it is unlikely that economic concentrations of cassiterite will be found south of the deposits worked by Tableland Tin Dredging NL and Ravenshoe Tin Dredging Ltd.

The alluvial cassiterite ranges from black to amber, brown, ruby, and honey-coloured. Some of the cassiterite from Smiths Creek, in particular the black variety, was found to be magnetic by Baker & Edwards (1956). The grainsize of the alluvial cassiterite has not been studied in detail. In addition to cassiterite, the heavy mineral assemblage includes topaz, monazite, zircon, ilmenite, and iron oxides; isolated occurrences of spinel, garnet, corundum, barite, and beryl are also known.

Smiths Creek

Tableland Tin Dredging NL began dredging in the Smiths Creek area in 1953, and up to the end of 1969 about 31,000,000 cu m had been treated for a yield of 9869 tons of cassiterite concentrate. The average gradient in the dredged area is 3 to 4 m per kilometre.

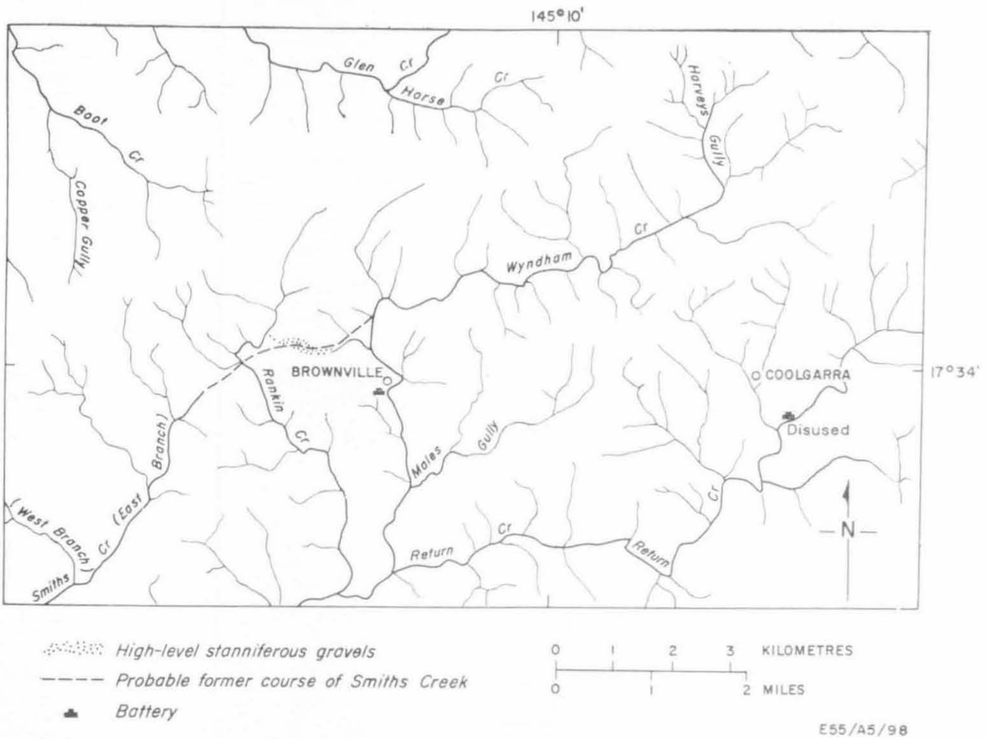

Figure 17. Drainage systems of Smiths Creek (East Branch) and Wyndham Creek, Mount Garnet 1-mile Sheet.

The main source of the cassiterite in Smiths Creek is uncertain. Some undoubtedly came from the Blacks Creek and Tuckers Gully drainage areas, on Elizabeth Creek Granite, but upstream from Nymbool Smiths Creek mainly traverses non-stanniferous Nanyeta Volcanics. However, it seems likely that Smiths Creek formerly drained part of the stanniferous area near Brownville, in particular the Wyndham Creek drainage area (Fig. 17). This view is supported by the abrupt change of course (from west-southwest to south) of Wyndham Creek just north of Brownville, and by the occurrence of high-level cassiterite-bearing gravels west and northwest of Brownville on hill slopes 15 m above the present main drainage lines: these gravels probably represent the bed of the ancestral Wyndham Creek (= Smiths Creek).

Surprise Creek, a tributary of Smiths Creek near Nymbool, was worked by hydraulic sluicing between 1940 and 1962. About 245,000 cu m were treated during this period for a recorded yield of 286 tons of cassiterite concentrate. In addition, the eluvial deposits adjacent to Smiths Creek mine, at the head of Surprise Creek, were worked in 1904 by the Smith's Creek Pty Co. for a yield of about 125 tons of concentrate. The eluvium near the mine was mostly cemented, and required special treatment. The Surprise Creek area has therefore produced at least 391 tons of cassiterite concentrate, and some ground is still available for treatment. The deposits appear to be shallow (about 3 m), and consist mainly of coarse gravel.

Return Creek

Return Creek consists of an upper section, upstream from Return Creek Dam (destroyed in March 1967), a middle section between the dam site and Strathvale homestead, and a lower section downstream from the homestead.

The *Upper Return Creek System* includes the entire drainage system of the stanniferous Brownville-Coolgarra area. Individual alluvial deposits are small, and consist mainly of coarse gravel, but about a kilogram of cassiterite per cubic metre can be expected in places. Records show a production of 203 tons of alluvial cassiterite concentrate in the Coolgarra area, but the actual production is probably very much greater.

Middle Return Creek has been dredged from near the confluence with Glutton Gully to just south of the highway at Mount Garnet. Payable ground exists around Strathvale homestead, but dredging ceased here because the Company and the landholder could not agree on compensation. Sluicing was carried out in the Glutton Gully area from 1906 to 1908, but no production records are available. Dredging began in Return Creek near Glutton Gully in 1928, but the dredge was apparently unsuitable, and operations ceased in 1932. Records for 1928 and 1931-32 show a production of 150 tons of concentrate from about 380,000 cu m. Tableland Tin Dredging NL rehabilitated the old dredge, and resumed operations in 1939. This old dredge was swamped by floods in 1942, and was replaced by No. 2 dredge in 1943. Dredging ceased in 1952. In the period 1939 to 1952 about 26,000,000 cu m were treated for a yield of 6114 tons of cassiterite concentrate.

Lower Return Creek has been tested but not put into production. Extensive testing by Tableland Tin has shown that alluvial cassiterite is present, but no figures on the volume and grade of the deposits have been published.

The alluvial deposits of middle and lower Return Creek are characterized by gravel containing abundant brown rhyolite pebbles derived from the Carboniferous Nanyeta Volcanics. Numerous fragments of a hard subsurface lateritic duricrust 0.5 to 1 m thick have been brought up by the dredging.

Battle Creek

Ravenshoe Tin Dredging Ltd worked the deposits at Battle Creek between 1957 and 1965, treating about 14,000,000 cu m for a yield of 4170 tons of cassiterite concentrate. This represents a recovery of about 75 percent of the cassiterite indicated by boring. Dredging ceased in February 1965.

The alluviated part of Battle Creek (Pl. 16, fig. 2) is relatively narrow, and has an average gradient of between 6 and 7 m per kilometre. In some parts dredging has continued laterally up to, and against, rock outcrops. The bottom of the dredged area is very irregular because of transverse rock bars. The alluvium reaches a maximum depth of about 25 m in the southern part of the dredged area. The cassiterite concentrates obtained by the dredge are relatively clean, probably because most of the cassiterite is derived from lodes in Elizabeth Creek Granite.

Nettle Creek

Alluvial cassiterite was discovered in Nettle Creek in 1881, and alluvial mining appears to have been carried out since about this time whenever water has been available. Before 1965 the main production recorded was in the period 1931 to 1946, when hydraulic sluicing was carried out, first by Nettle Creek Co. and later (1941-46) by the Broken Hill Pty Co. Ltd. During this period 410 tons of cassiterite concentrate were obtained from about 760,000 cu m. Ravenshoe Tin Dredging Ltd began dredging the area in 1965, and by the end of 1969 had recovered 2935 tons of cassiterite concentrate from about 8,000,000 cu m of alluvium. This includes 587 tons of concentrate obtained by a mobile plant which was constructed in 1965 to treat the shallow alluvium at the northern end of the alluviated part of the Nettle Creek valley. The average gradient of the deposits is about 6 m per kilometre. Most of the cassiterite is probably derived from areas of Elizabeth Creek Granite, and the alluvial deposits are characterized by abundant pebbles of greisen.

An alluviated area of about 28,000 sq m near Top Nettle Camp does not appear to have any significant tin values.

Wild River area (excluding the Herberton Deep lead)

The Wild River area has not been mined on a large scale, as individual deposits are small and scattered. Prospects within the Wild River itself are poor, because most of the larger areas of alluvium are underlain at shallow depth by basalt. The only important recorded production is 126 tons of cassiterite concentrate won from deposits along Woolooman Creek between 1894 and 1900.

Two areas of perched alluvium about 15 m above the present stream level occur near the junction of Woolooman Creek and the Wild River. The alluvium is only a few metres thick, and has mostly been worked out. Other deposits include about 150,000 cu m of alluvium (average thickness about 1 m) at the junction of Mowbray and Woolooman Creeks, and about 150,000 cu m of alluvium in Deadmans Gully near the Herberton road crossing. In addition, coarse cassiterite is present in coarse bouldery alluvium along Sandy Creek.

Ancestral River Tate hypothesis

In 1962 J. G. Best suggested that a river, which he named the 'ancestral River Tate', may have flowed westwards across the Mount Garnet Basin to join the present Tate River (Best, 1962a). If this river had existed, its abandoned channel could have been expected to contain alluvial cassiterite coming from Smiths, Return, Nettle, and Battle Creeks and also from the Wild River. The Wild River, in fact, was postulated by Best to have been the headwaters of the ancestral River Tate. To test this hypothesis gravity and seismic refraction surveys were carried out in 1962 by the geophysical branch of the Bureau of Mineral Resources

(Horvath & Hussin, 1966; Sedmik & Williams, 1967) in conjunction with a drilling programme undertaken by Tableland Tin Dredging NL. The geophysical and drilling investigations located five old buried valleys in the area, but these valleys trended southwards rather than westwards, indicating that the former drainage of the Mount Garnet Basin, like the present drainage, was to the south and southeast, and not to the west as suggested by Best.

Herberton 1-mile Sheet Area

The only major deposits of alluvial cassiterite known in the Herberton 1-mile Sheet area are those of the Herberton Deep Lead. Deposits of intermediate size occur in Eureka Creek at Stannary Hills, in Emu Creek upstream from its confluence with Thompson Creek, and in the same creek downstream from Emuford. No information has been obtained about the Emu Creek occurrences.

Stannary Hills

Alluvial cassiterite deposits on narrow alluvial flats flanking Eureka Creek, 2 km northeast of Stannary Hills, were worked by Loloma Mining Corporation NL from September 1965 to January 1967. The deposits cover about 26 ha and consist of gravelly alluvium which has an average depth of 2 m and a maximum depth of about 4 m. The alluvial cassiterite is derived from nearby tin lodes. The deposits were worked by dry mining methods, the alluvium being collected by trucks, Tournapuls, and end loaders, and taken to a stationary washing plant. This plant had a throughput of about 1500 cu m per 24 hours. Total production for the whole operation was 279½ tons of cassiterite concentrate from 518,000 cu m.

HERBERTON DEEP LEAD

by L. G. Cuttler*

Introduction

The Herberton Deep Lead is the name given to the course of the ancestral Wild River along which stanniferous river alluvium is overlain by Tertiary basalt flows. The deep lead extends from Herberton to the junction of the Millstream and the Wild River, and is the longest and richest and one of the most extensively worked stanniferous deep leads in Australia. The richer and more accessible parts are now almost completely exhausted.

The deep lead between Herberton and Basalt Creek (Fig. 18), a distance of about 13 km, was surveyed in 1964 as part of the systematic geological mapping of the Herberton 1-mile Sheet area. Owing to the collapse of most of the shafts and tunnels, especially in the important areas of Wondecla, Tepon, and Kalunga, much of the information was gleaned from examination of dumps, details contained in previous reports, and personal communications.

Location, history, and production

The Herberton Deep Lead extends from Herberton to Prairie Creek, on the southern margin of the Herberton Sheet area, and southwards for a further 26 km in the Mount Garnet Sheet area, to the junction of the Millstream and Wild River, giving a total known length of about 42 km. The section of the deep lead in the Herberton Sheet area is roughly parallel to the present Wild River to the west

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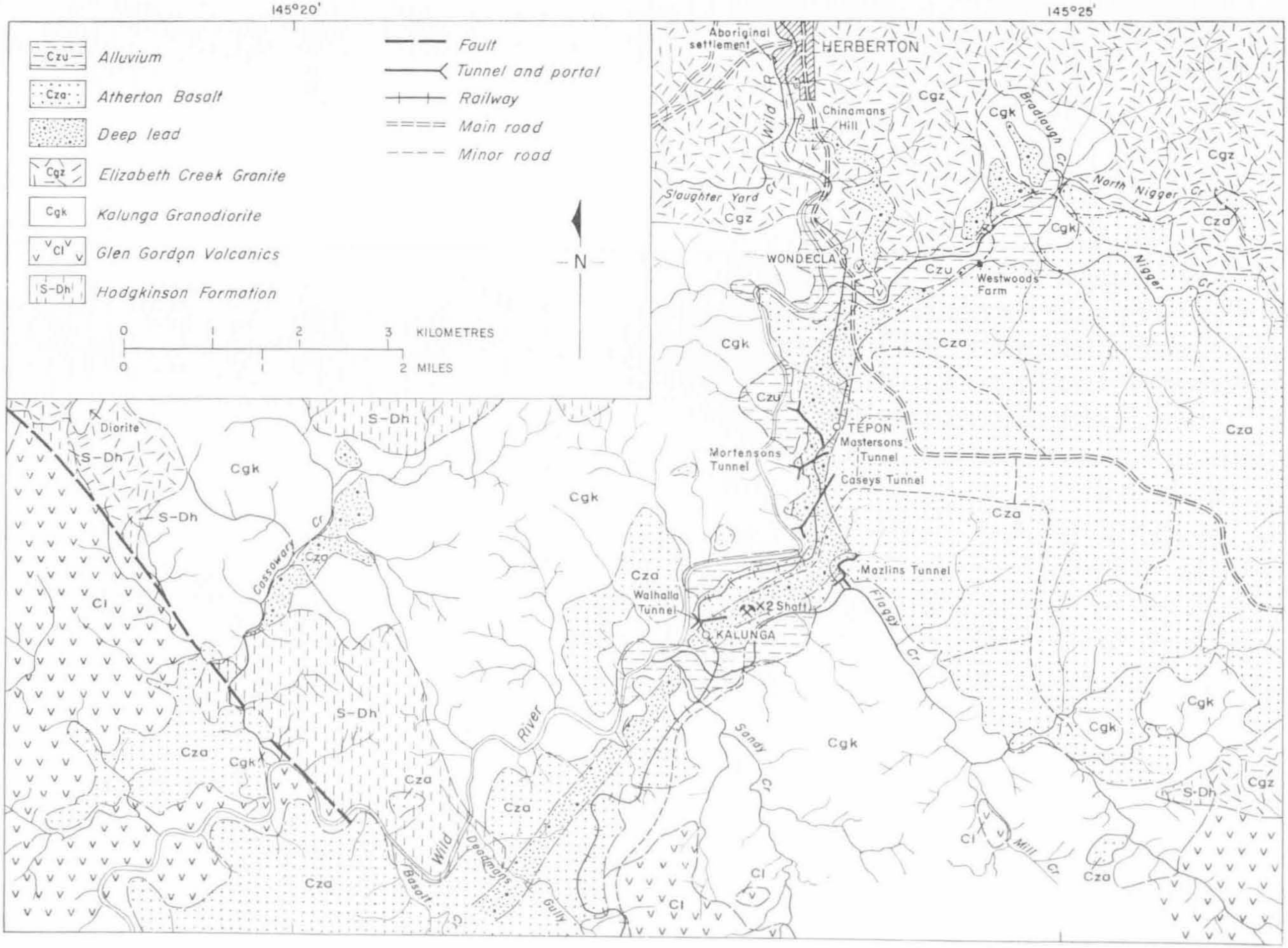

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Figure 18. Herberton Deep Lead.

(Fig. 18). It ranges in width from about 40 m north of Wondecla and south of Flaggy Creek to about 600 m in the Tepon and Kalunga areas. In the central portion of the Tepon area the deep lead has two distinct channels separated by a ridge of Kalunga Granodiorite.

In addition to the main deep lead, there are two tributaries, the Bradlaugh Deep Lead, 3 km southeast of Herberton, and the Cassowary Creek Deep Lead, 8 km southwest of Herberton.

The Herberton Deep Lead was discovered in May 1883 by J. Macdonald, a prospector, who found stanniferous wash passing under basalt at Chinamans Hill, about 2 km south of the Herberton Post Office. However, it is quite likely that the wash at the bottom of the deep lead, where the basalt cover had been removed by erosion, had been worked earlier than this, without the miners being aware of its true nature. Within a short time of the discovery over 100 men had pegged out its supposed course for a distance of 8 km, but it was not worked with any immediate success, and it was not until 1884 that the first production, 10 tons of cassiterite concentrate, was recorded. Production rose to 50 tons in 1885, and to over 100 tons during each of the next few years. Production declined after 1895, and from 1946 to 1966 it has rarely exceeded 1 ton of cassiterite concentrate.

Although returns are incomplete, probably more than 4000 tons of cassiterite concentrate, valued at about $8 million on present-day prices, have been won from the Lead.

Previous investigations

The first published reference to the Herberton Deep Lead was by the Mineral Lands Commissioner for the Herberton Mining District, Mr W. M. Mowbray, in the 1885 Annual Report of the Queensland Department of Mines. He recognized the deep lead as an old river bed, which he considered to lie at a higher level than the present course of the Wild River, although running parallel to it. Brief references were later made to the deep lead by Jack (1892) and Munday (1895). It was first described in detail by Skertchley (1896), who traced it from its source near Herberton downstream to Flaggy Creek, and also reported the existence of the tributary Bradlaugh Deep Lead. Skertchley (1896, p. 18) came to the following conclusions:

'(1) The Deep Lead is not a single run of stanniferous sand and gravel, but a series of old stream-deposits flowing from the north, which spread out in the area south of Nigger Creek;

'(2) Of the tributaries flowing into this central area, two have already been traced—

(a) one from Herberton, practically along the general run of the Wild River,

(b) one roughly down Bradlaugh Creek;

'(3) None of the Deep Lead streams followed the course of the present streams, but were at a higher level, and not quite on the same sites.'

The following year Skertchley briefly mentioned the deep lead gravels and the Tertiary basalt in a report on the tin mines of Watsonville, etc. (Skertchley, 1897). Later Marks (1911) discussed the merits of various schemes for draining the deep lead, and outlined the geological setting of the lead and the three most likely courses between Tepon and Kalunga. Marks also reported the existence of an upper and a lower basalt, separated by an intermediate gravel.

The most comprehensive and detailed examination was by Jensen (1939), who traced the course of the deep lead from the vicinity of Herberton to near the Wild River/Millstream junction in the Mount Garnet Sheet area. In addition to giving detailed information on the economic geology of the deep lead, Jensen went into considerable detail on the present and past history of the Wild River as a possible guide to the location of lost or unknown sections of the lead, including the effect on the ancestral stream of two episodes of basalt outpouring.

A geophysical survey of the Herberton Deep Lead was carried out by Thyer (1939), using electrical resistivity. The results were generally disappointing, but disclosed the apparent presence of another valley parallel to but east of the main deep lead, which it appeared to join at its northern and southern extremities. The results of a drilling programme undertaken in 1942 to test the geophysical results were summarized by Cribb (1946); the drilling confirmed the presence of a short narrow sediment-filled valley, but the gravels penetrated by the drilling contained only low tin values.

General geology

Except for a small area of sedimentary rocks along Deadmans Gully, the main deep lead is bottomed by igneous rocks (Fig. 18). In the northern part, from Herberton to Nigger Creek, the basement consists of Upper Carboniferous Elizabeth Creek Granite. This is a pink coarse-grained leucocratic biotite granite, locally greisenized, which has been intruded by numerous dykes of quartz-feldspar porphyry and less common dykes of pink to buff aplite. From Nigger Creek to Basalt Creek the deep lead channel has mainly been cut into Kalunga Granodiorite, a grey fine to medium-grained slightly porphyritic biotite-hornblende granodiorite probably of Middle or Upper Carboniferous age; this granodiorite is also cut by dykes of quartz-feldspar porphyry. Along Deadmans Gully the deep lead gravels overlie greywacke, sandstone, siltstone, shale, and conglomerate of the Silurian to Devonian Hodgkinson Formation. Between Basalt Creek and Prairie Creek welded tuff and flow-banded rhyolite of the Carboniferous Glen Gordon Volcanics, which unconformably overlie rocks of the Hodgkinson Formation, form the basement. The stanniferous gravels of the tributary Bradlaugh Deep Lead mostly overlie Kalunga Granodiorite. The tributary Cassowary Creek Deep Lead overlies Hodgkinson Formation, Kalunga Granodiorite, and Glen Gordon Volcanics.

In the upper section of the deep lead, at least as far south as Wondecla, the course of the ancestral stream was largely controlled by dykes of quartz-feldspar porphyry, most of which have a northwesterly trend. Even though the dykes have been breached locally, most of the abrupt changes in direction of the deep lead can be attributed to them.

Overlying the bedrock is a variable thickness of alluvium ranging from a few centimetres to a maximum of about 6 m, and averaging about 3 m. Only the bottom 1 to 2 m is generally made up of the stanniferous wash proper. The alluvium consists largely of loose to cemented sand and gravel containing pebbles, cobbles, and boulders of quartz, granite, greisen, and porphyry. In sections exposed at Tepon, along the western edge of the deep lead, the cemented and indurated sediments display current-bedding.

The sands and gravels are overlain by over 30 m of olivine basalt which was probably erupted during the Pleistocene. An upper and a lower basalt, related to two distinct periods of volcanicity, can be recognized. The two basalt flows are separated by sands and gravels up to 6 m thick, but generally only about 2 m thick. The basalt belongs to the Atherton Basalt Province (Best, 1960), and is probably of Pliocene or Pleistocene age. Some of the basalt probably came from vents in the Innisfail Sheet area to the east (Fig. 9). The lava issuing from the vents flowed westwards into the valley of the Wild River, backing up tributary streams and covering the deep lead gravels. However, much of the basalt, in particular the upper basalt, appears to have issued from a vent at the head of Gilbey Creek, in the southeastern corner of the Herberton 1-mile Sheet area.

The lower basalt is generally much more weathered than the upper basalt and does not seem to have been so widely distributed as it does not appear to have extended south of Sandy Creek. Its thickness in the deep lead area averages between 12 m and 15 m.

The upper basalt forms a plateau mainly to the east and south of the earlier flow. Its maximum thickness is not known, but where it can be distinguished it ranges from 10 to possibly 30 m in thickness. The two basalts cannot always be distinguished from each other despite the fresher appearance and greater resistance to erosion of the upper basalt, unless the intermediate wash is present. Both commonly show columnar jointing.

In present-day streamcourses the basalts are overlain by a variable thickness of Quaternary alluvium.

The stratigraphic sequence of the Herberton Deep Lead system can be summarized as follows:

CAINOZOIC	Quaternary	Alluvium
	Pleistocene	Upper basalt Intermediate wash Lower basalt Deep lead wash
	—— UNCONFORMITY ——	
PALAEOZOIC	Carboniferous	Elizabeth Creek Granite Kalunga Granodiorite Glen Gordon Volcanics
	—— UNCONFORMITY ——	
	Silurian to Devonian	Hodgkinson Formation

Previous courses of the Wild River

From an examination of the workings along the deep lead it appears that the pre-basalt course of the Wild River was very similar to that of the present stream. Although the bottom of the lead is about 15 m above the present bed of the Wild River on the southern outskirts of Herberton, it is almost at the same level as the present stream between Flaggy Creek and Basalt Creek. Like the present Wild River, the deep lead channel seems to have had a relatively level bed for long stretches, with a fall of about 2 m per kilometre in the Wondecla/Basalt Creek section (Jensen, 1939). The level stretches, as in the present stream, were separated by short steep sections.

A greater rainfall run-off, combined with the local steep gradients, may have been the main factors giving the ancestral Wild River sufficient carrying power to transport cassiterite grains and associated pebbles, cobbles, and boulders relatively long distances from their source.

When the lower basalt filled the valleys of the deep lead system, the ancestral Wild River was diverted to the west of its original position. The diverted river deposited stanniferous alluvium and basalt debris in its new channel, forming the intermediate wash. Later another basalt flow, the upper basalt, forced the river still farther to the west. The presence of stanniferous wash 30 m above the present-day Wild River at the aboriginal settlement, Herberton, and also about 0.5 km farther to the northwest, indicates that locally the Wild River at one time occupied a position west of its present course.

The deep lead deposits

In the Herberton to Tepon section of the main deep lead, and also in the Bradlaugh Deep Lead, the wash proper consists dominantly of mottled red, yellow, greyish, and white fine to coarse-grained sand containing pebbles, cobbles, and boulders of white quartz, unaltered chloritized and tourmalinized granite, greisen, acid porphyry, and hornfels. The wash proper is commonly tightly cemented. It has an average thickness of 1 m, and a maximum of 3 m.

Overlying the wash proper are reddish, yellowish, and greyish fine silty sand and reddish to white fine sand. These sands range up to 5 m thick, but the average is 2 m.

Thin hard bands of strongly cemented ferruginized sand, containing coarse cassiterite grains, commonly cap the wash proper, and also occur lower down in the wash. These ferruginized bands, although rich in tin, are too hard to be broken down by washing or sluicing, and need some form of comminution to release the cassiterite. Bands of silicified and commonly ironstained wash, up to 30 cm thick, immediately underlie the basalt in the Herberton and Bradlaugh Deep Leads north of Nigger Creek.

In the Flaggy Creek and Kalunga areas the wash is quite different from that farther north. It consists of unconsolidated white to greyish fine to coarse-grained and somewhat loose sand containing pebbles and cobbles and occasional large boulders of granite at the base. The wash here is generally 1 to 3 m thick, and is overlain by up to 4 m of overburden made up of white clay, clayey sand, and fine to medium-grained loose sand.

South of Sandy Creek the wash ranges from fine and medium-grained yellow sand containing pebbles and cobbles at its base to fine white sand, buff-coloured coarse granitic sand, and white fine pebbly wash. The white pebbly wash is commonly hard and well cemented, and is very rich in black cassiterite. In addition to the usual types of pebbles, cobbles, and boulders, the wash here also contains cobbles and boulders of basalt. Jensen (1939) considered that south of Flaggy Creek there was an intermingling of the intermediate wash and the deep lead wash, as the earlier basalt is missing in this section of the lead. Such intermingling would probably have resulted in dilution of the high tin content of the deep lead proper by the lower-grade intermediate wash.

The intermediate wash, between the lower and upper basalts, has been examined at only a few localities. According to Jensen (1939), it is characterized by water-worn boulders of basalt derived from the earlier flow, although these boulders do not always appear to be present. Between Wondecla and Kalunga the intermediate wash contains very little cassiterite, but it has been worked at several localities south of Flaggy Creek.

Exposures of the intermediate wash occur on the eastern side of a small hill, 300 m south-southeast of Westwoods farm, and also just south of Westwoods house, where it can be seen about 15 m above workings in the wash of the Bradlaugh Deep Lead. Some exploratory work has been carried out to the east of the first exposure, on the flanks of the small hill. The stanniferous alluvium here is about 0.5 m thick, and ranges from grey clayey wash containing grains, pebbles, and cobbles of quartz up to 18 cm in diameter, to red, yellow, and white coarse-grained sandy to gritty wash containing quartz pebbles up to 2.5 cm in diameter. The wash contains a little fine-grained cassiterite and ilmenite.

About 1 km south of Tepon Siding, at the southern end of the old Herberton Tin Syndicate's workings, and about 100 m east of the Herberton-Ravenshoe railway, a shaft has penetrated 1.7 m of intermediate alluvium. The alluvium consists of 1 m of red, yellow, and grey mottled medium to coarse grained sand and sandy clay containing small quartz pebbles (up to 1 cm across) and basalt cobbles up to 7.5 cm in diameter, overlain by brownish silty soil and brownish, red, and yellow mottled silty clay. The maximum known thickness of intermediate alluvium occurs in the railway cutting to the west of the shaft. Here the lower basalt is overlain by up to 6 m of red, brownish, yellow, and whitish indurated coarse sand and intercalated lenses and bands of coarse gritty to pebbly wash containing a little fine cassiterite.

The two main tributary deep leads of the Herberton Deep Lead have both been worked. The Bradlaugh Deep Lead, which joins the Herberton Deep Lead south of Nigger Creek, Wondecla, is similar to the main lead in type of tin, wash, and basalt cover. The Cassowary Creek Deep Lead has mostly been worked on the southern and, to a lesser extent, the northern margins of a small basalt knoll to the east of the present stream and about 3 km north of its junction with the Wild River. Here rich pockets and thin seams of fine-grained cassiterite occur in brown to white pebbly and cobbly wash, up to 2 m thick, containing lenses of coarse loose sand. Pebbles, cobbles, and boulders of quartz, porphyritic acid volcanics, granite, and hornfels occur mainly in the lower part of the wash.

On the northern side of the Wild River, about 1 km north of Kalunga Siding and 200 m north of the river, a small thin remnant of basalt is underlain by stanniferous wash. The alluvium consists of 1.5 m of lightly mottled brown and white medium to coarse sandy wash containing gritty lenses and a pebbly to cobbly layer near its base. The cassiterite is much coarser than at Kalunga, and ranges up to 5 mm in diameter.

The cassiterite found in the deep lead wash is black or less commonly yellow, amber, ruby, and grey. It ranges up to 4.5 cm in diameter, but is mostly 0.5 to 1.5 mm. The crystals are generally subangular to well rounded. Small quantities of ilmenite, wolframite, and topaz, and a trace of gold and rare diamonds accompany the cassiterite. Fossil trees and common opal have also been found in the wash. The cassiterite concentrate from the deep lead assays about 73 percent tin metal.

The wash has been extremely rich. Values of 18 to 30 kg of cassiterite per cu m were very common, and 60 to 180 kg per cu m were not exceptional.

The main source of the cassiterite in the deep lead has been the lodes on Herberton Hill, especially the richer greisen lodes, many of which have probably been completely eroded away.

South of Nigger Creek the deep lead system passes over the non-stanniferous Kalunga Granodiorite, and it is therefore unlikely to become enriched in tin southwards. However, the cassiterite in a small tributary lead, about 1 km north of Kalunga Siding, is coarser than that in the adjacent main deep lead, and was probably fed from a local source. Hence, south of Flaggy Creek, the deep lead has probably been slightly enriched by this locally derived cassiterite, and may also have been enriched by cassiterite brought down by Flaggy Creek. However, any enrichment has probably been nullified by dilution from the poorer intermediate wash and by the greater distance from the main source on Herberton Hill, hence tin values are generally poor in this section of the deep lead.

The cassiterite in the Cassowary Creek Deep Lead has probably come mainly from lodes northwest of Kalunga, in the Stella mining area.

Methods of working

The Herberton Deep Lead has been worked by shafts and tunnels driven beneath the basalt from the Wild River and from small creeks and gullies. The stanniferous wash collected was carted to communal sluice boxes on the Wild River and on other creeks. The deep lead has been intensely worked: more than 1000 shafts and tunnels intersect the lead in the Herberton/Basalt Creek section. In a much-worked section at Wondecla there are over 200 shafts, connected by drives, in an area 90 m by 55 m.

A major problem in mining the stanniferous wash was the heavy flow of water in the deepest and richest parts of the lead. To drain the lead several tunnels were driven beneath the basalt and below the level of the deep lead from the Wild River and other streams. The tunnels also provided a convenient way of working the lead, as they were used for carting the wash to the sluice boxes. The portals of the tunnels were located in granite and some were driven more than 150 m before they struck wash in the tunnel roof. The first of these tunnels was begun by Masterson in 1884.

On reaching the stanniferous wash some of the tunnels continued for more than 1 km within the deep lead. They provided a life-time of work for some miners, such as W. Stewart and party in the Whyalla (or Walhalla) tunnel, Kalunga. Most of the production from the deep lead came from the tunnels, and Masterson and party are credited unofficially with having produced 800 tons of cassiterite concentrates. Other major tunnels include Caseys, Mazlins, and Mortensons (Fig. 18).

Conclusions and recommendations

The Herberton deep lead has not been explored systematically and in detail, as it has generally been worked by small parties and syndicates of miners. In 1938 some electric resistivity prospecting was carried out by geophysicists of the Aerial Geological and Geophysical Survey of Northern Australia with the express purposes of (1) tracing the deep lead in the more or less unworked portions between Wondecla and Kalunga, and (2) determining its eastern limits. The results were interpreted as indicating the existence in the Tepon area of a valley parallel to and east of the main deep lead, from which it was separated by a narrow ridge of granite. The valley was thought to be a wide flat-bottomed tributary on the same level as the deep lead, and consequently constituted a possible important untapped source of alluvial cassiterite. The course of the postulated stream was drilled in 1942 by Alluvial Prospectors Ltd, under contract to the Queensland Department of Mines, and the results of the drilling were summarized by Cribb (1946). Three of the eight boreholes drilled penetrated deep ground with bedrock at a depth of 39 to 42 m, but still 6 to 9 m above the level of the main deep lead. Values were poor, the maximum being 1.2 kg of cassiterite per cu m over 1 m between 41 and 42 m. The drilling results indicated that the deep ground occurred in a narrow tributary of undetermined course, and was uneconomic. In addition all boreholes indicated the presence of low-grade stanniferous wash (0.4 to 0.6 kg of cassiterite per cu m over 1 to 2 m) about 26 m below the surface. The alluvium occurs beneath the upper basalt, and the lower basalt appears to be absent.

The richest parts of the deep lead have now been almost completely exhausted, but the lead still has considerable potential. This could be evaluated by a programme of detailed geophysical work, combined with drilling and geological mapping, directed at the following targets:

1. The course of the deep lead between the eastern end of Caseys tunnel (in the area of the Herberton Tin Syndicate's old workings) and Mazlins tunnel, and between Mazlins tunnel and Kalunga. The deep lead has not been satisfactorily located in this region, and there is a distinct possibility that the ancestral Wild River had two channels here, separated by a ridge of granite, as at Tepon. There is also a possibility that an ancestral bed of Flaggy Creek carrying stanniferous wash might be located in this area. To test part of this unknown section of the deep lead a shaft, the X2, was put down in 1963 by L. G. Stewart and party about 320 m northeast of the area worked from the Whyalla tunnel. The shaft intersected 2 m of wash between 25 and 27 m which contained 1.2 kg of cassiterite per cu m. Drives 6 m to the east and west encountered high bedrock.

2. The course of the deep lead between the workings south of Sandy Creek and Deadmans (Wet) Gully.

3. The deep lead channel between Deadmans Gully, Basalt Creek, and Prairie Creek. The course of the deep lead has not been definitely located in this section, but because of the occurrence of wash here Jensen (1939) suggested that two stanniferous channels might be present along the eastern and western edges of the basalt in this region. Although the tin content would probably be much lower than in the upper section of the deep lead, because of the distance from the source of the cassiterite, and because of the intermingling of the poorer intermediate alluvium with deep lead wash proper, the wash may be economic. In addition, some enrichment could be expected south of the junction of Cassowary Creek and the Wild River.

4. The bed of the Cassowary Creek Deep Lead south of the worked part.

5. The course of the upper main deep lead. This section contains some fine grained cassiterite in the intermediate wash 15 m above the Bradlaugh Deep Lead and about 300 m south-southeast of Westwoods farm. This part of the lead may be

related to an earlier course of Nigger Creek which may have been located by the boring northeast of Tepon in 1942.

In addition to the finding and working of unlocated parts of the deep lead, the sluicing of its edges appears to offer a profitable return, especially close to the Wild River, where the wash is exposed or covered by only 5 to 10 m of decomposed basalt. The basalt could easily be removed by bulldozer and ripper. However, such an operation would be on a relatively small scale. Although water is available from the Wild River for only part of the year, the supply could be supplemented by conserving in storage dams the water issuing from beneath the basalt, especially during the wet season. By recirculating the water an ample supply should be available for the greater part of the year.

Using sluicing methods much of the overburden, and also the mullock and fill in the old drives may be payable, especially in the Tepon area, where the alluvium is thickest.

CONCLUSIONS AND RECOMMENDATIONS

Lode deposits

The Herberton Tinfield is characterized by an abundance of small rich lodes and an almost complete lack of large lodes. The lodes have been worked for tin, copper, silver, lead, and tungsten, of which tin has been by far the most important product. Small amounts of antimony, bismuth, gold, molybdenum, zinc, fluorite, fluxing ore, ironstone, calcite, and mica have also been produced, some of them as by-products of tin, copper, and tungsten mining.

The lodes are found in Upper Carboniferous Elizabeth Creek Granite, Carboniferous Featherbed and Nanyeta Volcanics, sedimentary rocks of the Silurian to Devonian Hodgkinson Formation, unnamed granite of probable Carboniferous age east of Mount Garnet, and Precambrian rocks. The Featherbed and Nanyeta Volcanics, the Hodgkinson Formation, and possibly also the unnamed granite, are intruded by Elizabeth Creek Granite.

The mineralization has a zonal distribution which is related to the Elizabeth Creek Granite and its associated thermal metamorphic aureole. The tin and tungsten mineralization occurs in inner zones which pass outwards into a copper zone and a silver and lead zone.

Because of the mineral zoning and the restriction of the mineralization to the Elizabeth Creek Granite and rocks older than this granite, it is concluded that the economic mineralization was introduced during the emplacement of the Elizabeth Creek Granite. A possible exception is minor gold mineralization, which may be Precambrian, near Mount Garnet. Acid dykes cutting the Elizabeth Creek Granite are thought to be post-mineralization in age.

Over 2400 mines and prospects have been located in the Herberton Tinfield. The largest tin mine is the Vulcan mine, Irvinebank, which produced 13,712 tons of tin concentrates between 1891 and 1933, worth about $A25,000,000 on present-day prices. The second largest tin mine, the Great Northern, Herberton, produced 5000 tons of concentrates. Only 8 other tin mines in the area have produced more than 1000 tons of concentrates, and fewer than 100 have produced more than 50 tons of concentrates. The largest copper mine, the Mount Garnet copper mine, produced 4415 tons of copper between 1901 and 1903. The total production of silver (4,206,780 oz) and lead (11,645 tons) in the area amounts to less than 4/5 and 1/5, respectively, of the silver and lead production at Mount Isa in 1964.

Although the area has been extensively prospected, new lodes will be discovered as long as mining continues in the area. There may still be a few undiscovered lodes cropping out on the surface, and there are undoubtedly many at depth. They can be expected to be of similar size and type to the known lodes, and it is most unlikely that any low-grade deposits suitable for exploitation on a large scale will be found. However, if the tin lodes on Herberton Hill had been discovered within the last ten years, it is possible that the most economic method of mining them would have been by excavating the whole hill as an open-cut operation.

In 1966 only tin mines were being worked in the area. These were old mines which had been recently re-opened, such as De Wett mine, Emuford, and mines which had been worked more or less continuously since their discovery, such as the Rainbow mine, Adventure Creek. The success of such mines indicates that lode-mining for tin should continue as long as tin commands a high price on world markets.

Local tradition has it as a general rule that the tin mineralization cuts out at shallow depth, and few of the tin mines are over 30 m deep. Many of the abandoned mines closed down when the tin lodes the miners were following could not readily be located on the far sides of joints, faults, or dykes, or when the grade of the ore became too low or the ore too contaminated with sulphides to be worth mining. However, there are several exceptions to the rule, notably the Vulcan mine, Irvinebank, which was worked to a depth of over 430 m in sedimentary rocks, and the Great Northern mine, Herberton, which was worked to a depth of over 180 m in granite. On several occasions at both these mines the lodes appeared to cut out, and the mines were in danger of closing, until either new lodes or continuations of old lodes were found at greater depth. The success of the Vulcan and Great Northern mines indicates that many of the shallow mines were probably abandoned prematurely.

In several cases, such as the mines on the A1 line near Emuford, mines were abandoned when tin lodes passed downwards into sulphide lodes containing little or no cassiterite, or cassiterite completely enclosed in sulphides, and therefore difficult to separate. In many such cases the sulphide lodes may contain stannite, which may in places be present in sufficient quantities to form an economic mineral deposit.

To find lost or new lodes in the abandoned tin mines it is recommended that a detailed geological survey of the mine workings be carried out, paying particular attention to shears or joints which may be associated with the mineralization. This survey would indicate areas where lodes are most likely to be found. These areas could then be tested by a combination of underground mining, long-hole drilling, and, in selected cases, diamond drilling.

To date geophysical and geochemical methods of prospecting have been unsuccessful in locating tin lodes. Geophysical methods have located sulphide lodes at Watsonville, but these lodes contain little or no tin. Geochemical prospecting may be useful in the future, especially if readily detectable trace elements are found to be systematically associated with the tin mineralization.

It is considered that the most efficient method of working the tin mines in the area is for a company, syndicate, or co-operative to operate several closely spaced mines concurrently, and to have the ore crushed at a nearby treatment plant. The four batteries operating in the area in 1966 were working at or close to their maximum capacity, so additional treatment plants are needed if the annual production of lode tin is to be significantly increased.

In searching for tin lodes, the most promising areas appear to be outcrops of sedimentary rocks and granite which are already known to contain abundant cassiterite-bearing chloritic lodes. Such areas include outcrops of Hodgkinson Formation at Brownville, Coolgarra, Emuford, Irvinebank, and Stannary Hills, and granite outcrops at Herberton and Watsonville.

Less promising but worth investigating are areas of greisen, especially those associated with known tin lodes such as the greisens between Emuford and Geebung Hill. Some of these greisens may be potential low-grade large-tonnage deposits, though random greisen samples obtained from Geebung Hill and Mount Gibson by K. R. Yates in 1963 contained only traces of tin.

Further research into the methods of extraction of cassiterite from its host rock could be of major importance to the mining industry, as the present methods of milling and concentration result in large losses of cassiterite, especially in sulphide-bearing ores. Ore is crushed by stamps, rod mills, or ball mills, and the pulp is then fed to concentrating tables of the Wilfley type. Losses occur chiefly in the slimes, and may be 50 percent or more of the cassiterite content of the ore. Improved recoveries would enable lower-grade ore to be profitably worked.

The copper, silver, and lead mines in the area were opened up on high grade near-surface secondarily enriched ores, and were abandoned when these were worked out. The secondary ores pass down below the watertable into primary sulphide lodes which, except possibly at the Mount Garnet copper mine, were, and still are, too small and of too low a grade to form economic deposits.

Tungsten mineralization is widespread in the area, but the individual lodes are mostly too small and too low grade to be attractive for mining at present prices. The same can be said for the antimony, bismuth, gold, fluorite, and zinc deposits.

Alluvial deposits

The future of alluvial cassiterite mining in the area when the known large deposits near Mount Garnet are worked out early in the 1970s is not promising, as attempts to find additional major reserves have not been successful. However, there is a strong possibility that some of the dredge tailings could be profitably worked (S. R. Strachan, pers. comm., 1966).

Small alluvial and eluvial tin deposits occur along creeks in many parts of the area, but these can only be worked by small groups of miners during the wet season, and are unsuitable for large-scale mining.

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APPENDIX

TABLE 16. SYMBOLS AND ABBREVIATIONS

Ref. No. Reference number of mine, corresponding to that shown on Plates 17 and 18.

Name. Name of mine, if known.

Host rock symbol. Country rock or rocks in which mine is located:

Pgn, Nymbool Granite
Cgz, Elizabeth Creek Granite
Cgk, Kalunga Granodiorite
Cgu, unnamed Carboniferous granite
Cf, Featherbed Volcanics
S-Dh, Hodgkinson Formation—interbedded sandstone, siltstone, and shale
S-Dha, Hodgkinson Formation—massive sandstone
S-Dhc, Hodgkinson Formation—limestone
S-Dhd, Hodgkinson Formation—chert
pC, Precambrian schist

APPENDIX

USED IN TABLES 17-50

Product. Product of mine, indicated in most cases by chemical symbols.

Associated metals. Other metals present which have not been exploited, indicated by chemical symbols.

Gangue. Ca, calcite; Ch, chlorite; CS, complex sulphide; F, fluorite; Ga, garnet; G, greisen; K, kaolin; Q, quartz; T, tourmaline; Tp, topaz.

Structural control. S, shear(s); J, joint(s); V, vein(s); Dip and Strike, general orientation of structural control.

Surface workings. sh(s), shaft(s) greater than 3 m deep; pit(s), hole(s) less than 3 m deep; ad(s), adit(s); open cut, hole greater than 3 m deep and 10 m or more across.

Remarks. Letter symbols in parentheses refer to references at end of each table.

TABLE 17. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	} Mount Babinda	S-Dh	Cu	Fe	Q	S
2	} Mount Babinda	S-Dh	Cu	Fe, Pb	Q	S
3	—	S-Dh	Cu	Fe, Pb	Q	S
4	Combination E?	S-Dh	Cu	Fe	Q	S
5	—	S-Dh	Cu	Fe	Q	S
6	Little Joey	S-Dh	Sn	Fe, As	Q, Ch	S
7	De Wett	S-Dha	Sn	Cu, Fe, As	CS, Ca	S
8	Warburton Mountain	S-Dh	Sn	—	Q, Ch	S
9	Ice Box	S-Dh	Sn	Cu, Fe	CS	S
10	Brown Snake (Speculation)	S-Dh	Sn	—	Q, Ch	S
11	—	Cgz	W	Fe	Q	V
12	—	Cgz	W	Fe	Q, Ch	V
13	—	Cgz/S-Dha	?	—	Q	S
14	Mistake	Cgz	F, W	Fe	G	S
15	Gold Rod	Cgz	W	Fe	G, F	J
16	—	Cgz	W	Fe	G	S
17	—	Cgz	W	Fe, Sn	G, F	—
18	—	Cgz	W	Fe, As	G	J
19	—	Cgz	W	As, Fe	G	J
20	Dreadnought	Cgz	W	Fe	G, F	J
21	—	Cgz	W	Fe	G, F	J
22	—	Cgz/S-Dh	W	As, Fe, Cu	G, F	—
23	—	Cgz	W	Fe	Q	V
24	—	Cgz	W	Fe	Q	J
25	—	S-Dh	W	As, Fe	Q	—
26	—	Cgz	W	Fe	G, F	V
27	—	S-Dh	?	—	—	—
28	Mystery	Cgz	W	Cu, Fe, As, Pb, Bi	Q, F, T	S
29	—	Cgz	?	As, Fe	G	V
30	—	Cgz	W	As, Fe	G, F	—
31	—	Cgz	W	Fe	G	—
32	Maori Boy	Cgz	W	Fe	Q	J
33	—	Cgz	W	Fe	Q	J
34	Johnny Graham	S-Dha	Sn	Fe	Q, Ch	S
35	—	S-Dha	?	—	Q	V
36	Viking Amalgamated	S-Dha	Cu	Fe	Q	S
37	Majorie	S-Dha	Cu	Fe	Q	S
38	—	S-Dha	Cu	Fe	Q	S
39	—	S-Dha	?	—	—	S
40	Gem (California?)	S-Dha	Sn	Cu	Ch, K	S
41	} Mixture	S-Dha	Sn	Fe, Cu	Q, Ch	S
42	} Mixture	S-Dha	Sn	Fe	Q, Ch	S
43	—	S-Dha	?	—	—	S
44	Ironclad (Buffalo?)	S-Dha	Sn	Fe	Q, Ch	S
45	Beauty? (Baltic?)	S-Dha	Sn	—	Ch	S
46	—	S-Dha	Sn	—	Q, Ch	S
47	Ivy Extended (Balkan?)	S-Dha	Sn	Cu, Fe, As	Q, Ch	S
48	Luck?	S-Dha	Sn	Fe	Q	S
49	Hassy Shaft (Bengal?)	S-Dha	Sn	—	Q, Ch	S
50	Ivy	S-Dha	Sn	Fe	CS	S
51	Yellow Shaft (Bombay?)	S-Dha	Sn	—	Q, Ch	S
52	Al?	S-Dha	Sn	—	Q, Ch	S
53	Glass Bottle (Berlin?)	S-Dha	Sn	Fe	Q, Ch	S

OF THE EMUFORD AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
150	90	7 shs, pits	(f,h)
150	75W	6 shs, pits	
150	75W	5 shs, pits	—
010	90	1 sh, pits	—
155	85E	2 shs	—
145	90	2 shs, pits	—
150	75W	6 shs, pits	over 36 m deep, 40 tons SnO_2 1904-69
180	80W	open cuts	—
135	40N	1 sh	—
140	90	4 shs, pits	(k), worked to depth of 23 m in 1950s; 38 tons SnO_2 1941-64
—	—	2 shs, 2 adit, pits	—
015	—	open cut, pit	—
135	—	sh	—
075	90	adit, open cut, pits	(b,d,g,k), 1139 tons fluorite 1920-21
145	—	adit, 2 shs, pits	(k)
—	—	sh, pits	—
—	—	adit, sh	—
135	—	pit	—
125	—	open cut	—
155	—	pits	—
155	—	pits	—
—	—	open cut, sh, pit	—
175	—	pit	—
175	—	sh, pits	—
—	—	pits	—
—	-	sh	—
130	—	pit	—
165	90	5 shs, adit, pits	(k), 12 tons wolframite 1952-57
155	—	open cut	—
—	—	sh, pits	—
—	—	3 shs, pits	—
165	90	2 shs, pits	—
155	—	pits	—
105	80S	2 shs, pits	12 tons SnO_2 1936-53
165	85E	1 sh	—
155	80S	1 sh, pits	—
135	90	2 shs	—
170	80W	1 sh	—
025	75W	sh, pit	—
170	65W	2 adit, open cut, pit	(c), 9 tons SnO_2 1913-57, at least 20 tons SnO_2 before 1913
170	75W	4 shs, pits	—
175	75W	2 shs, pits	—
115	90	pit	—
135	85E	2 shs, pits	on Al line
175	75W	sh, pits	on Al line
175	75W	3 shs, pits	on Al line
125	90	2 shs, open cut	on Al line
125	—	pits	on Al line
125	90	4 shs, pits	on Al line
130	90	2 shs, pits	(c,f), on Al line, 30 tons SnO_2 1913-60
135	90	3 shs, pits	on Al line
135	80S	2 shs, pits	on Al line
125	80S	3 shs, pits	on Al line

TABLE 17. MINES AND PROSPECTS OF

Ref. No.	Name		Host Rock Symbol	Product	Associated Metals	Gangue	Type
54	Halley's Comet (Belfast?)		S-Dha	Sn	Fe, Pb, As	Q, Ch	S
55	Sunburst		S-Dha	Sn	—	Ch	S
56	—		S-Dha	Sn	Fe	Q, Ch	S
57	—		S-Dha	Sn	—	Q, T	S
58	—		S-Dha	Sn	—	Q, Ch, T	S
59	—		S-Dha	Sn	—	Q, Ch, T	S
60	—	Johnny	S-Dha	Sn	—	Q, Ch, T	S
61	—		S-Dha	Sn	—	Q, Ch, T	S
62	Sunshine		S-Dha	Sn	—	Q, Ch, T	S
63	—	Walker	S-Dha	Sn	—	Q, Ch, T	S
64	Dead Finish		S-Dha	Sn	—	Q, Ch, T	S
65	—		S-Dha	Sn	—	Q, Ch, T	S
66	Johnny Walker?	Line	S-Dha	Sn	—	Q, Ch, T	S
67	Maginot Line		S-Dha	Sn	—	Q, Ch, T	V
68	—		S-Dha	Sn	—	Q, Ch	S
69	—		S-Dha	Sn	—	Q	S
70	—		S-Dha	Sn	—	Q, Ch	S
71	Panquay		S-Dha	Sn	As, Fe, Pb, Ag, Zn	Q, Ch, T	S
72	—		S-Dha	Sn	—	Ch	S
73	—		S-Dha	Sn	—	Q, Ch, T	S
74	—		S-Dha	Sn	—	Q, Ch	S
75	—		S-Dha	Sn	—	Q, Ch	—
76	Normanby		S-Dha	Sn	—	Q, Ch	S
77			S-Dha	Sn	—	Q, Ch	S
78	—		S-Dha	Sn	—	Q, T	—
79	—		S-Dha	Sn	—	Q, Ch, T	—
80	—		S-Dha	Sn	—	Q, Ch, T	S
81	Surprise		S-Dha	Sn	Fe	Q, Ch, T	S
82	C.C.C.		S-Dha	Sn	Fe, Cu	Q, Ch, T	—
83	—		S-Dha	Sn	—	Q, Ch, T	—
84	—		S-Dha	Sn	—	Q, Ch, T	S
85	Waratah		S-Dha	Sn	—	Q, Ch, T	S
86	—		S-Dha	Sn	—	Q, Ch	—
87	—		S-Dha	Sn	—	Q, T	—
88	Stallon (Easy Street)		S-Dha	Sn	—	Q, Ch, T	—
89	Bonnie Dundee		S-Dha	Sn	—	Q, Ch, T	S
90	New Talk of the Hills		S-Dha	Sn	—	Q	S
91	—		S-Dha	Sn	—	Q	?
92	—		S-Dha	Sn	—	Q, Ch, T	S
93	Robinson Tunnel		S-Dha	Sn	—	Q, Ch, T	S
94	—		S-Dha	Sn	—	Q	V
95	Better Luck		S-Dha	Sn	—	Q	S
96	Marvel		S-Dha	Sn	As, Fe	Q, Ch	S
97	Gilded Rose (Theodore?)		S-Dha	Sn	Fe	Q, Ch, T	S
98	—		Cgz	?	—	G	V
99	Evans Show		Cgz	Sn, W	Cu, Bi, As, Fe	G, F	S
100	—		Cgz	W	Fe	G	—
101	—		Cgz	W	Fe, As	Ch, G	S
102	—		Cgz	W	Fe	Q, K	—
103	—		Cgz	W	Fe, Sn?	G	V
104	Little Marvel		Cgz	W	—	—	—
105	—		Cgz	W	Fe, Mo	G	S
106	—		Cgz	Cu	Fe	G	S
107	Daisy Bell		Cgz	Sn	W, Fe	G	V
108	—		Cgz	?	—	G	—
109	—		Cgz	?	—	G	—

Structural Control Strike	Dip	Surface Workings	Remarks
140	90	2 shs, pits	(c), on A1 line, sulphide below 21 m; 1 ton SnO_2 1918-35
155	55S	4 shs, pits	—
145	80S	2 shs	—
135	70S	pits	—
005	90	sh, pits	—
135	85S	sh, pits	—
150	75S	3 shs, pits	—
145	75S	3 shs, pits	—
145	65S	3 shs, pits	3 tons SnO_2 1939-41
175	75W	2 shs, pits	—
175	70W	4 shs, pits	(l,m), 4 tons SnO_2 1947
175	70W	3 shs, pits	—
175	70W	6 shs, pits	11 tons SnO_2 1935-55
080	—	pits	—
140	90	pits	—
165	75W	pits	—
135	—	pits	—
065	80S	sh	24 tons SnO_2 1933-60
—	—	pits	—
095	65S	sh, pits	—
130	90	2 shs	—
—	—	pits	—
130	90	sh, pit, open cut	(c), 24 tons SnO_2 1913-68 (applies to this and next row)
—	90	sh, pit	
—	—	pits	—
—	—	sh	—
130	83S	sh	—
155	80W	3 shs, pits	—
—	—	sh, pits	31 tons SnO_2 1943-62
—	—	sh, pit	—
180	—	2 shs, pits	—
165	80W	2 shs, pits	15 tons SnO_2 1912-28
—	—	pits	—
—	—	sh, adit, pits	—
—	—	5 shs, pits	—
000	90	4 shs, pits	Being worked as Easy Street 1966, 4 tons SnO_2 1966
145	85W	2 shs, pits	10 tons SnO_2 1906-07
—	—	pits	—
155	70W	6 shs, pits	—
—	—	5 shs, pits, adit	—
—	—	pit	—
170	65W	sh, pits	—
060	90	sh, pit	15 tons SnO_2 1913-33
060	90	2 shs, pits	(c), may be **Theodore** (e), pyrite at depth, 16 tons SnO_2 1917-19
—	—	pit	—
135	—	pits	—
—	—	pit	—
125	90	sh	—
—	—	pit	—
—	—	sh, pits, adit	—
—	—	—	not examined
140	90	pit	—
120	90	sh	—
—	—	pits	(c), 15 tons SnO_2 1908-33
—	—	pits	—
—	—	pit	—

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
110	Emu?	Cgz	Sn	Fe	G	—
111	Cave	Cgz	Sn	Cu, Fe	G, F, Ch, T	—
112	Glenora? (Combination?)	Cgz	?	—	G, Ch	S
113	Mars	Cgz	Sn	As, Fe, Zn, W	G, Ch, F	S
114	—	Cgz	W	—	G, Ch,	S
115	—	Cgz	?	Cu, Fe	G	—
116	Billings	Cgz	W, Cu	Mo, Fe	Q	V
117	Billings	Cgz	W	Fe	Q	V
118	Paddymelon	Cgz	Cu, W	Fe	Q	S
119	—	Cgz	?	—	Q	—
120	—	S-Dha	Sn	—	Q	—
121	Dove	Cgz	Sn	W, Fe	G, K	V
122	—	Cgz	?	—	G, K	—
123	Sugar Bag	Cgz	Sn	—	G	—
124	Mountain Maid	Cgz	Sn, W, Bi	Fe	Q, Ch	S
125	—	Cgz	?	—	Ch, G	—
126	Hard Hole (White Eagle)	Cgz	Sn	As, Fe	G	—
127	—	Cgz	Sn	—	Q	—
128	D.C.L.?	Cgz	?	—	G	S
129	White Eagle Ext.?	Cgz	Sn	—	G	S
130	Great Granite	Cgz	Sn	—	G	—
131	White Hawk (Daisy?)	Cgz	Sn, W	Fe	Q	V
132	—	Cgz	Sn	—	Ch, G	—
133	—	Cgz	?	—	G	—
134	Hit or Miss	S-Dha	Sn	—	Q, Ch, Ca	S
135	—	S-Dh	?	—	—	S
136	—	Cgz	W, Cu	Fe, As	G	S
137	—	Cgz	W	Fe	G	—
138	—	Cgz	?	—	G	—
139	—	Cgz	W	Fe, As	G, F	S
140	—	Cgz	?	—	G	—
141	—	Cgz	W	Fe	G	—
142	Sydney	Cgz	W	Fe	G	S
143	Lucky Spot	Cgz	W	Fe	G	S
144	Sultan?	Cgz	?	—	G	—
145	Dividend	Cgz	W	Fe	Q	—
146	Second Division (Dividend?)	Cgz	?	—	G	—
147	—	Cgz	?	—	G	—
148	Barney	Cgz	?	—	G	—
149	Havelock	Cgz	?	—	G	—
150	Royal Standard	Cgz	Sn	—	G	S
151	Royal Standard	Cgz	Sn	—	G, F	—
152	Homeward Bound	Cgz	?	—	G	—
153	—	Cgz	W	Fe	G	S
154	—	Cgz	W	Fe, As, Cu	G, F, Ch	—
155	Granite Boulder	Cgz	?	—	G	—
156	—	Cgz	?	—	—	—
157	—	Cgz	?	—	—	—
158	Gibralta (Mountain View) (Summer Hill)	Cgz	Sn	—	G, Ch	—
159	Titania (Titania-Ennishowan)	Cgz	Sn	—	G	—
160	Tom?	Cgz	Sn	Fe	G, F, Ch	—
161	Starlight?	Cgz	?	—	G	S
162	—	Cgz	?	Cu, Fe	G	—
163	Hesperus	Cgz	W	Fe	G	S

Structural Control		Surface Workings	Remarks
Strike	Dip		
—	—	pits	—
—	—	7 shs, pits	—
160	75W	2 shs, pits	—
145	90	pits, adit	—
155	75E	pits	—
—	—	pits	—
—	—	2 shs, adit, pits	—
—	—	adit, sh	—
135	90	sh	—
—	—	pits	—
—	—	pit	—
170	—	4 shs, pits	(c), 33 tons SnO_2 1909-56
—	—	pits	—
—	—	pit, open cut	4 tons SnO_2 1938-39, working 1966
120	90	open cut, adit	—
—	—	pits	—
—	—	2 shs	—
—	—	sh, pits	—
135	—	pits	—
130	90	pits	—
—	—	pits	—
—	—	sh, pit	—
—	—	pit	—
—	—	pit	—
135	80W	2 shs, pits	(j), 11 tons SnO_2 1905-06, grade 13% SnO_2
065	40W	pit	—
125	90	pits, sh	—
—	—	pit	—
—	—	pits	—
140	90	pits	—
—	—	sh	—
—	—	pits	—
145	90	sh, pits	(k), 1 ton wolframite 1952-53
145	90	sh, pits	—
—	—	sh, pits	—
—	—	sh	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
150	90	5 shs, pits, adits	(a,f,i), probably produced well over 10 tons SnO_2
—	—	sh, pits	
—	—	pits	—
025	40W	pits	—
—	—	sh, pits	—
—	—	pits	—
—	—	—	no information
—	—	—	no information
—	—	pits	(a,f), 10 tons SnO_2 1908-16, grade 3% SnO_2
—	—	pits, open cut, sh	—
—	—	sh, pits	—
125	—	pits	—
—	—	pits	—
135	90	sh, pit	(a), 8% wolframite

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
164	Lights of London	Cgz	Sn, W	Fe	Ch, G	S
165	—	Cgz	?	—	Ch, G	—
166	—	Cgz	?	—	Q	—
167	—	Cgz	?	—	Ch, G	—
168	—	Cgz	?	Cu, Fe	Ch, Q	S
169	Harp of Erin (Erins Isle)	Cgz	Sn	—	G	—
170	—	Cgz	?	—	G	—
171	Ruby	Cgz	Sn	—	G	—
172	Kookaburra	Cgz	Sn	—	G	—
173	Plutonic	Cgz	Sn	—	G	—
174	Better Luck	Cgz	Sn	—	G, Ch	—
175	Mount Kingston	Cgz	Sn, Pb	—	Q, Ch	—
176	—	Cgz	?	—	Q, Ch	—
177	—	Cgz	?	—	Q, Ch	—
178	Water Lily	Cgz	Sn	—	G, F	—
179	—	Cgz	Sn	—	G	—
180	Sparklet	Cgz	Sn	—	Ch, G	—
181	Saurian (Black Dog)	Cgz	Sn	—	Q, Ch	—
182	—	Cgz	W	Fe	Q	—
183	Dalziels Homeward Bound	Cgz	Sn	As, Fe	Q, Ch	S
184	Black Diamond	Cgz	Sn	—	G	—
185	Last Call (Cigarette?)	Cgz	Sn	—	Q, Ch	S
186	—	Cgz	Sn	—	Q, Ch	—
187	Denford	Cgz	Sn	—	G, Ch	—
188	First Dividend	Cgz	Sn	—	G	—
189	Canadian	Cgz	Sn	Mo, We, Fe	G	—
190	—	Cgz	Sn	Mo	Ch, Q	—
191	—	Cgz	?	Cu, Fe, W	G, F	—
192	—	Cgz	?	—	—	—
193	—	Cgz	?	—	—	—
194	—	S-Dh	Cu, Pb	Fe	—	S
195	—	S-Dha	Sn?	—	—	S

References: (a) Lees (1907), (b) Saint-Smith (1917), (c) Saint-Smith (1920), (d) Saint-Smith (1921), (e) Saint-Smith (1925a), (f) Jensen (1939), (g) Ridgway (1945), (h) Knight (1949), (i) Dimmick & Cordwell (1959), (j) Syvret (1963b), (k) De Keyser & Wolff (1964), (l) Brien (1964a), (m) Brien (1964b).

THE EMUFORD AREA—*continued*

Structural Control Strike	Dip	Surface Workings	Remarks
155	90	sh, pit	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
165	90	pit	—
—	—	pit	—
—	—	pit	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	adit, pit	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	2 shs, adit, pits	—
—	—	sh, adit, open cut	—
—	—	pits	—
—	—	open cuts	(a), 6½% SnO_2 reported
—	—	sh, pits	—
135	—	sh	—
—	—	pits	—
165	65E	sh, pit	6 tons SnO_2 1906-18, grade 3% SnO_2
—	—	pit	—
—	—	pits, open cut	28 tons SnO_2 1906-09
—	—	open cut, adit, pit	—
—	—	pits, adits	—
—	—	pits	—
—	—	sh	—
—	—	—	no information
—	—	—	no information
155	72W	sh, pit	—
150	90	shs	—

TABLE 18. MINES AND PROSPECTS
(For key to symbols and

Ref. No.	Name		Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	Antimony Reward		Cf	Sb	—	Q	S
2	—		S-Dha	Cu	Fe	Q	S
3	Penang		S-Dha	Cu	Fe	Q	S
4	Pekin		S-Dha	Cu	Fe	Q	S
5	—	Slogger	S-Dha	Cu	Fe	Q	S
6	—		S-Dha	Cu?	Fe	Q, Ch	S
7	—	Cullens	S-Dha	Sn	—	Q	S
8	—		S-Dha	Sn	—	Q	S
9	—	Line	S-Dha	Sn	—	Q	S
10	Elizabeth		S-Dhd	Sn	Cu, Fe, As	CS	S
11	Bloodwood (Cornucopia)		S-Dh	Sn	Pb, Ag, Fe, As, Cu, Zn	CS	S
12	—		S-Dha	Sn	—	Q	S
13	Hallmark		S-Dhd	Sn	—	Q	S
14	—		S-Dh	?	—	Q	—
15	Silver Star?		S-Dh	Pb, Ag	—	Q	S
16	Trafalgar?		S-Dh	Pb, Ag	As, Fe	Q	S
17	Brisbane?		S-Dh	Pb, Ag	As, Fe	Q	S
18	—		S-Dh	?	—	Q	S
19	—		S-Dh	Cu	Fe	Q	?
20	Victory		S-Dh	Cu	Fe	Q	S
21	Tharis		S-Dh	Cu	Fe, As	Q	S
22	Hamilton		S-Dh	Cu	Fe, As	Q	S
23	Morning Star		S-Dh	Cu	Fe, As	Q	S
24	Mount Emma		S-Dh	Cu	Fe, As, Pb	Q	S
25	—		S-Dh	Cu	Fe, As	Q	—
26	Mount Volk		S-Dh	Cu	Fe, As, Pb	Q	S
28	Rainbow?		S-Dh	Cu	Fe, As	Q	S
27	Mont Gossan West		S-Dh	Cu	—	Q	V
29	Mount Gossan Extended	Siberia Lode	S-Dh	Cu	Fe, As	Q	S
30	—		S-Dh	Cu	—	—	—
31	Mount Prophey		S-Dh	Cu	—	—	—
32	Mount Gossan		S-Dh	Cu	Fe, As	Q	—
33	St Ledger		S-Dh	Cu	Fe, As	Q	S
34	—		S-Dh	Cu	As, Fe	Q	S
35	—		S-Dh	Cu	Fe, As	Q	S
36	—		S-Dh	Sn	Fe	Q, Ch, T?	S
37	—		S-Dh	Sn	—	Q, Ch, T, F	V
38	—		Cgz	mica	—	G	J
39	—		S-Dh	Sn	—	Q	V
40	—		Cgz	?	Fe, As	Q	?
41	—		S-Dh	Sn	—	G	V
42	—		Cgz	Sn	—	G	?
43	Panorama (Bente?)		Cgz	Sn	—	G, Ch	J

References: (a) Lees (1907), (b) Jensen (1939), (c) Syvret (1963b), (d) Dep. Min. metll. Engng (1965)

OF THE BLOODWOOD CREEK AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
075	35N	4 shs, pits	—
015	60E	pit	—
140	90	2 shs, adit, pit	—
150	90	sh, adit	—
160	90	pits	—
135	85E	sh, pits	—
130	—	pits	—
150	80E	3 shs, pits	—
125	90	sh, pits	—
—	—	6 shs, adit, pits	(c), 8 tons SnO_2 1908-22, grade about 6% SnO_2, 38 tons SnO_2 1960-69
097	85N	shs, adit, pits	56 tons SnO_2 1908-1969
—	—	sh, adit, pits	—
065	90	2 shs	(b), 2 tons SnO_2 1938-39
—	—	pit	—
140	60E	sh	—
065	60E	sh, pit	—
120	90	sh, pit	52% Pb (a)
065	30N	pit	—
—	—	pit	—
—	—	pit, 2 adits	—
175	90	2 adits	—
175	75E	2 shs, pit	10% Cu (a)
080	45N	sh, adit	(c)
065	40N	2 shs, 2 adits	(c)
—	—	sh	—
075	40N	2 adits, 2 shs, pit	—
080	45N	3 shs, adit, pits	—
—	—	2 pits	—
120	40N	3 shs, adit	—
—	—	sh, adit	—
—	—	adit, pit	—
—	—	adit	(c)
075	45N	5 shs, adit	—
070	40N	sh, 2 adits	—
115	45N	sh	—
175	—	open cut	—
—	—	pits	—
—	—	sh	—
145	—	pit	—
—	—	pit	—
—	—	pits	—
—	—	pits	—
120	90	pits, open cut	(b), 9 tons SnO_2 1918-38

TABLE 19. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	Lady Jane No. 1	S-Dha	Pb, Ag	—	Q	S
2	Lady Jane No. 2	S-Dha	Pb, Ag	—	Q	S
3	Barossa No. 2	S-Dha	Pb, Ag	Cu, Fe, Zn	Q	S
4	Albion	S-Dha	Pb, Ag	Cu	Q	S
5	Rio Tinto	S-Dha	Pb, Ag	Fe, Cu, Zn	Q	S
6	Barossa No. 1	S-Dha	Pb, Ag	—	Q	S
7	—	S-Dha	?	—	—	—
8	—	Cf	Pb, Ag	—	Q	S
9	Chirnoide	S-Dha	Pb, Ag	—	Q	S
10	Sammys Luck	S-Dh	Pb, Ag	Cu, Fe	Q	S
11	—	S-Dh	?	—	—	S

References: (a) Skertchley (1897), (b) Saint-Smith (1916c), (c) Jensen (1939), (d) Dimmick & Cordwell (1959), (e) Syvret (1963b)

OF THE MONTALBION AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	sh	(a,d,e)
060	70E	2 shs, pits	
—	—	4 shs, open cuts	
—	—	open cut, adits, 2 shs, pits	(b,e), 61 m deep
—	—	3 shs, adits, pits	(b,c,e)
—	—	2 shs, adit	(a,d,e)
—	—	pits	—
060	80E	2 shs, pits	—
—	—	pits	—
160	90	sh, pits	(c)
178	—	pit	—

TABLE 20. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	S-Dh	?	—	—	—
2	Victoria Amalgamated	S-Dha	Pb, Ag, Cu	Fe, Zn	Q	S
3	Victoria Amalgamated	S-Dha	Pb, Ag, Cu	Fe, Zn	Q	S
4	Lady Mary	S-Dh	Pb, Ag	As, Zn	Ch, Q	S
5	—	S-Dh	?	—	—	—
6	Comeno	S-Dh	Pb, Ag	Cu, Fe	Q, Ch	S
7	—	S-Dh	?	—	—	S
8	—	S-Dh	?	—	Q	S
9	Silver Queen	S-Dh	Ag, Pb, Sn	As, Cu, Fe, Zn	Q	S
10	Kangaroo	S-Dh	Sn	—	—	S
11	Primrose	S-Dh	Sn	—	Q, Ch	S
12	Minuet	S-Dh	Sn	—	Q	S
13	Dolly Grey	S-Dh	Sn	—	Q	S
14	Cosgrove	S-Dh	Ag, Pb, Cu	Fe, Zn	Q	S
15	—	S-Dh	?	—	—	S
16	—	S-Dh	?	—	Q	S
17	Lady Agnes	S-Dh	Sn	—	Ch	S
18	Mountain Maid	S-Dh	Ag, Pb	—	Q	S
19	—	S-Dh	Ag, Pb	Cu, Fe, Zn	Q	S
20	—	S-Dha	?	—	—	—
21	St George?	S-Dh	Sn	—	Q, T	S
22	Cosmopolitan	S-Dha	Sn	—	Q	S
23	Sunset	S-Dha	Sn	—	Q	S
24	Rainbow	S-Dha	Sn	Pb	Q	S
25	Bruce	S-Dha	Sn	—	Q	S
26	St Patrick	S-Dha	Sn	—	Q	S
27	Dead Bat	S-Dha	Sn	—	Q	S
28	Democrat	S-Dha	Sn	—	—	S
29	Adventure	S-Dha	Sn	Pb, Fe	Ch	S
30	Adventure	S-Dha	Sn	Pb, Fe	Ch	S
31	Champion	S-Dh	Sn	Fe	Q	S
32	—	S-Dh	Sn	—	—	S
33	—	S-Dh	Sn	—	Q	S
34	Viceroy	S-Dh	Sn	Pb	Q	S
35	Welcome (Just-in-Time)	S-Dh	Sn	Fe	Q, Ch	S
36	—	S-Dha	?	—	—	—
37	Smalgamar	S-Dha	?	—	Q	S
38	Patrick	S-Dh	Sn	—	Q	S
39	—	S-Dha	?	—	Q	S
40	Hard Hit	S-Dha	Sn	—	Q	S
41	—	S-Dha	Sn	—	Q, Ch	S
42	—	S-Dh	Sn	—	Q, Ch	S
43	—	S-Dh	?	—	—	—
44	—	S-Dh	?	—	Q, T	S
45	Lone Hand	S-Dha	Sn	—	Q, Ch?	S
46	—	S-Dha	Sn	—	Q, Ch	—
47	Dead Bird	S-Dh	Sn	—	Q	S
48	—	S-Dh	?	—	—	—
49	—	S-Dh	?	—	—	S
50	—	S-Dh	?	—	—	—
51	Wowser	S-Dh	Sn	—	Q	S
52	Anzac (Bulletin?)	S-Dh	Sn	—	Q	S
53	Right Bower (Left Bower?)	S-Dh	Sn	—	Q, Ch	S

OF THE ADVENTURE CREEK AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	—	no information
180	35-60W	shs, open cuts, adit, pits	(a,d,e,f), workings filled in, over 18,000 oz Ag and 200 tons Pb up to 1900
180	35-60W		
055	85N	2 adits, pits	may be **Silverfield** (a), reported to be 47 m deep
—	—	—	no information
165	85E	3 shs, pits, adit	—
180	15W	shs, pits	—
180	85E	shs, pits	—
065	85E	2 shs, adits, pits	(f), 117 tons tin ore, grade 5.5% SnO_2, 8 tons Sn-Pb ore
085	12N	pits	4 tons SnO_2 1907-17
170	85E	2 shs	—
158	85E	3 shs	—
—	—	—	28 tons SnO_2 1934-68
005	75W	2 shs, pits	(e)
170	—	pits	—
130	—	pits	—
170	70W	2 adits, shs	(e,f), 83 tons SnO_2 1906-36, grade 15% SnO_2
155	75W	6 shs, 2 adits, pits	(a,c,e,f), opened 1895, worked for 6 years to produce 12 tons Pb and 17,433 oz Ag
130	75S	sh, pits	may be **Silver** (f)
—	—	pit	—
030	60E	pits, sh	—
050	40E	shs, pits	—
—	—	shs	13 tons SnO_2 1912-30
—	—	shs	(e,g) over 76 m deep, 417 tons SnO_2 1934-69
—	—	shs	(e), 54 tons SnO_2 1930-58
145	40W	shs, pits, adit	88 tons SnO_2 1916-66
105	—	sh	—
120	—	shs, adit	5 tons SnO_2 1929-49
165	75W	shs	also known as **Great Adventure**, 352 tons SnO_2 1905-69
—	—	adit	
175	90	sh	—
155	70W	pits	—
125	90	sh	—
120	70S	adit, open cut, pit	2 tons SnO_2 1963
130	80S	9 shs	(a), 15 tons SnO_2 1901-18
—	—	pits	—
130	80S	2 shs, pits	—
—	—	3 shs, pits	(a), 16 tons SnO_2 1959-66
170	70W	2 shs	—
050	70E	3 shs, pits	—
130	85S	sh, pits	—
—	—	3 shs, pit	—
—	—	pit	—
125	75S	sh	—
155	80W	sh, pits	—
—	—	pit	—
035	80E	sh, pits	—
—	—	pit	—
—	—	adit, pits	—
—	—	sh	—
—	—	4 shs, pits	(f), 9 tons SnO_2 1941-48
140	45E	shs, pit	4 tons SnO_2 1916-49
175	45W	5 shs, pits	102 tons SnO_2 1906-09

TABLE 20. MINES AND PROSPECTS OF

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
54	—	S-Dh	?	—	Q	S
55	—	S-Dha	?	—	Q, Ch	S
56	Omeo	S-Dha	Sn	As	Q, Ch	S
57	—	Cgz	Sn	—	G	—
58	—	S-Dh	?	—	G	S
59	Euchre (Julie Ward)	S-Dh	Sn	—	G	—
60	—	S-Dh	?	—	G	—
61	—	S-Dh	Sn	—	Q	—
62	—	Cgz	?	—	G	S
63	—	S-Dha	?	—	Ch, G	S
64	Rose of Tralee	Cgz	Sn	Mo, As, Fe, Bi	Ch, Q	S
65	Jessie	Cgz	?	—	G	—
66	—	Cgz	?	W, Fe	G	—
67	—	Cgz	?	—	G	—
68	—	Cgz	?	Fe	G, Ch	S
69	—	Cgz	Sn	—	G, F	S

References: (a) Skertchley (1897), (b) Cameron (1904b), (c) Lees (1907), (d) Saint-Smith (1916a), (e) Jensen (1939), (f) Syvret (1963b), (g) Dep. Min. metall. Engng (1965).

THE ADVENTURE CREEK AREA—*continued*

Structural Control Strike	Dip	Surface Workings	Remarks
165	85W	sh	—
130	70S	pit	—
025	60W	2 shs	(e), discovered 1932, 58 m deep, 62 tons SnO_2 1936-66
—	—	sh, pit	—
125	90	sh, pits	—
—	—	2 shs	—
—	—	sh, pits	—
—	—	sh, pits	—
125	—	sh	—
175	75W	2 shs, pits	—
080	30W	sh, open cut, adit	9 tons SnO_2 1906-39
—	—	pit	—
090	—	pits	—
—	—	sh	—
—	—	4 shs, pits, adit	—
020	80S	sh, pits	—

TABLE 21. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	Huntingfield	S-Dha	Sn	Fe	Q	S
2	—	S-Dha	Sn	Fe	Q	S
3	—	S-Dha	Sn	Fe	Q	S
4	—	S-Dha	Sn	—	Q	S
5	Isolation	Cgz	Sn	Fe	G	S
6	Atlanta (Lady Iris?)	Cgz	Cu, Ag	Fe, Sn	Q	S
6a	Atlanta N	Cgz	Cu, Ag	—	Q	S
7	—	Cgz	?	—	—	—
8	Lady Ena(?)	Cgz	?	—	—	—
9	Robin Hood	Cgz	Cu, Ag	Fe	G	S
10	—	Cgz	?	—	Q	—
11	Rio Tinto	Cgz	W	Fe	—	—
12	—	Cgz	W	Fe	G	—
13	Eagle	Cgz	?	Cu, As, Fe	Q	V
14	Tungsten Hill	Cgz	W	Fe	G	—
15	Last Chance	Cgz	W	Cu, Fe	Q	—
16	—	Cgz	W	Fe	Q	—
17	—	Cgz	W	Fe	G	—
18	—	Cgz	W	Cu, Fe	Q	—
19	—	Cgz	?	—	G	—
20	Victory?	Cgz	Sn	—	G	—
21	Iona	Cgz	Sn	—	G	—
22	Rose of England	Cgz	Sn	—	G	—
23	Victoria Extended(?) (Ruby?)	Cgz	Sn	—	—	—
24	Sasan of Victoria?	S-Dh	Sn	—	—	—
25	Intermediate?	S-Dh	Sn	As, Fe	Ch	—
26	Lady Duff?	S-Dh	Pb, Ag	As, Pb, Fe	Q	V
27	Stannary Rainbow?	S-Dh	Sn	As, Fe	G	—
28	Lad O'Gowrie	Cgz	Sn	As, Fe	G	—
29	Glengarry } New Lass O'Gowrie	Cgz	Sn	As, Fe	Q	—
30	Lass O'Gowrie	Cgz	Sn	As, Fe	G	S
31	Glen Ayron	Cgz	?	As, Fe	G	—
32	—	Cgz	?	As, Fe	G	—
33	Empire	Cgz	?	Fe	G	—
34	—	Cgz	?	As, Fe	G	—
35	—	Cgz	?	—	—	—
36	Barytes	Cgz	?	—	—	—
37	—	Cf	?	—	—	—
38	—	Cgz	?	—	G	S
39	Dead Finish	S-Dh	Sn	As, Fe	Q, Ch	S
40	Dead Finish Extended	S-Dh	Sn	As, Fe	Q	V
41	You and Me	S-Dh	Sn	Cu, Fe	Q	S
42	Kitchener Extended	S-Dh	Sn	—	Q, Ch	S
43	Black Rock	S-Dh	Sn	—	Q, Ch	S
44	} Kitchener	S-Dh	Sn	—	Q, Ch	S
45		S-Dh	Sn	—	—	—
46	Maori	S-Dh	?	—	Ch	—
47	—	Cf	?	Fe, As	Q	—
48	—	Cf	?	—	—	—
49	—	S-Dha	Sn	–	G	S
50	Highland Mary	Cgz/S-Dha	?	—	G	S
51	Shasta (Gladstone Extended?)	S-Dha	Sn	Cu, Fe, Pb, As	CS	S

OF THE STANNARY HILLS AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
145	70N	sh	(e), 7 tons SnO_2 1936-37
—	—	sh, pits	—
165	—	sh	—
—	—	sh	—
—	—	2 shs, open cuts, pits	—
135	60W	sh, adit	(d,h,j), lode discovered about 1911, drilled by GSQ 1965, produced less than 2500 tons (grade 18% Cu, 3 oz Ag per ton)
—	—	sh	(i)
—	—	—	no information
—	—	—	no information
145	—	pits	—
—	—	pits	—
—	—	—	—
—	—	pit	—
—	—	sh	—
—	—	2 shs	—
—	—	adit, sh, pits	—
—	—	sh, open cut	—
—	—	adit, shs, open cut	—
136	50S	shs, open cut	—
—	—	open cut	—
—	—	shs	—
140	—	shs, open cuts	(i), 13 tons SnO_2 1954-65
150	—	adit, shs, open cut	—
—	—	—	—
030	80E	adit, sh	—
—	—	sh	—
—	—	adit, shs	—
—	—	2 adits, shs	—
160	—	adit, open cut	—
—	—	adit, sh	—
N-S	—	3 shs, open cut	(c,e,f), stannite recorded (g), 432 tons SnO_2 1901-33, grade 20.1% SnO_2
—	—	sh, open cut	—
—	—	adit	—
155	—	pits	—
—	—	sh	—
157	90	open cut, pits	—
—	—	—	no information
—	—	open cut	—
165	—	pit	—
010-155	60W	5 shs	(d), 150 tons SnO_2 1906-13
—	—	pit	—
—	—	adit, shs, open cut	(e,f,i), 176 tons SnO_2 1916-69
110	—	adit, 2 shs	(a,b,e,f), 144 tons SnO_2 1906-27, grade 1.55% SnO_2
065	—	adit, sh, open cut	(a,f), over 10 tons SnO_2 1908-11
110	—	shs, open cut, pits	} (c,e,f), 410 tons SnO_2 1907-35, grade 1.7% SnO_2
—	—	adit	}
—	—	sh	—
—	—	sh, pits	—
—	—	?	no information
—	—	sh	—
—	—	pits	—
—	—	sh	over 30 m deep, 6 tons SnO_2 1965-66

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
52	Gladstone	Cgz	Sn, W	Cu, Fe, As	CS	S
53	—	S-Dha	?	—	Q, T	S
54	—	Cgz/S-Dha	Sn	—	G	—
55	—	S-Dh	Sn	—	Q, Ch	S
56	Ivanhoe	S-Dh	Sn	Cu, Fe	Ca, Q, Ch	—
57	—	S-Dh	Sn	—	Q, Ch	—
58	—	S-Dh	Sn	—	Q, Ch	—
59	Eclipse	S-Dh	Sn	Pb, As, Fe, Cu, Zn	CS	—
60	—	S-Dh	Sn	—	Ch, Q	—
61	Yam	S-Dh	Sn	As, Fe	Q, Ch	S
62	—	S-Dh	Sn	—	Ch	S
63	—	S-Dha	Sn	Cu, Fe	Ch	S
64	Bowyang	S-Dh	Sn	—	Ch, Q	—
65	Crack in the Rock	S-Dh	Sn	—	Ch, Q	S
66	—	S-Dh	Sn	Fe, Cu	Ch, Q	S
67	Good Friday	S-Dh	Sn	—	Ch	S
68	Hornets Nest	S-Dh	Sn	Fe, As	Ch, Q	S
69	General White(?)	S-Dh	Sn	—	Ch, Q	S
70	—	S-Dh	Sn	—	Ch, Q	S
71	William	S-Dh	Sn	—	Ch, Q	—
72	—	S-Dha	?	Fe	—	—
73	Colenso(?)	S-Dha	?	Pb	Ch, Q	—
74	Great Western No. 2	S-Dha	Cu, Sn	Cu, Pb, Fe, As, Zn	Ch	—
75	Telegraph	S-Dh	Sn	—	Ch, Q	—
76	—	S-Dh	?	—	Ch, Q	—
77	—	S-Dh	?	—	Q, Ch	—
78	—	S-Dh	?	Pb, Fe	Q	—
79	Great Western	S-Dha	Sn	—	—	—
80	—	S-Dha	?	Fe	K	—
81	Katherine	S-Dh	Sn	Pb, Fe	Ch, K	S
82	Thea	S-Dh	Sn	Sn, Pb	Ch, Q	S
83	Evelyn (83–85)	S-Dh	?	Pb, Cu, Fe	Q	S
84		S-Dh	?	Pb, Fe, As	Q	S
85		S-Dh	?	Pb, Fe	Q	S
86	Baalgammon	S-Dh	Sn	Pb, Fe, Zn	Ch, Q	?
87	Young Australian	S-Dh	Sn	—	Ch, Q	S
88	Ronald Valley	S-Dh	Sn	Pb, Fe	Ch, Q	V
89	Ironclad	S-Dh	Sn	Fe	—	S
90	Bock Hill (Box Hill)	S-Dh	Pb, Ag	Zn	Ch, Q	V
91	Silver Lining	S-Dh	Sn	Fe, As, Pb, Zn	CS	V
92	—	S-Dha	?	Fe	—	S
93	—	S-Dha	?	—	—	S
94	Mary	S-Dha	?	—	Ch	—
95	Jimminy Cricket	S-Dha	Sn	—	Ch	S
96	Zimmerian	S-Dh	?	—	Ch	S
97	—	S-Dh	?	—	—	—
98	Leslie?	S-Dha	Sn	Fe	—	S
99	Culwullar	S-Dha	Sn	Fe	—	S
100	—	S-Dha	?	—	—	—
101	—	S-Dh	?	—	—	—
102	—	S-Dh	?	—	—	—
103	Hard Cash (Home Rule)	S-Dh	Sn	Fe, Zn	Ch	—
104	Mary of Argyle (Home Rule)	S-Dh	Sn	—	Ch	—
105	—	S-Dh	?	Fe	—	—

Structural Control Strike	Dip	Surface Workings	Remarks
N-S	—	shs, pits	(f), also called **Atlanta**, 183 tons SnO_2 1890-66
—	—	open cut	—
145	—	sh, pit	—
135	50S	sh, pits	—
	—	adit, shs	(a,b,c,f), stannite recorded (g), 91 m deep, 795 tons SnO_2 1896-1918, grade 3.6% SnO_2
—	—	adit, shs, pits	—
—	—	adit, shs, open cuts	—
	—	adit, shs, open cut	(a,f), 121 tons SnO_2 1904-20
	—	sh	—
110	—	adit, sh, pits	6 tons SnO_2 1911-12
170	—	sh, pits	—
—	—	adit, shs	—
—	—	sh, open cut, pits	—
105	—	2 adits	—
100	70N	adit	—
105	—	2 shs	—
145	—	adit, shs, pits	(a), 4 tons SnO_2 1968-69
120	—	adit, sh, pit	—
060	40N	3 shs, pits	—
—	—	sh	—
—	—	pit	—
—	—	sh, pit	—
—	—	open cut, shs, adit	—
—	—	2 shs, open cut	—
—	—	shs, open cuts, pit	—
—	—	open cuts, pits	—
—	—	2 open cuts, pits	—
—	—	shs	—
—	—	2 pits	—
—	—	adit, sh, pit	—
—	—	3 adits, shs, pits	—
—	—	adit, sh, pits	—
160	—	2 shs	—
050	—	adit, sh, pits	—
—	—	shs, pits	—
100	55W	adits, shs, pits	—
—	—	sh, pits	—
105	—	adit, shs, pits	(a)
—	—	2 shs, pits	—
—	—	2 shs, pits	—
150	75N	2 shs	—
060	—	adit	—
—	—	pits	—
145	80W	sh, pits	—
155	90	pits	—
—	—	open cuts, pits	—
165	—	shs, pits	—
165	—	shs, pits	—
—	—	sh	—
—	—	pits	—
—	—	prospect pit	—
—	—	2 shs, open cuts	—
—	—	pits	6 tons SnO_2 1912-35
—	—	open cut	—

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
106	—	S-Dh	?	—	Q	—
107	—	S-Dh	?	—	—	S
108	—	S-Dh	?	—	Ch	S
109	New Eastern(?)	S-Dh	Sn	Pb, As	Ch	S
110	Great Eastern	S-Dh	Sn	Fe, Zn, Cu, As, Bi	CS	S
111	—	Cf	?	—	Ch	—
112	Jubilee	S-Dh	Sn	Fe	Ch, Q	—
113	Silver Belle	S-Dh	?	—	—	S
114	—	S-Dh	?	—	—	—
115	—	S-Dha	Sn	Fe, As	Q	S
116	—	S-Dh	?	—	—	—
117	Eureka	S-Dh	Sn	—	—	S

Location of **Lady Mary** (a), **Lord Beauchamp** (a), and **Monarch** (a) not known.

References: (a) Maclaren (1900), (b) Cameron (1904c), (c) Lees (1907), (d) Reid (1932i), (e) Reid (1938), (f) Jensen (1939), (g) Edwards (1951), (h) Levingston (1956), (i) Dep. Min. metall. Engng (1965), (j) Levingston (1967a).

OF THE STANNARY HILLS AREA—*continued*

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	pits	—
140	85W	open cuts	—
140	90	open cuts	—
155	90	shs, pits	—
130	65E	shs, pits	(c), discovered 1885, sulphides at depth, 96 tons SnO_2 1901-18
—	—	2 shs	—
—	—	adit, open cut, pits	—
165	—	shs, pits	—
—	—	open cut	—
135	80E	sh	—
—	—	2 prospect pits	—
—	—	—	not examined

TABLE 22. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	Cf	Calcite	—	—	S
2	—	Cf	Calcite	—	—	S
3	Silver Star	Cf	Pb, Ag	Fe	—	S
4	—	Cf	Pb, Ag	Fe	—	S
5	—	Cf	Pb, Ag	—	—	S
6	—	Cf	Pb, Ag	—	—	—
7	—	Cf	Pb, Ag	Cu, Zn, As, Fe	—	S
8	—	Cf	Pb, Ag	Fe	—	S
9	Weinert	Cf	Pb, Ag	—	Q	S
10	Weinert	Cf	Pb, Ag	—	Q	S
11	—	Cf	Pb, Ag	—	—	S
12	—	Cf	Pb, Ag	—	—	S
13	—	Cf	Pb, Ag	Zn, Fe	—	S
14	—	Cf	Pb, Ag	Fe	—	S
15	—	Cf	Pb, Ag	—	—	S
16	—	Cf	Pb, Ag	—	—	S
17	—	Cf	Pb, Ag	—	—	—
18	—	Cf	Pb, Ag	—	—	S
19	—	Cf	Pb, Ag	—	—	—
20	—	Cf	Pb, Ag	Zn, Fe, As	—	S
21	—	Cf	Pb, Ag	Fe	—	S
22	—	Cf	Pb, Ag	Fe, As	—	S
23	—	Cf	Pb, Ag	Fe	—	S
24	—	Cf	Pb, Ag	—	—	S
25	—	Cf	Pb, Ag	—	—	S
26	—	Cf	Pb, Ag	—	—	—
27	—	Cf	Pb, Ag	—	—	—
28	—	Cf	Pb, Ag	Fe	—	S
29	—	Cf	Pb, Ag	—	—	—
30	—	Cf	Pb, Ag	—	—	—
31	East Orient	Cf	Pb, Ag	Fe, As, Zn	—	S
32	—	Cf	Pb, Ag	Fe	—	S
33	—	Cf	Pb, Ag	—	—	—
34	—	Cf	Pb, Ag	—	—	S
35	Nannum Amalgamated	Cf	Pb, Ag	—	—	S
36	—	Cf	Pb, Ag	—	—	—
37	—	Cf	Pb, Ag	—	—	—
38	—	Cf	Pb, Ag	—	—	S
39	—	Cf	Pb, Ag	—	—	—
40	—	Cf	Pb, Ag	—	—	—
41	—	Cf	Pb, Ag	—	—	—
42	—	Cf	Pb, Ag	—	—	—
43	—	Cf	Pb, Ag	—	—	—
44	—	Cf	Pb, Ag	—	—	—

References: (a) Lees (1907), (b) Morton (1936b), (c) Jensen (1939).

OF THE WEINERT AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
035	60N	open cuts	—
165	—	open cuts	—
165	45S	shs, open stope, pits	—
100	50S	shs	—
060	50S	sh, pit	—
—	—	small open cut	—
035	47E	2 adits, 4 shs	—
050	45S	3 shs, pits	—
058	70S	adit, 2 shs, pits	(a,b,c), opened about 1890
080	35S-90	6 shs, pits	
070	60S	sh, pits	—
080	35S	2 shs, pits	—
045	45S	adit, 4 shs, pits	—
043	40E	pits	—
085	55S	sh, open stope	—
068	48S	sh	—
—	—	shallow pits	—
065	50S	sh, pits	—
—	—	prospect pit	—
053	70S	sh	—
060	73S	sh	—
075	75S	2 shs, pits	—
045	70S	small open cut	—
050	90	sh	—
100	50S	adit, 3 shs, pits	—
—	—	open cut, pit	—
—	—	open cut, pits	—
055	65N	3 shs, pits	—
—	—	adit, sh, pits	—
—	—	shs, pits	—
085	50-75S	4 shs, pits	(b), over 36 m deep
085	70S	2 shs, pits	—
—	—	adit	—
045	60S	3 shs, pits	—
095	70N	4 shs, pits	—
—	—	2 shs	—
—	—	2 shs, pits	—
105	90	2 shs, pits	—
—	—	pits	—
—	—	shs	—
—	—	pits	—
—	—	sh, pit	—
—	—	pit	—
—	—	pit	—

TABLE 23. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	S-Dh	?	Fe	Q	S
2	Heres Luck	S-Dh	?	Fe	Q	S
3	—	S-Dh	?	As, Fe	Q	S
4	—	S-Dh	Sn	—	Q, Ch	—
5	—	S-Dh	?	—	Q	S
6	—	S-Dh	?	—	Q, T	S
7	—	S-Dh	?	—	—	—
8	Kynoch	S-Dha	Sn	Fe	Q	S
9	—	S-Dh	?	—	—	—
10	Perseverance	S-Dha	Sn	Fe	Q, Ch	S
11	—	S-Dha	Sn	—	Ch	S
12	Old Perseverance	S-Dha	Sn	Cu, Fe	Ch	S
13	—	S-Dh	?	—	—	S
14	Brass Bottle	S-Dha	Sn	Pb, Cu, Fe, As, Zn	CS	S
15	—	S-Dh	?	Cu, Fe	Q	S
16	Consolidated	S-Dh	Sn, Cu, Ag	Zn, Pb, Fe, As	CS	S
17	Native Star IV	S-Dh	?	Pb	Q	S
18	Monte Cristo	S-Dh	?	Cu, Fe	Q	S
19	—	S-Dh	?	—	—	S
20	—	S-Dha	?	—	—	—
21	—	S-Dha	?	—	Ch	S
22	Irish Guard	S-Dha	Sn	—	Q, Ch	S
23	Mountain View (Hill View)	S-Dha	Sn	—	—	S
24	—	S-Dh	?	—	—	S
25	—	S-Dh	?	—	—	S
26	Welcome?	S-Dha	Sn	—	—	S
27	Little Wonder	S-Dha	Sn	Cu, Fe	Q	S
28	—	S-Dha	Sn	Pb	Q	S
29	Humbug	S-Dha	Cu, Ag	Fe	Q	S
30	—	S-Dha	?	—	—	S
31	—	S-Dha	?	—	—	S
32	—	S-Dha	?	—	Ch	S
33	—	S-Dha	?	—	Q	S
34	Sunbeam	S-Dha	Sn	—	Q, T	S
35	—	S-Dh	?	—	—	—
36	Lamb	S-Dha	Sn	—	Q, T	S
37	—	S-Dha	?	—	Q, T	V
38	Perchance?	S-Dh	?	—	—	S
39	Star of the South	S-Dh	Sn	—	Ch, Q	S
40	Native Star (Southern Star)	S-Dh	Sn	—	Q	—
41	All Nations (Chance)	S-Dh/Cgz	Sn	—	—	—
42	—	Cgz	?	—	—	—
43	—	Cgz	?	—	—	—

References: (a) Lees (1907), (b) Keid (1938), (c) Jensen (1939), (d) Edwards (1951), (e) Dep. Min. metall. Engng (1965).

OF THE HALES SIDING AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
050	—	3 shs, pits	—
—	—	6 shs, pits	—
—	—	open cut, pit	—
—	—	sh	—
165	—	sh, pits	—
155	—	sh, pits	—
—	—	pits	—
125	90?	sh, pits	—
—	—	pits	—
145	80E	shs, pits	(c), 193 tons SnO_2 1897-1965
095	70S	3 shs, pits	—
170	—	4 shs, pits	—
140	85E	sh, pits	—
—	—	2 adits, open cut	(b,c,d), over 75 m deep, 364 SnO_2 1913-69
—	—	sh, pits	—
150	90	4 shs, pits	(b,c,d), over 60 m deep, 164 tons SnO_2 1901-53, 236 tons Cu and 23,262 oz Ag 1938-41
125?	—	sh, pits	—
—	—	3 shs, pits	—
155	—	pit	—
—	—	adit, sh?	—
—	—	sh, pits, adit	—
035	70W	adit, 3 shs, pits	(b,c), discovered 1912, 36 tons SnO_2 1916-62
135	—	adit, 5 shs, pits	—
125	70W	pit	—
012	70W	pit	—
005	90	sh, adit, pits	—
—	—	adit, sh, pits	—
040	—	pits	—
140	75E	2 shs, pits	(a,c)
115	—	2 shs, pits	—
140	—	sh, pits	—
125	—	2 shs, pits	—
—	—	pit	—
165	60E	3 shs, pits	—
—	—	—	not examined
—	—	shs, pits	(c), 36 tons SnO_2 1961-66
160	65W	pits	—
105	90	pits	—
140	90	open cut, sh	(a,c), 64 tons SnO_2 1896-1911, grade 3.4% SnO_2
—	—	2 shs, pits	—
—	—	sh, pits	—
—	—	pit	—
—	—	pits	—

TABLE 24. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	Moonta	S-Dh	Cu, Ag	Fe	Q	S
2	Montague	S-Dh	Cu, Ag	Fe	Q	S
3	William Morris	S-Dha	Sn	—	Q, Ch	S
4	Snapper	S-Dh	Sn	—	Q, T	S
5	—	S-Dh	Sn	—	Q, T	S
6	—	S-Dh	Sn	—	Q, T	S
7	Jumna	S-Dh	Sn	Cu, Fe	Q, Ch	S
8	Jumna No. 3	S-Dh	Sn	—	Q	S
9	Punjab	S-Dh	Sn	—	—	—
10	Mount Alva (Mount Allah)	S-Dha	Sn	—	Q, T	—
11	—	S-Dha	?	—	—	—
12	Bulldog	S-Dha	Sn	—	Q, T	S
13	—	S-Dha	Sn	—	—	—
14	Snorter	S-Dha	Sn	—	Q, Ch	S
15	Magpie	S-Dha	Sn	—	—	S
16	—	S-Dh	Sn	—	—	S
17	—	S-Dh	Sn	—	—	S
18	Columbia (Gladys)?	S-Dh	Sn	—	Q	S
19	Welcome	S-Dh	Sn	—	Q	S
20	—	S-Dh	Sn	—	—	S
21	Mount Agnes	S-Dha	Sn	Cu, Fe	Q	S
22	—	S-Dha	Sn	—	—	—
23	Gordon	S-Dh	Sn	As, Fe, Bi, Cu	CS	—
24	—	S-Dha	Sn	—	—	S
25	—	S-Dh	Sn	—	T	S
26	Gladys?	S-Dha	Sn	—	T, Q	S
27	—	S-Dh	Sn	—	—	—
28	Rajah	S-Dha	Sn	—	Q, T	S
29	—	S-Dha	Sn	—	—	—
30	Lucks Head	S-Dha	Sn	—	—	—
31	—	S-Dha	Sn	—	Q, T	—
32	Glen Roy	S-Dha	Sn	—	Q, T	S
33	Scab	S-Dha	Sn	—	Q, T	S
34	—	S-Dha	Sn	—	Q, T	S
35	Comet	S-Dha	Sn	Fe	Q, Ch	S
36	—	S-Dha	Sn	—	—	—
37	—	S-Dha	Sn	—	—	S
38	Queenslander	S-Dha	Sn	—	Q T, Ch	S
39	Alexandria	S-Dha	Sn	—	Q, T, K	—
40	—	S-Dha	Sn	—	Q, T, K	—
41	Herron	S-Dha	Sn	—	Q, T	S
42	Kangaroo (Our 2)	S-Dh	Sn	—	Q, T, K	S
43	White Lightening	S-Dh	Sn	—	Ch, T, Q	S
44	Jack-in-the-Box	S-Dh	Sn	—	Q, T	V
45	Jack Johnson	S-Dh	Sn	—	Q, T	S
46	—	S-Dh	Sn	—	Q, T	S
47	Katherine	S-Dha	Sn	—	Q, T	S
48	Mary	S-Dha	Sn	—	Q, T	S
49	Sunshine	S-Dh	Sn	—	Q	S
50	—	S-Dh	?	—	—	S
51	Wildman	S-Dh	Sn	—	Q	S
52	—	S-Dh	?	Cu, Fe	Q	S
53	Waratah	S-Dh	Sn	Cu, Fe	Ch	—

OF THE IRVINEBANK AREA

abbreviations see Table 16)

Structural Control		Surface Workings	Remarks
Strike	Dip		
105	75S	sh	—
100	85S	sh	—
145	80S	sh	20 tons SnO_2 1921, grade 18.6% SnO_2
065	70N	2 shs, 2 adits, pit	3 tons SnO_2 1906, grade 5% SnO_2
—	—	sh, pits	—
155	75W	sh	—
115	45N	adit, open cut	(c,i), 149 tons SnO_2 1896-1927
—	—	adit	—
—	—	sh	—
NE.	—	sh	(h)
—	—	pits	—
150	—	pits	—
—	—	pits	—
145	80S	2 shs, pits	—
045	90	2 shs, pits	—
155?	—	pits	—
135	—	2 shs, pits	—
105	80N	adit, shs, pits	—
080	—	shs, adits, pits	16 tons SnO_2 1901-18
120	70S	adit, sh	—
150	90	shs, adits, pits	46 tons SnO_2 1901-09
—	—	2 shs	—
—	—	2 shs, pits	(h,j), 181 tons SnO_2 1920-48
020?	—	sh	—
175	—	pits, 2 shs	—
115	90	adit, sh	—
—	—	open cut	—
140	—	sh, pits	(h)
—	—	pits	—
—	—	—	not examined
—	—	pits	—
015	90	2 shs, pits	—
140	90	sh, pits, adit	—
130	70W	2 shs, pits	—
145	90	shs, 2 open cuts, adit	33 tons SnO_2 1905-66
—	—	adit, 4 shs, pits	—
115	—	pits	—
155	70W	2 shs, open cut	5 tons SnO_2 1906-19
—	—	2 adits, sh, pits	—
—	—	2 shs	—
120	70N	2 shs, pits	—
140	—	2 shs, adit, pit	4 tons SnO_2 1907-17
175	65W	open cut	—
020	75W	open cut	22 tons SnO_2 1907-10
115	—	2 shs, pits, open cut	2 tons SnO_2 1912-35
005	—	sh, pits	—
130	85W	sh, pits	—
175	—	adit, sh, pits	2 tons SnO_2 1918
105-130	—	adit, sh	10 tons SnO_2 1936
160	—	pits	—
—	—	adit, shs, pits	—
170?	—	2 shs	—
—	—	6 shs, pits	—

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
54	Nicholas Barnardo	S-Dh	Sn	Fe, As	Q	S
55	Nil Desperandum	S-Dha	Sn	—	—	—
56	Krakatau	S-Dha	Sn	Cu, Fe	Q, Ch	S
57	—	S-Dha	?	—	Q	S
58	—	S-Dha	?	—	—	S
59	—	S-Dh	?	—	—	S
60	—	S-Dhc	Pb, Cu, Ag	Fe	Ch	—
61	Manoa	S-Dha	Sn	—	—	—
62	White Cliffs	S-Dha	?	—	—	—
63	—	S-Dha	?	—	—	—
64	—	S-Dha	?	—	—	—
65	Tornado	S-Dh	Sn	—	Q, Ch	S
66	Skully (Heffernan?)	S-Dh	Sn	—	T, Q	S
67	Roaring Annie	S-Dha	Sn	—	—	—
68	Free Thinker	S-Dh	Sn	—	Ch	S
69	—	S-Dha	?	—	—	S
70	—	S-Dha	?	—	—	—
71	Mount Blanche	S-Dha	Sn	—	Ch	S
72	Homeward Bound	S-Dha	Sn	—	Q, T, Ch	S
73	Sugar Bag	S-Dha	Sn	—	Q, T, Ch	S
74	Valetta	S-Dha	Sn	—	Q, T, Ch	S
75	—	S-Dha	?	—	Q, T	V
76	—	S-Dha	?	—	—	—
77	Chance	S-Dha	Sn	—	Q, T	S
78	—	S-Dh	?	—	—	—
79	Here and There	S-Dh	Sn	—	Q, T	S
80	—	S-Dh	?	—	Q	V
81	Town Talk	S-Dh	Sn	—	Q, Ch	S
82	Old Tornado?	S-Dha	Sn	—	—	S
83	Vulcan	S-Dh	Sn, W	Fe, Pb, Cu, Bi	Ch, Q	S
84	—	S-Dh	Sn	—	—	S
85	—	S-Dh	?	—	—	—
86	Vulcan Hope Extended?	S-Dh	Sn	—	Ch	S
87	Vulcan Hope?	S-Dh	Sn	—	Ch	S
88	—	S-Dh	?	—	—	—
89	Lucky (Chance?)	S-Dha	Sn	—	Q	S
90	Alexander	S-Dh	Sn	—	—	—
91	Snifter	S-Dh	Sn	—	Ch?	—
92	Bundys	S-Dh	Sn	—	Ch	S
93	Trelawney	S-Dh	Sn	—	K, T	S
94	—	S-Dh	Sn	—	Q, T, Ch	—
95	Rin Tin Tin	S-Dh	Sn	Fe	Q, T	S
96	Lizzie	S-Dh	Sn	—	Q, T	S
97	Buzzie } Wyatts Lease	S-Dh	Sn	—	Q, T	S
98	Streak	S-Dh	Sn	—	Q, T	S
99	White Angel	S-Dha	Sn	—	—	S
100	Rosy Rose Line	S-Dha	Sn	—	T, Ch	S
101	Worlds Fair	S-Dh	Sn	—	T, K	S
102	Stannum Ace	S-Dh	Sn	—	—	S
103	Referendum	S-Dh	Sn	—	Ch, T, Q	S
104	Ibis	S-Dh	Sn	Cu, Fe	Ch	S
105	Beetle	S-Dh	Sn	—	Q, T	S
106	Three in One	S-Dh	Sn	—	Q, T	S
107	Francis	S-Dh	Sn	—	—	—

Structural Control Strike	Dip	Surface Workings	Remarks
155	75W	adit, sh	15 tons SnO_2 1912-28
—	—	—	not examined
080	90	adit	—
—	76E	sh, pits	—
—	—	adit, shs, pits	—
135	90	pits	—
—	—	pits	—
—	—	shs, pits	—
—	—	adit, shs	—
—	—	sh, pits	—
—	—	4 shs, pits	—
150	—	adit, sh	(b,c,h), oldest large mine in area, 680 tons SnO_2 1938-55
175	85E	5 shs, adits, pits	—
—	—	—	not examined
175	85W	shs, pits, adit	2 tons SnO_2 1938-39, 38 tons SnO_2 1910-69
135	75S	open cut	—
—	—	adit, sh	—
—	—	sh, adit, pits	2 tons SnO_2 1906-16
120	—	sh, pits	3.7 tons SnO_2 1906-07
—	—	adit, sh, pits	—
—	—	open cut, shs, adit	132 tons SnO_2 1904-37
100	—	pits	—
—	—	pits	—
—	—	open cut	—
—	—	pits	—
—	—	open cut, pits	0.7 tons SnO_2 1935
—	—	pits	—
020	—	adit, 2 shs	29 tons SnO_2 1938-66
105	—	adit, 4 shs, pits	—
—	—	shs	(a,b,c,h,k,l,m,n), 447 m deep, 13,712 tons SnO_2 1891-1933, some wolframite produced in 1915
160	40W	sh, pits	—
—	—	adit	—
140	70S	adit, 2 shs	—
130	90	adit, sh, pits	17 tons SnO_2 1906-17
—	—	pits	—
—	—	2 shs, pits	—
—	—	—	not examined
—	—	adit	(h), 9 tons SnO_2 1938-45
—	—	open cut, adit?	—
—	—	shs, pits, adit	—
—	—	sh, adit, pit	—
SW	35W	open cut	(i), 2 tons SnO_2 1943
—	—	open cut	(d,n,a), 56 tons SnO_2 1908-63
—	—	sh, pit	(d,n), 4 tons SnO_2 1943-66
160	50W	open cut, sh, adit	(f,i), 47 tons SnO_2 1925-64 (includes **Chance?**)
—	—	open cut, sh, pit	—
175	—	sh, pits	—
170	—	adit, open cut, 2 shs, pits	17 tons SnO_2 1906-16
170	90	sh, pits	(m)
180	85W	2 adits, 2 shs, pits	24 tons SnO_2 1962-66
—	—	open cut, 3 adits	(c,m), 45 m deep, 249 tons SnO_2 1897-1947
025	90	2 shs, pits	—
040	50N	2 shs, open cut, pits	(g), 32 m deep, 3 tons SnO_2 1929
—	—	—	not examined

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
108	United	S-Dh	Sn	—	—	—
109	Governor Norman	S-Dh	Sn	—	Ch, Q, T	—
110	Lady Norman South	S-Dh	Sn	—	Q, T	S
111	—	S-Dh	?	—	Q, T	V
112	Mount Peterson	S-Dha	Sn	Fe, As	Q, T, Ch	S
113	Lady Jane	S-Dha	Sn	—	Q, T	S
114	Rebound (Judge)	S-Dha	Sn	—	Q, T	S
115	—	S-Dh	?	—	—	—
116	Phantom	S-Dh	Sn	—	Q, T	S
117	—	S-Dh	?	—	—	—
118	—	S-Dh	?	—	—	—
119	Hell of a Fix	S-Dha	Sn	—	Q	—
120	—	S-Dh	?	—	Q, T	S
121	Vulcan West	S-Dh	Sn	—	Ch?	—
122	Submarine	S-Dh	Sn	Fe	Q, T	S
123	—	S-Dh	?	—	Q, T	—
124	—	S-Dh	?	—	—	—
125	Neptune	S-Dha	Sn	—	Q, Ch	S
126	—	S-Dha	?	—	Q, Ch	—
127	—	S-Dha	?	—	Q, Ch	—
128	—	S-Dha	?	—	—	S
129	—	S-Dha	?	—	—	—
130	Target	S-Dha	Sn	—	Q, T	S
131	—	S-Dha	?	—	Q	S
132	—	S-Dha	?	—	Q, T	S
133	—	S-Dh	?	—	—	—
134	White Ant	S-Dh	Sn	—	Q, Ch	S
135	Rio Grande	S-Dh	Sn	Sn	Q, T	S
136	Lady Norman	S-Dh	Sn	—	Ch, Q, T	S
137	—	S-Dh	?	—	Q, T	S
138	—	S-Dh	?	—	—	—
139	Chance	S-Dh	Sn	—	Q, T	S
140	United?	S-Dh	Sn	—	Q, T	S
141	—	S-Dh	Sn	—	Q, T	S
142	—	S-Dh	Sn	—	Q, T	S
143	—	S-Dha	?	—	Q, T	S
144	Jester (Joker)	S-Dha	Sn	—	Q, T	S
145	Florence	S-Dha	Sn	—	Q, T	S
146	Brown Snake	S-Dh	Sn	—	Q, T, Ch	S
147	Coon (Coan)	S-Dh	Sn	—	Q, T, Ch	S
148	—	S-Dh	?	—	—	S
149	—	S-Dh	Sn	—	Q, T	S
150	—	S-Dh	?	—	—	—
151	Hard Case (Birthday)	S-Dha	Sn	—	Q, T	S
152	Maid of Athens	S-Dh	Sn	—	Q, T	S
153	Bomerang	S-Dha	Sn	—	Ch	S
154	—	S-Dha	?	—	Q, T	S
155	—	S-Dha	?	—	Q, T	S
156	—	S-Dha	?	—	Q, T	S
157	Surprise (Go Ahead)	S-Dh	Sn	—	Q, T	S
158	Syndicate?	S-Dh	Sn	—	Q, T	S
159	—	S-Dh	?	—	Q, T	S
160	Tyrconnell	S-Dh	Sn	—	Q, T	S
161	—	S-Dh	?	—	—	S

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	adit	(h), position uncertain
—	—	open cuts, adit, shs	(e,h,m) 1100 tons SnO_2 1935-68
135	60S	adits, open cuts	(c)
080	—	pits	—
075	—	open cut, 2 adits	(c,h,i), 133 tons SnO_2 1906-68
—	—	sh, pits	—
145	90	open cut, adits, pits	—
—	—	—	not examined
—	—	sh, pits	—
—	—	sh, pits	—
—	—	pits	—
—	—	pit	—
—	—	sh, pit	—
—	—	sh	—
090	90	adit, shs	(h), lode discovered 1937, 50 tons SnO_2 1938-69
—	—	4 shs, adit, pits	—
—	—	—	not examined
170	90	shs, pits	—
—	—	adit, pits	—
—	—	adit, pits	—
120	—	pits	—
—	—	—	not examined
135	90	pits	—
030	80E	pits	—
160	60W	sh, pits	—
—	—	pits	—
145	90	2 shs, pits	15 tons SnO_2 1920
075	90?	adit	—
115	70S	2 shs, pits	—
075	90	2 shs	—
—	—	—	not examined
180	90	adit	15 tons SnO_2 1907-36
150?	—	2 shs	—
170	90	2 shs, pits	—
—	—	adit, sh, pits	—
—	—	sh, pit	—
050	—	2 shs, pits	3 tons SnO_2 1906-34
110	—	adit, sh, pits	1.7 tons SnO_2 1906-08
140	90	3 shs, adit, pits	—
115	75S	open cut, adit, sh	working 1966, 17 tons SnO_2 1905-66
010	—	pit	—
065	—	adit, pits, sh	—
—	—	pits	—
170	80W	adit, 2 shs	8 tons SnO_2 1902-11
175	—	pits	—
150	—	sh, pits	6 tons SnO_2 1911-55
100	—	2 shs, pits	—
130	—	sh, pits	—
110	75N	sh, pit	—
015	—	2 shs, adit, pits	70 tons SnO_2 1896-1937
155	—	sh, pits, adit	—
—	—	adit, 4 shs, pit	—
—	—	2 open cuts, 5 shs, adit	75 tons SnO_2 1907-12, 8 tons 1967
090	80S	pits, 3 shs	—

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
162	—	S-Dha	?	—	—	S
163	—	S-Dha	Sn	—	—	S
164	Great Southern	S-Dh	Sn, W	Fe	Q, T, Ch	S
165	Red King	S-Dh	Sn	Fe	Ch, Q, T	S
166	Garibaldi	S-Dh	Sn	—	Q, T, Ch	S
167	—	S-Dh	?	—	—	S
168	—	S-Dh	Sn	—	Q, T	S
169	—	S-Dh	?	—	Q, T	S
170	Marvel Lock	S-Dha	Sn	—	Q, T	S
171	—	S-Dha	?	—	Q, T	S
172	Standard	S-Dh	?	—	—	S
173	—	S-Dha	Sn	—	Q, T	S
174	—	S-Dh	Sn	—	Q, T	—
175	—	S-Dh	Sn	—	Q, T	—
176	—	S-Dh	?	—	Q, T	—
177	—	S-Dh	?	—	—	—
178	—	S-Dh	Sn	—	Q	S
179	Agnes	S-Dh	Sn	As, Fe	Q	S
180	—	S-Dh	Sn	As, Cu, Fe	Ch	S
181	—	S-Dh	?	—	—	S
182	Eclipse	S-Dh	Sn	As, Fe	Q	S
183	Little Gem	S-Dh	Sn	—	Q, T	—
184	—	S-Dh	?	Pb	Q, T, Ca	S
185	—	S-Dh	?	—	—	S
186	—	S-Dh	?	—	—	S
187	Belgium	S-Dh	Sn	—	Q, T	S
188	White Queen	S-Dh	Sn	—	Q, Ch	S
189	—	S-Dh	Sn	—	Q	S
190	—	S-Dh	Sn	Fe	Q, T	S
191	—	S-Dh	Sn	—	Q, T	S
192	—	S-Dh	Sn	—	Q, T	S
193	—	S-Dh	Sn	—	Q	—
194	—	S-Dh	Sn	—	Q	S
195	Mount Thistle	S-Dha	?	—	—	—
196	Mary Ellen	S-Dha	Sn	—	Q	S
197	Magpie	S-Dh	Sn	—	Q, T	S
198	—	S-Dh	Sn	—	Q, T	S
199	—	S-Dh	?	—	—	—
200	Venture?	S-Dh	Sn	W, Fe	Q, T	S
201	Experience	S-Dh	Sn	As, Fe	Q, T	S
202	—	S-Dh	?	—	T	—
203	—	S-Dh	?	—	—	—
204	—	S-Dh	?	—	—	—
205	Black Sparkle	S-Dha	Sn	As, Fe	Q, Ch, T	S
206	—	S-Dh	Sb	—	Q	S

Locations of **Pandora** (b), **Attacker** (c), **Grace Norman** (c), **Norse Norman** (e), and **Vesuvius** (h) are not known.

References: (a) Skertchley (1897), (b) Cameron (1904b), (c) Lees (1907), (d) Morton (1932), (e) Reid (1932b), (f) Reid (1932c), (g) Reid (1932g), (h) Jensen, (1939), (i) Morton (1944c), (j) Edwards (1951), (k) Broadhurst (1953), (l) Mason (1953), (m) Dimmick & Cordwell (1959), (n) Syvret (1963b), (o) Dept. Min. metall. Engng (1965).

Structural Control Strike	Dip	Surface Workings	Remarks
170	—	pit	—
—	—	2 adits, sh, pit	—
—	—	shs, open cut, adit, pit	(b,c,e,h,m,o), 119 m deep, 1352 tons SnO_2 1886-1969
—	—	adit, shs	(b, c, m), 5 tons SnO_2 1910-14
045-010	80W	shs, pits	—
130	—	pits	—
170	90?	sh, pits	—
135	—	pits	—
100	—	pits	—
—	—	adit	—
140	—	pit	—
005	80W	sh, pits	—
—	—	pits	—
—	—	adit, pits	—
—	—	pit	—
—	—	sh, pits	—
140	—	2 shs, pits	—
150-175	70W	4 shs, adit, pits	—
—	—	2 shs, adit, pits	—
150	—	pits	—
155	50E	sh	—
—	—	sh	—
040	—	pits	—
180	—	pits	—
025	—	pits	—
050	90	2 sh, pits	—
—	—	shs, adits, pits	—
030	85E	pits	—
155	80E	sh	—
145	60W	sh, pits	—
165	85E	sh, pits	—
—	—	pits	—
140	—	sh, pits	—
—	—	—	not examined
165	—	3 shs, pits	—
165	—	2 shs, pits	—
—	—	sh	—
—	—	sh	—
100	—	sh, pits	—
010	50W	adit, shs, pits	—
—	—	pits	—
—	—	pit	—
—	—	—	not examined
150	80W	sh	—
075	—	pits	—

TABLE 25. MINES AND PROSPECTS

(For key to symbols and

Ret. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	Froggy	S-Dh	Sn	—	Q, Ch	S
2	—	Cgz	?	Fe	Ch, G	—
3	—	Cgz	?	W, Fe	G	—
4	Scratcher	Cgz	Sn	—	Ch, Q	J
5	—	Cgz	W	Fe	G	—
6	Rose	Cgz	Sn	—	G	V
7	Elsie	Cgz	Sn	—	Q, F	V
8	—	S-Dh	?	—	—	—
9	—	S-Dh	Sn	—	Q	S
10	—	S-Dh	Sn	—	Q	S
11	—	S-Dh	Sn	—	Q	—
12	—	S-Dh	Sn	—	Q, Ch	S
13	—	S-Dh	Sn	—	Q	—
14	Fanny Parnell	S-Dh	Sn	Pb, Ag, Fe	Q	S
15	Fanny Square	S-Dh	Sn	—	F, Q	S
16	—	S-Dh	Sn	—	Q	—
17	—	S-Dh	?	—	Q	—
18	—	S-Dh	Sn	—	G	S
19	—	S-Dh	Sn	—	Q, T	S
20	—	Cgz	Sn	—	Q	—
21	Scandinavian	Cgz	Sn	—	Q, K	J
22	Monroe (Eidelweiss)	Cgz	Sn	—	Q, Ch	J
23	Alf Rose	Cgz	Sn	—	Q	J
24	—	Cgz	Sn	—	Q, K	J
25	—	Cgz	Sn	—	G	J
26	Belfast	Cgz	Sn	—	Q, K	J
27	Murphys Luck	Cgz	Sn	—	Q, K	J
28	—	Cgz	Sn	—	G	—
29	—	Cgz	Sn	—	Q	—
30	—	Cgz	Sn	—	Q, Ch, F	—

References: (a) Cameron (1901b), (b) Jensen (1939).

OF THE UPPER EMU CREEK AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
030	—	open cut, pits	—
—	—	pits	—
—	—	2 shs, pits	—
155	90	2 shs, adit	15 tons SnO_2 1920-22
—	—	pit	—
145	90	3 shs, pits	2 tons SnO_2 1949
165	—	4 shs, pits	2 tons SnO_2 1907
—	—	pit	—
—	—	pit	—
—	—	pits	—
—	—	pit	—
135	—	sh, pits	—
—	—	pits	—
045	80E	2 shs, adit, pits	(a), 2 tons SnO_2 1938-54
—	—	4 shs, adit	(b), lode discovered 1930, 45 tons SnO_2 1931-54
—	—	pit	—
—	—	pit	—
125	77S	sh, pits	—
155	75W	pits	—
—	—	pits	—
010	80E	sh?, pits	—
180	90	sh, pits	—
—	—	3 shs, pit	2 tons SnO_2 1921
015	90	2 shs	—
160	90	open cut, pits	—
—	—	sh, pits, open cut	—
—	—	open cut	10 tons SnO_2 1956-57
—	—	sh, pits	—
—	—	2 shs, pits	—
—	—	2 shs, pits	—

TABLE 26. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	Cgz	Sb	—	Q	V
2	—	S-Dh	Sn	—	Ch	—
3	Admiral	S-Dh	Sn	—	Ch, Q	S
4	Arbouin	S-Dh	Sn	W, Fe	Ch, K, T	S
5	Sunset	Cgz	Sn, Pb, Ag	Sn, As, Fe	G	S
6	—	Cgz	?	Pb, Fe	Q	S
7	—	Cgz	Sb	—	Q	V
8	—	Cgz	Sb	—	Q	V
9	—	Cgz	Sb	—	Q	V
10	—	Cgz	Sb	—	Q	V

References: (a) Lees (1907), (b) Saint-Smith (1925b), (c) Jensen (1939), (d) Dimmick & Cordwell (1959)

OF THE ARBOUIN AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
NNE	—	pits	—
—	—	2 adits	—
105	85S	5 shs, open cut, pits	(c,d), lode 365 m long, 58 tons SnO_2 1897-1945, grade over 10% SnO_2
—	85S	3 open cuts	(a,b,c,d), discovered 1900, 1182 tons SnO_2 1901-66, grade less than 1.6%
075	90	5 shs, adit, pits	(c,d), 13 tons SnO_2 1912-30, 5.5% SnO_2
150	75W	sh, pits	—
090	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—

TABLE 27. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	S-Dh	Sn	—	Q, Ch	S
2	Amy	S-Dh	Sn	Fe	Q	S
3	—	S-Dh	Sn	—	Q, T	S
4	—	S-Dh	Sn	—	Q, T	V
5	—	S-Dh	Sn	—	Q, T	S
6	—	S-Dh	Sn	—	Q, T	S
7	—	S-Dh	Sn	—	Q, T	S
8	—	S-Dh	Sn	—	Q, T	S
9	—	S-Dh	Sn	—	Q, T	S
10	—	S-Dh	Sn	—	Q	V
11	—	S-Dh	Sn	—	Q	S
12	—	S-Dh	Sn	—	Q, T	S
13	—	S-Dh	Sn	—	Q, T	S
14	—	S-Dh	Sn	—	Q, T	S
15	—	S-Dh	Sn	—	Q, T	S
16	—	S-Dh	Sn	—	Q, T	S
17	—	S-Dh	Sn	—	Q, T	—
18	—	S-Dh	Sn	—	Q, T	S
19	Queen of the Mountain	Cgz	W	Fe	G	V
20	—	Cgz/S-Dh	W	Fe	G	S
21	—	S-Dh	?	—	—	S
22	Peacemaker	Cgz	Sn	Cu, Fe, As, W, U	Q	V
23	—	S-Dh	W	Fe	Q	—
24	Bay Shore	Cgz/S-Dh	Sn	—	-	—
25	Bonanza	Cgz/S-Dh	Sn	—	G	S
26	—	Cgz	?	—	G	S
27	—	Cgz	?	—	—	—
28	—	Cgz	?	—	—	S
29	Clinton	S-Dha	Pb, Ag	Zn	Ch	S
30	Callao	S-Dha	Pb, Ag	—	Q, Ch	S
31	—	S-Dha	Cu, Ag	Cu, Fe	Q, Ch	—
32	—	S-Dha	?	—	Q, Ch	—
33	Monte Carlo	S-Dh	Sn	—	Ch, Ga	S
34	—	S-Dh/Cgz	Sn	As, Fe	Q	S
35	—	S-Dh	?	—	G	—
36	—	S-Dh	Sn	—	Ch, G, Q	S
37	Etna (Mount Etna)	S-Dh	Sn	Cu, Fe	Q, Ch	S
38	—	S-Dh	Sn	—	G	S
39	Yan Yean	S-Dh	Sn	—	Q, Ch	—
40	Reliance (Alliance, Last Kick, Bakerville Battery)	S-Dh/Cgz	Sn	—	Q, Ch, Ga, T, G	—
41	Stromboli (Strombo)	S-Dh	Sn, W	Fe	—	—
42	Red Mont	S-Dh/Cgz	Sn	—	—	—
43	Pompeii	S-Dh	Sn	—	—	S
44	Vesuvius	S-Dh	Sn	—	Q, Ga, Ch	S
45	—	S-Dh	Sn	—	Ch, Ga	S
46	—	S-Dh	Sn	—	Ch, G	S
47	Brown Beauty (Gordon)	S-Dh	Sn	—	Ch, Ga	S
48	Bakers	S-Dh	Sn	—	Ch, Ga	S
49	Sulphide	S-Dh	Cu, Ag	Fe	Q	S
50	—	S-Dh	?	—	Q	S
51	—	S-Dh	Sn	—	G	S
52	—	S-Dh	Sn	—	—	S
53	New Era (Romans, Phoenoecians Claim)	S-Dh	Sn	As, Fe, W	K	—

OF THE BAKERVILLE AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
095	85N	adit, sh, pits	—
080	45N	adit, sh, pits	(c,e), 50 tons SnO_2 1906-43
030	75E	sh	—
—	—	pits	—
050	90	sh, open cut, pits	—
—	—	sh, pit	—
130	75E	sh, pit	—
—	—	2 shs, pits	—
120	90	sh, pits	—
—	—	pit	—
020	75S	sh	—
135	75W	2 shs, pits	—
125	65N	sh, pit	—
040	90	2 shs	—
120	70N	sh, pits	—
145	90	sh, pits	—
—	—	pit	—
145	—	open cuts, pits	—
—	—	pit	—
010	65W	sh, pits	—
120	—	pit	—
—	—	adit, 4 shs, 2 open cuts	(c), 186 tons SnO_2 1896-1969
—	—	pit	—
—	—	sh	—
165	50E	2 shs, open cut	—
125	50N	sh, pits	—
—	—	2 shs	—
115	50N	open cut, sh, pit	—
105	90	adit, 2 shs	(b)
005	80W	adit, 2 shs, open stope	—
—	—	sh	—
—	—	open cut	—
165	—	2 shs	—
175	75W	sh, pit	—
—	—	4 open cuts	—
120	90	5 shs	—
005	70E	7 shs, pits, adit	(c,d), 39 tons SnO_2 1925-36, grade 9.2% SnO_2
055	85E	sh, open cut, pits	—
—	—	3 shs, pits	may be **Tourmaline United** (a)
—	—	3 open cuts, shs, pit	(a,c,e), 18 tons SnO_2 since 1931
—	—	filled in	(c,d)
—	—	infilled sh	(d), formerly 30 m deep
NNW	—	shs	(c,d), main shaft 61 m deep, granite at depth, 450 tons SnO_2 1883-1921
175	80E	adit, 5 shs, pits	(c), 53 tons SnO_2 1938-65
170	70E	adit, 4 shs, pits	—
065	85N	adit, 4 shs, open cut	—
010	40E	adit, 2 shs, pits	—
055	—	2 open cuts, shs, pits	(c), 99 tons SnO_2 1904-11, grade 2.8% SnO_2
045	—	2 shs	—
—	—	sh	—
010	90	2 shs	—
115	70N	adit, sh, pits	—
—	—	open cut, pit, adit	(b,e), 175 tons SnO_2 1904-56

TABLE 27. MINES AND PROSPECTS OF

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
54	—	Cgz	Cu, Ag	Fe	—	S
55	—	Cgz	Sn	W, Fe	G	S
56	Ruby Anne	Cgz	Sn	—	Q	S
57	—	Cgz	W	Fe	G	S
58	—	Cgz	W	Fe	Q	S
59	Tungstate	Cgz	W	Cu, Fe	Q, F	S
60	—	Cgz	W	Fe	Q	S
61	—	Cgz	?	?	—	S
62	Wells	Cgz	W, Sn	Fe	G, T	S
63	—	Cgz	?	—	Q	—
64	—	Cgz	?	—	Q	S
65	—	Cgz	?	—	Q	S
66	Hawk	S-Dh	Sn	—	Q, T	S
67	—	Cgz	?	—	—	—

References: (a) Skertchley (1897), (b) Lees (1907), (c) Jensen (1939), (d) Dimmick & Cordwell (1959), (e) Syvret (1963b)

THE BAKERVILLE AREA—*continued*

Structural Control Strike	Dip	Surface Workings	Remarks
090	45N	sh	—
045	85W	adit, sh	—
090?	25N	shs	—
105	75S	2 shs, pits	—
105	—	pits	—
105	75S	4 shs, pits	(c), may be **Norma** (b)
110	—	sh, pit	—
—	—	prospect pit	—
115	50S	2 shs, pits	(c,e)
—	—	sh, pit	—
110	—	sh, pit	—
—	30S	2 shs, pits	—
—	—	adit, 3 shs, pits	—
—	—	pits	—

TABLE 28. MINES AND PROSPECTS
(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	Bluff	S-Dh	Sn	—	—	—
2	—	Cgz	W	Fe	G	S
3	Eagle (Hawk)	S-Dh	Sn	—	Ch	S
4	—	S-Dh	Sn	—	Q, T	S
5	Law King	S-Dh	Sn	—	—	S
6	Relief	S-Dh	Sn	—	—	—
7	Pretty Polly	S-Dh	Sn	—	Q, T	S
8	Sailor Boy	S-Dh	Sn	—	Q, T	S
9	—	S-Dh	?	—	—	—
10	Dargo	S-Dh	Sn	—	Q, T	S
11	George	S-Dh	Sn	—	Q, T	S
12	Western Dargo	S-Dh	Sn	—	Q, T	S
13	Bulldog (May Be)	S-Dh	Sn	—	Q, T	S
14	—	S-Dh	Sn	—	Q, T	S
15	Whandoodle	S-Dh	Sn	Fe	Q, T	S
16	Pharlap	S-Dh	Sn	—	Q, T	S
17	—	S-Dh	Sn	—	Q, T	S
18	Mount Ormonde	S-Dh	Sn	—	Q, T	S
19	Edward	S-Dh	Sn	—	Q, T	S
20	Talisman	S-Dh	Sn	—	Q, T	S
21	Leslie	S-Dh	Sn	—	Q, T	S
22	Martins	S-Dh	Sn	—	Q, T	S
23	Cobbie	S-Dh	Sn	—	—	—
24	Bella Venetia	S-Dh	Sn	—	Q	—
25	—	S-Dh	Sn	—	Q, T	—
26	Longline	S-Dh	Sn	—	Q, T	S
27	Alexandra	S-Dh	Sn	—	Q, T	S
28	New Endeavour	S-Dh	Sn	—	Q, T	S
29	Endeavour	S-Dh	Sn	—	Q, T	—
30	—	S-Dh	Sn	—	Q, T	S
31	—	S-Dh	Sn	—	—	S
32	Daisy	S-Dh	Sn	—	Q, T	S
33	Priscilla	S-Dh	Sn	—	—	—
34	Centipede	S-Dh	Sn	—	—	—
35	Christmas Gift	S-Dh	Sn	—	—	—
36	Native Bee	S-Dh	Sn, Cu, Ag	Fe, As	Ch, Q	S
37	—	S-Dh	Sn	Cu, Fe	Q	S

References: (a) Jensen (1939, (b) Syvret (1963b).

OF THE DARGO RANGE AREA
abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	—	not examined, 32 tons SnO_2 1929-40
105	75S	sh, pits	—
—	—	sh, pits, adit	—
—	—	pits	—
045	—	pits	—
—	—	pits	—
015	70W	sh, pits	—
080	—	2 shs, pits	(a), lode discovered 1913, 70 tons SnO_2 1913-59
—	—	—	not examined
—	—	shs, pits	—
—	—	sh, pits	—
035	85W	sh	—
055	—	open cut	—
—	—	sh, pits	—
—	—	2 shs, pits	9 tons SnO_2 1897, grade 22% SnO_2
—	—	pits	—
—	—	pits	—
—	—	3 adits, 2 shs, pits	(a,b), 4 tons SnO_2 1907-18
060	—	sh, pits	2 tons SnO_2 1905-06, grade 2.8% SnO_2
—	—	2 shs, pits	(a), 17 tons SnO_2 1905-35, grade 13.2% SnO_2
—	—	2 shs, pits	(a)
140	—	sh, pits	—
—	—	adit	6 tons SnO_2 1920-26, grade 15% SnO_2
—	—	open cut	—
—	—	sh, pits	—
110	—	pits	—
175	75W	4 shs, pits, adit	(a,b), 10 tons SnO_2 1906-11
—	—	2 shs, pits	—
—	—	3 shs, open cut, pits	(a,b), 87 tons SnO_2 1906-16
110	—	sh, pit	—
030	—	pits	—
145	70S	sh, pits	(a)
—	—	pits	3 tons SnO_2 1910, grade 10% SnO_2
—	—	pits	5 tons SnO_2 1911-18, grade 7% SnO_2
—	—	sh, pit	—
135	90	adit, sh, pits	Cu-Ag ore at depth, 49 tons SnO_2 1918-63
120	—	pits	—

TABLE 29. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	Steve Mac	Cgz	Sn	—	Q, Ch	S
2	Moonlight	Cgz	Sn	—	—	—
3	Hadleigh Castle	Cgz	Sn	Pb, Fe, Cu, As	CS	S
4	Valley View	Cgz	Cu, Ag	Fe	Q	J
5		Cgz	Cu, Ag	Fe	Q	J
6	Plum	Cgz	Cu, Ag	Fe, As	Q	J
7	—	Cgz	Cu, Ag	As, Fe	Q	J
8	—	Cgz	?	—	Q	—
9	—	Cgz	Cu, Ag	As, Fe	Ch, G	J
10	—	Cgz	Cu, Ag	Fe, As	Ch	J
11	—	Cgz	?	As, Fe	G	J
12	—	S-Dh	?	—	Q, Ch	—
13	—	S-Dh	?	—	Q, Ch	—
14	Saumerez	S-Dh	Sn	—	Q	S
15	—	S-Dh	?	—	—	—
16	—	Cgz	?	—	Q	V
17	—	S-Dh	?	—	—	—
18	Mount Nolan (Lord Nolan)	S-Dh	Sn	Fe, Cu	Q, Ch	S
19	Mount Nolan (Nolan)	S-Dh	Sn	Fe, Cu	Q, Ch	S
20	Mount Nolan (Eleanor)	S-Dh	Sn	Fe, Cu	Q, Ch	S
21	Minerva	S-Dh	Sn	—	—	S
22	—	S-Dh	Sn	Fe	Q	S
23	—	S-Dh	Sn	Fe	Q	S
24	—	S-Dh	?	Cu, Fe	Q	S

References: (a) Skertchley (1897), (b) Stirling (1905), (c) Lees (1907), (d) Denmead (1933b), (e) Jensen (1939), (f) Dimmick & Cordwell (1959), (g) Syvret (1963b).

OF THE MOUNT NOLAN AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	2 shs, pits	2 tons SnO_2 1947-48
—	—	—	not examined, 2 tons SnO_2, grade 7.6% SnO_2
090	70N	adit, 3 shs, open cut, pits	(a,b,e,f), over 300 tons SnO_2 1895-1927, grade about 20% SnO_2, 7 tons SnO_2 1967-68
030	40W	sh	—
030	40W	sh	—
100	48N	4 shs, pits	(c)
035	70W	sh	—
—	—	pit	—
155	90	sh	—
E-W	—	sh	—
—	—	sh, pit	—
—	—	pits	—
—	—	pits	—
E-W	60S	2 shs, 2 adits, pits	(e,g)
—	—	pits	—
025	—	pits	—
—	—	pits	—
150	85W	sh, over 30 m deep	(d,g), lode discovered 1914, 372 tons SnO_2 1914-65
165	85W	adit, 2 shs, pits	
170	85W	adit, sh	
125	65S	4 shs, 2 adits, pits	1 ton SnO_2 1920, grade 8% SnO_2
160	75W	sh	—
125	70S	2 shs, pits	—
135	80W	sh	—

TABLE 30. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	S-Dh	?	Pb, Cu, Fe	Q	S
2	—	S-Dh	Sn	—	Q	—
3	M. & R.	S-Dh	Sn	Fe	Q	S
4	—	S-Dh	Sn	—	—	—
5	—	S-Dh	Sn	—	Q	S
6	—	S-Dh	Sn	—	Q	S
7	—	S-Dh	Sn	—	Q	S
8	—	S-Dh	Sn	As	Q	S
9	Dawn of Hope	S-Dh	Cu, Ag	Fe	Q	S
10	Dawn of Hope	S-Dh	Cu, Ag	Cu, Fe	Q	S
11	Doc and Doris	S-Dh	Pb, Ag	—	—	S
12	Dunns Tunnel Claim? (Dennis Tunnel?)	S-Dh	Pb, Cu, Ag	Fe	—	S
13	—	S-Dh	Pb, Cu, Ag	Fe	Q	S
14	Lancelot (Lancelot Lease)	S-Dh	Sn	Cu, As, Pb, Bi, Zn, Ag, Fe, W	CS	S
15	Lancelot (Lancelot Lease)	S-Dh	Sn	Cu, As, Pb, Bi, Zn, Ag, Fe, W	CS	S
16	Pride of the Valley (Lancelot Lease)	S-Dh	Cu, Pb, Ag	Fe, Zn, As	Q, Ch	S
17	Pride of the Valley (Lancelot Lease)	S-Dh	Cu, Pb, Ag	Fe, Zn, As	Q, Ch	S
18	Battery	S-Dh	Cu, Pb, Ag	Fe, Zn	Q, Ch	S
19	Pup	S-Dh	?	—	Q	S
20	Colorado	S-Dh	Cu, Ag	Fe, Pb	Q	S
21	Schlumacher	S-Dh	Cu, Pb, Ag	Fe, Zn	Q	S
22	—	S-Dh	Cu, Pb, Ag	Fe, Zn	Q	S
23	—	S-Dh	Cu, Ag	Fe	Q	S
24	—	S-Dh	Cu, Ag	Fe	Q	S
25	—	S-Dh	Cu, Ag	Fe	Q	S
26	—	S-Dh	Cu, Ag	Fe	Q	S
27	Mulligan	S-Dh	Cu, Pb, Ag	Fe	Q	S
28	Mulligan	S-Dh	Cu, Pb, Ag	Fe	Q	S
29	Mulligan	S-Dh	Cu, Pb, Ag	Fe	Q	S
30	—	S-Dh	Cu, Ag	Fe	Q	S
31	—	S-Dh	?	—	Q	S
32	—	S-Dh	?	—	Q	S
33	Shorts	S-Dhc	Pb, Ag, Lst	—	Q	S
34	—	S-Dh	Pb, Ag	—	Q	S
35	—	S-Dh	Cu, Ag	Cu, Fe	Q	S
36	—	S-Dh	?	—	Q	S
37	Lanette (Lenette)	S-Dh	Cu, Pb, As, Sn	Fe, Zn	CS	S
38	Glencoe	S-Dhc	Lst, Pb?	—	—	S
39	Glencoe	S-Dhc	Lst, Pb?	—	—	S
40	—	S-Dh	Sn	Cu, Fe, W	Q	S
41	—	Cgz	?	Pb, As, Fe, Cu	G, F	S
42	Little Vulcan	Cgz	?	—	G	—
43	Anglo Saxon	S-Dh	Cu, Ag	Fe	Q	S
44	—	S-Dh	Cu, Ag	Fe	Q	S
45	—	S-Dh	Cu, Ag	Fe	Q	S
46	—	S-Dh	Cu, Ag	Fe	Q	S
47	—	S-Dh	Cu, Ag	Fe	Q	S
48	—	S-Dh	Cu, Ag	Fe	Q	S
49	—	S-Dh	Cu, Ag	Fe	Q	S
50	—	S-Dh	Cu, Ag	Fe	Q	S
51	—	S-Dh	Cu, Ag	Fe	Q	S
52	—	S-Dh	Cu, Ag	Fe	Q	S

OF THE SILVER VALLEY AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
020	90	adit, sh	—
—	90	sh, pit	—
120	60S	2 shs, pits	11 tons SnO_2 1911-20
—	—	shs, open cut	—
110	90	pits	—
110	65S	sh	—
105	90	sh, pits	—
145	75W	sh, pits	—
105	—	pits	worked copper carbonates
—	—	adit	
160	—	pit	worked secondary lead minerals
135	72S	adit, sh	(a,d), worked galena and copper carbonates
095	72S	pit	—
135	—	2 shs, pits	(b,c,d,e,f,g,h,j), worked 1895-1915 to 500 ft depth for 1173 tons SnO_2, grade 7.7% SnO_2
135	—	sh, pits	
135	—	adit, sh	(i), also known as **Prospectors Claim** (a) and **Reibels Tunnel** (f)
135	—	adit	
135	—	2 shs	(f,h), lode discovered 1929, worked to depth of 45 m
130	90	2 shs	—
115	80S	sh	(f), 35 ft deep
130	50S	2 shs, adit, pits	(a,d,g,j)
140	62W	sh	—
110	80S	3 shs, pits	—
110	90	adit, 2 shs, pits	—
105	90	pit	—
090	90	sh, pits	—
115	90	sh, pits,adit	(d)
115	90	3 shs, pit	
110	90	adit, sh, pits	
100	90	adit, 3 shs, pits	—
130	—	pits	—
140	—	pits	—
—	—	2 shs, open cut, pits	—
115	70S	sh	—
130	90	sh, pit	—
150	70W	collapsed sh	—
135	75W	5 shs, pits	(f,g,j), 36 m deep, 273 tons Cu and 6910 oz Ag 1930-35 and 1938-41, grade 12% Cu, 1 ton SnO_2 1932
125	70W	pits	(i), limestone mined for Irvinebank smelter
125	—	adits	
135	80W	sh	—
145	90	adit	—
—	90	sh	—
120	72S	shs, pits	—
130	90W	sh, pits	—
165	50W	sh, pits	—
140	75W	2 shs, pits	—
145	70W	4 shs	—
145	80W	3 shs, pits	—
180	70W	sh, pits	—
130	70S	3 shs, pits	—
140	70W	pits	—
150	90	sh, pits	—

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
53	White Star?	S-Dh	Cu, Pb, Ag	Pb, Cu, Fe	Q	S
54	—	S-Dh	?	—	Q	S
55	Agnes (Caledonia?)	S-Dh	Pb, Cu, Ag	Fe, Zn	Q	S
56	McFaddens?	S-Dh	Pb, Ag	Pb, Fe	Q	V
57	—	S-Dh	?	—	—	—
58	Target	S-Dh	Pb, Ag	Zn, Fe, Cu	Q	S
59	Silver Valley	S-Dh	Pb, Ag	—	Q	S
60	—	S-Dh	?	—	Q	—
61	—	S-Dh	?	—	Q	—
62	Target No. 1?	S-Dh	?	—	Q	—
63	Elsie	S-Dh	?	—	Q	S
64	—	S-Dh	Pb, Ag	Fe	Q	S
65	Glencoe	S-Dh	Cu, Ag	Fe	Q	S
66	Glencoe	S-Dh	Cu, Ag	Fe	Q	S
67	Glencoe	S-Dh	?	—	Q	S
68	—	S-Dh	Cu, Ag	Fe	Q	S
69	Westward Ho (Rainbow)	S-Dh	Cu, Pb, Ag	Fe, Zn	Q	S
70	Westward Ho (Rainbow)	S-Dh	Cu, Pb, Ag	Fe, Zn	Q	S
71	”	S-Dh	Cu, Pb, Ag	Fe, Zn	Q	S
72	Magnum Bonum	S-Dh	Sn, Cu, Pb, Fe	—	CS	S
73	Peronne	S-Dh	Sn	—	Q, Ch	S
74	—	Cgz	Cu, Ag	Fe	Ch	—
75	—	S-Dh	?	—	Q, Ch	S

References: (a) Jack (1883), (b) Skertchley (1897), (c) Cameron (1904b), (d) Stirling (1905), (e) Lees (1907), (f) Reid (1932e), (g) Jensen (1939), (h) Edwards (1951), (i) Dimmick & Cordwell (1959), (j) Syvret (1963b).

Structural Control Strike	Dip	Surface Workings	Remarks
130	70S	2 shs, pits	—
135	40S	pits	—
105	90	2 shs	—
130	—	pit	—
—	90	prospect sh	—
—	—	2 adits, sh, pits	—
—	—	pits	—
—	—	pit	—
—	—	sh	—
—	—	sh	—
135	70W	sh	—
125	85N	2 shs, pit	—
110	—	adit, pits	may be **Agnes No. 1** (g)
170	45W	sh, pits	
110	67S	sh	
140	75W	3 shs, pits	—
153	70W	3 shs, pits	(a,d,g,i), over 60 m deep, 198 tons Cu, 28 tons Pb, 41,786 oz Ag 1933-1940
153	70W	adit, 2 shs, pits	
153	70W	2 shs, pits	
—	—	shs, adit	(d,g,i), probably a calc-silicate lode, 40 tons SnO_2 1903-24, grade 4.8% SnO_2
—	—	sh, pits	—
—	—	sh	—
085	80N	2 shs, pit	—

TABLE 31. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name		Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	Brilliant (Starlight)		S-Dh	Sn	—	Q	S
2	Consolation		S-Dh	Sn, Cu, Ag	Fe, As	Ch, K?	S
3	Separation		S-Dh	Sn, Cu, Ag	As, Fe	Ch	S
4	—		S-Dh	Sn	—	—	S
5	Federation		S-Dh	Sn, Cu, Ag	Fe, As	Q	S
6	Red Wing		S-Dh	Sn, Cu, Ag	Zn, Fe	Q	S
7	—		S-Dh	Cu, Ag	Fe	Q	S
8	Independence		S-Dh	Sn, Cu, Ag	Fe, As	Q	S
9	—		S-Dh	?	—	—	S
10	Easter Monday		S-Dh	Sn, Cu, Ag	Fe	Q	—
11	" "		S-Dh	Sn, Cu, Ag	Fe	Q	—
12	Baal Gammon		S-Dh	Sn, Cu, Ag	As, Fe	Q	—
13	Big Gossan		S-Dh	Sn, Cu, Ag	Fe	Q	—
14	Crucible		S-Dh	Sn, Cu, Ag	Fe	Q	—
15	Crucible Adit		S-Dh	Sn, Cu, Ag	Fe	Q	—
16	Ironclad		S-Dh	Sn, Cu, Ag	Fe	Q	—
17	North Australian		S-Dh	Sn, Cu, Ag	Fe	Q	—
18	Shaughraun	United North Australian Group (Nos. 10–26)	S-Dh	Sn, Cu, Ag	Fe	Q	—
19	Wyatt		S-Dh	Sn, Cu, Ag	Fe	Q	—
20	Easter Sunday		S-Dh	Sn	—	Q	S
21	—		S-Dh	Cu, Ag	As, Fe	Q	S
22	Good Friday		S-Dh	Sn	Cu, Fe	Q, Ch	S
23	Grand Secret		S-Dh	Sn, Cu, Ag	Fe	—	—
24	—		S-Dh	?	—	—	—
25	—		S-Dh	?	—	—	—
26	Quartette		S-Dh	Sn	—	Q	—
27	Duggan		S-Dh	Sn	Cu, Fe	Q	—
28	New Year		S-Dh	Cu, Ag	Fe	Q	—
29	Ulster		S-Dh	Sn	As, Fe	Q, Ch	S
30	Jubilee		S-Dh	Sn	—	Q, Ch	—
31	—		S-Dh	Cu, Ag	As, Fe	Q	S
32	de Gipps		S-Dh	Cu, Ag	Fe	Q	S
33	—		S-Dh	?	—	Q	S
34	—		S-Dh	Cu, Ag	Fe	Q	S
35	Rely		S-Dh	Sn	—	Ch, K	S
36	Rosalee		S-Dh	Sn	—	Ch, K	S
37	Mount Leinster		S-Dh	Cu, Ag	Fe, As	?	S
38	—		S-Dh	Cu, Ag	Fe, As	Q	S
39	Big Chance		S-Dh	Cu, Ag	Fe, As	Ch, Q	S
40	—		S-Dh	Cu, Ag	Fe, As	Q	S
41	—		Cgz	Cu, Ag	Fe, W	Q	?
42	Fanny Parnell		Cgz	Sn	—	—	—
43	Caledonian		Cgz	Sn	Fe	Q	S
44	—		Cgz	Sn	Fe	Q	S
45	—		Cgz	Sn	Fe	Q	S
46	Dinkum		Cgz	Sn	—	Q, Ch	S
47	Black Dog		Cgz	Sn	—	Q, Ch, G	S
48	Skeleton		Cgz	Sn	—	—	S
49	Irish Girl		Cgz	Sn	Fe	Q, Ch	S
50	Prodigal		Cgz	Sn	As, Fe, W	—	—
51	Bismarck		Cgz	Sn	Fe	Q	S
52	Spear		Cgz	Sn	—	—	—
53	King of the Ranges		Cgz	Sn, Cu, Ag	Fe, Pb, W	Ch, F, Q, Ga	S
54	Mountaineer		Cgz	Sn	Pb, Fe	Q, Ch	S
55	Stewarts T. Claim		Cgz	Sn	Fe, W, Cu, As	Q	—

OF THE WATSONVILLE AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
070	60N	4 shs, pits	11 tons SnO_2 1902-11
—	—	2 shs, open cut, adit, pit	(g,h,i,m,n), first worked 1911, produced fluxing ore for Chillagoe smelters, 118 tons SnO_2 1911-68, 318 tons Cu and 24,755 oz Ag 1932-33
150	90	2 adits, 2 shs	18 tons SnO_2 1912-36
085	90	2 shs, pits	—
135-150	—	8 shs, pits	(a,c,q), 65 tons SnO_2 1911-19
—	—	sh, adit, pits	lode discovered 1910, 10 tons SnO_2 1910-11
060	45S	sh	—
165	70E	2 shs, pits	30 m deep, worked up to 1907
140	—	sh	—
—	—	pits, open cuts	(b,c), 27 tons SnO_2 1907-14
—	—	sh	
—	—	2 open cuts, 2 adits	(c,h,i), 88 tons SnO_2 1911-13, also produced fluxing ore for Chillagoe smelters
—	—	adit	—
—	—	adit	(a,b)
—	—	shs, pits	
—	—	adit, open cuts	(a,b,c,i), 100 tons SnO_2 to 1883, 6 tons SnO_2 1912-14
—	—	adit, shs, open cuts, pits	(a,b,c,e,i,p,q), 179 tons SnO_2 1902-37, grade 2.6%, 21 tons Cu and 1534 oz Ag to 1939
150	53W	3 shs	(a,i)
—	—	—	(a,b), not examined
130	65N	adit, 2 shs, pits	—
100	55S	pit	—
145	—	4 shs, pits	(a,b,i)
—	—	open cut	(a,i), 16 tons SnO_2 to 1883
135	—	3 shs	—
—	—	sh	—
—	—	pits	(i), 14 tons SnO_2 1919-20
—	—	2 shs	—
—	—	2 shs	—
175	85E	4 shs	(a,g,j), 11 tons SnO_2 1912-35
—	—	sh, pit	—
—	—	adit, shs	—
175	—	sh	—
155	70E	2 shs, pit	—
—	—	sh, pits	—
025	—	sh	—
125	70S	3 shs, pits	18 tons SnO_2 1907-36
120	—	3 shs, pit	(e)
075	90	5 shs	—
160	50N	sh, pits	(i), fluxing ore, 17 tons Cu, grade 5.6%, and 830 oz Ag to 1938
090	80N	3 shs	—
—	—	sh, open cut	—
—	—	2 shs, pits	—
—	—	5 shs, pits	(a,c,g,i,q), 14 tons SnO_2 1902-15
—	—	sh, pits	—
070	—	4 shs, pits, adit	—
—	—	2 shs, pits	(q), 22 tons SnO_2 1920-36
—	—	sh	—
—	—	4 shs, adit, pits	7 tons SnO_2 1902-25
—	—	5 shs, adit, pits	(i,j), 20 tons SnO_2 1901-50
—	—	—	(q), not examined
—	—	4 shs, 2 adits, pits	(e,j,q), 43 m deep, 16 tons SnO_2 1901-25, grade 8.5% SnO_2
—	—	minor workings	(a), 5 tons SnO_2 1948-49
—	—	adit, 3 shs, pits	(d,c,e,f,i,j,q), worked to depth of 91 m, 69 tons SnO_2 1896-1951, minor Cu and Ag
—	—	sh, costean	(a,i,q)
—	—	sh	(a,c,e,i,j,g), 152 m deep, sulphides at depth, 512 tons SnO_2 to 1896 (c), 145 tons SnO_2 1896-1951

TABLE 31. MINES AND PROSPECTS OF

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
56	Ben Lomond	Cgz	Sn	Cu, Fe	Q	—
57	Sylvia	Cgz	Sn	—	Q, Ch	—
58	Victor	Cgz	Sn	—	Q, Ch	S
59	Jack Head	Cgz	Sn	Fe	Q, Ch	—
60	Tom Snob (Dreadnought)	Cgz	Sn	W, Fe	Q	—
61	Dillans Garnet Show	Cgz	Sn	W, Fe	Q, Ch, Ga	S
62	Rose of England	Cgz	Sn	Fe	Q, Ch	S
63	Cock O' The North/King of the North	Cgz	Sn	Fe	Q, Ch	?
64	Chance (Lump of Fat)	Cgz	Sn	Cu, Fe, As	Q, Ch	S
65	Chance Extended	Cgz	Sn	Fe, As	—	S
66	—	Cgz	Sn	Fe, Cu	Q, Ch	—
67	Bar of Soap	Cgz	Sn	Fe, Cu, As, W	Q, Ch	S
68	Bessie	Cgz	Sn	Fe, Cu, As	Q, Ch	—
69	Billie Lewis (Just in Time)	Cgz	Sn	—	Ch	S
70	Last Chance	Cgz	Sn	Cu, Fe	Q	—
71	Patrick	Cgz	Sn	—	Q, Ch, F	S
72	Snob	S-Dh	Sn	—	—	S
73	St George	Cgz	Sn	—	Q, Ch	S
74	—	Cgz	W	Fe	—	—
75	—	Cgz	Sn, W	Fe	—	—
76	Glencairn	Cgz	Sn	Cu, Fe	Q	S
77	Sullivan	Cgz	Sn	Fe	Tp, Q, Ch	S
78	Anna Parnell	Cgz	Sn	—	Q, Ch	S
79	Crown	Cgz	Sn	W, Fe	Q	S
80	Montgomery	Cgz	Sn	—	Q, Ch	S
81	Great Western	Cgz	Sn	Cu, Fe	Q	S
82	Queen of the West	Cgz	Sn	Cu, Fe	Q	S
83	Little Western	Cgz	Sn	W, Fe	Q, Ch	S
84	—	Cgz	Sn	—	Q, Ch	S
85	Elaine Mary	Cgz	Sn	W, Fe	Q, Ch	S
86	Boundary	Cgz	Sn, W	Cu, Fe	Q, Ch, F	S
87	(Boundary?)	Cgz	Sn	—	Q, Ch	—
88	Broken Mirror	Cgz	Sn	—	Q	S
89	—	Cgz	Sn	—	Q, Ch	—
90	—	Cgz	Sn	—	—	—
91	Leinster	Cgz	Sn	—	Q, Ch	—
92	—	Cgz	Sn	—	Q, Ch	S
93	H.T.R.	Cgz	Sn	—	Q, Ch	—
94	—	Cgz	?	W, Fe	—	V
95	—	Cgz	?	—	—	—
96	Victoria	Cgz	Sn	—	—	S
97	—	Cgz	?	—	—	—
98	—	Cgz	?	—	Q	—
99	St Kilda	Cgz	Sn	W, Cu, Fe	Q	?
100	Nearly Missed	Cgz	Sn	—	Q, Ch	S
101	—	Cgz	Sn	As, Fe	Q	S
102	North Star	Cgz	Sn	—	Q, Ch, G	S
103	Boomer	Cgz	Sn	—	—	—
104	—	Cgz	Sn	Mo, W, Fe	Q, Ch, F	S

The following mines were not located during the present survey: **Argyll** (a), **Australia** (q), **Boultons Folly** (a), **Come by Chance** (a), **Day Dawn** (a,q), **Diamantina** (q), **Doris** (q) **Excelsior** (a,q), **Herbertina** (a), **Parnell** (a), **Pride of the West** (a), **Prince of Wales** (q), **Roslyn** (q), **St Patricks Day** (a,q), **Scottish Chief** (g), **Two Crowns** (q), **Watsons Folly** (q).

References: (a) Jack (1883), (b) Jack (1887), (c) Skertchley (1897), (d) Cameron (1904b), (e) Lees (1907), (f) Ball (1910), (g) Reid (1933), (h) Denmead (1934), (i) Jensen (1939), (j) Wade (1939), (k) Ridgway (1946), (l) Jolly (1946), (m) Blanchard (1947a), (n) Edwards (1951), (o) Connah (1956), (p) Dimmick & Cordwell (1959), (q) Syvret (1963).

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	adit	(c,j), 40 tons SnO_2 1896-1917
025	60W	sh, pits	(i, q)
—	—	3 shs	—
—	—	3 shs, pits	(i)
—	—	adit, sh	(a), 8 tons SnO_2 1912-26
050	—	adit, sh	(i)
080	—	4 shs, pits, adits	(j,q), 41 m deep, 27 tons SnO_2 1902-20
—	—	2 shs	(a), 72 tons SnO_2 to 1883
—	—	sh, open cut, pits	(a,c,e,i,j), 30 tons SnO_2 1901-08, grade 7% SnO_2
045	—	2 shs, pits	—
—	—	2 shs, pits	—
—	—	5 shs	(e,j), 36 tons SnO_2 1929-30
—	—	adit	(i)
130	60N	adit, sh	(i)
—	—	sh, adit	(q)
—	—	sh, 2 open cuts, pits	5 tons SnO_2 1966
—	—	2 shs, open cut	—
—	—	sh, 2 open cuts, pits	—
—	—	open cut	—
—	—	open cut	—
—	—	2 shs, open cut, adit, pit	(a,q), 5 tons SnO_2 1911-19
—	—	2 shs, pits	(q), 41 tons SnO_2 1940-66
—	—	adit, pits	(a,l)
—	—	3 shs, pits	—
135	55W	2 shs, pits	(d,j)
—	—	open cut, shs, pits, adit	(a,c,e,j,i), first mine opened in area, over 61 m deep, over 500 tons SnO_2 to 1883, 22 tons SnO_2 1905-29, grade 5.2% SnO_2
050	—	2 shs, pits	(a)
050	—	adit, 3 shs	(o), lode discovered 1947, 133 tons SnO_2 1947-61
—	—	sh, pits	—
—	—	3 shs, adits, pits	(k,l,q), lode discovered 1946, 155 tons SnO_2 1946-69
N-S	—	adit, open cut, 7 shs, pit	(a,i,j,k), 247 tons SnO_2 1883-1964
—	—	adits	—
035	—	adit, sh, pits	—
—	—	sh, pits	—
—	—	—	not examined
—	—	sh, pits	(a), 2 tons SnO_2 1905
—	—	adits, sh, open cut, pit	—
—	—	2 shs	(a), 24 m deep
—	—	pits, 2 shs	—
—	—	pits	—
015	—	2 shs	(a)
—	—	sh, pits	—
—	—	sh, pits	—
—	—	sh	(a)
155	70W	3 shs, pits	1 ton SnO_2 1918
—	—	pits	—
—	—	4 shs, 2 open cuts, pits	1 ton SnO_2 1904-20
—	—	open cut	1 ton SnO_2 1954
—	—	adit, 2 open cuts	—

TABLE 32. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	Lady Harrod	S-Dh	Sn	—	Q	S
2	Alice Harrod Extended East	S-Dh	Sn	—	Q, T	S
3	Alice Harrod	S-Dh	Sn	—	Q	S
4	—	S-Dh	Sn	—	Q, T	S
5	—	S-Dh	Sn	—	—	—
6	Stella Extended	S-Dh	Sn	—	—	S
7	Little Stella	S-Dh	Sn	—	—	S
8	Stella	S-Dh	Sn, Cu, Ag	Fe, W	Q	S
9	Good Hope (Lady Gladys, Big Tourmaline)	S-Dh	Sn	Fe, As	Q	S
10	Lea	S-Dh	Sn	—	Q	S
11	—	S-Dh	Sn	—	Q, K	—
12	Marianne	S-Dh	Sn	—	Ch, Ga	?
13	Anti Socialist	S-Dh	Sn	—	Q	S
14	—	Cgz	Cu, Ag	Fe	G	—
15	—	Cgz/Cgk	Sn	—	Q	V

References: (a) Morton (1931b), (b) Jensen (1939), (c) Syvret (1967b)

OF THE STELLA AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
066	85N	2 shs, pits	—
115	65S	sh, pits	2 tons SnO_2 1965-66
090	—	2 shs, pits	(c), 1 ton SnO_2 1911-12
180	60W	sh	—
—	—	pit	—
100	—	3 shs, pits	—
—	—	4 shs, pits	—
145	80E	3 shs, pits	(a,b,c), lode discovered 1910, 379 SnO_2, 45 tons Cu, 5369 oz Ag 1910-37
—	—	6 shs, open cuts, pits	(c), opened 1910, may include **Harry Lauder,** which produced 17 tons SnO_2 1914-26
115	—	2 shs, pits	—
—	—	pits	—
—	—	5 shs, pits, adits	—
115	85S	sh, open cut, pits	6 tons SnO_2 1907-12
—	—	2 shs, pits	—
—	—	3 shs, pits	—

TABLE 33. MINES AND PROSPECTS OF

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	Cgz	Sb	—	Q	S
2	Ellenvee	Cgz	Sb	Bi	Q	S
3	—	S-Dh	Ag, Cu	As, Fe	Q	—
4	—	Cgz	Cu, Ag	As, Fe	Q	S
5	—	Cgz	Cu, Ag	As, Fe	Q	—
6	—	Cgz	Cu, Ag, W	Fe	Q, F	S
7	—	Cgz	Cu, Ag	As, Fe	Q	S
8	—	Cgz	?	W, Fe	Q	S
9	Rangiteer	Cgz	Cu, Ag	As, Fe	Q, Ch	—
10	—	Cgz	?	W, Fe	Q	S
11	—	Cgz	Cu, Ag	As, Fe	Q	S
12	—	Cgz	Cu, Ag, W	Fe, As	Q, F, T	S
13	—	Cgz	Cu, Ag, W	Fe	Q, Ch	—
14	Morton	Cgz	Cu, Ag	Fe, As	Q, Ch, F	—
15	—	S-Dh	Cu, Ag	Fe, As	Q	S
16	—	Cgz	Cu, Ag	Fe, As	Q	S
17	Captain Extended	Cgz	Cu, Ag	Fe	Q	S
18	—	Cgz	Cu, Ag	Fe	Q	—
19	Captain	Cgz	Cu, Ag	Fe, As	Q	S
20	—	S-Dh	?	—	—	—
21	—	S-Dh	?	—	—	—
22	—	S-Dh	?	Fe, As	Q	S
23	—	Cgz	Cu, Ag, W	Cu, Fe, As	Q, F	S
24	—	Cgz	?	Fe, As	Q	S
25	Easter Monday	Cgz	Sn	As, Fe	Q, Ch	—
26	—	Cgz	?	—	—	—
27	Uncle Sam	S-Dh	Cu, Ag	Fe, Pb	—	S
28	—	Cgz	W, Sn	Cu, Fe	Q	S
29	—	Cgz	W, Sn	Cu, Fe	Q	S
30	—	Cgz	Cu, Ag	Fe	Q	S
31	—	Cgz	Cu, Ag, W	Fe	Q	—
32	Blutcher	S-Dh	?	—	—	—
33	—	S-Dh	?	—	—	—
34	You and I	S-Dh	Cu, Ag	Fe, As	Q	S
35	Empress	S-Dh	Cu, Ag	Fe, As, Pb, Mo	Q	S
36	Blue Jacket	S-Dh	Cu, Ag	Fe, Pb, As	Q, Ch	S
37	—	S-Dh	Cu, Ag	Fe, Pb, As	Q, Ch	S
38	—	S-Dh	Cu, Ag	Fe, Pb, As	Q, Ch	S
39	Jocelyn	Cgz	Sn	—	Q, Ch	—
40	—	Cgz	?	As, Fe	Q	—
41	Yellow Jacket	S-Dh	Cu, Ag	Fe	Q	S
42	Big Gossan (Deep Gossan?)	S-Dh	Cu, Ag	Fe	Q	S
43	New Year	S-Dh	Cu, Ag	Fe	Q	—
44	—	S-Dh	W, Cu, Ag	Pb, Fe, As	Q	S
45	Richard Queen	S-Dh	Cu, Ag	Fe, As	Q	S
46	America?	S-Dh	Cu, Ag	W, As, Fe	Q	S
47	—	S-Dh	Cu, Ag, Sn	Fe	Q	S
48	Myra	S-Dh	Cu, Ag, Sn	Fe	Q	S
49	Queen of Kentucky	S-Dh	Cu, Ag, Sn	Fe	Q	S
50	—	S-Dh	Cu, Ag	Fe	Q	S
51	Royal Actor (Royal Hector)	S-Dh	Cu, Ag	Fe, As	Q	S
52	Duchess?	S-Dh	Cu, Ag	Fe	Q	S
53	—	S-Dh	?	—	—	—

THE HERBERTON DIVIDING RANGE AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
ENE	—	pit	—
075	70N	shs, pits	—
—	—	sh	—
115	90?	2 shs, pits	—
—	—	sh, pits	—
—	—	2 shs	—
005	—	2 shs, pits	—
085	—	2 shs	—
—	—	sh	—
—	—	2 shs, pits	—
—	—	2 shs, pits	—
090	90?	2 shs, pits, adit	—
—	—	3 shs, pits	—
—	—	sh	—
090?	—	2 shs, pits	—
—	—	2 shs	—
—	—	6 shs, pits	—
—	—	sh, pit	—
—	—	10 shs, pits	(g)
—	—	2 shs, pits	—
—	—	2 shs	—
E-W	90	5 shs	—
—	—	2 shs, pits	—
065-005	—	5 shs	—
—	—	sh, pits	—
—	—	2 shs, adit	—
095	—	7 shs, pits	—
090	—	sh, pit	—
125	—	8 shs, pits	—
—	—	6 shs, pits	—
—	—	sh, pit	—
—	—	—	not examined
—	—	sh, pits	—
—	—	5 shs	max. depth 46 m
—	—	sh	(g), lode discovered 1915, idle since 1937, 107 m deep, 95 tons Cu and 8780 oz Ag, grade 6.3% Cu, 1930-37
—	—	8 shs	(g)
—	—	4 shs, pits	—
—	—	5 shs, pits	—
—	—	adit, open cut, 2 shs, pit	—
—	—	2 shs, pits	—
050	—	3 shs, pits	(g), 203 tons Cu and 21,467 oz Ag, grade 6% Cu, 1930-37
—	—	2 shs, pits	(g), 11 tons Cu and 2143 oz Ag, grade 4% Cu, 1930-37
—	—	2 shs	—
—	—	9 shs, pits	—
105	85S	adit, 3 shs, pits	—
085	—	7 shs, pits	(g)
030	—	2 shs, pits	—
—	—	5 shs, pits	9 tons SnO_2 1918-27
—	—	5 shs, pits	—
—	—	sh, pits	—
150	—	7 shs, pits	(g)
—	—	2 shs	—
—	—	sh, pits	—

TABLE 33. MINES AND PROSPECTS OF THE

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
54	Day Dawn	S-Dh	Cu, Ag	Fe, As	Q	S
55	—	Cgz	?	—	—	—
56	—	S-Dh	?	—	—	—
57	—	S-Dh	?	—	—	—
58	Anniversary	Cgz	Cu, Ag	Fe, As	Q	S
59	St Patrick	Cgz	Cu, Ag	Fe, W	Q	S
60	New Chum	Cgz	Sn	—	Q, Ch	—
61	—	Cgz	Sn	—	Q	S
62	Bosker (Boska)	Cgz	Sn	—	Q	—
63	—	Cgz	?	—	Q	S
64	Wisharts Claim?	Cgz	Sn?	—	Q	—
65	Rutledge?	Cgz	Cu, Ag	Fe	Q	S
66	—	Cgz	?	—	—	—
67	Queen of the South	Cgz	Sn	—	Ch	S
68	New Chum?	Cgz	Sn	—	Q, Ch	S
69	Triumph?	Cgz	Sn	—	Q, Ch	S
70	Gadfly?	Cgz	Cu, Ag?	—	Ch	S
71	All Nations?	Cgz	Sn	—	Ch, Q	S
72	Scorpeus?	Cgz	Sn	Fe, W	Ch, F, Q	S
73	Clarence	Cgz	?	—	Q, Ch	S
74	Surprise	Cgz	Sn	Fe	Q, Ch	S
75	Poor Stroller	Cgz	Sn	—	Q, F, Ch	—
76	—	S-Dh	?	Pb, Fe	Q	—
77	Isabel (Dividend)	S-Dh	Sn, Pb, Ag	Zn, Fe, Cu, As	Q	S
78	Stannum? (Kanaka?)	Cgz	Sn	—	Q, Ch	—
79	Sandra Mary	Cgz	Sn	—	CS	S
80	—	Cgz	?	—	—	—
81	Big Ben (St Mungo)	Cgz	Sn	Cu, Fe	Q, Ch	S
82	Maori Chief	Cgz	Sn	W, Fe	Q, T, Ch	S
83	—	Cgz	Sn	—	Q	—
84	Butterbox (Perseverance?)	Cgz	Sn	Fe, W	Q, Ch	S
85	—	Cgz	Sn	—	Q	S
86	True Blue	Cgz	Sn	Fe, As, W	Q, Ch	S
87	Archer (Queen)	Cgz	Sn	Fe	Q, Ch	S
88	Day Dawn	Cgz	Sn	Fe	Q, Ch	—
89	—	Cgz	Sn	—	—	—
90	Clyde	Cgz	Sn	W, Fe	Q, Ch	—
91	Silver King	Cgz	Sn	—	Q	—
92	—	Cgz	?	—	—	—
93	—	Cgz	?	—	—	—
94	—	Cgz	?	—	—	—
95	Black Chief	Cgz	Sn	—	Q	—
96	—	Cgz	?	—	—	—
97	—	Cgz	?	—	Q, Ch	—
98	Eileen (Lovely Nancy?)	Cgz	?	—	Q, Ga	S
99	Eileen	Cgz	?	—	Q	S
100	Telegraph	Cgz	Sn	—	—	—
101	—	Cgz	?	—	Q	—
102	Wheal Vohr (Happy Jack)	Cgz	Sn	Cu, Fe, Mo	Ch, G, Q	—

The following mines mentioned or described by other workers have not been located: tin mines—**Anna Parnell** (k), **Beatrice** (c), **Black Diamond** (k), **Boomer** (k), **Capricorn** (c), **Christmas Gift** (g,k), **Last Fall** (c), **Louisa** (a), **Millionaire** (g,k), **Nancy Lee** (a), **Princess** (c), **Rising Sun** (g), **St Patrick** (k), **Sky Scraper** (k), **Unicorn** (c), **Wildman** (g,k); copper mines—**Black Prince** (g), **Bon Accord** (g).

References: (a) Jack (1883), (b) Lees (1907), (c) Ball (1923b), (d) Denmead (1932a), (e) Denmead (1932b), (f) Reid (1932h), (g) Jensen (1939), (h) Morton (1944b), (i) Blanchard (1947a), (j) Dimmick & Cordwell (1959), (k) Syvret (1963b).

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	11 shs	(g)
—	—	pits	—
—	—	sh, pit	—
—	—	sh, pit	—
—	—	adit, 8 shs, pits	(g,k), 163 tons Cu, grade 6.7% Cu, 14,308 oz Ag, 1930-37
—	—	3 shs, 2 adits	(k)
—	—	adit, 4 shs, pits	(a), 6 tons SnO_2 1906-28
130	—	sh, pits	—
—	—	2 shs	(k), 1 ton SnO_2 1913-18
—	—	sh, pits	—
—	—	sh	(f)
110	60S	2 shs	(f)
—	—	sh	—
100	85N	sh	(g,k)
110	85S	2 shs	—
010	—	open cut	(f,k), 1 ton SnO_2 1905-30
095	70S	adit, sh, pits	(g), 1 ton Cu and 140 oz Ag, grade 8% Cu, 1930-38
095	70S	adit	(g,k)
—	—	6 shs, adit, pits	(c,k), 10 tons SnO_2 1924
030	70W	sh, pits	(c), 3 tons SnO_2 1911-13
045	—	8 shs, pits	(a,k)
—	—	sh	(a,g,k)
—	—	pit?	—
—	30W	5 shs, pits	(b,g,i,k), two lodes, one worked for Sn, the other for Pb, Cu, Ag, and Zn
—	—	sh, pit	(e,k), 1 ton SnO_2 1933-34
—	—	2 shs	21 tons SnO_2 1963-69
—	—	sh, pit	—
060	55E	sh, pits, adit	(a,g,k)
085	75S	3 shs, pits	(a,g,k), 1 ton SnO_2 1912-15
—	—	2 shs	—
115	85N	sh	(a,g,k), 42 tons SnO_2 1882
050	90	sh, pit	—
—	—	adit, 2 shs	(a), 2 tons SnO_2 1907
050	—	2 shs, pits	(a,c,g,k), 5 tons SnO_2 1909-14
—	—	adit, sh	(a,g,k)
—	—	sh	—
—	—	adit, 5 shs, pits	(a,k)
N-S	—	2 shs, pits	(a,k)
—	—	open cut, sh	—
—	—	sh, pits	—
—	—	sh, pits	—
NW-SE	75NE	adit, sh	(a)
—	—	pits	—
—	—	2 shs, pits	—
—	—	4 shs, pits	(g,k), 29 tons SnO_2 1902-18
—	—	—	not examined
—	—	sh, open cuts, pit	(h,j), lode discovered 1941, 13 tons SnO_2 1941-54
—	—	pits	—
—	—	2 shs	(a,d), recorded production less than 1 ton SnO_2

TABLE 34. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	Cgz	?	—	G, Ch	—
2	—	Cgz	?	—	Q	—
3	—	Cgz	?	—	Ch	—
4	—	Cgz	Sn	—	Q, Ch	S
5	Great Northern Gully	Cgz	Sn	W, Fe	Q, Ch	S
6	Great Northern East	Cgz	Sn	W, Fe	Q, Ch	—
7	—	Cgz	?	—	—	—
8	Blue Star	Cgz	Sn	—	Ch	—
9	—	Cgz	?	—	Q	S
10	Froghole (Erin Go Bragh)	Cgz	Sn	—	Q, Ch, F	S
11	—	Cgz	?	—	—	—
12	Cottais	Cgz	Sn	—	—	—
13	—	Cgz	?	—	Q, Ch	—
14	—	Cgz	?	—	—	—
15	—	Cgz	W	Cu, Fe	Q	S
16	—	Cgz	?	—	G	—
17	—	Cgz	?	—	G	—
18	—	Cgz	W	Fe	G	S
19	—	Cgz	?	—	Q, Ch	—
20	—	Cgz	?	—	Q, Ch	S
21	—	Cgz	?	—	Q, Ch	S
22	Northern Extended	Cgz	Sn	Cu, Fe	Q, Ch, F	S
23	—	Cgz	?	Cu, Fe	Q, Ch	S
24	—	Cgz	?	—	Q	S
25	—	Cgz	?	—	—	—
26	Defiance	Cgz	Sn	W, Fe	Q, G, F	S
27	Cunnamulla	Cgz	Sn	—	Q, Ch, G, F	S
28	Dawn of Hope	Cgz	Sn	W, Fe	Q, Ch	—
29	Southern Cross	Cgz	Sn	W, Fe	Q, Ch	—
30	—	Cgz	W	Fe	Q	S
31	—	Cgz	?	—	Q, Ch	S
32	—	Cgz	Sn	Cu, Fe	Ch	—
33	—	Cgz	Sn	—	Q, Ch	—
34	St George	Cgz	Sn	—	Q, Ch	—
35	—	Cgz	?	Cu, Fe	Q, Ch	S
36	Golden Casket	Cgz	Sn	—	Ch	—
37	—	Cgz	?	—	Q, Ch, G	S
38	Iron Horse	Cgz	Sn	—	Q, Ch	S
39	—	Cgz	?	—	—	S
40	Scotsman	Cgz	Sn	—	Ch, G	S
41	Phoenix	Cgz	Sn	—	Q, F, Ch	S
42	General Grant	Cgz	Sn	—	Ch	—
43	General Grant Extended	Cgz	Sn	Fe, As	Ch, Q, G	S
44	General Striker	Cgz	Sn	—	Q, Ch, G	—
45	Irish National League?	Cgz	Sn	—	Ch	—
46	Goodenough	Cgz	Sn	—	Q, Ch	—
47	Nelly Grant?	Cgz	Sn	Fe, W	Q, Ch, G, F	—
48	Soggoarth	Cgz	Sn	W, Fe	Q, Ch, F, G	S
49	—	Cgz	?	—	—	—
50	Extenuate	Cgz	Sn	Cu, Fe	Q, Ch	S
51	—	Cgz	?	—	Q, G	S
52	Keegans Knob	Cgz	Sn	—	Q,Ch,G	S
53	—	Cgz	?	—	Q, Ch	—
54	—	Cgz	?	—	Q, Ch	—

OF THE HERBERTON HILL AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	2 shs, pits	—
—	—	pits	—
—	—	sh	—
016	—	2 shs, open cut, pit	—
140	—	6 shs, pits	(a,b,c,g,h,i,k,m,o,p,q,r,s,t), 169 m deep, 2500 tons SnO_2
—	—	4 shs	198 m deep, 2500 tons SnO_2
—	—	pits	—
—	—	2 pits	—
—	—	sh	—
075	75N	5 shs, pits	(a,s,t), about 200 tons SnO_2
—	—	pits	—
—	—	sh	(a)
—	—	sh	—
—	—	sh, pits	—
080	40N	6 shs, pits	—
150	—	adit, pits	—
130	—	pits	—
135	90	open cut, sh, pit	—
—	—	sh	—
080	90	sh, pit	—
165	85E	2 shs, pits	—
N-S	90	adit, shs, pits	(r,t)
180	—	2 shs, open cut	—
—	—	sh	—
—	—	sh, pit	—
000	—	sh, pits	(a,r,t) 49 m deep, about 20 tons SnO_2
015	85E	2 shs	(a,t)
—	—	adit, sh, open cut	(a,t), about 12 tons SnO_2
—	—	3 shs, adit, open cut, pits	(a,t), about 100 tons SnO_2, 25 tons SnO_2 1968
—	—	open cut, pits	—
130	—	sh, pits	—
—	—	2 shs, pits	—
—	—	2 shs, pits	—
—	—	adit, sh, pits	(t)
005	90	2 shs, pits	—
—	—	shs	(t)
035	80W	sh	—
000	90	sh	(r,t), 40 m deep
075	75N	sh, pit	—
—	—	adit, sh	(a,t)
NE-SW	—	shs, pits	(a,r,t,x), probably over 100 tons SnO_2
—	—	sh, pit	(a)
—	—	2 shs, adit	—
—	—	sh, pits	(t), about 55 tons SnO_2
—	—	sh, pits	(a)
—	—	open cut, adit, 4 shs	(t)
—	—	sh, pits	(a)
165	90	shs, pits	(a)
—	—	sh, pits	—
N-S/E-W	90	2 adits, shs, pits	(t,x), two main ore shoots, about 150 tons SnO_2
—	—	pit	—
—	—	open cut, 3 shs, adit, pit	(t,x)
—	—	sh, pits	—
—	—	sh	—

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
55	Canberra	Cgz	Sn	—	Ch, G, Q	S
56	—	Cgz	Sn	—	Ch, G	—
57	Dry Damper	Cgz	Sn	—	Q, Ch, G	—
58	Cornishman (Ly-Ee Moon)	Cgz	Sn	W, Fe	Q, Ch, G, F	—
59	Home Rule	Cgz	Sn	Bi	Q, Ch	S
60	Iron Clad	Cgz	Sn	As, Fe, Cu	Q, Ch, G	S
61	—	Cgz	Sn	—	Q, Ch, G	—
62	Good Friday	Cgz	Sn	Fe	Q, Ch, G	S
63	Orient	Cgz	Sn	—	Q, Ch	—
64	—	Cgz	?	—	Q, G	—
65	Rainbow	Cgz	Sn	—	Ch, G, F, Q	S
66	London	Cgz	Sn	—	Ch, G, F, Q	S
67	Birthday	Cgz	Sn	—	—	—
68	—	Cgz	Sn	—	Ch	S
69	Alma?	Cgz	Sn	—	Ch, G	S
70	—	Cgz	?	—	Q, Ch, G	—
71	—	Cgz	?	—	Ch, G	—
72	—	Cgz	W, Sn	Fe	K	—
73	—	Cgz	?	—	Ch	—
74	Lottery	Cgz	?	—	—	—
75	Irish Girl	Cgz	Sn	—	Q, Ch	—
76	St Patrick	Cgz	Sn	Fe, As, Mo, Cu	Q, F, G	S
77	St Patrick	Cgz	Sn	—	Q, Ch, F, G,	S
78	St Patrick	Cgz	Sn	—	Q, Ch, F, G	S
79	St Patrick (Young American)	Cgz	Sn	W, Fe, Mo	Q, Ch, F, G	S
80	Chance	Cgz	Sn	—	Ch, Q	—
81	St Patrick (Noonans Adit)	Cgz	Sn	—	Q, G	—
82	—	Cgz	?	—	Q, Ch, G	—
83	—	Cgz	?	—	Q, Ch, G	—
84	—	Cgz	?	—	Ch	—
85	—	Cgz	?	—	Q, Ch	S
86	Black King	Cgz	Sn	W, Fe	Q, Ch, G,	S
87	Black King	Cgz	Sn	As, Fe	Q, Ch	—
88	Black King	Cgz	Sn	As, Fe	Q	—
89	Black King (Shepherds Workings)	Cgz	Sn	—	—	—
90	Buddys Wax	Cgz	?	—	Ch	—
91	—	Cgz	?	—	Ch	—
92	—	Cgz	W, Sn	Fe	Q, Ch, G	—
93	Wild Irishman	Cgz	Sn	—	Q, Ch, G, F	—
94	—	Cgz	?	—	Ch	—
95	—	Cgz	?	—	Ch	—
96	Foys Chlorite	Cgz	Sn	—	Ch, Q	—
97	—	Cgz	?	As, Fe	Q	S
98	Shamrock	Cgz	Sn	—	Q, Ch, F	S
99	—	Cgz	?	As, Fe	Ch, Q	S
100	—	Cgz	?	As, Fe	Q	S
101	—	Cgz	Sn, W	Fe	Q, Ch	S
102	—	Cgz	W	Fe	Q, Ch	S
103	—	Cgz	?	—	—	—
104	New Dalcoath	Cgz	Sn	—	Q, Ch	S
105	Portland	Cgz	Sn	—	Q, Ch	S
106	—	Cgz	W	Fe	Ch, G	—
107	—	Cgz	—	—	—	S
108	Three Star?	Cgz	Sn	—	Q	S

Structural Control Strike	Dip	Surface Workings	Remarks
045	80E	2 adits, 2 shs, pits	(j,r,t,x), 96 m deep, over 600 tons SnO_2, including 113 tons SnO_2 1938-55
—	—	sh	—
—	—	2 shs	(r,t)
030	—	shs, pits	(a,m,r,t,u,x), about 800 tons SnO_2
—	—	adit, 2 shs, pits	(a), probably over 50 tons SnO_2
070	—	open cuts, pits	(a,t,u,x), 20-30 tons SnO_2, 13 tons SnO_2 1967-68
—	—	sh, pits	—
020	80E	3 shs, pits	(f,r,t,x), first worked 1907, 195 tons SnO_2, grade about 8% SnO_2
—	—	4 shs, pits	(a,t)
—	—	sh	—
—	—	open cut, 15 shs, pits	(r,t,x), lode discovered 1910, about 600 tons SnO_2
—	—	open cut, adit, sh	(a,r,t)
—	—	—	(a), not examined
075	75S	sh, pits	—
—	—	3 shs	(a)
—	—	2 shs	—
—	—	sh	—
—	—	pits	—
—	—	sh, pits	—
—	—	adit, pits	(a,t), 'blind stab' only, no tin found
—	—	2 shs	(a)
—	—	shs, pits	
—	—	sh	(a,e,t), 267 tons SnO_2, grade 19% SnO_2
—	—	sh, pit, adit	
—	—	sh, pits	
—	—	adit, shs, pits, open cut	(a,b,x)
—	—	adit	(a,e,t)
—	—	sh	—
—	—	sh, pits	—
—	—	pits	—
165	80E	sh, pit	—
090	90	2 shs	
—	—	shs, pits	(a,d,r,t,x), over 100 tons SnO_2
—	—	sh	
—	—	shs, pits	
—	—	sh, pits	—
—	—	3 shs, pits	—
—	—	sh	—
—	—	adit, 6 shs, pits	(a,b,r,t,u,x,y), about 2300 tons SnO_2
—	—	sh, pit	—
—	—	pits	—
—	—	adit, shs, open cut, pit	(a,b,u,x)
070	90	sh	—
165	—	adit, sh, pit	(a,t), 12 tons SnO_2
080	75N	sh	—
095	90	sh, pit	—
075	—	shs, pits, adits	—
130	—	sh, open cut	—
—	—	pit	—
155	90	shs, pits	(a,r,t)
160	—	open cut, adit, shs	(t), 29 m deep, about 90 tons SnO_2
—	—	sh	—
165	—	open cut, adit, 3 shs	—
—	—	4 shs, pits	(a,t), 46 m deep, about 100 tons SnO_2

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
109	Charley East	Cgz	Sn	—	Q, Ch	S
110	—	Cgz	?	—	Q	—
111	—	Cgz	?	—	Q, Ch	S
112	—	Cgz	?	—	Q, Ch	—
113	—	Cgz	?	—	Q, Ch, G	—
114	Syndicate	Cgz	Sn	Sn	Q, F, G, Ch	—
115	—	Cgz	?	—	Q, Ch, G	—
116	—	Cgz	?	—	Ch, G	—
117	—	Cgz	?	—	Ch, G	—
118	White Hope	Cgz	W	Fe	Q, Ch, G	S
119	—	Cgz	?	Cu, Fe	Ch, G	S
120	New Zealand	Cgz	Sn	Cu, Fe	Q, Ch	—
121	Hopeful	Cgz	?	—	Q, Ch	—
122	North Star	Cgz	Sn	—	Q, Ch	S
123	Old Monarch	Cgz	Sn	—	Q, Ch	—
124	—	Cgz	?	Fe, As	Q	S
125	Levant	Cgz	Sn	Fe	Ch, Q, G, F	S
126	—	Cgz	Sn	Fe	Ch, Q, G, F	—
127	Brookman	Cgz	Sn	—	Q, Ch	S
128	Melbourne	Cgz	Sn	—	Q, Ch	—
129	Grass Humpy (Welcome Home)	Cgz	Sn	W, Fe	Q, K	—
130	—	Cgz	?	—	Q, Ch	S
131	Christmas	Cgz	Sn	—	—	—
132	Glanmire?	Cgz	Sn	W, Fe	Q	—
133	Star of the South?	Cgz	Sn	—	Ch, Q, G	—
134	New Monarch	Cgz	Sn	Fe, As	Ch, G, Q, T	—
135	Brisbane	Cgz	Sn	—	Ch, G, Q	—
136	Rip and Tear	Cgz	Sn	Fe	F	—
137	—	Cgz	?	—	Q, Ch	—
138	Great Eastern	Cgz	Sn	Cu	Ch, G	S
139	Nova Scotia	Cgz	Sn	Fe, W	Q, Ch, G	S
140	Atlanta (Bismarck)	Cgz	Sn	Fe	Ch, F	—
141	Belgium	Cgz	Sn	—	Ch, G	S
142	Cornstack	Cgz	Sn	W, Fe	Ch	—
143	Old Bradlaugh } United	Cgz	Sn	W, Fe	Q, Ch, F	—
144	New Bradlaugh } Bradlaugh	Cgz	Sn	?	Q, Ch, F	—
145	—	Cgz	Sn	Fe	F	—
146	—	Cgz	Sn	—	Q, F, Ch	S
147	—	Cgz	?	—	Ch, G	S
148	—	Cgz	?	—	Q, Ch	S
149	Lynette Marie	Cgz	Sn	—	G, F	S
150	Jean Agnes	Cgz	Sn	Sn	G	S
151	Handicap	Cgz	Sn	W, Fe	G, T	S
152	Epsom	Cgz	Sn	—	—	—

References: (a) Jack (1883), (b) Skertchley (1897), (c) Cameron (1904b), (d) Ball, (1923a), (e) Ball (1923c), (f) Ball (1923d), (g) Saint-Smith (1925c), (h) Reid (1932a), (i) Reid (1932d), (j) Reid (1932h), (k) Reid (1932j), (l) Reid (1932k), (m) Reid (1933b), (n) Reid (1933d), (o) Reid (1933e), (p) Denmead (1934), (q) Morton (1937), (r) Broadhurst (1937), (s) Morton (1944a), (t) Broadhurst (1951), (u) Dimmick & Cordwell (1959), (v) Bryan (1961), (w) Amos (1963), (x) Syvret (1963b), (y) Reid (1932m).

Structural Control		Surface Workings	Remarks
Strike	Dip		
155	90	shs, pits, open cut	(b)
—	—	2 shs	—
070	—	shs, pits	—
—	—	sh	—
—	—	2 shs, pits,	—
—	—	adit, 4 shs, open cut, pit	(a,r,t,x), 37 m deep, 200 tons SnO_2 reported
—	—	adit, 2 shs, pits	—
—	—	adit, open cut, sh	—
—	—	shs, pit	—
085	75N	shs, pits	—
105	90	shs, pits	—
—	—	adit, shs, pits	(a,r), working 1966, about 100 tons SnO_2
—	—	pits	(a)
075	75S	adit, shs, open cut, pit	(a,k,t), 35 tons SnO_2 1904-68
—	—	open cut, adits, shs	(a,t,x), had own battery on Nigger Creek, about 1000 tons SnO_2
080	70N	sh, pits	—
005	—	2 shs, open cut	(a,t), 10 tons SnO_2
—	—	adits, shs, pits	—
072	80W	open cut, adit, 2 shs, pit	(t)
—	—	adit, sh	(t)
—	—	adit, sh	(a,t)
—	—	shs, pits	—
—	—	adit, sh	—
—	—	sh	(a)
—	—	shs, pits	(a)
—	—	shs, adits, open cut, pit	(r,t,x,)
—	—	adit, sh, open cut	(a)
—	—	2 shs, adits, pits	(u,x), 49 tons SnO_2 1957-69
—	—	2 shs, open cut, pit	—
075	80N	3 shs, pits	(a)
100	—	3 shs	(a,t)
—	—	open cut, 2 shs	—
072	90	sh	—
—	—	open cut, sh, pits	(a)
—	—	6 shs	(a,r,t,v,w), includes **Leviathan** lode, 107 m deep } 96 tons SnO_2 1940-64
—	—	3 shs, adits, pits	(r,t), about 800 tons SnO_2
—	—	adit, sh	—
130	—	sh, pits	—
—	—	sh, pits	—
075	—	open cuts, pits	—
—	—	sh	10 tons SnO_2 1967-69
105	70N	pit	—
165	—	shs, open cuts, pits	37 tons SnO_2 1913-20
—	—	—	no information

TABLE 35. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	Village Blacksmith (Malvern)	Cgz	Sn	—	G	J
2	—	Cgz	Sn	—	—	—
3	—	Cgz	Sn	—	—	—
4	—	Cgz	Sn	—	—	—
5	—	Cgz	Sn	—	G	J
6	Tinsmith (Locksmith)	Cgz	Sn	As, Fe	G, F	—
7	Pandanus	Cgz	Sn	—	G	J
8	—	Cgz	Sn	—	G	—
9	—	Cgz	Sn	—	G	—
10	—	Cgz	Sn	—	G	J
11	—	Cgz	Sn	—	G	J
12	—	Cgz	?	—	—	—
13	Luxton?	Cgz	Sn	—	—	—
14	Reliance (Rose)	Cgz	Sn	—	—	—
15	Rising Sun	Cgz	Sn	—	—	—
16	—	Cgz	Sn	—	G	—
17	Greisen	Cgz	Sn	—	G	—
18	Tricky	Cgz	Sn	—	G	—
19	—	Cgz	Pb	As, Fe	G	—
20	Waimate Hill	Cgz	?	—	—	—
21	—	Cgz	Sn	Pb	G	—
22	Victor	Cgz	Sn	Bi	Q, F	J
23	—	Cgz	?	—	—	—
24	Last Chance	Cgz	Sn	—	G	—
25	Mount Margery	Cgz	Sn	—	G	—
26	Big Blow	Cgz	Sn	—	G	—
27	Big Blow	Cgz	Sn	—	G	—
28	Boulder West	Cgz	Sn	—	G	—
29	—	Cgz	?	—	G	—
30	—	Cgz	?	—	G	—
31	—	Cgz	Sn	—	—	—
32	—	Cgz	?	—	—	—
33	Great Boulder (Dalziels)	Cgz	Sn	As, Fe, Cu	G, F	J
34	Hero?	Cgz	Sn	—	G	J
35	Portsmouth?	Cgz	Sn	—	G	J
36	Shamrock (Clifton Hill)	Cgz	Sn	—	G, Ch	—
37	Victory	Cgz/S-Dh	Sn	—	G	—
38	—	Cgz	?	—	—	—
39	Surprise	Cgz	Sn	—	G	—
40	—	Cgz	?	—	G	J
41	Ballot Box	Cgz	Sn	—	G	J
42	Aunt Janet	Cgz	Sn	—	G	—
43	—	Cgz	?	—	G	J
44	—	Cgz	?	—	G	J
45	Adelaide	Cgz	Sn	As, Fe, Cu, Ti	G	J
46	—	Cgz	?	—	—	—
47	—	Cgz	Sn	—	G	—
48	Enterprise?	Cgz	W	Fe	G	—
49	Boulder Block	Cgz	Sn	—	Q	—
50	Maori Boulder	Cgz	W	Fe, As	G	—
51	—	S-Dh	W	Fe, As	G	—
52	—	S-Dh	W	Fe	G	—
53	—	S-Dh/Cgz	W	Fe	G	—

OF THE GURRUMBA AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
—	<10	5 adits, sh, pits	(b,c,e,i), 95 tons SnO_2 1897-1920
—	—	pit	—
—	—	pit	—
—	—	pit	—
150	—	pit	—
—	—	sh, pits	—
140	—	open cut, sh	(g,i,k,l), 5 tons SnO_2 1913-19
—	—	pit	—
—	—	pit	—
170	—	sh, pit	—
150	—	sh, pits	—
—	—	pit	—
—	—	pit	—
—	—	pit	7 tons SnO_2 1930
—	—	pit	4 tons SnO_2 1909-12
—	—	pit	—
—	—	adit, pits	(f), 25 tons SnO_2 to 1925
—	—	pits	—
—	—	pit	—
—	—	pit	—
—	—	sh, pits	—
100	90	3 shs	(f)
—	—	pit	—
—	—	sh, adit, pits	—
170	—	pits	—
170	—	sh, pit	—
—	—	sh, pit	—
150	—	open cut, sh, pits	(d,g,i,j,l), 20 tons SnO_2 1903-35
150	—	pits	—
—	—	pits	—
—	—	pit	—
—	—	pit	—
155	—	open cut, adit, 2 shs, pits	(c,g,i,k,l), discovered 1903 by J. Dalziel, 182 tons SnO_2 1903-08
160	—	pit	(c)
160	—	pits	(c), 2 tons SnO_2 1907
—	—	2 shs, pits	(f), 40 tons SnO_2 to 1925
—	—	adit, sh, pits	—
—	—	pit	—
—	—	pit	(c)
160	—	pits	—
160	—	2 shs, pits	(c,g,i)
—	—	sh, pit	3 tons SnO_2 1908-09
160	—	pit	—
160	—	pit	—
165	90	open cut, adit, shs, pits	(c,g,h,k,l), 72 tons SnO_2 1905-19, grade 1.4% SnO_2
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	sh, pits	4 tons SnO_2 1908
—	—	sh, pits	—
—	—	sh, pits	—
—	—	pit	—
—	—	sh, pits	—

TABLE 35. MINES AND PROSPECTS OF

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
54	—	Cgz/S-Dh	W	Fe	G	—
55	—	S-Dh	?	—	—	—
56	Canberra	S-Dh	Sn	—	Q	—
57	Globe	Cgz	Sn	As, Fe	G	—
58	Nil Desperandum?	Cgz	W	Fe	—	—
59	Independence (Homeward Bound)	Cgz	Sn	—	—	—
60	—	Cgz	Sn	—	G	J
61	—	Cgz	W	Fe, Mo	G, F	—
62	—	Cgz	Sn	—	—	—
63	Mount Luxton	S-Dh	Au	Pb, Fe	Q	S
64	Mount Luxton	S-Dh	Au	—	Q	S
65	Macgregors	S-Dh	Au	Pb, Fe	Q	V
66	Sugarloaf	Cgz	Sn	—	Ch, G, F	—

References: (a) Skertchley (1897), (b) Cameron (1904b), (c) Lees (1907), (d) Saint-Smith (1916a), (e) Saint-Smith (1916d), (f) Saint-Smith (1925a), (g) Jensen (1939), (h) Dimmick & Cordwell (1959), (i) Syvret (1963b), (j) Brien (1963b), (k) Brien (1964a), (l) Brien (1964b).

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	shs	—
—	—	pit	—
—	—	2 shs, adit	—
—	—	2 shs	green biotite lode, 18 tons SnO_2 1907-20
—	—	pit	—
—	—	pits	3 tons SnO_2 1906-07
145	—	open cut, pits	—
—	—	pits	—
—	—	pits	—
065	80S	sh, pits	(a,g,l), quartz reef worked to depth of about 12 m
075	80S	sh, pits	(a,g,l), quartz reef worked to depth of about 12 m
088	85S	pit	(a), quartz reef
135	—	4 shs, pits	8 tons SnO_2 1928-58

TABLE 36. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	Cgz	W	Fe	G	—
2	—	Cgz	W	Fe	G	J
3	—	Cgz	W	Fe	G	J
4	—	Cgz	W	Fe	G	J
5	—	Cgz	W	Fe	G	J
6	—	Cgz	W	Fe	G	J
7	—	Cgz	W	Fe	G	J
8	—	Cgz	W	Fe	G	J
9	—	Cgz	W	Fe	G	J
10	—	Cgz	W	Fe	G	J
11	—	Cgz	W	Fe	G	J
12	—	Cgz	W	Fe	G, Tp	J
13	—	Cgz	W	Fe	G, Tp	—
14	Crooks	Cgz	W, Bi	Fe, As	G, Tp	J
15	Gows	Cgz	W, Bi	Fe, As	G, Tp	J
16	Simpsons	Cgz	W, Bi	Fe, As	G, Tp	J
17	Youngs	Cgz	W, Bi	Fe, As	G, Tp	J
18	Byrnes (Manaposa)	Cgz	W, Bi	Fe, As, Cu	G, Tp	J
19	Dredges	Cgz	W, Bi	Fe, As	G, Tp	J
20	Toogoods (I.X.L.)	Cgz	W, Bi	Fe, As	G, Tp	J
21	—	Cgz	W	Fe	G	J
22	—	Cgz	?	—	G	J
23	—	Cgz	Pb	Fe	G	J
24	—	Cgz	W	Fe	G	—
25	—	Cgz	W	Fe	G	—
26	—	Cgz	W	Fe	G	—
27	—	Cgz	W	Fe	G, Tp	—
28	—	Cgz	W, Mo	Fe	G	—
29	—	Cgz	W	Fe	G, Tp	—
30	—	Cgz	W	Fe	G, Tp	—
31	—	Cgz	W	Fe	G, Tp	J
32	—	Cgz	W	Fe	G, Tp	J
33	—	Cgz	W	Fe	G	—
34	—	Cgz	W	Fe	G, Tp	J
35	—	Cgz	W	Fe	G, Tp	J
36	—	Cgz	W	Fe	G	—
37	—	Cgz	Sn	—	—	—

OF THE GLEN AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	pits	—
130	—	pits	—
130	—	pits	—
130	—	pits	—
130	—	sh	—
130	—	pits	—
130	—	pits	—
130	—	pits	—
150	—	pits	—
150	—	pits	—
150	—	pits	—
—	<10	2 adits	—
—	—	pit	—
—	<10	2 adits	—
—	<10	adits	—
—	<10	adits	—
—	<10	adits	—
—	<10	adits	—
—	<10	adits	—
—	<10	adits	—
150	—	pit	—
090	—	pit	—
090	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	adit	—
—	—	pit	—
—	—	pits	—
—	—	pits	—
—	<10	adit	—
—	<10	adit	—
—	—	—	—
—	<10	adit	—
—	<10	adit	—
—	—	pit	—
—	—	pits	—

TABLE 37. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	S-Dh/Cgz	Sn	—	G	—
2	—	S-Dh/Cgz	Sn	—	G	—
3	—	S-Dh	Sn	—	—	—
4	General Gordon	S-Dh	Sn	Bi, Pb, Zn, Cu, Fe	Q, T, F	—
5	General Gordon	S-Dh	Sn	Bi, Pb, Zn, Cu, Fe	Q, T, F	—
6	—	S-Dh	Sn	—	Q, F	—
7	—	S-Dh	Sn	—	Q	—
8	Oberlin	S-Dh	Sn	—	Q, T	—
9	—	S-Dh	Sn	—	Q	—
10	—	S-Dh	Sn	Fe	G	—
11	Black Prince	Cgz	Sn	As, Fe, Cu	G	J
12	Black Prince	Cgz	Sn	—	G	J
13	—	Cgz	W	As, Fe	G	J
14	—	Cgz	W	Ti, Fe	Q	—
15	—	Cgz	?	Ti, Fe	Q	—
16	—	Cgz	W	As, Fe	G, Tp	J
17	—	Cgz	?	—	—	—
18	—	Cgz	W	Fe	Q	—
19	Jimbilly	S-Dh	Sn	W, Fe	Q, Ch, F	—
20	Harveys	S-Dh	W, Sn	Fe	Tp, G	—
21	Devlins	S-Dh	Sn	—	G	—
22	—	Cgz	?	—	—	—
23	Rock of Ages	Cgz	W	Mo, Cu, Fe	G	—
24	Rock of Ages	Cgz	W	Mo, Cu, Fe	G	—
25	—	Cgz	W	Mo, Cu, Fe	G	—
26	—	Cgz	W	Fe	—	—
27	—	Cgz/S-Dh	W	Fe	G, Tp	—
28	Harveys	S-Dh	W	Fe	Q	—

Reference: (a) Syvret (1963b).

OF THE GLENLINEDALE AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	shs	—
—	—	shs	—
—	—	sh, pit	—
—	—	adit, sh, pits	(a), discovered 1886, worked as open cut 24 m deep, 479 tons SnO_2 1886-90
—	—	adit, open cut, pits	
—	—	open cut	—
—	—	sh	—
—	—	sh	(a), production included with **General Gordon**
—	—	sh	—
—	—	sh, pit	—
165	—	shs, open cut, pits	pegmatitic greisen lode
165	—	pits	
165	—	adit	—
—	—	pit	—
—	—	pit	—
—	<10	pits	—
—	—	pit	—
—	—	sh	—
—	—	open cut, shs, pits	44 tons SnO_2 1952-66
—	—	pits	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	shs, pits	—
—	—	—	—
—	—	2 shs	—
—	—	shs	—

TABLE 38. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	Cgz	Sn	—	G	J
2	—	Cgz	Sn	—	G	J
3	—	Cgz	Sn	—	G, K	—
4	—	Cgz	?	—	—	—
5	—	Cgz	?	—	—	—
6	—	Cgz	Sn	—	G	—
7	—	Cgz	Sn	—	Q, K	J
8	—	Cgz	Sn	—	G	—
9	—	Cgz	Sn	—	G	—
10	—	Cgz	Sn	—	G	J
11	—	Cgz	Sn	—	G	J
12	—	Cgz	Sn	—	Q, K	—
13	Vesuvius	Cgz	Sn	—	G, K	J
14		Cgz	Sn	—	G, K	J
15	—	Cgz	Sn	—	G, K	J
16	Pompeii	Cgz	Sn	—	Ch, G	—
17		Cgz	Sn	—	G, Ch	—
18	—	Cgz	Sn	—	G	J
19	—	Cgz	Sn	—	Q	J
20	—	Cgz	Sn	—	Q	J
21	—	Cgz	Sn	—	Q	J
22	—	Cgz	Sn	—	G, F	J
23	—	Cgz	Sn	—	G, F	—
24	—	Cgz	Sn	—	G	J
25	—	Cgz	Sn	—	G	—
26	—	Cgz	Sn	—	Q	—
27	—	Cgz	Sn	—	G	—
28	Alexander	Cgz	Sn	—	K, G	—
29		Cgz	Sn	—	K, G	J
30		Cgz	Sn	—	K, G	J
31		Cgz	Sn	—	K, G	J
32		Cgz	Sn	—	K, G	J
33	—	Cgz	Sn	—	—	—
34	—	Cgz	Sn	—	—	—
35	—	Cgz	?	—	G	J
36	—	Cgz	Sn	—	G, K	—
37	Surprise?	Cgz	Sn	—	—	—
38		Cgz	Sn	—	—	—
39	Sunrise	Cgz	Sn	—	G	J
40	—	Cgz	?	—	—	—
41	—	Cgz	?	—	—	—
42	—	Cgz	?	—	—	—
43	Pillar?	Cgz	Sn	—	—	J
44		Cgz	Sn	—	—	J
45	Tasmanian	Cgz	Sn	—	Q	J
46	—	Cgz	?	—	G	—
47	—	Cgz	?	—	G	—
48	Chesterfield	Cgz	Sn	—	G	J
49		Cgz	Sn	—	G, F, Tp	—
50	—	Cgz	?	—	—	—
51	—	Cgz	?	—	—	—
52	Farleys	Cgz	W	Fe	—	—
53	—	Cgz	Sn, W	Fe	Q, F	J
54	Black Angel	Cgz	Sn	Fe	G	J

OF THE MOWBRAY CREEK AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
100	—	open cut, sh, pits	—
025	82E	2 shs	—
—	—	adit, sh, pit	—
—	—	—	no information
—	—	—	no information
—	—	3 shs	—
160	80E	sh	—
—	—	2 pits	—
—	—	sh	—
110	—	pits	—
110	—	pits	—
—	—	adit	—
170	85E	2 shs, pit	(a,b,c)
170	85E	sh, adit	
170	85E	pits	—
—	—	sh, pits	(a,b,c)
—	—	sh, pits	
120	70N	sh, pits, open cut	—
150	—	sh, pits	—
150	—	shs, pits	—
150	—	shs, pits	—
150	—	sh	—
—	—	3 open cuts, 2 shs	—
065	—	sh	—
—	—	shs, pits	—
—	—	pit	—
—	—	adit, pit	—
—	—	shs, pits	
180	—	sh, pits	
160	—	sh, pits	(b,c)
160	—	shs, pit	
160	—	shs, pits	
—	—	pit	—
—	—	sh, pit	—
135	—	pit	—
—	—	sh	—
—	—	pit	—
—	—	pit	—
170	—	6 shs, 2 open cuts, pits	—
—	—	pit	no information
—	—	pit	no information
—	—	pit	no information
180	—	pit	(a,b,c)
180	—	pit	
180	—	—	(a,b,c), probably over 100 tons SnO_2 by 1883
—	—	—	no information
—	—	—	no information
145	—	sh, pit	—
—	—	shs	—
—	—	—	no information
—	—	—	no information
—	—	—	—
100	73W	sh	—
140	—	sh, pit	—

TABLE 38. MINES AND PROSPECTS OF

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
55	—	Cgz	Sn	—	G, Tp	—
56	—	Cgz	Sn	—	G	—
57	Croesus	Cgz	Sn	—	G	—
58	—	Cgz	Sn	—	G	—
59	—	Cgz	Sn	—	G	—
60	—	Cgz	Sn	—	G	—
61	—	Cgz	?	—	—	—
62	Bagdad (City of Bagdad)	Cgz	Sn	—	G	J
63	—	Cgz	?	—	G	—
64	—	Cgz	Sn, W	Fe	G	—
65	—	Cgz	Sn	—	G	J
66	—	Cgz	Sn	—	G, F	J
67	—	Cgz	Sn	—	G	J
68	—	Cgz	Sn	—	—	—
69	—	Cgz	W	Fe	—	—
70	—	Cgz	Sn	—	—	—
71	—	Cgz	Sn	—	G, F	J
72	—	Cgz	Sn	—	G	—
73	Black Elephant	Cgz	Sn, W	Fe	G, F	—
74	White Elephant	Cgz	Sn	—	G, F	—
75	—	Cgz	Sn	—	G	J
76	—	Cgz	Sn	—	—	—
77	Eileen	Cgz	Sn	—	—	—
78	—	Cgz	Sn	—	G	J
79	—	Cgz	Sn, W	Fe	G	—
80	—	Cgz	Sn	—	G	J
81	Scorpion	Cgz	Sn	—	G	—
82	—	Cgz	Sn	—	G	—
83	—	Cgz	W, Sn	Mo, Fe	G, Ch	J
84	—	Cgz	Sn	—	G, Ch	—
85	—	Cgz	Sn	—	—	—
86	Great Dalcoath	Cgz	Sn	—	Q, K	—
87	—	Cgz	Sn	—	G	—
88	—	Cgz	Sn	—	G	—
89	Great Divide (Main Divide)	Cgz	Sn	—	F, G	J
90	Dingo	Cgz	Sn	—	Q, F, Tp	J
91	—	Cgz	Sn	—	G	—
92	—	Cgz	Sn	—	G, F	—
93	22	Cgz	Sn	—	G	—
94	Seven Drunks?	Cgz	Sn	—	F, G	—
95	—	Cgz	Sn	—	G	J
96	—	Cgz	Sn	—	—	—
97	—	Cgz	Sn	—	—	—
98	Patterson	Cgz	Sn	—	—	—
99	—	Cgz	Sn	—	—	—
100	—	Cgz	Sn	—	—	—
101	—	Cgz	Sn	—	G	—
102	Esther	Cgz	Sn	—	G	—
103	Better Luck	Cgz	Sn	—	—	—
104	—	Cgz	?	—	—	—
105	—	Cgz	?	—	—	—
106	—	Cgz	Sn	—	G, Ch	J
107	Kangaroo	Cgz	Sn	—	G, F	J
108	Belfast	Cgz	Sn	—	G	J

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	sh	—
—	—	2 shs, pit	—
—	—	2 open cuts, 2 adits, shs	—
—	—	sh, open cut	—
—	—	3 shs	—
—	—	pits	—
—	—	pit	—
150	—	open cut, 2 shs	—
—	—	pit	—
—	—	pits	—
060	—	pit	—
135	80N	sh	—
140	85W	open cut	—
—	—	—	—
—	—	—	—
—	—	—	—
145	80E	pit	—
—	—	pit	—
—	—	2 pits	—
—	—	2 open cuts, sh	(d,e), 51 tons SnO_2 1903-60
145	83E	adit	—
—	—	—	—
—	—	—	9 tons SnO_2 1912-18
160	85E	pit	—
—	—	pits	—
145	75E	open cut	—
—	—	open cut	—
—	—	2 open cuts, sh	—
175	—	open cut, sh	—
—	—	3 shs, open cut, pits	—
—	—	—	—
—	—	sh	—
—	—	sh	—
—	—	2 shs	—
175	85E	open cut, sh	(d,c), over 15 m deep, 14 tons SnO_2 1952-61
140	80E	open cut, sh, adit, pits	(d), 13 tons SnO_2 1917-68
—	—	sh, pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	(d)
140	85E	pits	—
—	—	—	—
—	—	—	—
—	—	—	—
—	—	—	—
—	—	—	—
—	—	2 shs, open cut, pits	—
—	—	sh, pit	—
—	—	—	—
—	—	—	—
—	—	—	no information
150	—	sh, pit	—
125	90	sh, pits	—
130	90	3 shs, open cut, pit	—

TABLE 38. MINES AND PROSPECTS OF

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
109	—	Cgz	Sn	—	G	J
110	Snake Juice	Cgz	Sn	—	Q, Ch	J
111	—	Cgz	Sn	—	Q, Ch	—
112	—	Cgz	Sn	—	Q, Ch	—
113	—	Cgz	Sn	—	Q, Ch	J
114	—	Cgz	Sn	—	Ch	J
115	—	Cgz	Sn	—	Q, Ch	J
116	—	Cgz	Sn	—	G	—
117	—	Cgz	Sn	—	G, Ch	J
118	—	Cgz	Sn	—	Ch, Q	J
119	—	Cgz	Sn	—	Ch, G	—
120	—	Cgz	Sn	Cu, Fe	G, F, Ch	—

Location of Colossus (a) = Cardigan (b,c) not known.

References: (a) Jack (1883), (b) Cameron (1901a) (c) Cameron (1901b), (d) Jensen (1939), (e) Dimmick & Cordwell (1959).

Structural Control Strike	Dip	Surface Workings	Remarks
145	90	open stope, sh, pit	—
120	90	6 shs, pits	at least 12 m deep
—	—	sh	—
—	—	sh	—
135	—	4 pits	—
155	90	pits	—
175	90	sh, pits	—
—	—	sh	—
110	—	2 shs	—
145	90	pits	—
—	—	pits	—
—	—	sh	opened up 1968

TABLE 39. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	S-Dha	Sn	Fe	Ch	—
2	Gibraltar	S-Dha	Sn	—	Q	S
3	—	S-Dha	Sn	—	Q	S
4	Captain	S-Dha	Sn	Fe, Zn	Q, Ch, F	S
5	General	S-Dha	Sn	—	Q	S
6	Bluff (Rise and Shine)	S-Dh	Sn	—	Ch, Q	S
7	—	S-Dh	?	—	—	—
8	—	S-Dh	Sn	—	—	—
9	—	S-Dh	Sn	—	—	—
10	—	S-Dh	Sn	Fe	Q	—
11	—	S-Dh	Sn	—	—	—
12	—	S-Dh	Sn	—	—	—
13	—	S-Dh	Sn	—	—	—
14	—	S-Dh	?	—	Q	S
15	—	S-Dh	?	Fe	G	—
16	—	S-Dh	?	Fe	Q	—
17	—	S-Dha	?	—	Q	—
18	—	S-Dha	?	—	Q	—
19	—	S-Dh	?	—	Q	—
20	Fern	S-Dh	Sn	—	—	—
21	—	S-Dh	Sn	—	Q	S
22	—	S-Dh	Sn	—	—	—
23	—	S-Dh	Sn	—	—	—
24	Johnston (Cousin)	S-Dh	Sn	—	Q, Ch	—

References: (a) Jensen (1939), (b) Dimmick & Cordwell (1959), (c) Zimmerman et al. (1963).

OF THE DRY RIVER AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	adit, sh	—
140	50W	2 shs, open cut, pits	—
055	90	2 shs	—
115	—	2 shs	(a,b,c), about 60 m deep, 62 tons SnO_2 1908-42, grade 12.3%, 1 ton SnO_2 1915
160	80N	sh	—
115	70S	adit	working 1966
—	—	—	no information
—	—	—	—
—	—	—	—
—	—	3 shs	—
—	—	—	—
—	—	—	—
—	—	—	—
135	90	sh, pits	—
—	—	pits	—
—	—	sh	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	sh	—
175	—	pits	—
—	—	—	—
—	—	—	—
—	—	sh	—

TABLE 40. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	Cgz	W	Fe, As	G, Tp	—
2	—	Cgz	W	Fe, As	G, Tp	—
3	—	Cgz	Sn	W, Fe, As	G	J
4	—	Cgz	W	Fe, As	G	—
5	—	Cgz	Sn	—	G	—
6	Wariki	Cgz	W	Fe, As, Sn	G	J
7	—	Cgz	W	Fe	G	—
8	—	Cgz	W	Fe	G	—
9	—	Cgz	W	Fe	G	—
10	Treasure	Cgz	W	Fe, Mo, As, U	G	J
11	—	Cgz	Cu	Fe	G, F	J
12	—	Cgz	W	Fe, Mo	G	—
13	—	S-Dh/Cgz	?	—	G	—
14	—	Cgz	W	Fe, Mo	G	—
15	—	S-Dh/Cgz	W	Fe	G	—
16	—	S-Dh/Cgz	W	Fe	F, G	—
17	—	S-Dh/Cgz	W	Fe, Mo	G	J
18	—	S-Dh/Cgz	W	Fe	G, F	—
19	—	Cgz	W	Fe, Mo	G	—
20	Geebung	Cgz	W, Sn	Fe, Cu, As	G	J
21	New Geebung	Cgz	W	Fe, Mo	G	—
22	—	S-Dh/Cgz	W	Fe	Q, F	—
23	Shetlands	S-Dh/Cgz	W	Fe, Mo, As	G	J
24	—	S-Dh/Cgz	W	Fe, Mo	G	—
25	Gauntlet?	S-Dh/Cgz	W	Fe	G	—
26	—	S-Dh/Cgz	W	Fe	G	—
27	—	S-Dh/Cgz	W	Fe, Cu	G	—
28	—	S-Dh/Cgz	W	Fe	G	—
29	—	S-Dh/Cgz	W	Fe	G	—
30	—	S-Dh/Cgz	W	Fe	G	—
31	Fingertown	S-Dh/Cgz	W	Fe, Be	G, F	J
32	—	Cgz	W	Fe, As	G	J
33	—	Cgz	W	Fe, As	G	J
34	—	Cgz	W	Fe, As	G	J
35	—	Cgz	W	Fe	G	J
36	Jimmy Sherrill	Cgz	W	Fe	G	J
37	—	Cgz	W	Fe	G	J

References: (a) Jensen (1939), (b) Knight (1949), (c) Zimmerman et al. (1963).

OF THE GEEBUNG HILL AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	shs	—
—	—	open cut, shs	—
160	—	2 pits	—
—	—	pits	—
—	—	—	—
145	90	open cut, 3 shs, pits	—
—	—	pits	—
—	—	—	—
—	—	—	—
080	—	3 shs, adit	—
110	70N	shs	—
—	—	pits	—
—	—	—	—
—	—	sh	—
—	—	—	—
—	—	pit	—
075	—	pits	—
—	—	pits	—
—	—	pits	—
N-S	—	shs	—
—	—	adit, shs	—
—	—	pit	—
135	—	shs	—
—	—	pits	—
—	—	—	—
—	—	—	—
—	—	—	—
—	—	—	—
—	—	—	—
—	—	—	—
110	—	open cut, pits	(a,b,c), 22 tons wolframite 1942-55
115	—	pit	—
160	—	sh, pits	—
140	—	sh, pits	—
135	—	sh, pits	—
095	—	sh	—
125	80N	sh, pits	—

TABLE 41. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	Cgz	W	Fe	G	J
2	—	Cgz	W	Fe	G	J
3	—	Cgz	W	Fe	G	J
4	Union Jack	Cgz	Sn	—	G	—
5	—	Cgz	W	Mo, Cu, Fe	G, Tp, F	—
6	—	Cgz	W	Mo, Cu, Fe	G, F, Tp	—
7	—	Cgz	W	Mo, Cu, Fe	G, F, Tp	—
8	—	Cgz	W	Fe	G	—
9	—	Cgz	W	Fe	G	—
10	—	Cgz	W	Fe	G	—
11	—	Cgz	W	Fe	G	—
12	O.K. (Stingo)	S-Dh	Sn	Fe	Q, Ch, G	—
13		S-Dh	Sn	Fe	Q, Ch, G	—
14	—	S-Dh	?	—	F, G	—
15	—	S-Dh	?	—	F, G	—
16	Good Luck	S-Dh	Sn	—	Q	S
17		S-Dh	Sn	—	Q	S
18	London	S-Dh	Sn	—	—	—
19		S-Dh	Sn	—	—	—
20	—	S-Dh	Sn	—	—	—
21	—	S-Dh	Cu	Fe	Q, G	S
22	Spranklins	S-Dh	Sn	—	Q	—
23	Good Hope	S-Dh	Sn	—	Q, Ch	—
24		S-Dh	Sn	—	Q, Ch	—
25	—	S-Dh	Sn	—	Q	—
26	Bulletin	S-Dh	Sn	—	Q	—
27	—	S-Dh	Sn	—	—	—
28	—	S-Dh	Sn	—	—	—
29	Excelsior	S-Dh	Sn	W	Ch, T, Q	S
30	—	S-Dh	Sn	—	Q, Ch	S
31	—	S-Dh	?	—	—	—
32	—	S-Dh	?	—	Q, G	—
33	—	S-Dh	Sn	—	—	—
34	Little Wanderer	S-Dh	Sn	—	Q	S
35	Britannia	S-Dh	Sn	—	Q	—
36	De La Ray (Little Wonder)	S-Dh	Sn	—	Q, Ch	—
37	—	S-Dh	Sn	—	Q	—
38	—	S-Dh	Sn	—	Q	—
39	Melba	S-Dh	Sn	—	Q, Ch	S
40	Miracle	S-Dh	Sn	Pb, Cu, Fe	Q, Ch	S
41	Homeward Bound	S-Dh	Sn	—	Q, Ch	S
42	—	S-Dh	Cu, Pb	Fe	Q	—
43	—	S-Dh	Sn	—	—	—
44	—	S-Dh	Sn	—	Q, Ch	—
45	—	S-Dh	Sn	—	Q, Ch	—
46	Wards	S-Dh	Sn	—	Q, Ch	S
47	—	S-Dh	Sn	—	Q	—
48	—	S-Dh	W, Cu	Fe	Ch	—
49	Mount Fairy (Fairyland)	S-Dh	W, Cu	Fe	Q	S
50	—	S-Dh	?	—	—	—
51	—	S-Dh	?	—	—	—
52	—	S-Dh	Sn	—	—	—

OF THE BROWNVILLE AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
165	—	2 pits	—
—	—	pit	—
—	—	2 pits	—
—	—	—	—
—	—	shs, pits	—
—	—	shs, pits	—
—	—	shs, pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
165	—	sh	—
145	—	pits	—
—	—	2 pits	—
—	—	pit	—
140	—	open cut	(c), 2 tons SnO_2 1906-11
140	—	sh	
—	—	pit	—
—	—	sh, pit	—
—	—	pits	—
075	—	pit	—
—	—	shs, pits	—
—	—	sh, pits	—
—	—	sh, pits	—
155	—	shs	—
—	—	3 shs, pits	—
—	—	sh	—
—	—	pit	—
140	80W	open cut, shs	(b,c,d,e,h), 40 m deep, some scheelite present, 171 tons SnO_2 1906-60, grade 1.5% SnO_2
165	—	sh, open cut	—
—	—	pit	—
—	—	sh	—
—	—	pit	—
140	—	2 shs	—
—	—	sh, pits	—
—	—	sh	—
—	—	pits	—
—	—	pits	—
E-W	—	2 shs, pits	—
110	—	4 shs, pit	24 m deep, 17 tons SnO_2 1937-42
100	—	sh, pits	—
—	—	pits	—
—	—	pit	—
—	—	pit	—
—	—	pits	—
175	—	open cut, shs	—
—	—	pits	—
—	—	pits	—
145	80W	2 shs, pits	(h), 19 tons Cu from 94 tons ore 1893
—	—	pits	—
—	—	pit	—
—	—	pit	—

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
53	—	S-Dh	Sn	—	—	—
54	—	S-Dh	Sn	—	—	—
55	—	S-Dh	?	—	—	—
56	Iri Fune	S-Dh	Cu	Fe	—	—
57	Flo (Arafuran)	S-Dh	Sn	W, Fe	Ch	S
58	—	S-Dh	?	—	—	S
59	Excellent	S-Dh	Sn	Fe, Cu, Pb, As	Ch, Q	—
60	—	S-Dh	?	—	—	—
61	—	S-Dh	Sn	—	—	—
62	—	S-Dh	Sn	—	—	—
63	—	S-Dh	Sn	—	—	—
64	—	S-Dh	Sn	—	—	—
65	—	S-Dh	?	—	—	—
66	—	S-Dh	Sn	—	—	—
67	—	S-Dh	Sn	—	—	—
68	—	S-Dh	?	—	—	—
69	—	S-Dh	?	—	—	—
70	Mount Fraser	S-Dh	Sn	—	Q, Ch, G	S
71	Frazers	S-Dh	Sn	—	Q, G, Ch	S
72	Veteran	S-Dh	Sn	—	Ch	—
73	—	S-Dh	?	—	—	—
74	—	S-Dh	Sn	—	—	—
75	—	S-Dh	Sn	—	—	—
76	Tank (East Alexander)	S-Dh	Pb, Cu, Ag	Fe	Q	S
77	Alexander	S-Dh	Cu, Ag	Pb, Fe, Zn	Q	S
78	—	S-Dh	Sn	—	—	—
79	—	S-Dh	?	—	—	—
80	—	S-Dh	?	—	—	—
81	Neita	S-Dh	Sn	—	Ch	—
82	Neita	S-Dh	Sn	—	Ch	—
83	—	S-Dh	Cu	Fe	—	—
84	—	S-Dh	Cu	Fe	—	—
85	May Day Claim	S-Dh	Sn	—	Q	—
86	Rose and Thistle	S-Dh	Sn	—	Q	—
87	Rose and Thistle	S-Dh	Sn	—	Q	S
88	—	S-Dh	?	—	—	—
89	South Dalcoath	S-Dh	Sn	—	Ch	—
90	Dalcoath	S-Dh	Sn	—	Ch, Q	S
91	—	S-Dh	?	—	—	—
92	—	S-Dh	Sn	—	—	—
93	—	S-Dh	Sn	—	Ch	—
94	Summer Hill	S-Dh	Sn	Cu, Fe	Q, Ch	—
95	—	S-Dh	Sn	—	Ch	—
96	Mount Cardiff	S-Dh	Sn	—	Q, Ch	S
97	Mount Cardiff	S-Dh	Cu	Fe	Q	S
98	—	S-Dh	Sn	—	—	—
99	Swagman	S-Dh	Sn	—	Ch	S
100	—	S-Dh	Cu	Fe	—	—
101	Chinamen (Ruby)	S-Dh	Sn	—	Ch	S
102	Trostin	S-Dh	?	—	—	—
103	Kohinoor	S-Dh	Pb, Ag	Zn	Q	S
104	—	S-Dh	Cu	Fe	—	—
105	—	S-Dh	?	—	—	—
106	—	S-Dh	Pb, Cu, Ag	Fe	—	—

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	pit	—
—	—	pit	—
—	—	pits	—
—	—	sh	—
165	90	sh	—
125	—	pits	—
140	80E	shs, pits	(c.f.), pipe-like orebodies, 33 m deep, 33 tons SnO_2 1931-44, grade 1.5% SnO_2
—	—	pit	—
—	—	pit	—
—	—	pits	—
—	—	pit	—
—	—	pits	—
—	—	pit	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pit	—
145	90	3 shs	12 tons SnO_2 1906-07
145	90	2 shs	—
145	—	2 shs	—
—	—	pit	—
—	—	pits	—
—	—	pits	—
105	70N	sh	(h), 50 tons ore 1917-20, parcel in 1920 averaged 64% Pb and 11 oz Ag per ton
105	—	2 adits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
140	—	2 shs	—
140	—	3 shs, pits	—
—	—	pit	—
—	—	pit	—
—	—	2 shs	—
—	—	pits	—
160	—	sh	—
—	—	pits	—
—	—	shs, adit	(c,d,e), 45 m deep, 55 tons SnO_2 1897-1954
105	70S	2 shs, adit, pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	open cut, adit, pits, sh	23 tons SnO_2 1939-65, grade 1.6% SnO_2
—	—	pits	—
065	—	sh	—
135	—	adit, sh	—
—	—	pits	—
120	—	sh, pits	—
—	—	pit	—
140	70E	sh	—
—	—	2 shs	—
115	90	5 shs, adit	(d,g,h), opened 1883, 18 m deep, probably includes **Brilliant** (g)
—	—	pit	—
—	—	pit	—
—	—	pit	—

TABLE 41. MINES AND PROSPECTS OF

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
107	Dingo	S-Dh	Pb	—	Q	S
108	—	S-Dh	?	—	—	—
109	Red Rose	S-Dh	Pb, Ag	—	—	—
110	White Rose	S-Dh	Sn	—	Q	S
111	—	S-Dh	Sn	—	Q	S
112	Starlight	S-Dh	Sn	—	Q, Ch	—
113	—	S-Dh	Sn	—	Q, Ch	—
114	—	S-Dh	Sn	—	Ch	—
115	Old Boot (Surprise)	S-Dh	Sn	—	Ch	S
116	Old Boot (Surprise)	S-Dh	Sn	—	Ch	—
117	—	S-Dh	Sn	—	Ch	—
118	—	S-Dh	Sn	—	Ch	—
119	—	S-Dh	Sn	—	Ch	—
120	—	S-Dh	Sn	—	Ch	—
121	—	S-Dh	Sn	—	Ch	—
122	—	S-Dh	Sn	—	Ch	—
123	—	S-Dh	Sn	—	Ch	—
124	Home Sweet Home	S-Dh	Sn	—	Ch	—
125	—	S-Dh	Sn	—	Ch	—
126	—	S-Dh	Sn	—	Ch	—
127	—	S-Dh	Sn	—	Ch	—
128	—	S-Dh	Sn	—	Ch	—
129	—	S-Dh	?	—	—	—
130	—	S-Dh	?	Pb	—	—
131	—	S-Dh	?	Pb	—	—
132	—	S-Dh	?	Pb	—	—
133	—	S-Dh	?	Pb	—	—
134	—	S-Dh	?	—	—	—
135	—	S-Dh	Sn	—	—	—
136	Hopetown	S-Dh	Sn	—	—	—
137	Hopetown	S-Dh	Sn	—	—	—
138	Federal	S-Dh	Sn	—	Ch	S
139	—	S-Dh	Sn	—	—	—
140	—	S-Dh	?	—	—	—
141	—	S-Dh	?	—	—	—
142	Marshall Hey	S-Dh	Sn	—	—	—
143	—	Cgz	W	Fe	G	—
144	—	S-Dh	Sn	—	—	—
145	—	Cgz	W	Fe	G	J

References: (a) Maitland (1891), (b) Lees (1907), (c) Ball (1933), (d) Morton (1936a), (e) Jensen (1939), (f) Morton (1944d), (g) Knight (1949), (h) Zimmerman et al. (1963).

THE BROWNVILLE AREA.—*continued*

Structural Control Strike	Dip	Surface Workings	Remarks
E-W	80N	sh	—
—	—	pit	—
—	—	pit	—
NNW	—	open cuts	—
NNW	—	open cuts	—
—	—	pits	—
—	—	pits	—
—	—	pit	—
N-S	—	sh, pit	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
N-S	—	pits	—
N-S	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
140	75E	shs, pits	(e), 15 tons SnO_2 1901-36, grade 4.8% SnO_2
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	sh, pits	—
—	—	2 pits	—
—	—	pits	—
035	85E	sh, open stope	—

TABLE 42. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	S-Dh	?	—	—	—
2	—	S-Dh	Sn	—	Q	—
3	—	S-Dh	Sn	Cu, Fe	Q	—
4	Never Can Tell	S-Dh	Sn	—	Q, F, Tp, Ch	—
5	Mountain Maid	S-Dh	Sn	—	Q	—
6	Dawn	S-Dh	Sn	—	—	—
7	Mount Emslie	S-Dh	Sn	—	Q	—
8	—	S-Dh	Sn	—	—	—
9	—	S-Dh	Sn	—	Q, Ch	—
10	Do Come In	S-Dh	Sn	—	Q	—
11	Micky McIntyre (Austral)	S-Dh	Sn	—	Q	—
12	—	S-Dh	Sn	—	Q, Ch	—
13	—	S-Dh	Sn	—	Q, Ch	—
14	—	S-Dh	Sn?	Fe	—	—
15	—	S-Dh	Sn	—	—	S
16	—	S-Dh	Sn	—	—	S
17	—	S-Dh	?	—	—	—
18	—	S-Dh	?	—	—	S
19	—	S-Dh	?	—	—	—
20	—	S-Dh	?	—	—	—
21	—	S-Dh	Sn	—	Q, Ch	—
22	—	S-Dh	Sn	—	Ch, Ch	—
23	Bally Green	S-Dh	Sn	—	Q, Ch, K	S
24	—	S-Dh	Sn	As, Fe	Q, Ch	—
25	—	S-Dh	Sn	—	Q, Ch	—
26	—	S-Dh	Sn	—	Q, Ch	—
27	—	S-Dh	Sn	—	Q, Ch	—
28	—	S-Dh	Sn	—	Q, Ch	—
29	—	S-Dh	Sn	—	Q	—
30	—	S-Dh	Sn	—	Q	—
31	All Nations?	S-Dh	Sn	—	Q	—
32	New Moon?	S-Dh	Sn	—	Q	—
33	—	S-Dh	?	—	—	—
34	Hoods	S-Dh	Sn	Fe	Q, Ch	—
35	Hoods	S-Dh	Sn	Fe	Q, Ch	—
36	—	S-Dh	Sn	—	Q	—
37	—	S-Dh	Sn	—	Q	—
38	—	S-Dh	?	—	—	—
39	—	S-Dh	Sn	—	—	—
40	—	S-Dh	?	—	—	—
41	—	S-Dh	?	—	—	—
42	—	S-Dh	?	—	—	—
43	Sunlight	Cgz/S-Dh	Sn	—	Ch	—
44	Bonnie Dundee	Cgz/S-Dh	Sn	—	Ch, Q	—
45	—	Cgz/S-Dh	Sn	—	—	—
46	—	Cgz/S-Dh	Sn	—	—	—
47	Nelson	Cgz	Sn	—	—	—
48	—	Cgz	Sn	—	—	—
49	—	Cgz	Sn	Fe, Pb, As	Q, F	—
50	Bolivia (N. Britain)	Cgz	Sn	Fe, Pb, As, Zn	CS	S
51	John Bull	Cgz	Sn	Fe	Ch, Q	S
52	—	Cgz	Sn	—	—	—
53	—	Cgz	Sn	—	—	—

OF THE COOLGARRA AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	pit	—
—	—	adit	—
—	—	sh	—
—	—	2 shs, adit, pits	(a), 39 tons SnO_2 1905-25
—	—	2 shs, adit	—
—	—	2 adits	—
—	—	2 shs	—
—	—	pit	—
—	—	sh	—
—	—	2 shs	—
—	—	adit, sh	(a), 8 tons SnO_2 to 1891
—	—	pit	—
—	—	pit	—
—	—	pits	—
NW	—	pit	—
NW	—	pits	—
—	—	pit	—
NW	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
015	—	2 shs	40 m deep, 6 tons SnO_2 1906-26
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pits	—
—	—	pits	—
—	—	sh	—
—	—	open cut	—
—	—	—	—
—	—	shs	—
—	—	shs	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pit	—
—	—	pits	—
—	—	pits	—
—	—	sh	—
—	—	sh, adit	(a), 23 m deep, 40 tons SnO_2 to 1891
—	—	adit	—
—	—	pits	—
—	—	3 shs, pits, adit	—
—	—	shs, pits, adit	—
—	—	sh, open cut, pits	—
180	85W	shs, pits	(a,c,d,e), 30 tons SnO_2 to 1891, 2 tons SnO_2 1920
180	85W	3 shs, pits	(a,c,e), 52 tons SnO_2 to 1891, 21 tons SnO_2 1905-20
—	—	shs, pits	—
—	—	pit	—

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
54	Beaconsfield	Cgz	Sn	—	Ch	—
55	Magdala (McDalla)	S-Dh	Sn	Fe, Bi	Q, Ch	S
56	—	S-Dh	Cu	Fe	—	—
57	—	S-Dh	?	—	—	—
58	—	S-Dh	Cu	—	—	—
59	Patrick (Merry England/St Patrick)	S-Dh	Sn	—	Ch, Q	S
60	—	S-Dh	Cu	—	—	—
61	Armagnacs	S-Dh	Sn	—	Q, Ch	S
62	—	S-Dh	?	—	—	
63	—	S-Dh	?	—	—	
64	—	S-Dh	?	—	—	—
65	—	S-Dh	?	—	—	—
66	—	S-Dh	?	—	—	—
67	—	S-Dh	?	—	—	—
68	—	S-Dh	?	—	—	—
69	—	S-Dh	?	—	—	—
70	—	S-Dh	?	—	—	—
71	—	S-Dh	?	—	—	—
72	—	S-Dh	Sn	—	Q	—
73	—	S-Dh	Sn	—	—	—
74	—	S-Dh	?	—	—	—
75	—	S-Dh	?	—	—	—
76	—	S-Dh	?	—	—	—
77	—	S-Dh	?	—	—	—
78	Snake	S-Dh	Sn	—	Q	—
79	—	S-Dh	?	—	—	—
80	—	S-Dh	?	—	—	—
81	—	S-Dh	?	—	—	—
82	—	S-Dh	?	—	—	—
83	—	S-Dh	Sn	—	—	—
84	—	S-Dh	Sn	—	—	—
85	—	S-Dh	?	—	—	—
86	—	S-Dh	Sn	—	—	—
87	—	S-Dh	?	—	—	—
88	—	S-Dh	?	—	—	—
89	—	S-Dh	Sn	—	—	—
90	—	S-Dh	?	—	—	—
91	Phoenix	S-Dh	Sn	Fe	—	S
92	Phoenix	S-Dh	Sn	—	—	—
93	Phoenix	S-Dh	Sn	—	—	—
94	—	S-Dh	Sn	—	—	—
95	—	S-Dh	Sn	—	—	—
96	—	S-Dh	Sn	Fe	Ch	S
97	—	S-Dh	Sn	Fe	Ch	S
98	—	S-Dh	?	—	—	—
99	—	S-Dh	?	—	—	—
100	—	S-Dh	Sn	—	—	—
101	Lone Hand	S-Dh	Sn	—	—	—
102	—	S-Dh	Sn	—	Ch, Q	—
103	Walkover (Silent Friend)	S-Dh	Sn	—	Ch, Q	—
104	—	S-Dh	?	—	—	—
105	—	S-Dh	?	—	—	—
106	Agnes	S-Dh	Sn	—	—	—

Structural Control Strike	Dip	Surface Workings	Remarks
—	85N	sh	(a), at least 23 m deep, 15 tons SnO_2 to 1891
155	90	shs, adit	(a,c,e), at least 33 m deep, 130 tons SnO_2 to 1891, 3 tons SnO_2 grade 0.9% SnO_2 1920-26
—	—	sh	—
—	—	pit	—
—	—	pits	—
120	50E	sh, open cut, pits	(a,c), 18 tons SnO_2 to 1891
—	—	pit	—
150	90	sh	—
—	—	pit	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pit	—
—	—	pit	—
—	—	pits	—
—	—	pit	—
—	—	pits	—
—	—	pits	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pits	—
—	—	pit	—
—	—	open cut	4 tons SnO_2 1913-18
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pits	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pit	—
—	—	pit	—
055	—	adit, sh	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
140	—	open cut	—
140	—	sh	—
—	—	pits	—
—	—	pit	—
—	—	pits	—
—	—	pits	—
—	—	sh	—
155	—	open cut, pit, adit, sh	1 ton SnO_2 1920
—	—	pit	—
—	—	pit	—
—	—	pit	—

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
107	Lovely Ethel	S-Dh	Sn	—	—	—
108	—	S-Dh	?	—	—	—
109	—	S-Dh	?	—	—	—
110	Rose of Denmark	S-Dh	?	—	—	—
111	—	S-Dh	?	—	—	—
112	Young Almanack	S-Dh	Sn	Cu, Fe	—	—
113	—	S-Dh	Sn	—	—	—
114	—	S-Dh	Sn	—	—	—
115	Alhambra No. 1	S-Dh	Sn	—	—	—
116	Alhambra No. 2	S-Dh/Cgz	Sn, Bi	Pb, Fe, Cu, Fe	Ch, F, Q	S
117	—	Cgz	Sn	—	Q	—
118	—	Cgz	Sn	—	Q	—
119	—	Cgz	Sn	—	Q	—
120	—	Cgz	Sn	—	Q	—
121	Victoria	Cgz	Sn	As, Fe	Q, Ch	S
122	Caledonia	Cgz	Sn	—	—	—
123	—	Cgz	?	—	—	—
124	Ben George	Cgz	Sn	—	—	—
125	Wandering Digger	S-Dh	Sn	—	—	—
126	—	S-Dh	?	—	—	—
127	—	S-Dh	?	—	—	—
128	Phoenix Extended	S-Dh	Sn	—	—	—
129	—	S-Dh	Sn	—	—	—
130	Extended	S-Dh	Sn	Fe	Q, F, Ch	S
131	—	S-Dh	Sn	Fe	Q, F, Ch	S
132	—	S-Dh	Sn	Fe	Q, F, Ch	S
133	—	S-Dh	Sn	Fe	Q, F, Ch	S
134	—	S-Dh	?	—	—	—
135	—	S-Dh	?	—	—	—
136	—	S-Dh	?	—	—	—
137	—	S-Dh	?	—	—	—
138	Chance	S-Dh	Sn	Pb, Fe	Ch, Q	—
139	—	S-Dh	Sn	—	—	—
140	—	S-Dh	Cu	—	—	—
141	—	S-Dh	Sn	—	—	—
142	—	S-Dh	?	—	—	—
143	—	S-Dh	?	—	—	—
144	—	S-Dh	Sn	—	—	—
145	—	S-Dh	?	—	—	—
146	Homeward Bound?	S-Dh	?	—	—	—
147	Homeward Bound?	S-Dh	?	—	—	—
148	—	S-Dh	?	—	—	—
149	—	S-Dh	?	—	—	—
150	—	S-Dh	Sn	—	—	—
151	—	S-Dh	Sn	—	Ch	—
152	—	S-Dh	Sn	—	Ch	—
153	—	S-Dh	Sn	—	Q, Ch	—
154	—	S-Dh	Sn	—	—	—
155	—	S-Dh	Sn	—	—	—
156	—	S-Dh	Sn	—	—	—
157	—	S-Dha	Sn	—	—	—
158	—	S-Dh	Sn	—	—	—
159	—	Cgz	Cu	Fe	—	—
160	—	Cgz	?	—	—	—

Structural Control Strike	Structural Control Dip	Surface Workings	Remarks
—	—	sh, pits	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	sh, pits	—
—	—	adit	(a), 34 tons SnO_2 to 1891
—	—	pit	—
—	—	pits	—
—	—	sh	(c,e), 17 tons SnO_2 1901-02, grade 1.4% SnO_2
145	—	open cut, sh, adit, pit	(b,c,e), first worked 1886 but little production to 1901. 429 tons SnO_2 1901-33, grade 2% SnO_2, 6 cwt Bi 1908
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
170	90	2 shs	(a,c,e), over 33 m deep, 140 tons SnO_2 reported to 1891
—	—	pits	—
—	—	pit	—
—	—	sh	2 tons SnO_2 1909
—	—	sh	—
—	—	pits	—
—	—	pit	—
—	—	sh	lode discovered 1961, 2 tons SnO_2 1961-62
—	—	pit	—
105	90	shs, open cut	(e,f) 76 m deep, 150 tons SnO_2 1886, 18 tons SnO_2 1901-59; may be **Stephens Extended** (a), 185 tons SnO_2 to 1891
105	—	pits	—
105	—	pits	—
105	—	pits	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	sh, pit	3 m deep, 1 ton SnO_2 1966
—	—	pits	—
—	—	pit	—
—	—	pits	—
—	—	pit	—
—	—	pit	—
—	—	sh	—
110	—	pit	Mayday line of lode
110	—	pits	Mayday line of lode
110	—	sh	Mayday line of lode
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	sh	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
161	—	Cgz	W	Fe	—	—
162	—	Cgz	W	Fe, Mo	G	—
163	—	Cgz	W	Fe	—	—
164	—	S-Dh	?	—	—	—
165	—	S-Dh	Sn	—	—	—

Locations of **Christmas Eve** (a), which produced 5 tons SnO_2 up to 1891, **Grand Junction** (a), **Junction Extended** (a), and **Tasmanian** (a) are not known.

References: (a) Maitland (1891), (b) Cameron (1904b), (c) Jensen (1939), (d) Knight (1949), (e) Zimmerman et al. (1963), (f) Levingston (1967b).

OF THE COOLGARRA AREA —*continued*

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	sh	—
—	—	shs	—
—	—	sh	—
—	—	pit	—
—	—	pit	—

TABLE 43. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	Cgz	?	—	—	—
2	Happy Jack?	Cgz	Sn	—	G, F	J
3	Mount Fairy?	Cgz	Sn	—	—	—
4	Lighthouse?	Cgz	Sn	—	—	—
5	—	Cgz	Sn	—	—	—
6	—	Cgz	Sn	—	G	J
7	Tramby	Cgz	Sn	—	G	J
8	White Dove	Cgz	Sn	—	G	—
9	—	Cgz	Sn	—	G	J
10	—	Cgz	Sn	—	G	J
11	—	Cgz	Sn	—	G	J
12	Grass Tree	Cgz	Sn	—	G	J
13	—	Cgz	Sn	—	G	J
14	—	Cgz	Sn	—	—	—
15	Spring Hills?	Cgz/S-Dh	Sn, W	Fe	Tp, F, G	—
16	Granite Castle	Cgz	Sn	—	G	V
17	Barcaldine	Cgz	Sn	W, Fe, As	G, Tp	J
18	—	Cgz	W	Fe	—	—
19	Mount Spec	Cgz	Sn	—	G	—
20	Mount Spec	Cgz	Sn	—	G	—
21	—	Cgz	?	—	—	—
22	Mount Larcombe	Cgz	?	—	—	—
23	—	Cgz	Sn	—	G	—
24	Lady Edith?	S-Dh	W	Fe	—	—
25	—	S-Dh	Sb	—	Q	—
26	—	Cgz	W	Fe	Q	J
27	—	Cgz	Sn	—	G	—
28	Mount Morgan	Cgz	Sn	—	Tp, G, F	J
29	Mount Morgan	Cgz	Sn	—	Tp, G	J
30	—	Cgz	Sn	Fe	Tp, G	J
31	—	Cgz	?	—	—	—
32	Red Rose	Cgz	Sn	—	Tp, G	J
33	Red Rose	Cgz	Sn	W, Fe	G	—
34	Red Terror	S-Dh	Sn	—	—	—
35	—	S-Dh	Sn	—	—	—
36	—	S-Dh	W	—	—	—
37	—	Cgz	W	Sn, Fe, Mo	G	—
38	Old Horse (Rose of Coolgarra?)	S-Dh	Sn	—	Q	—
39	—	S-Dh	Sn	—	Q	—
40	—	S-Dh	Sn	—	Q, Tp	—
41	Griffin	S-Dh	W, Sn	Fe, As, Mo, Bi, Cu	F, G	S
42	—	S-Dh	Sn	—	Q	—
43	Reno	S-Dh	Sn	—	Q	—
44	—	S-Dh	Sn	—	Q	S
45	—	S-Dh	Sn	—	Q	—
46	—	S-Dh	Sn	—	—	—
47	—	Cgz	Sn	—	—	—
48	—	Cgz	Sn	—	—	—
49	Red Ant	Cgz	W	Fe	Q	—
50	—	S-Dh	W	Fe	Q	S
51	—	S-Dh	W	Fe	G	—
52	—	S-Dh	W	Fe	G	S
53	—	S-Dh/Cgz	W	Fe, Sn	G	—

OF THE TOP NETTLE CAMP AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	pit	—
—	—	sh	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
125	82N	sh, pit	—
125	82N	sh, pit	—
—	—	4 shs	—
150	70E	2 shs, pit	—
130	—	2 pits	—
105	70N	sh	—
110	—	3 pits	—
—	—	4 pits	—
—	—	pits	—
—	—	pits	—
130	85E	2 pits	—
130	80E	pit	—
—	—	pit	—
—	—	pit	—
—	—	sh, pits	—
—	—	—	—
—	—	—	—
—	—	pit	—
—	—	—	—
—	—	pit	—
040	60E	—	—
—	—	pit	White Rose line of lode
155	—	shs, pits	White Rose line of lode
155	—	sh	White Rose line of lode
155	—	shs, pits	White Rose line of lode
—	—	pit	—
160	—	sh, pits	—
—	—	sh	—
—	—	sh, pits	—
—	—	pits	—
—	—	shs	—
165	—	2 shs, pits	—
—	—	sh	—
—	—	pits	—
—	—	sh	—
170	70E	2 shs, open cut	(a), 55 m deep, 14 tons SnO_2 1908-53
—	—	3 shs	—
—	—	sh	2 tons SnO_2 1936
140	—	pits	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	shs	—
030	—	sh, pit	Monazite in ore
—	—	3 shs	—
170	—	sh	—
005	—	pits	—

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
54	—	Cgz	W	Fe	G	J
55	—	Cgz	W	Fe, As	G, F	J
56	—	Cgz	W	Fe	G	J
57	—	Cgz	W	Fe	G	—
58	John Bull (Blackwell?)	Cgz	W	Mo, Fe	G, F	J
59	—	Cgz	W	—	—	—
60	Black Widow	Cgz	Sn	Fe	F, G	S
61	Yorkshire Pudding	Cgz	W	Fe	—	—
62	—	Cgz	?	—	—	—
63	Dead Finish	Cgz	W	Fe	—	—
64	Granite Knob	Cgz	W	Fe, Be	Tp, G	J
65	Granite Knob	Cgz	W	Fe	G	J
66	—	Cgz	W	Fe	G	J
67	—	Cgz	W	Fe	G	J
68	Jungle Fowl (Lady Isabel)	Cgz	W	Cu, Fe	G, F	—
69	—	Cgz	W	Fe	—	—
70	—	Cgz	W	Fe	G	—
71	Devon	Cgz	W	Fe	G, F	—
72	Devon	Cgz	W	Fe	G, F	—
73	Devon	Cgz	W	Fe, Mo, Sn	G, F	J
74	—	Cgz	W	Fe	G, F	J
75	—	Cgz	W	Fe	G, F	J
76	—	Cgz	W	Fe	G, F	—
77	—	Cgz	Sn, W	Cu, Fe	F, G	—
78	—	Cgz	W, Sn	Fe, Cu	G	—
79	—	Cgz	Sn	—	G	J
80	—	Cgz	Sn	—	G	J
81	—	Cgz	Sn	—	G	J
82	—	Cgz	Sn	—	G	J
83	—	Cgz	Sn	—	G	J
84	—	Cgz	W	—	G	S
85	—	Cgz	W	—	—	—
86	—	Cgz	W	Fe	Q	J
87	—	Cgz	Sn, W	Fe	G	V
88	—	Cgz	?	—	—	—
89	—	Cgz	?	—	—	—
90	—	Cgz	?	—	—	—
91	—	Cgz	?	—	—	—
92	Merriwee	Cgz	W	Fe, Cu	G	—
93	Mora	Cgz	W, Sn	Fe	G	—
94	—	Cgz	?	—	—	—
95	—	Cgz	W	Fe	G	J
96	—	Cgz	W	Fe	G	J
97	—	Cgz	W	Fe	G	J
98	—	Cgz	W	Fe	G	J
99	—	Cgz	W	Fe	G	J
100	—	Cgz	W	Fe	G	J
101	—	Cgz	W	Fe	G	J
102	—	Cgz	W	Fe	G	—
103	—	Cgz	W	Fe	G	J
104	—	Cgz	W, Sn	Fe, As	G, Tp	J
105	Black Diamond?	Cgz	W	Fe	G	J
106	Eiffel?	Cgz	W	Fe	G	J
107	—	Cgz	W	Fe	G	J

Structural Control Strike	Dip	Surface Workings	Remarks
005	—	pits	—
015	—	3 shs, pits	—
160	—	sh, pits	—
—	—	2 shs, pits	—
040-135	90	9 shs, pits	Pegmatite greisen, 1-5 tons wolframite 1951-52
—	—	pit	—
080	90	sh, open cut	—
—	—	—	0.5 tons wolframite 1952
—	—	—	—
—	—	pits	1 ton wolframite 1952
005	—	pits	—
005	—	pits	—
005	—	pits	—
005	—	pits	—
—	—	2 shs, adit, pit	—
—	—	2 shs	position uncertain
—	—	2 pits	—
—	—	sh	(a), 43 m deep, pegmatitic greisen lode, 4.5 tons wolframite 1908
—	—	sh, pits	
155	—	open cut, 2 shs	
155	—	shs	—
160	—	adit, sh	—
—	—	adit, open cut, pits	—
—	—	sh	—
—	—	sh, pits	—
NW	—	—	—
NW	—	—	—
NW	—	—	—
NW	—	—	—
NW	—	—	—
150	—	sh	—
—	—	—	—
115	—	pit	—
130	—	pit	—
—	—	—	—
—	—	—	—
—	—	—	—
—	—	—	—
135	82S	sh	—
—	—	3 pits	—
—	—	—	no information
135	—	pits	—
135	—	pits	—
135	—	pits	—
135	—	pits	—
110	90	sh	—
010	—	shs, pits	—
030	—	3 shs	—
—	—	2 shs	—
170	—	4 shs, pit	—
090	—	2 shs	—
145, 050	90	6 shs, pits	—
130	—	2 shs, pits	—
080	—	sh	—

TABLE 43. MINES AND PROSPECTS OF

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
108	—	Cgz	W	Fe	G	J
109	—	Cgz	W	Fe	G	—
110	—	Cgz/S-Dh	W	Fe	G	J
111	—	S-Dh	Sn	W, Fe, Cu, Mo	G	—
112	Scotts	Cgz	Sb	—	Q	V
113	—	Cgz	W	Fe	G	J
114	—	Cgz	W	Fe, Cu, As	G	J
115	—	Cgz	W, Sn	Fe	G, F, Tp	J
116	—	Cgz	W	Fe	Q	J
117	—	Cgz	Sn	—	G	J

Reference: (a) Zimmerman et al. (1963).

THE TOP NETTLE CAMP AREA.—*continued*

Structural Control Strike	Dip	Surface Workings	Remarks
165	—	pit	—
—	—	pit	—
170	—	sh	—
—	—	pit	—
170	70E	2 shs, pits	—
170	80E	open stope	—
070	90	open stope	—
175	90	sh, pits	—
165	—	sh, pits	—
175	90	pit	—

TABLE 44. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	Gift	S-Dh	Sn	—	T, Q	—
2	—	S-Dh	?	—	—	—
3	—	Cgz	?	—	—	—
4	—	S-Dh	Sn	—	—	—
5	—	S-Dh	Sn	—	Q	—
6	—	S-Dh/Cgz	Sn	Cu, Fe	G	J
7	—	Cgz/S-Dh	Sn	Fe	Q	V
8	—	S-Dh	Sn	—	Q	—
9	Sailor Boy	Cgz/S-Dh	Sn	As, Fe	G	S
10	—	Cgz/S-Dh	Sn	—	Q	—
11	—	Cgz/S-Dh	W	Fe	G	V
12	—	Cgz/S-Dh	Sn	—	G	S
13	—	Cgz	?	—	—	—
14	—	S-Dh	W	Fe	Q	—
15	Mount Ogston	S-Dh	Sn	—	Q	—
16		S-Dh	Sn	—	Q	—
17		S-Dh	?	Cu, Fe	Q, Ca	—
18	Mount Ruby	S-Dh	?	Cu, Fe	Q, Ca	—
19		S-Dhc	?	Cu, Fe	Q, Ca	—
20	Gwendoline	S-Dh	?	—	—	—
21	—	S-Dh	Sn	—	—	—
22	—	S-Dh	Cu	Fe	—	—
23	—	S-Dh	Sn	—	Q	—
24	—	Cgz	Sn	—	Q	—
25	Mount View	Cgz	W	Fe	Q	—
26		Cgz	W	Fe	Q	—
27	Zig Zag?	Cgz	Sb	—	Q	—
28	Glencairn	Cgz	W	Fe	Q	J
29	—	Cgz	W	Fe	Q	—
30	—	S-Dh	?	—	—	—
31	—	Cgz	W	Fe	—	—
32	Black Band	S-Dh	W	Fe	Q	V
33	—	S-Dh	Sn	Cu, Fe	—	—
34	—	Cgz	W	Fe	G	—
35	—	Cgz	W	Fe	Q, Tp	—
36	Stiff Climb	Cgz	W	Fe	G	—
37		Cgz	W	Fe	G	—
38	—	Cgz	W	Fe	G	J
39	—	Cgz	W	Fe, Sn	G	J
40	—	Cgz	W	Fe, Sn	G	J
41	—	Cgz	W	Fe	G	—
42	—	Cgz	W	Fe	G	J
43	—	Cgz	W	Fe	—	—
44	Poverty Hill	Cgz	Sn	—	—	—
45	—	Cgz	W	Fe	G	—
46	—	S-Dh	Cu	Pb, Au, Fe	—	—
47	Kennedys	S-Dh	Cu	Fe	Q	S
48	—	Cgz	W	Fe, Sn	G	J
49	—	Cgz	W	Fe, Sn	G	J
50	—	Cgz	W	Fe, Sn	G	J
51	—	Cgz	Sn	W, Fe	G	J
52	—	Cgz	W	Fe, Sn	G	J
53	—	Cgz	Sn	W, Fe	G	J
54	—	Cgz	W	Fe, Sn	G	J

OF THE WILD RIVER AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	open cut	working 1966, 1.75 tons SnO_2 1947-61
—	—	—	—
—	—	—	—
—	—	—	—
—	—	—	—
130	40W	adit, pits	—
—	—	sh	—
—	—	sh	—
090	90	2 shs, pits	—
165	—	sh, pits	—
115	70S	sh, adit, pits	—
175	45W	adit, pits	—
—	—	pits	—
—	—	sh, pits	—
—	—	shs	—
—	—	shs	—
—	—	pits	(a), may have been worked on for fluxing ore
—	—	pits	(a), may have been worked on for fluxing ore
—	—	pit	(a), may have been worked on for fluxing ore
—	—	—	—
—	—	—	—
—	—	—	—
—	—	sh, open cut	—
—	—	sh	—
—	—	open cut, sh	—
—	—	2 shs	—
165	—	pit	(b), 8 tons 50% ore 1951
180	—	2 shs	—
—	—	—	—
—	—	—	—
—	—	—	—
020	—	2 shs	—
—	—	shs	—
—	—	sh	—
—	—	pit	—
—	—	—	—
—	—	—	—
155	90	sh, pits	—
155	90	sh	—
160	90	sh, pits	—
—	—	2 shs, open cut, pit	—
100	—	pits	—
—	—	sh	—
—	—	—	—
—	—	sh	—
—	—	pits	—
140	—	sh, pits	—
160	—	sh, pits	—
155	—	pits	—
150	—	pits	—
150	—	pits	—
140	—	pits	—
140	—	pits	—
140	—	pits	—

TABLE 44. MINES AND PROSPECTS OF

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
55	—	Cgz	W	Fe, Sn	G	J
56	—	Cgz	W	Fe, Sn	G	J
57	—	Cgz	Sn	W, Fe	G	J
58	—	Cgz	Sn	W, Fe	G	J
59	—	Cgz	W, Sn	Fe	G	J
60	—	Cgz	Sn	—	G	—
61	—	Cgz	W	Fe	G	—
62	—	Cgz	W	Fe	G	—
63	—	Cgz	W	Fe, Sn	G	J
64	—	Cgz	W	Fe	G	—
65	Black Band	S-Dh	W	Fe	Q	V
66	Black Band	S-Dh	W	Fe	Q	V
67	—	S-Dh	W	Fe	Q	V
68	—	S-Dh	W	Fe	Q	V
69	—	Cgz	W	Fe	G	J
70	—	Cgz	W	Fe	G	J
71	—	Cgz	W	Fe	G	J
72	—	Cgz	W	Fe	G	J
73	—	Cgz	W	Fe	G	J
74	—	Cgz	Fe	—	—	—

References: (a) Jensen (1939), (b) Zimmerman et al. (1963).

THE WILD RIVER AREA —*continued*

Structural Control Strike	Dip	Surface Workings	Remarks
150	—	pits	—
NW	—	pits	—
160	—	sh	—
160	—	pits	—
135	—	sh, pits	—
—	—	sh	—
—	—	pits	—
—	—	open cut	—
NW	—	open cut	—
—	—	—	—
005	—	sh, pits	—
170	—	2 shs	3 tons wolframite 1949
070	—	pits	—
045	—	sh	—
105	—	pits	—
100	—	pit	—
105	—	pit	—
095	—	pit	—
105	—	sh, pit	0.5 tons wolframite 1953
—	—	open cut	being worked by Ravenshoe Tin 1968

TABLE 45. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	Cgz	?	—	G	—
2	—	S-Dh	W	Fe	—	—
3	—	S-Dh	W	Fe	—	—
4	—	S-Dh	Sn	—	—	—
5	Halls	Cgz	Sn	—	G	S
6	—	Cgz	Sn	—	G, Tp	—
7	—	Cgz	?	—	G	—
8	—	Cgz	?	—	G	—
9	—	Cgz	Sn	—	G	—
10	—	Cgz	Sn	—	G	—
11	—	Cgz	Sn	—	G	—
12	Adelaide	Cgz/Pgn?	Sn	—	—	S
13	Smiths Creek	Cgz/Pgn?	Sn	Cu, Fe	Ch, Q	S
14	Lucey	Cgz/Pgn?	Sn	—	G, Ch	—
15	—	Cgz	W	Fe	G	—
16	Nightengale	Cgz	W	Fe	G	—
17	—	Cgz?	Sn	—	—	—
18	—	?	Sn	—	—	—
19	—	Cgz	Sn	—	—	—
20	Mercury	Cgz	Cu	Fe	—	—
21	—	Cgz	Cu	Fe	Q	V
22	Bald Hill (Monte Christo)	S-Dh	Pb, Cu	Zn, Fe, As	Q	—
23	—	S-Dh	?	—	Q, Ch	—
24	April Fool	Cgz?	Sn	—	Q	S
25	Nymbool Queen?	?	Sn	—	—	—
26	—	Cgz	W	Fe	G	—
27	—	Cgz	Sn	—	Q	—
28	Midnight	Cgz	W	Fe	G, F	J
29	—	Cgz	Sn	—	G	—
30	—	Cgz	Sn	—	—	—
31	—	Cgz/S-Dh	Sn	—	G	—
32	—	Cgz/S-Dh	Sn	—	Q	S
33	—	Cgz	Cu	Fe	G	—
34	White Australia	Cgz	Sn	—	G	—
35	Ballarat	Cgz	Sn	—	G	—
36	—	Cgz	W	Fe	Q	V
37	—	Cgz	W	Fe	Q	V
38	—	Cgz	Sn	—	—	—
39	Horseshoe?	Cgz	Sn	—	G	—
40	—	Cgz	Sn	—	G	—
41	—	Cgz	Sn	—	G	—
42	—	Cgz	Sn	—	G	—
43	—	Cgz	Sn	—	G	—
44	} Christmas Gift	{ Cgz	Sn	—	G	J
45	} Christmas Gift	{ Cgz	Sn	—	G	—
46	—	Cgz	W	Fe	G	—
47	—	S-Dh	?	Fe	—	—

References: (a) Cameron (1904b), (b) Lees, (1907), (c) Jensen (1939), (d) Bacon (1949), (e) Zimmerman et al. (1963).

OF THE NYMBOOL AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	sh, pit	—
—	—	—	—
—	—	—	—
—	—	—	—
125	—	sh	(c), 5 tons SnO_2 1910-15
—	—	open cut, pit	—
—	—	pit	—
—	—	open cut, pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
N-S	—	5 shs	—
120	—	sh, open cut	(a,b,c,e), discovered 1901, 152 m deep, worked to 1909, 1561 tons SnO_2 1903-09 plus over 100 tons eluvial SnO_2 in immediate vicinity
—	—	shs	—
—	—	shs, pits	—
—	—	pits	—
—	—	pit	—
—	—	pit?	—
—	—	pit	—
—	—	pit	—
E-W	45N	2 shs, pit	—
—	—	sh, pits	(d,e)
—	—	open cut, pits	—
140	90	sh, pits	(c), 2 tons SnO_2 1930
—	—	—	(c)
—	—	sh, pit	—
—	—	pit	—
125	—	2 shs	1 ton wolframite 1920
—	—	shs, pits	—
—	—	pit	—
—	—	pit	—
E-W	—	sh	—
—	—	sh	—
—	—	pit	—
—	—	pit	—
125	—	2 pits	—
125	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	2 shs	—
—	—	sh, pit	—
—	—	3 pits	—
135	—	pits	—
—	—	pit	—
—	—	pits	—
—	—	sh	—

TABLE 46. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	S-Dh	Cu, Pb	Fe	Q	—
2	—	S-Dh	Cu, Pb	Fe	Q	—
3	Queenslander	S-Dh	Sn	—	Q, Ch	S
4	Queenslander	S-Dh	Sn	—	Q, Ch	S
5	Coronation	S-Dh	Sn	—	Ch, Q	S
6	Coronation	S-Dh	Sn	—	Ch, Q	S
7	Coronation	S-Dh	Sn	—	Ch, Q	S
8	Coronation	S-Dh	Sn	—	Ch, Q	S
9	—	S-Dh	?	—	—	—
10	—	S-Dh	?	—	—	—
11	—	S-Dh	Cu	—	—	—
12	Tuckers?	S-Dh	Cu, Pb	Fe	Q	—
13	—	S-Dh	Cu, Pb	Fe	Q	—
14	—	S-Dh	Cu, Pb	Fe	Q	—
15	—	S-Dh	Cu	Fe	—	—
16	—	S-Dh	Sn	—	—	—
17	Tully	S-Dh	Sn	—	Q, Ch	S
18	Tully	S-Dh	Sn	—	Q, Ch	S
19	Mayday Line	S-Dh	Sn	—	Q, Ch	S
20	Mayday Line	S-Dh	Sn	—	Q, Ch	S
21	Mayday Line	S-Dh	Sn	—	Q, Ch	S
22	Victory	S-Dh	?	—	Ch	S
23	—	S-Dh	Pb	—	—	—
24	—	S-Dh	Pb	Fe	—	—
25	—	S-Dh	Pb	Fe	—	—
26	—	S-Dh	Sn	—	—	—
27	—	S-Dh	Sn	—	—	—
28	—	S-Dh	Sn	—	—	—
29	—	S-Dh	Sn	—	—	—
30	—	S-Dh	Sn	—	—	—
31	—	S-Dh	?	—	—	—
32	—	S-Dh	Cu, Pb	Fe	—	—
33	—	S-Dh	?	—	—	—
34	—	S-Dh	Sn	—	—	—
35	Lizzie	S-Dh	Sn	—	Ch	S
36	—	S-Dh	?	—	—	—
37	Pongo	S-Dh	Sn	—	Q, Ch	S
38	—	S-Dh	Sn	—	—	—
39	—	S-Dh	Sn	—	—	—
40	—	S-Dh	Sn	—	—	—
41	—	S-Dh	?	—	—	—
42	—	S-Dh	Sn	—	Q	S
43	—	S-Dh	Sn	—	Q	S
44	—	S-Dh	Sn	—	Q	S
45	—	S-Dh	Sn	Cu, Fe	Q	S
46	—	S-Dh	W	Fe	—	—
47	—	S-Dh	W	Fe	Q	—
48	—	S-Dh	W	Fe	Q	—
49	—	S-Dh	Sn	—	Q, Ch	S
50	Magdala?	S-Dh	Sn	—	—	—
51	Brisbane	S-Dh	Sn	—	Ch	—
52	Sydney	S-Dh	Sn	—	Ch	S
53	—	S-Dh	Sn	—	Ch	S
54	Four Aces?	S-Dh	Sn	—	Ch	—
55	Four Aces?	S-Dh	Sn	—	—	—

OF THE FIVE MILE CREEK AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	pit	—
—	—	pit	—
130	—	sh	—
130	—	sh	—
125	—	sh	1 ton SnO_2 1902-11
125	—	sh, pits	
125	—	sh	
125	—	sh	
—	—	—	—
—	—	—	—
—	—	pit	—
—	—	sh	(a)
—	—	sh	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
155	60E	sh	(b), working 1966, 12 tons SnO_2 1936, grade 5.2% SnO_2
165	—	sh, pits	
130	—	shs	—
130	—	shs	—
130	—	shs	—
125	—	2 shs	—
—	—	pit	—
—	—	sh	—
—	—	sh	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	pit	—
—	—	—	—
110	—	open cut, sh	—
—	—	—	—
115	75E	sh	—
—	—	pit	—
—	—	pit	—
—	—	—	—
—	—	—	—
100	90	2 shs, pits	—
130	—	2 shs	—
130	—	2 shs	—
110	90	2 shs	—
135	—	pits	—
—	—	—	—
—	—	—	—
150	90	2 shs	—
—	—	—	—
—	—	sh	(b)
115	80N	2 shs	—
—	—	—	—
—	—	—	(b)
—	—	—	

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
56	—	S-Dh	Sn	As, Fe	Q	S
57	—	Cgz	?	—	—	—
58	—	Cgz	?	—	—	—
59	Dreadnought	S-Dh	Sn	Fe, As, Zn	Ch, Q, F	S
60	Dreadnought	S-Dh	Sn	Fe, As, Zn	Ch, Q, F	S
61	Dreadnought	S-Dh	Sn	Fe, As, Zn	Ch, Q	S
62	—	S-Dh	Sn	—	Q, Ch	—
63	—	S-Dh	W	Fe	Q	V
64	—	S-Dh	W	Fe	Q	V
65	—	S-Dh	W	Fe	Q	S
66	—	S-Dh	W	Fe	—	—
67	—	S-Dh	?	Fe	Q	S
68	—	S-Dh	W	Fe	Q, F	S
69	—	S-Dh	W	Fe	Q, F	S
70	—	S-Dh	W	Fe	Q	S
71	—	S-Dh	Sn?	—	Q	S
72	—	S-Dh	Sn	—	—	S
73	—	S-Dh	W	Fe, As, Zn	Q, F	S
74	—	Cgz/S-Dh	Sn	—	Q	V
75	—	Cgz	Sn	Au	G	J
76	—	Cgz	Sn	W, Fe, As, Pb	G	J
77	—	Cgz	Sn	Fe, As, W	G, F	J
78	—	Cgz	?	—	—	—
79	—	Cgz	W	Fe	—	—
80	—	S-Dh	?	—	—	—
81	—	Cgz	?	—	—	—
82	—	S-Dh	Sn	—	—	—
83	—	S-Dh	?	—	—	—
84	—	Cgz	Sn	Fe	G	J
85	—	Cgz	Sn	—	—	—
86	—	Cgz	Sn	—	—	—
87	—	Cgz	W	Fe	—	—
88	—	Cgz	W	Fe	—	—
89	—	S-Dh	Pb, Cu	Fe	Q	S
90	Derby	S-Dh	Cu	Fe	Ca	—
91	—	S-Dh	Sn	—	G	S
92	—	Cgz	W	Fe	Q, F	—

References: (a) Maitland (1891), (b) Jensen (1939).

THE FIVE MILE CREEK AREA.—*continued*

Structural Control Strike	Dip	Surface Workings	Remarks
165	—	2 pits	—
—	—	—	—
—	—	—	—
125	90	3 shs	(b), discovered 1909, 40 m deep, 14 tons SnO_2 1911-41, grade 5.3% SnO_2
125	90	2 shs	
155	—	shs	
—	—	sh	—
105	90	open cut, pits	—
105	90	pits	—
110	—	sh	—
—	—	—	—
095	—	sh, pits	—
115	90	sh	—
140	90	2 shs	—
110	—	sh	—
095	—	sh, pits	—
130	—	sh	—
105	—	3 shs	—
120	90	sh	—
135	—	2 pits	—
150	75E	2 shs, pits	—
130	60E	sh	—
—	—	—	—
—	—	—	—
—	—	—	—
—	—	—	—
—	—	—	—
—	—	—	—
140	—	sh	—
—	—	—	—
—	—	—	—
—	—	—	—
—	—	—	—
E-W	80N	sh	—
—	—	pit	—
140	—	sh	—
—	—	pit	—

TABLE 47. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	S-Dh	Sn	—	—	—
2	—	S-Dh	W	Fe	Q	—
3	—	Cgz	Sn	—	G	—
4	Jack Johnson	Cgz	W	Fe, As	G	J
5		Cgz	W	Fe, As	G	J
6	—	Cgz	Sn	Pb	G	—
7	—	Cgz	W	Fe	G, F	—
8	—	Cgz	W	Fe	G, F	—
9	—	S-Dh	W	Fe	Q, F	—
10	Welcome?	S-Dh	Sn	—	—	—
11	Mountain Maid	S-Dh	Sn	—	—	—
12	—	Cgz	W	Fe, Mo	Q, F	—
13	—	Cgz	W	Fe	—	—
14	—	Cgz	W	Fe	G	—
15	—	Cgz	W	Fe	G	—
16	—	Cgz	W	Fe	—	—
17	—	Cgz	W	Fe	—	—
18	—	Cgz	W	Fe	—	—
19	—	Cgz	Sn	—	G	—
20	—	S-Dh	W	Fe	G	J
21	Stratten	S-Dh	W	Fe	G	J
22		Cgz	W	Fe	G	J
23	Leonards	Cgz	W	Fe	G	J
24		Cgz	Sn	—	G	J
25		Cgz	?	—	G	—
26	—	Cgz	?	—	G	J
27	—	Cgz	?	—	G	J
28	Mango?	Cgz	Sn	—	G	J
29	—	Cgz	?	—	G	J
30	—	Cgz	?	—	G	J
31	—	Cgz	?	—	G	J
32	—	Cgz	Sn	—	G	J
33	—	Cgz	Sn	—	G	J
34	—	Cgz	W, Sn	Fe	G	J
35	—	Cgz	Sn	—	G, Tp	J
36	—	Cgz	Sn	—	G, Tp	J
37	—	Cgz	W	Fe, Mo	G, Tp	J
38	Harbour Light	Cgz	W	Fe	G	J
39	—	Cgz	Sn	—	G	—
40	—	S-Dh	W	Fe	G	—
41	—	Cgz/S-Dh	W	Fe, As	G, Tp, F	—
42	—	Cgz/S-Dh	W	Fe, Cu, As	F, G, Tp	J
43	—	Cgz/S-Dh	W	Fe, Cu	Q, F, Tp	J
44	—	Cgz	W	Fe	G, Tp	J
45	—	Cgz	W	Fe	G, Tp	J
46	—	Cgz	W	Fe, Sn	G, Tp	J
47	—	Cgz	?	—	—	—
48	—	Cgz	Sn	—	G	J
49	—	Cgz	W	Fe	G	—
50	—	Cgz	W	Fe	G	—
51	—	Cgz	W	Fe	G	—
52	—	Cgz	W	Fe	G	—
53	—	Cgz	W	Fe	G	—

OF THE SOUTH COOLGARRA AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	pit	—
—	—	pit	—
—	—	—	—
160	—	shs	—
160	—	sh	—
—	—	5 shs	—
—	—	sh, pit	—
—	—	pits	—
—	—	pit	—
—	—	—	—
—	—	—	—
—	—	pit	—
—	—	—	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
140	—	pits	—
140	—	pits	—
140	—	sh, pits	—
N-W	—	pits	—
N-W	—	sh, pits	—
—	—	sh, pits	—
055	—	pits	—
055	—	pits	—
140	—	sh, pits	—
140	—	pits	—
135	—	pits	—
130	—	2 shs, pits	—
130	—	2 shs, pits	—
175	—	sh, pits	—
110	—	shs, pits	—
045	—	sh, pits	—
045	—	sh, pits	—
075	—	2 shs	—
055	—	2 shs, pits	—
—	—	sh	—
—	—	sh	—
—	—	sh, pits	—
130	90	sh, pits	—
120	—	2 shs, pits	—
020	—	3 shs	—
105	—	2 shs, pit	—
115	—	sh, pit	—
—	—	—	—
125	—	sh, pits	—
—	—	sh, pits	—
—	—	pits	—
095	—	pits	—
095	—	pits	—
095	—	pits	—

TABLE 47. MINES AND PROSPECTS

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
54	—	Cgz	W	Fe	G	—
55	—	Cgz	?	—	G	J
56	—	Cgz	Sn	—	G	—
57	—	Cgz	Sn	—	G	—
58	Rover	Cgz	Sn	—	G	J
59	—	Cgz	Sn	—	G	—
60	—	Cgz	Sn	—	G	—
61	—	Cgz	Sn	—	G	—
62	—	Cgz	Sn	—	G	—
63	—	Cgz	?	—	—	—
64	—	Cgz	?	—	G	J
65	—	Cgz	Sn	—	G	J
66	—	Cgz	Sn	W, Fe	G	J
67	—	S-Dh	W	Fe	G, F	—
68	—	Cgz	W	Fe	G, Tp	J
69	—	Cgz	W	Fe	G	J
70	—	Cgz	W	Fe	G	J
71	—	Cgz	W	Fe	G	J
72	—	Cgz	Sn	—	G	J
73	Mt Oliver	Cgz	Sn	—	G	J

OF THE SOUTH COOLGARRA AREA —*continued*

Structural Control Strike	Dip	Surface Workings	Remarks
095	—	pits	—
160	—	2 pits	—
—	—	pit	—
—	—	pit	—
125	90	sh, pits	lode found 1958, about 8 tons SnO_2 to 1968, 21 m deep
—	—	sh, pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	—	—
160	—	pits	—
015	90	sh	—
110	—	sh	—
125	—	sh	—
125	—	sh, 3 pits	—
110	—	sh, pit	—
015	90	sh, pit	—
155, 115	—	2 shs, pits	—
130	90	pits	—
130	90	4 shs, pits	—

TABLE 48. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	pC	Au	—	Q	V
2	—	pC	Au	—	Q	V
3	Golden Prospect	pC	Au	Fe, As	Q	V
4	—	pC	Au	Cu, Fe	Q	V
5	—	pC	Au	Cu, Fe	Q	V
6	—	pC	Au	Cu, Fe	Q	V
7	—	S-Dh	?	—	—	—
8	—	pC	Sn	—	—	—
9	—	S-Dh	Cu, Pb, Ag	Fe, Zn	CS	S
10	Mount Garnet	S-Dh	Cu, Pb, Ag	Fe, Zn	CS	S
11	Mount Garnet	S-Dh	Cu, Pb, Ag	—	—	—
12	Mount Garnet	S-Dh	Cu, Pb, Ag	Fe, Zn	CS	S
13	Mount Garnet	S-Dh	Cu, Pb, Ag	Fe, Zn	CS	S
14	—	pC	Sn	—	—	—
15	—	Cn	Sn	Fe	—	—
16	—	Cn	Sn	Fe	—	—
17	—	Cn/pC	Sn	—	—	—
18	—	Cn	Sn	As, Fe	Q	S
19	—	pC	Sn	Fe, As	Q	—
20	—	Cn	Sn	—	—	—
21	—	Cn	Sn	Fe, As	Q	—
22	—	S-Dh	?	Fe	Q, Ga	—
23	—	S-Dh	?	Fe	Q, Ga	—
24	Jessies Dream	S-Dh	Cu	Fe	Q	S
25	—	S-Dh	Cu	Fe	Q	—
26	—	S-Dh	?	—	—	—
27	—	S-Dh	?	—	—	—
28	—	S-Dh	?	—	—	—
29	—	S-Dh	?	—	—	—
30	Chinaman	Cgu	Cu, Pb	Fe	Q	V
31	Chinaman	Cgu	Cu, Pb	Fe	Q	V

References: (a) Jack (1898), (b) Jensen (1939), (c) Knight (1949), (d) Hare (1956), (e) Zimmerman et al. (1963), (f) Connah (1965).

OF THE MOUNT GARNET AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	pits	—
—	—	pits	—
—	—	sh	(e), 46 m deep, 185 oz Au and 217 oz Ag 1932-34, recovery grade 15 dwt Au and 17.6 dwt Ag per ton
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pit	—
—	—	pits	—
005	90	open cuts, shs	—
010	90	open cut, shs	
—	—	pits	(a,b,c,d,e,f), 67 m deep, 4415 tons Cu, 948,651 oz Ag 1901-03, grade 4.9% Cu and 10.7 oz Ag per ton
005	90	open cut	
160	90	open cut, sh	
—	—	pits	—
110	—	2 shs, pits	—
110	—	2 shs	—
—	—	sh, adit	—
020	70W	2 shs, pits	—
—	—	sh	—
—	—	pit	—
—	90	sh	—
—	—	sh	—
—	—	open cut	—
—	—	sh	(a), copper carbonates in quartz
—	—	—	—
—	—	—	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	(c), copper and lead carbonates in quartz veins
090	—	shs, pits	

TABLE 49. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	Cgz	W	Fe	G	J
2	—	Cgz	W	Fe	G	J
3	—	Cgz	W	Fe	G	J
4	—	Cgz	W	Fe	G	J
5	—	Cgz	W	Fe	G	J
6	—	Cgz	W	Fe	G	J
7	—	Cgz	W	Fe	G	J
8	—	Cgz	W	Fe	G	J
9	—	Cgz	Sn	—	G	—
10	—	Cgz	W	Fe	G	—
11	—	Cgz	W	Fe, Sn	G	J
12	—	Cgz	Sn	—	G	J
13	—	Cgz/S-Dh	Sn	—	G	V
14	—	Cgz/S-Dh	W	Fe	G	—
15	—	Cgz	Sn	—	G	—
16	Crystal	S-Dh/Cgz	Sn	—	G	V
17	—	S-Dh/Cgz	Sn	—	G, Tp	—
18	Pattersons	S-Dh/Cgz	Sn	—	G, Tp	J
19	—	Cgz/S-Dh	Sn	—	G, Tp	S
20	Mount Gibson	Cgz/S-Dh	Sn	—	G, Tp, F	J
21	—	Cgz	Sn	—	G	—
22	—	Cgz	Sn	—	G	—
23	—	Cgz	Sn	—	G	—
24	—	Cgz	Sn	—	G	—
25	—	Cgz	Sn	—	G	—
26	—	Cgz	Sn	—	—	—
27	—	Cgz	Sn	—	—	—
28	—	Cgz	Sn	—	G, Tp, F	V
29	—	Cgz	Sn	—	G, Tp, F	V
30	—	Cgz	Sn	—	—	—
31	—	Cgz	?	—	—	—
32	—	Cgz	Sn	—	G	J
33	—	Cgz	W	Fe	G	J
34	—	Cgz	Sn	—	G	—
35	—	Cgz	W	Fe	G	J
36	—	Cgz	Sn	—	G, Tp	J
37	—	Cgz	Sn	—	G, Tp	J
38	—	Cgz	Sn	—	G, Tp	J
39	—	Cgz	Sn	—	G, Tp	J
40	—	Cgz	Sn	—	G, Tp	J
41	—	Cgz	Sn	—	G, Tp	J
42	—	Cgz	W	Fe	G	—
43	—	Cgz	Sn	As, Fe	G	J
44	—	Cgz	Sn	As, Fe	G	J
45	—	Cgz	Sn	—	G	J
46	—	Cgz	Sn	—	G	J
47	—	Cgz	Sn	—	G	J
48	—	Cgz	Sn	—	G	J
49	—	Cgz	Sn	—	—	—
50	—	Cgz	Sn	Fe	G	J
51	—	Cgz	?	—	G	—
52	—	Cgz	?	—	G	—
53	—	Cgz	?	—	G	—

OF THE MOUNT GIBSON AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
135	—	pits	—
135	—	pits	—
135	—	pits	—
135	—	pits	—
155	—	pits	—
155	—	pits	—
155	—	pits	—
155	—	pits	—
—	—	pit	—
—	—	pits	—
140	90	sh, pits	—
125	90	pits	—
135	90	2 shs	—
135	—	2 shs	—
130	—	2 shs	—
130	—	sh, pits	worked 1938-39 to depth of 9 m, produced about 2 tons SnO_2
015	—	3 shs, pits	—
120	—	sh, pits	(a)
140	—	sh, pits	—
—	—	shs, pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
N-S	—	3 pits	—
135	—	pits	—
—	—	pit	—
160	—	pits	—
155	—	pits	—
160	—	pits	—
170	—	pits	—
170	—	pits	—
165	—	pits	—
170	—	pits	—
160	—	—	—
130	90	pit	—
130	90	sh	—
160	—	pits	—
160	—	pits	—
155	—	pits	—
150	—	pits	—
—	—	pits	—
145	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—

TABLE 49. MINES AND PROSPECTS OF

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
54	—	Cgz	?	—	G	—
55	—	Cgz	?	—	G	—
56	—	Cgz	?	—	G	—
57	—	Cgz	Sn	Fe, As, Pb	G	—
58	—	Cgz	Sn, W	As, Fe	G, Tp	J
59	—	Cgz/S-Dh	?	—	—	—
60	—	Cgz	Sn	—	G	—
61	—	Cgz	Sn	—	G	—
62	—	S-Dh	Cu	Fe	—	—
63	—	Cgz/S-Dh	Sn	—	—	—
64	—	S-Dh	?	—	—	—
65	—	S-Dh	Sn	—	Q, Ch	S
66	—	Cgz	W	Fe	G	J
67	—	Cgz	W	Fe	G	J
68	—	Cgz	W	Fe	G	J
69	—	Cgz	W	Fe	G	J
70	—	Cgz	W	Fe	G	J
71	—	Cgz	W	Fe	G	J
72	—	Cgz	W	Fe	G	J
73	—	Cgz	W	Fe	G	J
74	—	Cgz	W	Fe, Sn	G, Tp	J
75	—	Cgz	W	Fe	G	—
76	—	Cgz	W	Fe, As	Q	J
77	—	Cgz	W	Fe, As	G	J
78	—	Cgz	W	Fe, Cu	G	J
79	—	Cgz	Sn	—	G	J
80	—	Cgz	Sn	Fe, Cu, As	G	J
81	—	Cgz	Sn, W	Fe	G	J
82	—	Cgz	Sn	As	G, F	—
83	—	Cgz	Topaz	—	G	—
84	—	S-Dh	Sn	As, Fe	Q, T	—

Reference: (a) Jensen (1939).

THE MOUNT GIBSON AREA.—*continued*

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	sh	—
100	—	pit	—
—	—	—	—
—	—	pit	—
—	—	pit	—
—	—	pits	—
—	—	—	—
—	—	—	—
145	90	open cut, sh, pits	—
125	—	pit	—
135	90	sh	—
130	—	sh	—
130	—	sh, pits	—
130	—	sh	—
125	—	sh, pits	—
125	—	4 pits	—
125	—	2 shs, pits	—
125	—	2 shs, pits	—
—	90	sh	—
150	—	pits	—
130	—	2 pits	—
140	—	3 pits	—
—	—	pit	—
130	—	2 shs, pits	—
130	—	open cut, sh, pits	—
—	—	open cut, pits	—
—	—	pit	—
—	—	sh	—

TABLE 50. MINES AND PROSPECTS

(For key to symbols and

Ref. No.	Name	Host Rock Symbol	Product	Associated Metals	Gangue	Type
1	—	Cgz	W	Fe	Q	—
2	—	Cgz	W	Fe	Q	—
3	—	Cgz	W	Fe	Q	—
4	—	Cgz	W	Fe	Q	—
5	—	Cgz	W	Fe	Q	—
6	—	S-Dh	?	Fe	Q	—
7	—	S-Dh	?	Fe	Q	—
8	—	Cgz	Cu	Fe, As	G	J
9	—	Cgz	Sn, W	Fe	G	—
10	—	Cgz	W	Fe	G	—
11	—	Cgz	W	Fe	G	—
12	—	Cgz	Sn, W	Fe	G	—
13	—	Cgz/S-Dh	?	Fe	Q	—
14	—	S-Dh	?	Fe	Q	—
15	—	S-Dh	?	Fe	Q	—
16	—	S-Dh	?	Fe	Q	—
17	—	Cgz/S-Dh	?	Fe	Q	—
18	—	S-Dh	Cu	Fe	—	—
19	—	S-Dh	Cu	Fe	—	—
20	—	Cgz	?	—	G, F	—
21	—	S-Dh	W	Fe	—	—
22	—	S-Dh	W	Fe	—	—
23	—	Cgz	W	Fe	G	J
24	—	Cgz	W	Fe	G	—
25	—	Cgz	Sn	Fe	G	J

OF THE SEVEN MILE HILL AREA

abbreviations see Table 16)

Structural Control Strike	Dip	Surface Workings	Remarks
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	sh	—
—	—	pit	—
—	—	sh	—
045	—	sh	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	—	—
—	—	—	—
—	—	pits	—
—	—	pits	—
—	—	pits	—
—	—	—	—
—	—	—	—
—	—	—	—
—	—	—	—
—	—	—	—
—	—	—	—
140	—	open cut	—
—	—	pits	—
135	—	pits	—

PLATE 17
(Figs 16–33)

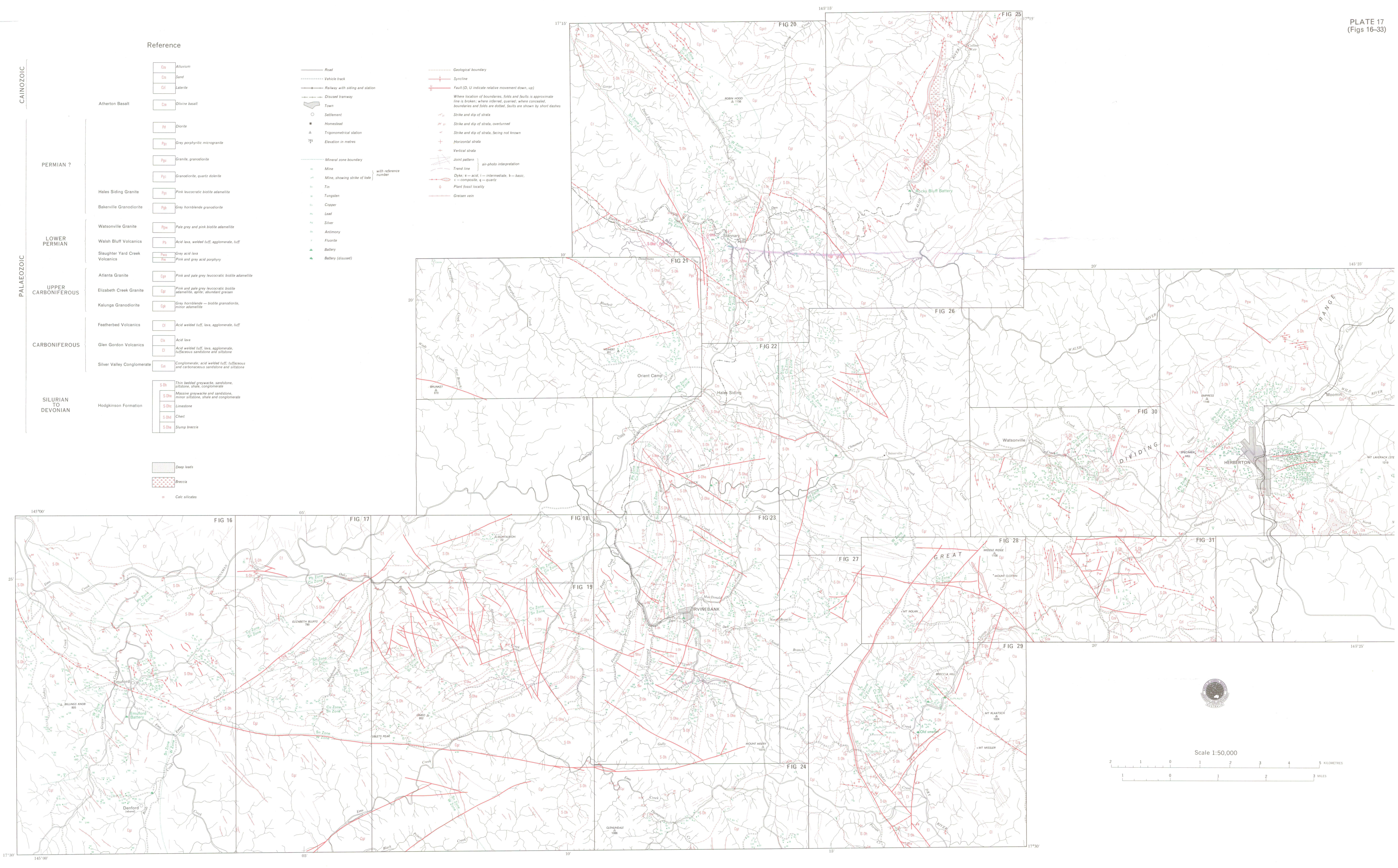
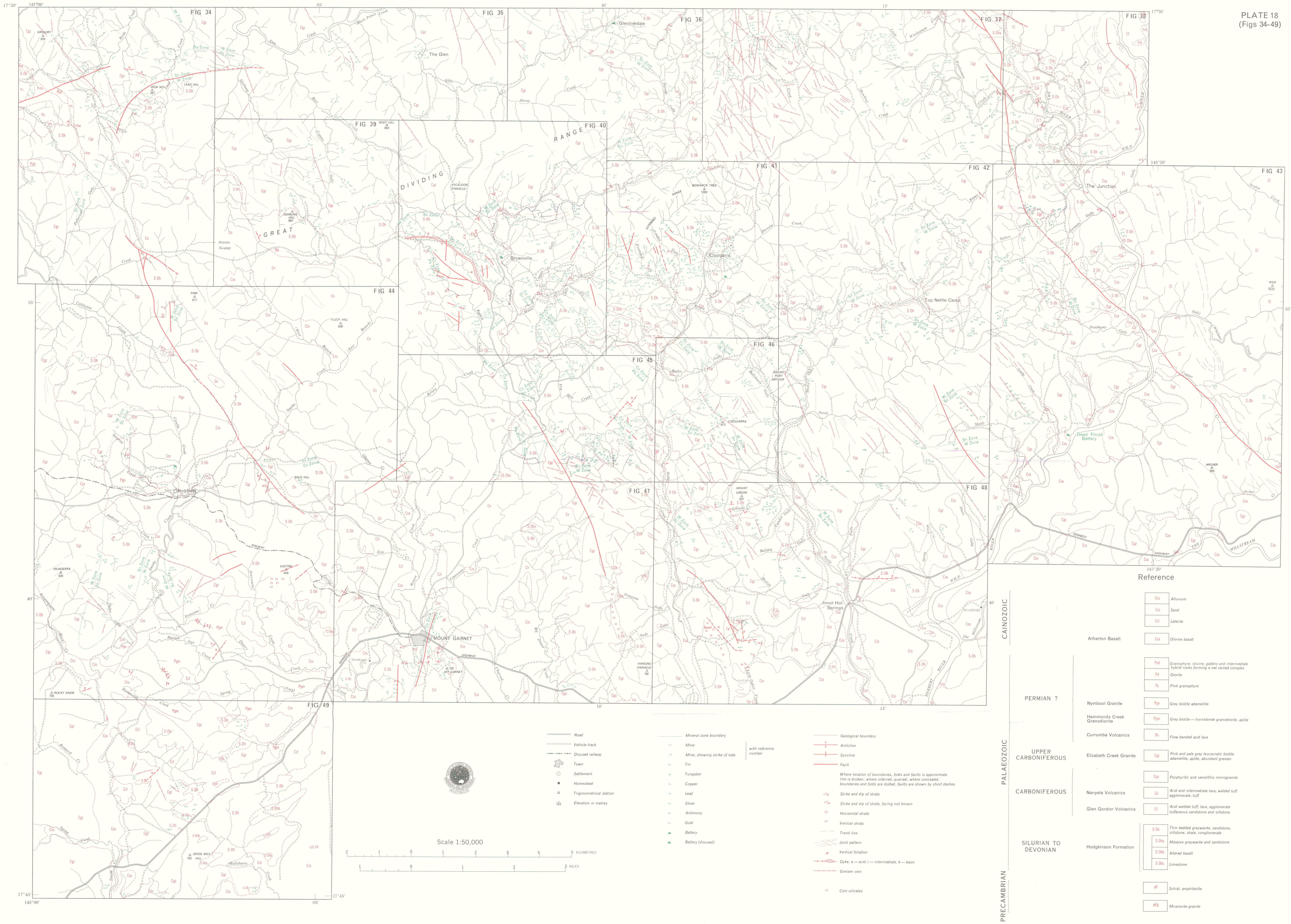
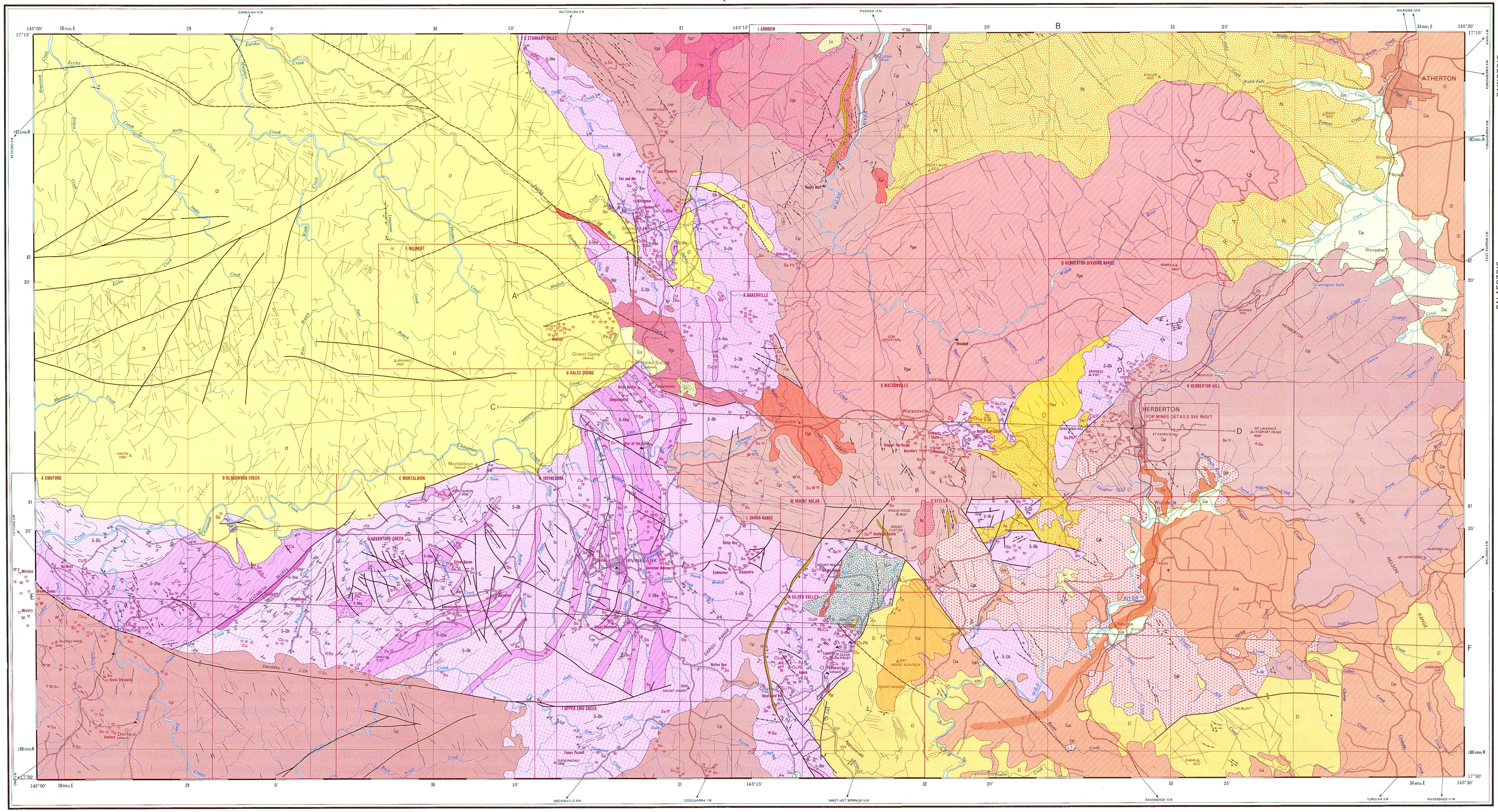


PLATE 18
(Figs 34-49)



HERBERTON
QUEENSLAND



Reference

CAINOZOIC

- Czu — Alluvium
- Czs — Sand
- Czl — Laterite
- Atherton Basalt — Cza — Olivine basalt

PALAEOZOIC

PERMIAN ?
- Pd — Quartz diorite
- Pgy — Grey porphyritic microgranite
- Pgu — Granite, granodiorite
- Pgc — Granodiorite, quartz dolerite
- Hales Siding Granite — Pgs — Pink leucocratic biotite adamellite
- Bakerville Granodiorite — Pgb — Grey hornblende granodiorite

LOWER PERMIAN
- Watsonville Granite — Pgw — Pale grey and pink biotite adamellite
- Walsh Bluff Volcanics — Pb — Acid lava, welded tuff, agglomerate, tuff
- Slaughter Yard Creek Volcanics — Pwa — Grey acid lava; Pw — Pink and grey acid porphyry

UPPER CARBONIFEROUS
- Atlanta Granite — Cga — Pink and pale grey leucocratic biotite adamellite
- Elizabeth Creek Granite — Cgz — Pink and pale grey leucocratic biotite adamellite aplite; abundant greisen
- Kalunga Granodiorite — Cgk — Grey hornblende—biotite granodiorite, minor adamellite

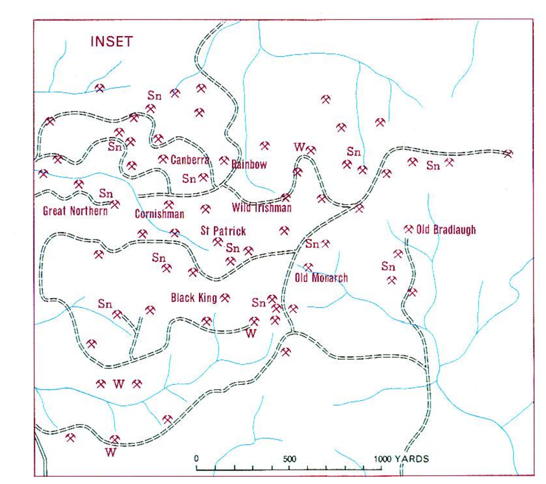
CARBONIFEROUS
- Featherbed Volcanics — Cf — Acid welded tuff, lava, agglomerate, tuff
- Glen Gordon Volcanics — Cla — Acid lava; Cl — Acid welded tuff, lava, agglomerate; tuffaceous sandstone and siltstone
- Silver Valley Conglomerate — Cus — Conglomerate; acid welded tuff; tuffaceous and carbonaceous sandstone and siltstone

SILURIAN TO DEVONIAN
- Hodgkinson Formation — S–Dh — Thin bedded greywacke, sandstone, siltstone, shale, conglomerate
  - S–Dha — Massive greywacke and sandstone, minor siltstone, shale and conglomerate
  - S–Dhc — Limestone
  - S–Dhd — Chert
  - S–Dhe — Slump breccia

- Deep leads
- Breccia
- Cs — Calc silicates

- Geological boundary
- Syncline
- Fault (D, U indicate relative movement down, up)
- Where location of boundaries, folds and faults is approximate, line is broken; where inferred, queried; where concealed, boundaries and folds are dotted, faults are shown by short dashes
- 52 Strike and dip of strata
- 48 Strike and dip of strata, overturned
- 53 Strike and dip of strata, facing not known
- Horizontal strata
- Vertical strata
- Joint pattern } air-photo interpretation
- Trend lines } air-photo interpretation
- Volcanic vent, basic (extinct)
- ? Inferred volcanic vent, acid (extinct)
- Dyke; a–acid, i–intermediate, b–basic, c–composite
- Greisen vein
- Fossil locality, general
- Plant fossil locality

- A EMUFORD — Mining area
- Mines (only main mines shown)
- Cu — Copper
- Sb — Antimony
- F — Fluorite
- Sn — Tin
- Pb — Lead
- W — Tungsten
- Battery
- Battery (disused)
- Road
- Vehicle track
- Railway with station and siding
- Disused tramway
- Town
- Settlement
- "Bakerville" — Homestead
- Landing Ground
- Dam
- Trigonometrical station
- • 3792′ — Elevation in feet
- (aband) — Abandoned



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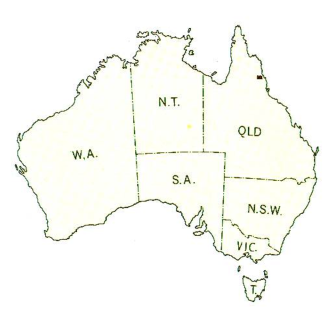
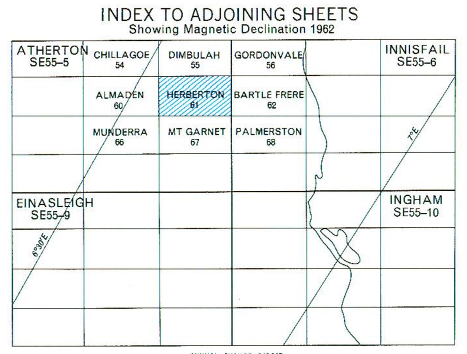




Scale

1 Mile to 1 Inch

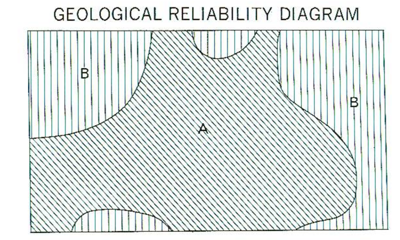
GREY NUMBERED LINES INDICATE THE 5,000 YARD TRANSVERSE MERCATOR GRID, ZONE 7 (AUSTRALIA SERIES)

Sections

Folding schematic

Scale: $\frac{V}{H} = 1.5$

GEOLOGICAL RELIABILITY DIAGRAM

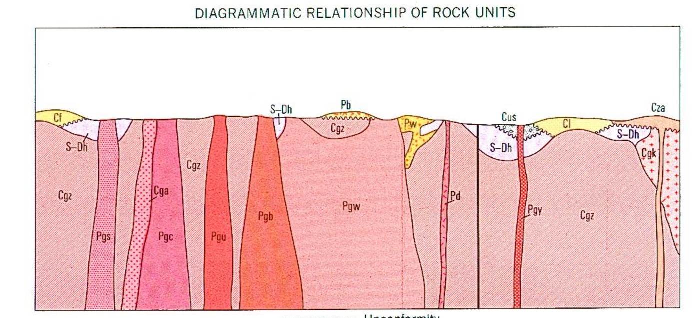


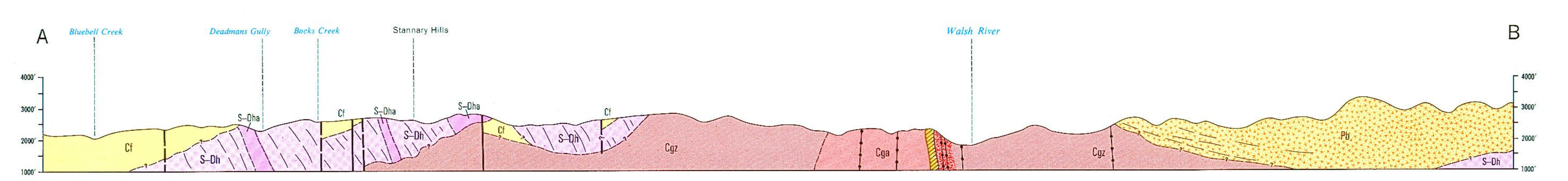
A Detailed mapping

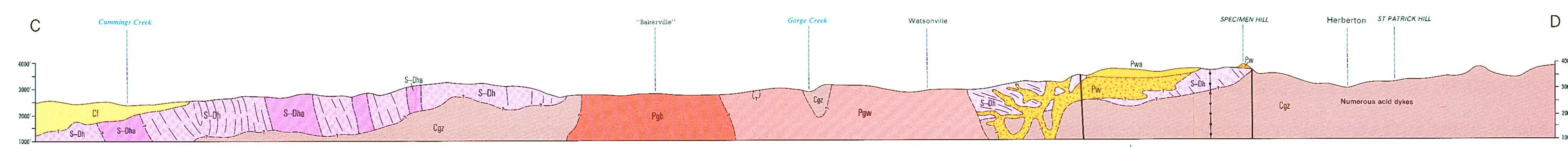
B Reconnaissance traverses and air-photo interpretation

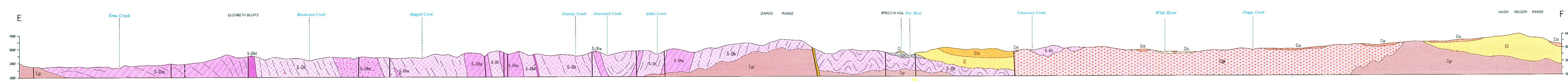
Geology, 1964–66 by D. H. Blake, J. W. Smith (B.M.R.), L. G. Cuttler, R. M. Tucker (G.S.Q.)
Compiled by J. W. Smith, D. H. Blake
Cartography by Geological Branch, B.M.R.
Drawn by R. Swoboda
Printed by Mercury-Walch Pty. Ltd. Hobart

DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS









FIRST EDITION 1970

HERBERTON

SHEET 61 ZONE 7

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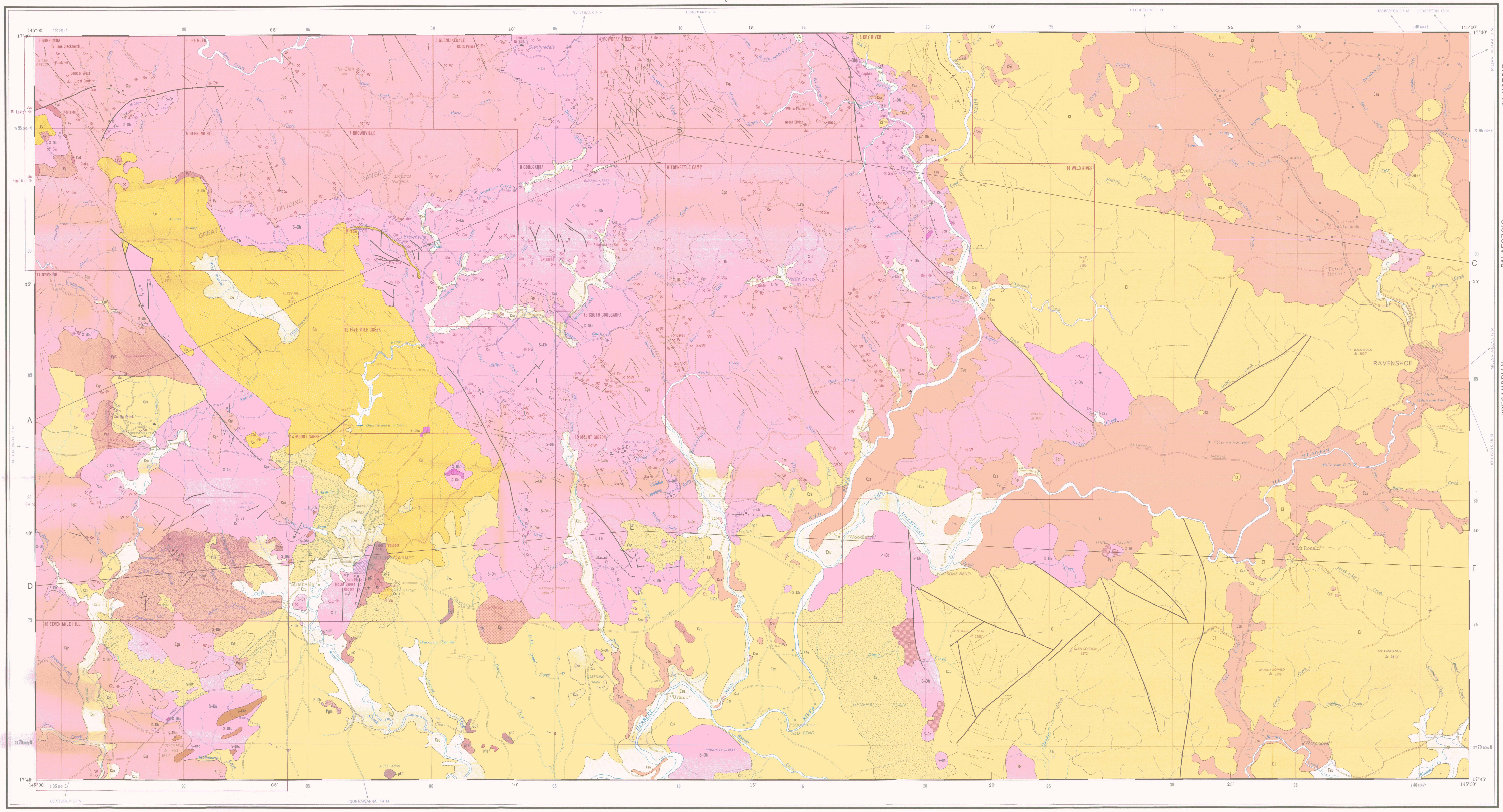
AUSTRALIA 1:63,360

MOUNT GARNET

QUEENSLAND

1 MILE GEOLOGICAL SERIES SHEET 67 ZONE 7



Reference

CAINOZOIC

	Czu	Alluvium
	Czs	Sand
	Czl	Laterite
Atherton Basalt	Cza	Olivine basalt

PALAEOZOIC

PERMIAN?

	Pyd	Granophyre, olivine gabbro and intermediate hybrid rocks forming a net-veined complex
	Pd	Grey diorite
	Py	Pink granophyre
	Pgy	Grey porphyritic microgranite
Nymbool Granite	Pgn	Grey biotite adamellite
Hammonds Creek Granodiorite	Pgm	Grey biotite—hornblende granodiorite, aplite
Gurrumba Volcanics	Pu	Flow-banded acid lava

UPPER CARBONIFEROUS

Elizabeth Creek Granite	Cgz	Pink and pale grey leucocratic biotite adamellite, aplite, abundant greisen

CARBONIFEROUS

	Cgu	Porphyritic and xenolithic microgranite
Nanyeta Volcanics	Cn	Acid and intermediate lava, welded tuff agglomerate, tuff
Glen Gordon Volcanics	Cl	Acid welded tuff, lava, agglomerate tuffaceous sandstone and siltstone

SILURIAN TO DEVONIAN

Hodgkinson Formation	S–Dh	Thin bedded greywacke, sandstone, siltstone, shale, conglomerate
	S–Dha	Massive greywacke and sandstone
	S–Dhb	Altered basalt
	S–Dhc	Limestone

PRECAMBRIAN

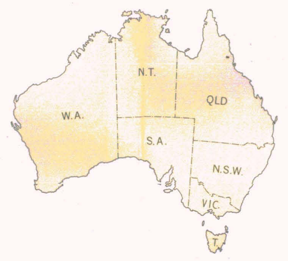
	p€	Schist, amphibolite
	p€g	Muscovite granite
	Cs	Calc – silicates
		Deep leads

Geological boundary
Anticline, showing plunge
Syncline
Fault (D, U indicate relative movement down, up)
Where location of boundaries, folds and faults is approximate, line is broken; where inferred, queried; where concealed, boundaries and folds are dotted, faults are shown by short dashes
Strike and dip of strata
Strike and dip of strata, facing not known
Strike and dip of strata, overturned
Vertical strata
Trend line } air-photo interpretation
Joint pattern } air-photo interpretation
Strike and dip of foliation
Vertical foliation
Fossil locality
Dyke; a — acid, b — basic
Greisen vein
Battery
Battery (disused)

Road
Vehicle track
Disused railway
Railway with station and siding
Town
Settlement
"Mandalee" Homestead
Dam
Trigonometrical station
abd Abandoned

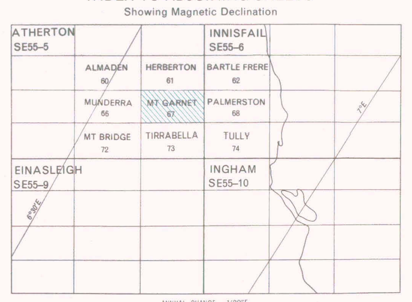
2 THE GLEN Mining area
Mine (only main mines shown)
Au Gold
Cu Copper
Pb Lead
Sb Antimony
Sn Tin
W Tungsten

Published by the Bureau of Mineral Resources, Geology and Geophysics, Department of National Development. Base map compiled from maps prepared 1964 by the Topographic Branch, Survey Office, Brisbane. Aerial photography by Adastra Airways; complete vertical coverage at 1:25,000 scale. Transverse Mercator Projection



INDEX TO ADJOINING SHEETS

Showing Magnetic Declination



Scale

1 Mile to 1 Inch

1 0 1 2 3 4 5 MILES

1 0 1 2 3 4 5 KILOMETRES

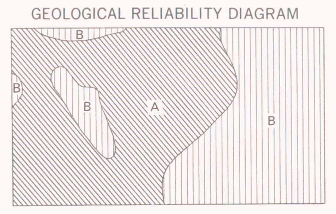
GREY NUMBERED LINES INDICATE THE 5,000 YARD TRANSVERSE MERCATOR GRID, ZONE 7 (AUSTRALIA SERIES)

Sections

Folding schematic

Scale: $\frac{V}{H} = 1{\cdot}6$

GEOLOGICAL RELIABILITY DIAGRAM



A Detailed mapping

B Reconnaissance traverses and air-photo interpretation.

Geology, 1962–66 by K. R. Yates, D. O. Zimmerman, B. J. Amos, D. H. Blake (B.M.R.), R. M. Tucker (G.S.Q.)
Compiled by K. R. Yates, D. H. Blake
Cartography by Geological Branch, B.M.R.
Drawn by D. B. Vitkunas and S. Daric
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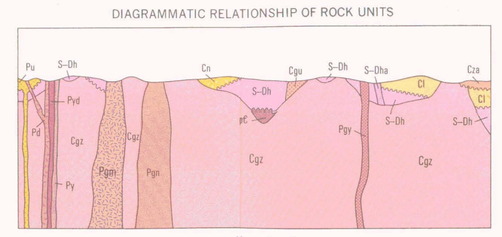
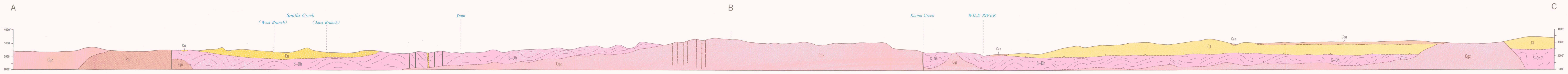
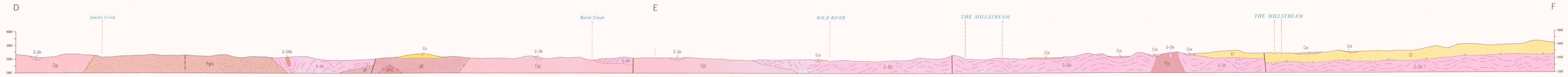
DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS







FIRST EDITION 1970

MOUNT GARNET

SHEET 67 ZONE 7

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