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Record 1974/117

SUMMARY OF INFORMATION ON MINERAL DEPOSITS OF THE ARUNTA COMPLEX, ALICE SPRINGS AREA, NT.

by

R.G. Warren, A.J. Stewart & R.D. Shaw

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INTRODUCTION

The Arunta Complex, or Arunta Block as it is shown on the Tectonic Map of Australia (Geological Society of Australia, 1971) is a metamorphic complex whose history has not yet been completely unravelled. Most of the area shown as Arunta Block is covered by sand, soil, laterite, and small Tertiary basins (Fig. 1). Good outcrop is confined to three areas: a small area in the centre of the Huckitta 1:250 000 Sheet area, the Reynolds and Anmatjira Ranges, and, most extensive of all, the Harts-Strangways-MacDonnell Ranges (Fig. 1). Mapping of the latter two areas is still in progress. and until a tectonic framework has been established, two geographic divisions, namely, the northern Arunta Complex (including the Jervois-Bonya-Jinka district) north of latitude 22°45'S, and the southern Arunta Complex south of this latitude will be used as a framework for the description of the mineral deposits. No attempt is made to interpret the metallogenesis of the deposits at this stage.

The northern Arunta Complex is characterized by granites and low-grade regional metamorphism. and the mineral deposits are either associated with transitional tectonism or located in faults and shears. The area may have been affected by more than one period of metamorphism and granite intrusion. The Jervois-Bonya-Jinka district in the eastern part of the northern Arunta Block includes the Jervois Mining District, numerous tungsten deposits, minor copper lodes, and fluorite-barite lodes. The area is still being mapped at regional scale; the mineralized areas have been studied in some detail by BMR and company geologists.

The southern Arunta Complex is mainly exposed in the Harts, Strangways, and MacDonnell Ranges, which are still being mapped and described. The area contains several types of mineral deposits. Gold, mainly of Carboniferous age, dominated the early mining history of the area, but the emphasis later shifted to mica from pegmatites of probable Carpentarian age. A distinctive zinc-copper-lead mineral assemblage associated with magnesium-rich granulite has been referred to as the Oonagalabi type (Warren, Stewart, & Shaw, in press); an alternative and possibly better example is the Harrys Bore Prospect. A fourth group, copper eposits, occurs in shear zones cutting basic granulite and amphibolite and in cross-cutting quartz veins in the Pinnacles district.

The descriptions of mines and prospects in this Record relies heavily on published and unpublished reports. Where a description has been compiled wholly from a report, 'after Fruzzetti, 1969' (for example) appears at the beginning of the description. Where some references have been used in a description, but others omitted (although known to exist), the latter are listed as 'Additional references' at the end of the description. Where no

references have been used in a description (although known to exist), they are listed as 'Bibliography' at the end of the description. Where no references of any sort appear in a description, that description has been compiled from one or more of the authors' personal knowledge of the deposit. Many of the deposits, especially details of their production, are poorly documented, necessitating the use of hearsay and unsubstantiated word-of-mouth reports. Much of the data was collated by Shaw, who also visited a number of the small mines and prospects to confirm reports. Warren completed the data collation, visited many mines and prospects, and wrote early drafts of this Record. Stewart wrote the final version of the Record. All the deposits described below, and some not described, are plotted in Figure 5 (at back of Record). Collation ceased at October 1973.

NORTHERN ARUNTA COMPLEX

The northern mineralized zone of the Arunta Complex extends from the Jervois district in the east to Mount Singleton in the west. It includes the copper-lead-zinc deposits at Jervois, the scheelite lodes of the Bonya area, fluorite veins in the Jinka Granite, the copper-lead-silver mine at Home of Bullion, numerous small wolframite deposits, the copper lodes at Mount Hardy, and several other small copper occurrences. The mineral deposits occur in areas where the regional metamorphic grade is low, either greenschist or lower amphibolite facies. Most lodes are in structures which cut across the trend of the country rocks, except for Jervois, where the copper-lead-zinc lodes are stratabound. None of the deposits has been dated, but samples for isotopic dating were collected in 1972 and 1973 by L.P. Black (BMR).

The northern mineralized zone had been related by Ryan (1961) to the wolframite deposits of the Hatches Creek area. However, until regional mapping of the northern Arunta Complex is complete, the nature of any link between the two areas remains speculative.

1. Jervois Mining District (centred on lat. 22°40'S, long. 136°16'E)

The Jervois Mining District is situated in a pediplained area about 5 km east of the Jervois Range (Fig. 2). Two distinct types of deposit are present: stratabound copper-lead-zinc lodes with associated bismuth and tungsten deposits which are localized around a north-plunging synform (Fig. 3), and small scheelite and scheelite-fluorite bodies which crosscut the country rock.

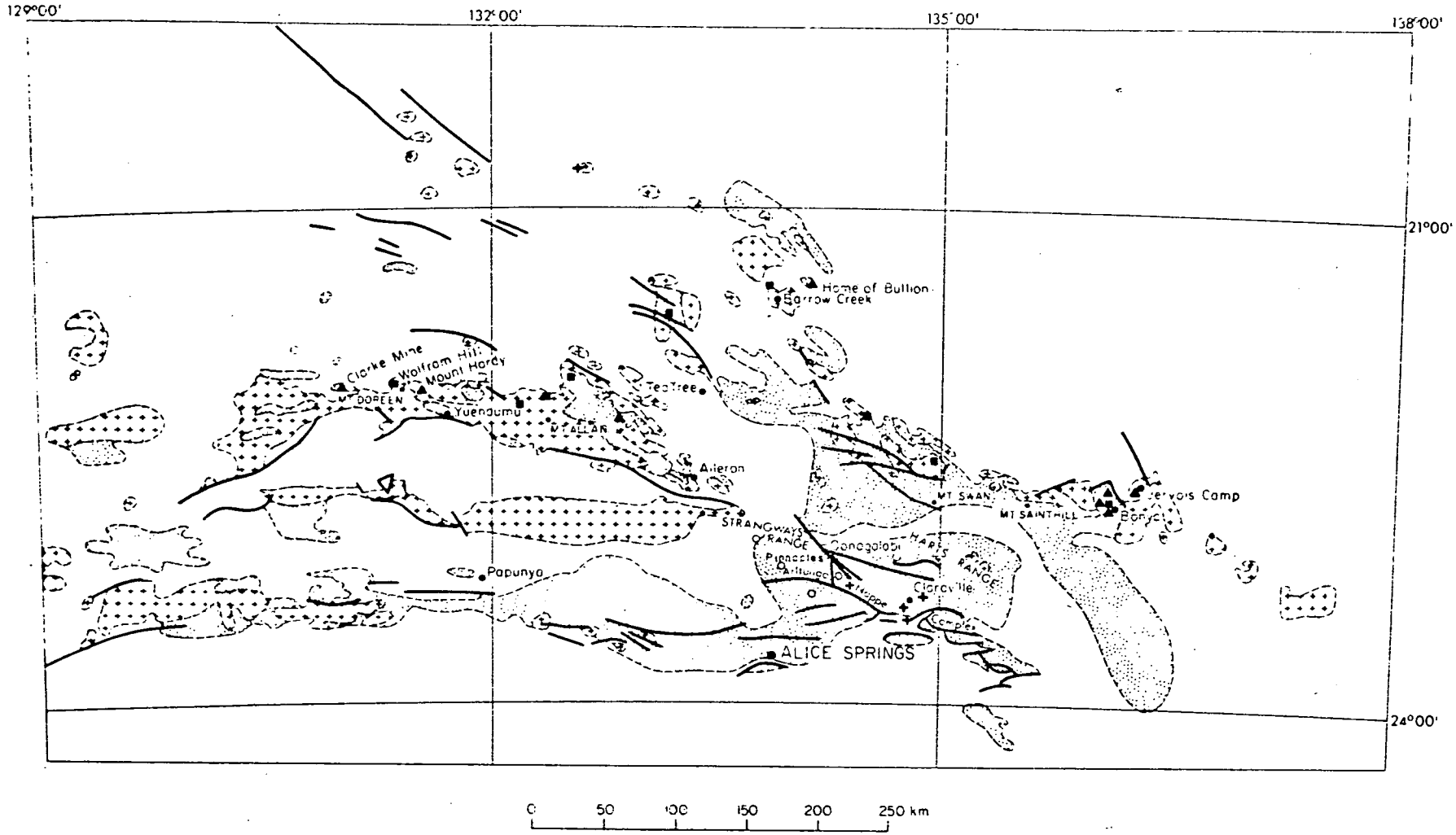

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Fig.1 Distribution of mineral deposits in Arunta Complex N.T.

Modified from 2500000 geological map of Northern Territory (B.M.R. in prep.

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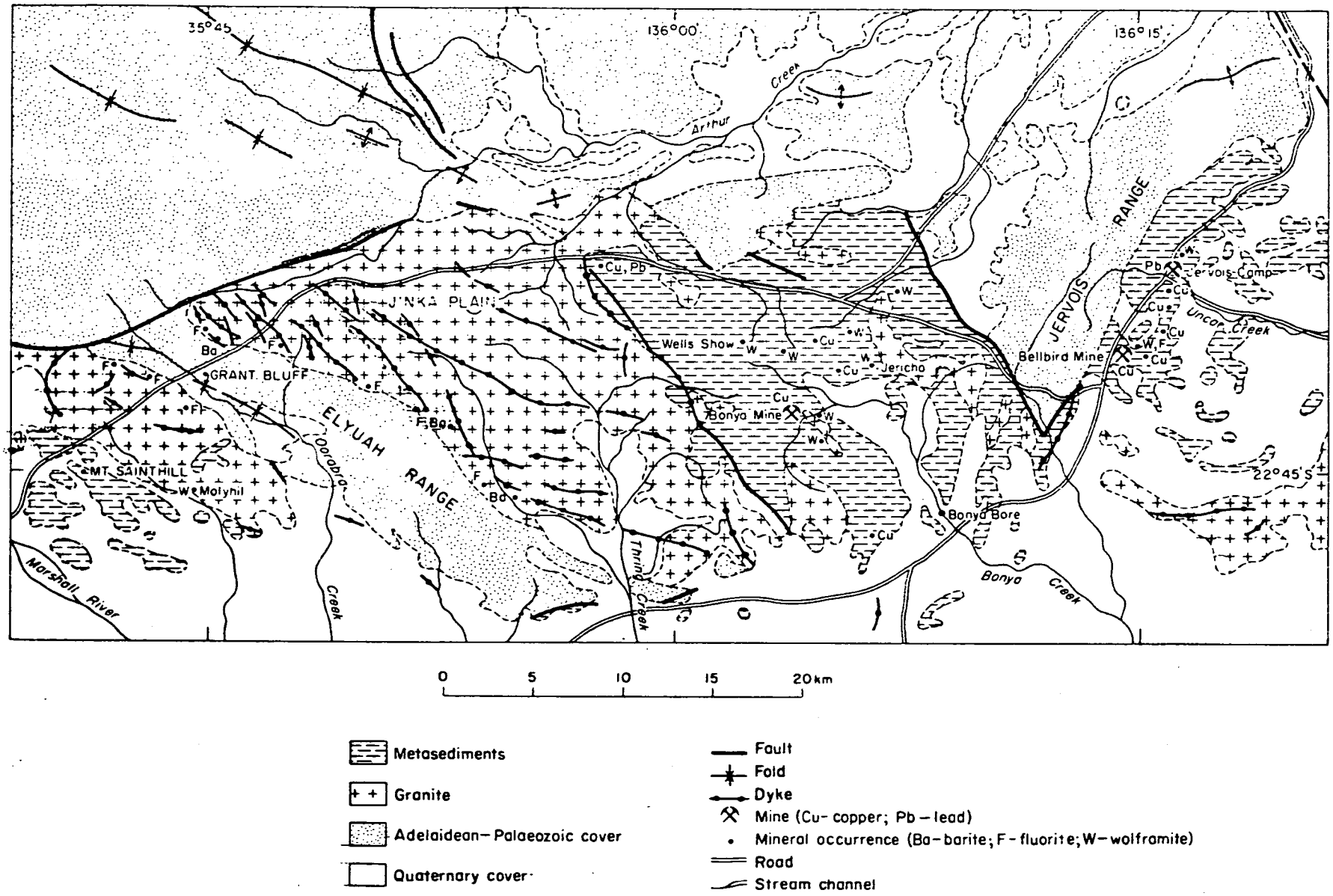

Fig. 2 Generalized geological map of Jervois, Bonya, and Jinka Districts, Arunta Complex, NT

Modified from Huckitta 1:250 000 geological sheet (First edition, 1964), published by Bureau of Mineral Resources

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The enclosing rocks at Jervois are metapelite and calc-silicate adjacent to the orebodies, and amphibolite to the east. Gabbro (now metagabbro) and granite intrude the metasediments. Pegmatites have been intersected during drilling, and quartz-tourmaline and tourmaline 'suns' occur along joints in one of the lodes (Cox's Orebody). The regional grade is either uppermost greenschist or low amphibolite (Robertson, 1959; Morgan, 1959). The calc-silicate rocks have been called skarns in the past, but the assemblages present can all be produced by regional metamorphism.

Copper-lead-zinc lodes form a series of low gossanous ridges which outline the synform (Fig. 3). Drilling by Petrocarb Exploration NL (Holmes, 1972) indicates that the mineralized zone is lenticular; the Attutra lode cuts out at a very shallow depth, whereas the Marshall and Green Parrot lodes continue irregularly to at least 100 m below plain level. The depth of the oxidized zone is about 30 m. Scheelite occurs in the hanging wall of the Marshall orebody, and has been detected in drill core from other lodes in the field. Reported bismuth values range up to 0.01% (Holmes, 1972), and some silver occurs with the lead.

Two discordant scheelite-bearing bodies occur in the Jervois area; an elongate scheelite-fluorite-quartz body up to 5 m wide is situated in the southern part of the axial zone of the main synform, and at a locality about 5 km north of the mining camp coarse scheelite occurs in calc-silicate rock (Robertson, 1959).

Exploration and assessment, including the sinking of an exploratory shaft and drives, are still in progress (1972); mining by previous lease holders was confined to rich surface ore. Regional mapping has been done by BMR (Robertson, 1959), by geologists of Petrocarb Exploration NL (Holmes, 1972), and by S. Dobos of Macquarie University.

Additional references: Anon, no date (a); Anon, no date (b); Bell, 1938; Blanchard, 1939; Morgan, 1939; Catley, 1965; Dodson & Grainger, 1967; Fruzzetti, 1970a; Hossfeld, 1971; Smith, 1964; Wilson, 1964a, 1964b; and Douglas & Maranzana, 1963.

2. Bonya Ore District (centred on lat 22°43'S, long. 136°05'E)

The hills drained by Bonya Creek (Fig. 2) consist of layered metasediments whose economically important members are calc-silicate gneiss and amphibolite. The metasediments have been intruded by granite and by large pegmatite bodies. The granite has been mapped as a single unit, the

Jinka Granite, which includes gneissic and massive variants, and so there may have been more than one period of granite intrusion in the area. The pegmatites are coarse-grained tourmaline-muscovite-quartz-feldspar rocks. Samples for isotopic dating were collected from the country rock, the granites, and the pegmatites in 1972.

Regional mapping by Central Pacific Minerals NL indicates that the metasediments extend from Bonya Bore west to beyond Mount Sainthill (Hill, 1972; D. Henstritdge, Central Pacific Minerals , NL, pers. comm.).

Scheelite occurs in the calc-silicate gneiss (locally called 'skarn rock') which contains either an epidote-garnet or a diopside-garnet assemblage. The scheelite is considered to be a metasomatic addition, but because it occurs preferentially in the calc-silicate beds it also appears to be stratigraphically controlled.

The lodes held under lease by Central Pacific Minerals NL are not yet being mined, but several small lodes elsewhere have been mined by L.A. Johannsen and by Petrocarb Exploration NL. The largest is the Jericho lode (Fig. 2), which has been open-cut to about 10 m below ground level (1972). The ore consists of coarse scheelite disseminated in grossularite-epidote-quartz gneiss. Cuproscheelite and oxidized copper minerals occur in the open cut, and diamond drill holes have penetrated chalcopyrite-bearing rocks at depths of about 30 m. The wall rocks are metapelite and calc-silicate rocks. A small body of micropegmatite in the open cut and wall rock was sampled for isotopic dating in 1972.

The deposit referred to by Nye & Sullivan (1942) as 'The Long Hole' is probably in the Bonya district. They reported that the scheelite occurred in a quartz vein cutting andalusite schist and mafic rocks, and that the highest values occurred opposite the mafic rocks. This deposit may be the one subsequently referred to as 'Wells Scheelite Show' (Fig. 2) by Morrison (1968): it produced a few bags of scheelite from shallow surface workings.

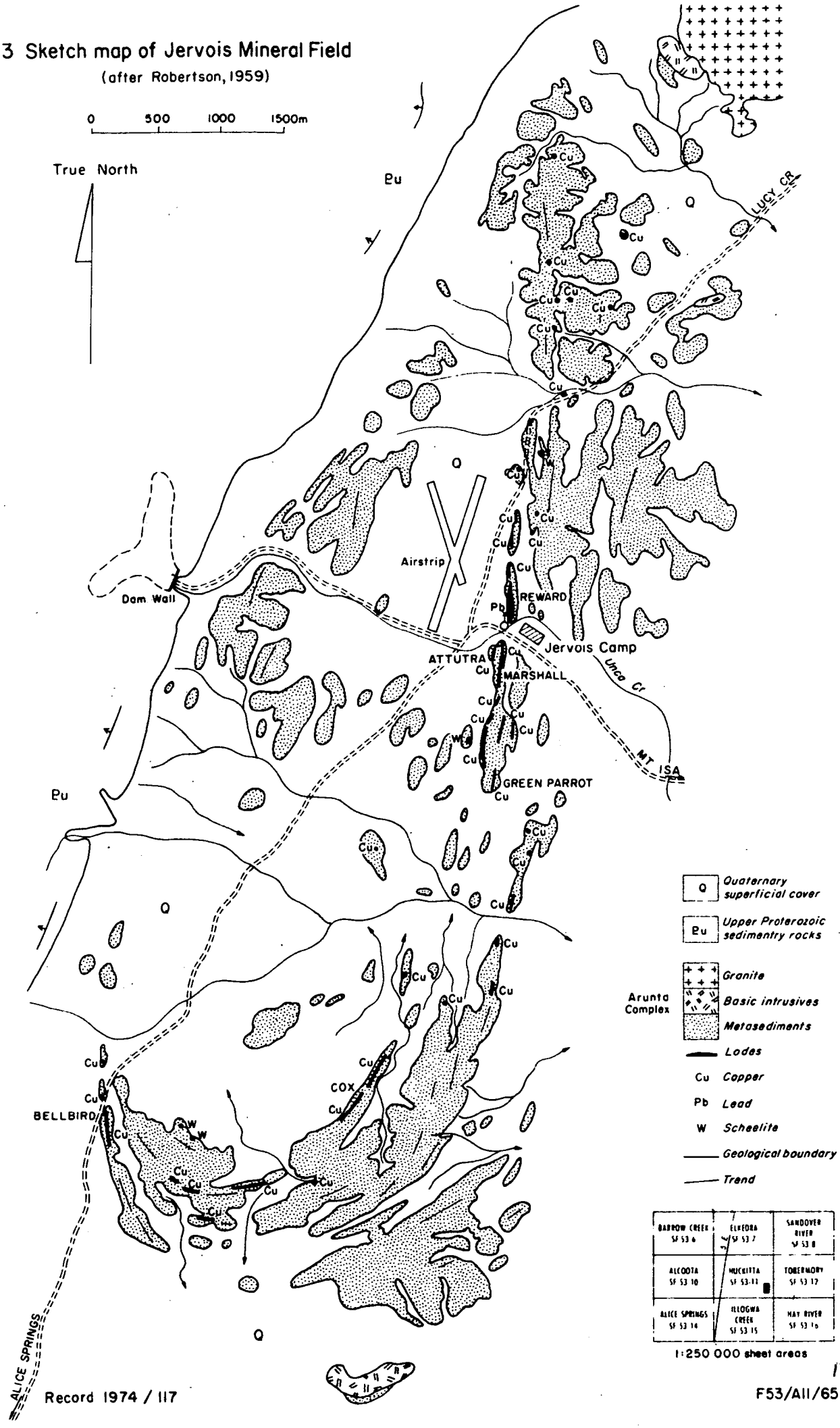
Additional reference: Sullivan, 1942.

3. Molyhil (lat. 22°44'S, long. 135°45'E)

About 8 km east of Mount Sainthill (Fig. 2), L.A. Johannsen has opened up several scheelite lodes in a small hill (known as Molyhil) composed of layered calc-silicate rock which forms a group of roof pendants in the Jinka Granite. The scheelite is fine to coarse-grained, and is disseminated in certain select bands in the calc-silicate rocks. Molybdenum is present in small quantities as coarse, irregularly distributed flakes of molybdenite

Fig.3 Sketch map of Jervois Mineral Field

(after Robertson, 1959)



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and as oxidized molybdenum minerals. The deposits have been opened by trenching with a bulldozer and by benching. A shaft about 4 m deep has also been sunk on a lode at plain level about 100 m east of the main hill. Several large pits have been sunk in low country southeast of the original discovery, exposing numerous large xenoliths of calc-silicate gneiss in decomposed granite. Shoad material is spread over an area of several thousand square metres. Allanite crystals occur on the southern side of the main hill.

4. Jinka Ore District (after Hill, 1972) Dcentred on lat. 22°43'S, long. 135°47'E)

The Jinka Granite is cut by prominent quartz veins and by less prominent quartz-fluorite-barite veins both north and south of the Elyuah Range (Fig. 2). The veins also cut the Adelaidean Elyuah Formation but not the Grant Bluff Formation, so they appear to be considerably younger than the Jinka Granite. Twenty occurrences are known of quartz-fluorite rock in hydrothermally deposited fissure veins and stockworks. The veins exhibit comb-structure and ribbon-structures, indicating the filling of tension structures during several phases of movement. Fluorite in concentrations up to 40% has been intersected over withs of about 5m, and barite content ranges up to 5%. Specular hematite aggregates range up to 10 cm across, and a little malachite, azurite, and galena are also present.

Hill suggested that the belt of veins north of the Elyuah Range lies in the axial zone of a postulated anticline north of the Elyuah Syncline, which formed in Mid-Palaeozoic time; the fluorite vein at Molyhil may also have been emplaced along a fault zone in Mid-Palaeozoic time, as it is parallel to the strike of the north-tilted Grant Bluff Formation immediately to the north. Alternatively, if, as Smith (1964) implied, the fault trends are reactivated structures inherited from the basement, the fluorite veins may also be Precambrian. Hill placed the veins in the telethermal-epithermal range; this is consistent with formation during either Precambrian or Mid-Palaeozoic time.

5. Perenti Copper Prospect (lat. 22°31'S, long. 135°02'E)

The copper prospect situated 15 km southwest of MacDonal Downs homestead (Anon, 1970a) is one of a series of quartz-breccia reefs lying in a major northwest-trending shear zone which cuts across the contact of the Mount Swan Granite. The Perenti reef is 850 m long and contains disseminated secondary copper minerals over a length of 460 m. Drilling has proved copper values to be very low.

6. Delmore Downs Wolfram Lodes (lat. 22°30'S, long. 134°53'E)

A number of pits and shafts have been sunk on small wolframite-bearing lodes about 12 km east of Delmore Downs homestead. They lie a few metres from the contact of the Mount Swan Granite in a small body of sillimanite-garnet-quartz-biotite gneiss; the contact is exposed in one of the shafts. The ore is coarse-grained and disseminated, and in places is contained in quartz. A little disseminated scheelite and fluorite were present in a specimen from one of the new shafts.

Most of the yield appears to have been from alluvial material in a drainage channel to the east, but some also probably came from eluvium. The lodes were mined during 1942-45, and the old shafts are now collapsed. Small-scale mining by one prospector was resumed in 1971; two shafts about 7 m and 3 m deep had been sunk by October 1971. About 50 kg of alluvial wolframite was said to have been taken from the uppermost 40 cm of the deeper shaft by a partner of the prospector, but the yield below that level was very poor.

A copper-stained quartz vein occurs about 100 m northeast of the shaft, but a pit sunk on this in 1971 failed to intersect additional copper minerals.

Bibliography: Anon, 1941; Clarke 1969a.

7. Delny Wolfram Prospect (after Nye & Sullivan, 1942) (lat. 22°34'S, long. 134°53'E)

A wolframite prospect was reported 7 km east of the abandoned Delny homestead by Nye & Sullivan (1942). The locality was not visited during the mapping of the Alcoota 1:250 000 Sheet area. Nye & Sullivan state that two parallel east-trending aplite veins intrude quartzite and amphibolite, and that wolframite is present to the south of the southern dyke, in graphic granite and pegmatite. The report mentions several hundred (square?) yards of shed material.

Additional reference: Anon, 1941

8. Bundey River Tantalite Prospect (lat. 22°25'S, long. 134°48'E)

A pegmatite about 6 km northwest of Delmore Downs homestead has been mined for mica and tantalite. Pegmatites are common in the area, and generally consist of potassium feldspar, quartz, muscovite, and tourmaline. The mineralized pegmatite carried tantalite and a bismuth mineral, probably

bismuthinite. The amorphous phosphate mineral griphite was reported from the locality by Jaffe (1946). Recorded production indicates only a few hundred kilograms of tantalite in about 1944-6. A local miner hoped to reopen the deposit during 1971.

The pegmatites crop out across a soil-covered plain; the country rock is assumed to be calc-silicate rock and metapelite of the Delmore Metamorphics (upper greenschist or lower amphibolite facies).

Additional reference: Daly & Dyson, 1963.

9. Utopia Tantalite Prospect (lat. 22°12'S, long. 134°26'E)

Tantalite is sparsely isseminated in a pegmatite lode about 11 km west of Utopia homestead. The pegmatite is parallel to the foliation of the country rock, a muscovite-biotite gneiss. Twelve prospecting pits, a small open cut, and some costeans have been sunk on the pegmatite but without success. Bismuth minerals and beryl are also present. The deposit is weakly radioactive (Daly & Dyson, 1963).

Additional references: Shaw, 1968; Rochow, 1961; Crohn, 1962.

10. Home of Bullion Mine (after Thomson, 1950a; Sullivan, 1953) (lat. 1°31'S, long. 134°10'E)

The Home of Bullion lodes lie in folded schist and amphibolite exposed in an inlier surrounded by Adelaidean and younger sediments about 30 km east-northeast of Barrow Creek. The schist is fine to medium-grained and includes both muscovite-quartz and biotite-muscovite-quartz assemblages. Amphibolite is present north of the lode, and appears to be partly conformable and partly cross-cutting, suggesting that basic rocks intruded the sequence before metamorphism. Amphibolite is also exposed in a test pit southeast of the eastern lode. Madigan (1934) reported clots of chloritoid in the schist.

The rocks in the area have been deeply weathered. In the hills to the south, the Precambrian basement exposed beneath a capping of Central Mount Stuart Beds is strongly altered, but in the vicinity of the mine the weathering profile has been partially stripped away, leaving less altered rocks. The supergene zone is close to the present water table, so it appears to have formed during the present cycle of denudation.

Four lodes are exposed - the 'Main Lode', where most of the mining activity and production was centred, the narrow 'East Lode', which is an extension of the Main Lode, and South Lode No. 1 and South Lode No. 2. The main lode occurs in a shear zone, which cuts across the trend of the country rocks at a slight angle and consists of chloritic and micaceous

schists. The main lode consisted of an upper oxidized zone 30 m thick of limonite, azurite, malachite, and cerussite; a thin leached zone (2 m); and a lower zone about 25 m thick of secondary sulphides (chalcocite, pyrite, and chalcopyrite), with a grade of up to 24% copper. The primary lode is known only from drill holes below 90 m, and consists of pyrite, sphalerite, bornite, chalcopyrite, galena, and chalcocite; the grade is 3 to 5% copper, up to 6% lead, and up to 15% zinc.

Only the main shaft on the Main Lode is in use (October, 1972), but the shaft on South Lode No. 2 was said to be accessible. The western shaft on the Main Lode has collapsed. On the East Lode an open adit and a shaft about 2 m below the floor of the adit were opened up during 1972. A sample of copper ore from here was sent to Mount Isa, but the lead content was too high for economic production, and development was discontinued.

Pits and costeans on possible extensions of the Main Lode to the southeast of the main outcrop have revealed only slight traces of copper minerals.

The low ironstone ridge referred to as the South Lode No. 1 by Sullivan (1953) has been surface-sampled by companies interested in the mine, but there is no record of drilling. There is no open boxwork, and only iron oxides are visible at the surface.

Most recent mining operations were confined mainly to shipping ore-at-grass of sufficiently high grade to Mount Isa by road. Tanks for a copper-leaching plant have been erected.

It appears that knowledge of the ore reserves and distribution has not changed greatly since the assessments of Sullivan (1953) and Bell (1953a) who estimated production at about 6000 tons (6100 tonnes) of high-grade ore (20% copper), and mining since their visits has been limited to extraction of small parcels of readily accessible rich ore.

Additional references: Basedow 1924; Blanchard, 1936a, 1968; Owen, 1934; Williams, 1925, Hossfeld, 1937.

11. Home of Bullion District (centred on lat. 21°30'S, long. 134°04'E)

Several small showings of copper minerals exist in Precambrian basement exposed beneath the bluffs of Central Mount Stuart Beds between the Home of Bullion Mine and Neutral Junction homestead. They have been visited by Resident Geologists stationed at Alice Springs since the 1950s

(e.g., NT Resident Geologist's Report for May 1965), but have never encouraged mining activity.

12. Barrow Creek District (centred on lat. 21°28'S, long. 133°47'E)

Tin, tantalum, tungsten, and mica have been mined at several localities north (Ivy Mine, 82) and northwest of Barrow Creek, but written records are meagre. Smith & Milligan (1964) report that the tin occurs in pegmatites, and their map shows most of the mines in the country rocks adjacent to the Barrow Creek Granite. Production has been small, and mining spasmodic and short-lived.

Additional references: Blanchard, 1940; Jensen, 1944.

13. Anningie Tin Field (lat. 21°41'S, long. 133°06'E)

The Anningie Tin Field, about 20 km north of Anningie homestead, comprises two main areas, the Reward area in the southern part of the field and a northern area west of Saddle Hole Dam. The field is situated amongst low hills of micaceous and quartzose schist and amphibolite, intruded by tourmaline-bearing pegmatite. There are both conformable and cross-cutting amphibolites. Rochow (1963) interpreted the area of metasediments as a roof pendant in a largely granitic terrain, down-faulted between prominent northwest quartz-filled faults.

The majority of the pegmatites appear to be barren, but some contain cassiterite, some tantalite, and some both (Rochow, op. cit.). The tantalite is radioactive, and the activity is assumed to be caused by included uranium or thorium, as in other similar pegmatites in the northern Arunta Complex. The lithium minerals spodumene and elbaite have been recorded in pegmatites from the Anningie Field by Pontifex (1965).

The main production has been from alluvial and eluvial sources, and the main productive period was from 1935, when the field was discovered, to 1944. Since then mining activity has been intermittent. In recent times some assessments of the deposits for large low-grade operations have been made, but these have apparently been unfavourable. In 1973, the Mines Branch of the Department of the Northern Territory tested the prospect by diamond drilling; the results of the investigation are not yet available.

Additional references: Daly, 1955; Daly & Dyson, 1963; Jensen, 1944a; Blanchard, 1936b.

14. Mount Peake (Griffith's) Lead Show (after Rochow 1961(?))
(lat. 21°31'S, long. 133°05'E)

The Mount Peake Lead Show is situated about 5 km southeast of Mount Peake Dam. The country rock is amphibolite with some thin beds of quartzite and phyllite. The regional structure is not obvious, although the strike of the enclosing bed swings from 70° to 100° in an arc on either side of the lenses. The deposit comprises several quartz-galena lenses up to 1 m long and 15 cm wide, which trend at an oblique angle to the strike of the country rock. Unmineralized pegmatites and quartz veins with limonite after pyrite also occur in the vicinity. A sample of galena assayed 279 g/tonne of silver. Alteration of the country rock is limited to very narrow zones around the lenses, and there is no shearing.

15. Waldron's Hill Gold Prospect (lat. 20°45'S, long. 132°29'E)

A gold occurrence 10 km east of Boomerang Waterhole on the Lander River was inspected by officers of the Aerial Geological and Geophysical Survey of North Australia during 1940 (Anon, 1941). The workings consisted of a costean 70 m long, 2 m deep, and 1 m wide, and a collapsed shaft. From the description it seems that the mineralized zone was a shear in basic and intermediate meta-volcanics. Pegmatites and an acid porphyritic rock crop out in the area. Assays of dump material gave only 5 g/tonne of gold.

16. Reward Copper Mine (lat. 22°11'S, long. 132°49'E)

The Reward Copper Mine is situated north of the Lander River and about 6 km east of Lander Bore (Napperby 1:250 000 Sheet area) in a flat scrub-covered plain with little outcrop. The lode is a quartzose zone which strikes subparallel to the schistosity of the surrounding andalusite-mica schist and quartz-mica schist. Reports indicate a strike length of several kilometres, but the main workings are confined to the northwestern end of the line of lode.

Two shafts with a connecting drive have been sunk to slightly less than 15 m. There are also shallow surface trenches and pits. Zinc Corporation diamond-drilled the prospect area (Thomson, 1948), and Australian Geophysical (Anon, 1965) surveyed the area in 1965. The results from both surveys were discouraging.

The mine is said to have produced about 70 tonnes of secondary ore for a yield of 8 tonnes of copper. The primary grade is very low.

The economic minerals are chalcopyrite, pyrite, and galena at depth, but the workings and dump material are mainly confined to the zone of secondary enrichment, where the minerals present are mainly chrysocolla, malachite, cerussite, azurite, and copper-bearing heulandite. Covellite occurs as coatings and replacements of chalcopyrite towards the base of the oxidized zone.

17. Mount Allan Tin Mine (after Fruzzetti, 1970b) (lat. 22°13'S, long. 132°10'E)

The Mount Allan Tin Mine is situated 6 km north-northwest of Mount Allan homestead at the junction between metasediments and intrusive granite. The metasediments close to the mine are calc-silicate gneiss and marble, but quartz-rich and biotite-rich rocks are also present in the area. The granite is a medium-grained, slightly foliated biotite granite. Some outcrops are porphyritic, and locally include xenoliths of metamorphic rocks. The contact between the granite and the metamorphic rocks appears to be transitional.

The mine is situated in kaolinized pegmatite. Workings (1971) consisted of one partly caved-in shaft sunk to about 8 m, and a deep costean. The Northern Territory Mines Branch diamond drilled the deposit in 1970, and the results showed that the ore minerals, cassiterite and columbite, were confined to kaolin-rich zones. Most of the production to 1971 has come from alluvial material on the hill slope below the mine. Total production is not known, but in 1968 the mine produced about 500 kg of cassiterite.

Additional references: Fruzzetti, 1969; Grainger, 1968a.

18. Aileron Gold Reefs (lat. 22°39'S, long. 133°17'S)

About 6 km southwest of Aileron, small quantities of gold are present in quartzose lodes in a schistose zone in an area of rough and broken topography. Two types of lode were mined, one consisting of limonite after pyrite in quartz, the other of finely disseminated arsenopyrite in a fine-grained quartzose matrix. A parcel of about 5 tonnes sent to the Peterborough Battery (S.A.) in the late 1930s returned 6.14 g/tonne gold; this apparently followed a much richer but smaller initial shipment (Anon, 1941). The workings were abandoned because of the unfavourable returns.

19. Mount Boothby Wolfram Show (lat. 22°37'S, long. 133°20'E)

About 2 km north of Aileron, wolframite is present in a pegmatitic segregation along the margin between a gneissic granite and a roof pendant of sillimanite-bearing pelitic gneiss. Most of the yield of about 350 kg came from shoad material hand-picked during 1971. A pit sunk to about 2 m produced only a few pieces of worframite.

20. Brookes Soak Wolfram Lodes (lat. 22°07'S, long. 132°19'E)

Wolframite occurs in small stringers and segregations in gneissic granite about 2 km south of Brookes Soak (Anon, 1941); the exact location is not known. Mining of the deposit ceased around 1940.

21. Coniston Tin Prospects (lat. 22°07'S, long. 132°34'E)

Cassiterite has been obtained from alluvial workings about 6 km northeast of Coniston homestead (Sullivan, 1943). Material examined by a petrologist (probably Prof. W.R. Browne) suggests that the primary lode is a greisen in an albite-quartz rock.

22. Mount Stafford Tin Lodes ((a) lat. 22°02'S, long. 132°34'E. (b) lat. 22°03'S, long. 132°36'E)

Low-grade tin ore occurs in two pegmatite bodies situated about 9 km west-southwest of Mount Stafford; one lode crops out 100 m west of Tin Bore, the other is 3 km southeast of Tin Bore. Cassiterite occurs in the pegmatites, which intrude the pelitic metasediments of the Mount Stafford Beds, but production probably was mainly from shoad material. Costeaning and adits in the lode west of Tin Bore have apparently revealed no worthwhile values in the primary lode.

Bibliography: Anon, 1941; Ryan, 1958.

23. Double Dams Tantalite Deposit (lat. 22°07'S, long. 132°16'E)

Tantalite is present in pegmatitic segregations in granitic rock about 4 km northeast of Double Dams. Most of the very small yield has been taken from alluvial material in gullies incised into the low hillside.

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24. Double Dams Wolfram Prospect (lat. 22°07'S, long. 132°13'E)

About 50 kg of wolframite was taken from a gully in a granite hill about 2 km northwest of Double Dams. Shoad material was traced to a pegmatitic vein in the granite, and a test shaft was sunk to about 2m; the grade of the primary lode was discouraging.

25. Patty Well and Stuart Bluff (lat. 22°47'S, long. 132°51'E)

Numerous hematitic quartz reefs cut both the granitic basement and the overlying Vaughan Springs Quartzite over a distance of about 50 km along the southern side of the Stuart Bluff Range, and gold has been reported several times from these reefs (Jones, 1954). Detailed investigation (including assays) revealed pyrite and specular hematite at depth, but no indications of gold or base metals (Layton, 1965). Minor fluorite occurs in some veins.

26. Pine Hill Gold-Copper Prospect (lat. 22°11'S, long. 132°47'E)

A gold prospect containing minor copper occurs in a quartz reef 3 km east-southeast of Lander Bore on the Napperby 1:250 000 Sheet area. A shaft about 24 m deep has been sunk on a steeply north-dipping vein 100 m long and about 0.5 m wide. Two chip samples gave assays of 6.14 g/tonne and 4.91 g/tonne of gold.

Bibliography: Thomson, 1948

27. Ingellina Gap Wolfram Show (lat. 22°09'S, long. 132°49'E)

Reports exist of wolframite at several localities near Ingellina Gap, about 6 km north of the Reward Mine, but have not been substantiated (Thomson, 1948).

28. Barney's Ironstone (after Ryan, 1958) (lat. 22°19'S, long. 132°46'E)

Several bodies of earthy brown limonite a few metres long in quartz schist southwest of Mount Thomas appear to be parallel to the strike of the country rock. Malachite stains were reputed to exist, but neither Ryan in 1958 nor Offe in 1972 (in Stewart et al., in prep.) found any malachite or evidence of gossanous boxwork which may cap mineralized rock.

29. Woodforde River Ironstones (lat. 22°33'S, long. 133°06'E)

Two dyke-like limonitic bodies in marble and calc-silicate rock in

the upper part of the valley of the Woodforde River are close to the contact with a granite intrusion. Neither shows boxwork textures nor indications of economic minerals, and analysis of a grab sample (72921217) from the northwestern body gave only 0.0375% zinc with lesser values for copper and lead (AMDL, 1972a).

30. White Hill Yard Copper Show (lat. 22°28'S, long. 133°06'E)

Secondary copper minerals in a shear zone 7 km west of White Hill Yard (Napperby 1:250 000 Sheet area) were located during the 1973 field season (Stewart et al., in prep.). A grab sample contained 5% copper.

31. Lander Copper Prospects (after Ryan, 1958) (lat. 22°09'S, long. 132°48'E)

Four small secondary copper concentrations in low hills northeast of Lander Bore are all about 30 m long by 5 m across. The ore is in lodes composed of quartz, malachite, cuprite, and iron oxides. The country rocks consist of psammitic schist intruded by hornblende diorite and, about 1 km to the east, by granite. They were not located during the 1972 mapping.

Additional reference: Thomson, 1948.

32. Wolfram Hill (Mount Doreen Wolfram Field, Mount Hardy Wolfram Mines) (lat. 22°03'S, long. 131°19'E) (after Clarke 1969b)

Wolfram Hill lies immediately west of the ruins of the old Mount Doreen homestead and about 40 km from Yuendumu on the Alice Springs-Tanami road. The hill itself consists mainly of metasiltstone and metamudstone with a few beds of argillaceous metasandstone up to 6 m thick. The rocks are tightly folded, and the sandstone members have fractured and thus provided sites for pegmatite emplacement. Mining activity has been concentrated on the northeastern limb of the fold. The wolframite occurs as coarse grains in quartz veins, micaceous seams, and pegmatitic quartz-mica segregations; hydrothermal alteration zones of bleached quartz-sericite rock up to 50 cm thick surround the pegmatites. Minor chalcopyrite and secondary copper minerals are present in some of the pegmatites, which range up to 100 m long by 50 cm across.

Kiek (1941) and Clark (op.cit.) consider that the economic minerals were introduced by granite which crops out 2 km to the northeast; the rock

is a coarse-grained gneissic muscovite-biotite granite with phenocrysts of alkali feldspar up to 5 cm across.

Recorded production figures are incomplete, but the main production is reputed to have come from alluvial material, particularly from the eastern end of the hill. However, there are numerous timbered shafts, adits, and open cuts, which indicate that some payable lode material was obtained. Estimates of production vary from 71 tonnes of wolframite to more than 90 tonnes, but it is possible that a large proportion was not recorded. Nye & Sullivan (1942) estimated that about 17 tonnes of wolframite was available in alluvial material. Clarke (1969) considers that the lode material was unsuited to large-scale operations. The latest venture to mine the alluvial material was in progress in August 1972.

Additional references: Anon, 1941; Sullivan, 1943; Dyson, 1956.

33. Mount Hardy Copper District (after Grainger, 1968b) (lat. 22°07'S, long. 131°33'E)

Several copper lodes are present in folded mica schist in an area of 25 km^2 northeast of Mount Hardy. The ore deposits are associated with pegmatite, and quartz veins which are slightly discordant to the foliation. The bulk of the copper ore is in the country rock adjacent to some of the veins.

At the Mount Hardy mine, the primary minerals are chalcopyrite and minor pyrite and galena, with an average grade of about 1% copper. At the surface the minerals present are mainly malachite and azurite; below these, chalcocite, cuprite, and metallic copper occur in drill core to about 15 m followed by the primary ore. Surface samples give about 4% copper and up to 56 g/tonne of silver. Grainger estimated the tonnage available at about 12 200 tonnes of 3-4% copper.

Kiek (1941) described nine other copper occurrences, and he mentioned the hearsay existence of eleven more occurrences or groups of occurrences in the district. Some have been investigated by shallow pits, but revealed only low-grade malachite.

An attempt was made at mining a deposit west of the present Mount Hardy Mine; this appears to have been either Deposit 13 of Kiek (1941), a quartz ironstone body about 215 m long and 2 m wide, or Deposit 14, which consists of several gossanous copper-bearing quartz reefs. Nothing is known of the history or production of this mine.

Additional reference: Wells, 1972, Tables; Ryan, 1956; Haigh, 1967; Dyson, 1956.

34. Rock Hill Copper Prospects (after Fruzzetti, 1970c) (lat. 22°11'S, long. 131°46'E)

The Rock Hill Copper Prospects are situated among low hills 8 km north of Yuendumu and about 5.5 km south of Rock Hill. Copper minerals occur at several localities along a line about 5 km long, in micaceous schist and phyllite with a general east-west trend and near-vertical dip. The individual lodes and the line of lodes cut slightly across the trend of the country rocks. The two largest lodes have been trenched and drilled, and a shallow open cut has been dug on a third. The lodes at the surface consist mainly of malachite and quartz with lesser amounts of azurite and chrysocolla. Tenorite and chalcocite are reported, and one drill hole intersected about 1 m of massive chalcopyrite at a depth of 37 m. Fruzzetti recorded an average grade for chip and channel samples of 10% copper, but the distribution of economic minerals is irregular.

35. Jubilee Silver King Mine (lat. 22°07'S, long. 131°11'E)

The Jubilee Silver King Mine is located 19 km southwest of the old Mount Doreen homestead at the western end of a low range of hills of sericite-quartz schist. The ore body is a pegmatitic segregation near the hinge of a large fold, and contains lead, copper, silver, and bismuth minerals. Granite crops out about 3 km to the east. Kiek (1941) stated that the ore was distributed over an area about 140 m by 80 m, but the main workings occupy an area only about 20 m across.

The workings comprise a deep trench, a timbered shaft 16 m deep, a pit about 3 m deep, and a drill hole which is not recorded by any known report. A grab sample (72661001) taken by R.G.W. contained 47% lead, 14% copper, 0.072% bismuth (which is a grade of about 0.89 kg/tonne), and 1490 g/tonne of silver (AMDL, 1972b). Other assays have shown silver ranging from 140 to 920 g/tonne, copper from 11 to 31%, and lead from 16 to 55% (CSIRO, 1957); but the amount of rich ore available appears to be very small. There is no sign of primary ore on the dumps, but Kiek reported the presence of pyrite and chalcopyrite. Several unusual minerals, including linarite, brochantite or antlerite, and massicot occur in the oxidized ore.

Additional reference: Wells, 1972, Table 3.

36. Vaughan Springs Fluorite Prospect (lat. 22°11'S, long. 131°19'E)

A prominent quartz vein south of the road from Yuendumu to Vaughan Springs (new Mount Doreen homestead) and about 30 km west of 20 Mile Bore contains fluorite, barite, galena, and copper minerals distributed irregularly

along its strike. It also includes Rankin's Reward, a radioactive gossan containing rare uraniferous silicate grains (J.F. Ivanac, Central Pacific Minerals NL, pers. comm.). This vein does not appear to have been affected by the Carboniferous folding which deformed the adjacent Ngalia Basin sediments, and so it may have been introduced after the folding. Other fluorite lodes are reported to exist in the area, but no written records are known.

37. Clark Copper Mine (after Grainger, 1968c, and Fruzzetti, 1971) (lat. 22°02'S, long. 131°01'E)

The Clark Copper Mine is situated about 30 km west of the old Mount Doreen homestead in a range of low hills composed of phyllite intruded by gneissic granite. Several veins of quartz and pegmatite cut the phyllite and granite, and copper minerals occur in three of the veins.

The workings consist of three sinuous open cuts up to 9 m deep and up to 500 m apart and several pits. The mines were worked for a short period in the 1950s, but were not investigated until 1968, when they were diamond-drilled and mapped in detail by Grainger and Fruzzetti.

Surface minerals include malachite and azurite. Chalcocite and native copper occur above the water table, and at depth a pyrite-chalcopyrite-bornite assemblage was intersected by the diamond drilling. Copper minerals occur in the quartz and pegmatitic veins and in the phyllite and in gneissic granite adjacent to the veins (Fruzzetti, 1970).

Production figures are unavailable, but the amount of ore mined was probably less than 50 tonnes of oxidized hand-picked material. Fruzzetti estimated total reserves at 2800 tonnes of broken ore averaging 7% copper, and 5700 tonnes of probable ore ranging from 2-3% copper spread over the three workings.

Additional reference: Wells, 1972, table 3.

38. Buger Creek Copper Show (lat. 22°07'S, long. 130°40'E)

Copper carbonate has been reported in the vicinity of Buger Creek Bore. The copper carbonate forms stains in quartz stringers along a probable fault zone about 4 m wide between schist and amphibolite.

39. Djagamara Banded Iron Formation (lat. 22°12'S, long. 131°17'E)

A mass of banded iron formation consisting of laminae of quartz-hematite and quartz-sericite(?) is situated 5 km north of Djagamara Peak.

The laminae are tightly folded and show a weak axial-plane cleavage. Geochemical sampling of the beds and adjacent quartz and ironstone bodies produced no results warranting further investigation.

40. Patmungala Copper Prospect (lat. 22°13'S, long. 131°12'E)

A small copper prospect occurs in quartz-mica schist of the Patmungala Beds along the northern side of the Naburula Hills (Wells et al., 1968). The minerals are mainly malachite and azurite with some cuprite, and appear to fill a large tension gash. An irregular pit about 2 m deep has been dug into the body. Assay results did not warrant further work.

Copper stains also occur in a quartz vein west of the main prospect. Prospecting pits 4.5 km east of the copper deposits (Wells, 1972) show galena in vitric crystal tuff of the Patmungala Beds.

41. Wilson's Find (Mount Singleton Wolfram Mine) (lat. 21°59'S, long. 130°41'E)

Wolframite was mined for a short time in the early 1940s in an area about 14 km west of Mount Singleton, in the Wabudali Range (Kiek, 1941). The lodes occur in low ground near the western end of the range. The country rock is gneissic granite, and the lodes occur in intersecting quartz veins close to the margin of the intrusion. Production was about 2 tonnes of concentrate which appears to have come from alluvial material and from three shallow trenches up to 3 m deep along the quartz veins. Triplite has been reported from this locality, and copper stains and chrysocolla occur in some of the quartz reefs.

Additional references: Nye & Sullivan, 1942; Sullivan, 1943; Dyson 1956.

SOUTHERN ARUNTA COMPLEX

The southern mineralized zone of the Arunta Complex extends from the Arltunga area in the east to Mount Leisler in the west. The mineral deposits can be divided into five groups, for descriptive purposes only; no metallogenic interpretation is necessarily implied by these groups.

1. Mica deposits in pegmatites of the Harts Range and Plenty River areas.
2. Minor copper deposits in felsic, mafic, or calcareous rocks.
3. Oonagalabi Group; these are base-metal deposits in high-grade magnesium and calcium-rich rocks.
4. Mineral deposits mostly formed during the Alice Springs Orogeny.
5. Unclassified deposits.

The country rocks around the mineral deposits are metamorphosed psammites, pelites, and calcareous rocks intruded by sills, dykes, and plugs of basic rock, and all complexly folded and metamorphosed to assemblages of the high amphibolite and granulite facies. To the south, the Arunta Complex is overlain by the Adelaidean to Palaeozoic Amadeus Basin sequence, the margin of which ws the site of intense mid-Palaeozoic thrust-faulting, folding, and greenschist facies metamorphism ('Alice Springs Orogeny' of Wells et al., 1970).

GROUP 1: MICA DEPOSITS IN PEGMATITES OF THE HARTS RANGE AND PLENTY RIVER AREAS

Detailed descriptions of the Harts Range and Plenty River mica mines are recorded in Joklik (1955) and earlier, more general, descriptions given by Hodge-Smith (1932) and Jensen (1945). The mica occurs in large undeformed bodies of pegmatite which fill crosscutting joints. Most of the mica was produced from zoned coarse-grained bodies. Only a few of the pegmatites contained economic minerals other than mica: minor copper minerals were found in the Desperate and Eldorado pegmatites. Beryl is known from the Disputed, Caruso, Dinkum, Eastern Chief, and Kismet pegmatites (Joklik, 1955; Jones, 1957) and is also said to occur in rocks in the Harts Range outside the pegmatite bodies. The radioactive minerals monazite and samarskite have been found in some of the pegmatites; the Last Hope and Lone Pine Mines southeast of the Huckitta Dome are the best documented localities for radioactive minerals, but several other pegmatites in the envelope of the dome also contain radioactive minerals (Daly, 1951; Daly and Dyson, 196). Samarskite, tantalite, and columbite are recorded in a pegmatite 6 km north-northeast of Mount Johnstone.

Additional references: Brown, 1890; Woolley, 1959; Tate, 1958, Tomich, 1952; Owen, 1945; Owen, 1943.

GROUP 2: MINOR COPPER DEPOSITS IN FELSIC, MAFIC, OR CALCAREOUS ROCKS

42. Tom Braun's Prospect (lat. 23°05'S, long. 133°52'E)

Copper stains occur in a lens of mafic rock in a metapelite sequence about 4 km north-northeast of Yambah homestead. A small prospecting pit was sunk, but results were discouraging.

43. Muller Creek Copper Prospect (lat. 23°01'S, long. 134°04'E)

Traces of oxidized copper minerals and chalcopyrite occur in north-striking mafic rocks at two separate localities near Muller Creek on the

northern side of the Strangways Range (Tipper, 1969). The location given for the lode places it in a photo-interpreted fault zone.

44. Copper Queen (lat. 23°09'S, long. 134°40'E)

The Copper Queen deposit lies 13 km south of Mount Riddock homestead in the Harts Range. It is described as chalocite-bearing lenses about 30 m long and 1.5 m wide occurring over a length of about 300 m in epidote-garnet-calcite-tourmaline rock in a metamorphosed calcareous sequence. The overall grade was estimated as perhaps 1% copper, with 10-15% in the richest zone.

Bibliography: Youles (no date)

45. Selin's Deposit (after Jensen, 1943) (lat. 23°05'S, long. 134°42'E)

A small copper prospect about 5 km south-southwest of Mount Riddock homestead consists of atacamite, chalcanthite, and melanterite in gossanous mafic rocks in an east-trending zone in biotite-quartz-feldspar gneiss. Youles (no date) listed another copper lode in the same area, consisting of bands of chalcopyrite and malachite in amphibolite.

Additional reference: Jensen, 1945.

46. Virginia Prospect (lat. 23°04'S, long. 134°40'E)

Malachite occurs along a gently dipping shear zone in garnet amphibolite in the hills 5 km south of Mount Riddock homestead.

47. Arthur Pope's Prospect (lat. 24°05'S, long. 135°27'E)

About 2 tonnes of rich copper ore have been obtained from a prospect on the northwestern edge of the Simpson Desert. The country rocks comprise granite gneiss, metabasic volcanics, and metasediments. The copper minerals are located in northeast-trending fractures and bedding planes.

Bibliography: King, 1954.

48. Pinnacles Lodes (after Shaw, 1970) (lat. 23°09'S, long. 134°14'E)

A number of copper-bearing lodes have been found in the hills north of Pinnacles Bore. The country rocks consist of calc-silicate marble, meta-quartzite, and quartz-feldspar gneiss, intruded by granite (now

orthogneiss), norite (now mafic granulite), and pegmatite.

The lodes, with the exception of Johnny's Reward, are narrow copper-bearing quartz veins which occupy shears and fractures mainly in the calc-silicate rocks. The copper content ranges up to 30%, with traces of gold, silver, and bismuth. The primary copper mineral is chalcopyrite, but most of the ore has come from the oxidized zone, where malachite, chalcocite, bornite, and more rarely, azurite, chrysocolla, and cuprite have been obtained. The richest zone occupies the upper 5 m of the ore bodies, and is considered to have been formed during the development of the present land surface.

Johnny's Reward appears to have many features in common with the deposits of Group 3, and is described with them.

Additional references: Haigh, 1971; Jensen, 1944; MacMahon & Partners, 1968; Bell, 1953b.

49. Sliding Rock Copper Prospect (lat. 23°19'S, long. 134°12'E)

Copper-stained schist and quartz-hematite rock occur in a retrograde schist zone southeast of Bald Hill near Sliding Rock Well. (This deposit may be better classed with Group 4.)

50. Turner's Prospect (lat. 23°19'S, long. 134°13'E)

Turners Prospect lies 5 km southeast of Bald Hill. Traces of gold, malachite, and chalcocite occur in coarse-grained amphibolite. An Induced Potential geophysical survey revealed no anomaly, and trenching revealed only very sparse disseminated minerals.

51. Paddy's Jump-up Copper Show (lat. 23°32'S, long. 134°37'E)

Malachite coats slickensided joints in coarse massive tremolite with minor diopside at a locality 3 km south of Paddys Jump-up. The tremolite forms a mass about 650 m across in sillimanite-biotite-quartz gneiss. (Paddys Jump-up is 11 km west of Arltunga Bore on the Ross River-Arltunga road).

52. Gecko Prospect (lat. 23°18'S, long. 134°09'E)

The Gecko Prospect is situated 2.5 km south of Bald Hill, and comprises several quartz-magnetite bodies near the contact between amphibolite and quartz-feldspar gneiss. Both country rock and lode are isoclinally folded with a steep northeast plunge. Copper, lead, and zinc are present in amounts up to 0.5%, 1.4%, and 7.8% respectively over narrow widths; silver has also

been detected (J.F. Ivanac, Central Pacific Minerals, NL, pers. comm.).

53. Rankin's Copper Prospect (lat. 23°17'S, long. 134°07'E)

Rankin's Copper Prospect is situated about 2 km west of Bald Hill and comprises two separate deposits. The first consists of copper-stained quartz-magnetite rock between quartz-feldspar gneiss and amphibolite; finely disseminated chalcopyrite occurs at a depth of about 1 m. The grade ranges from 16% copper at the surface to 4% at the bottom of a shaft about 4.5 m deep sunk on the deposit. The second prospect is about 150 m southwest of the first, and consists of coarse galena and possibly also zinc in marble. The two deposits are considered to be at roughly the same stratigraphic level of a steeply plunging S-shaped fold.

54. Glen Helen Prospects (after Faulks, 1967) ((a) lat. 23°26'S, long. 132°15'E: (b) lat. 23°27'S, long. 132°17'E)

Two minor occurrences of copper minerals have been located near Glen Helen homestea, one 3 km south-southeast and the other 11 km southeast of the homestead. Both consist of quartz-epidote veins with minor chalcopyrite. Malachite stains occur in the quartz and quartz-sericite schist wall rock in the first deposit, and the mica gneiss wall rock in the second. Both prospects have been investigated by shallow pits.

55. Stokes Yard (after Fruzzetti, 1973) (lat. 23°27'S, long. 132°06'E)

The Stokes Yard Prospect is situated about 5.6 km north-northwest of Stokes Yard, in the western part of the Hermannsburg Sheet area. It consists of pegmatite veins with argentiferous galena, pyromorphite, sphalerite, hemimorphite, smithsonite, chalcocite, malachite, chrysocolla, rhodonite, and tremolite, intruded into amphibolite, migmatitic granite gneiss, and calc-silicate country rocks. The mineralized zone extends over an area about 60 m by 15 m. Five diamond drill-holes in the prospect put down by the Mines Branch of the Department of the Northern Territory intersected only minor amounts of iron, copper, and zinc sulphides. Assay results of about seventy surface samples averaged 2.82% lead, 2.81% zinc, 0.27% copper, 35.15 g/tonne of silver. Assays of core samples gave maximum values of 0.85% copper, 0.22% zinc, and 0.08% lead. Fruzzetti concluded that the zone of economic mineralization was of epigenetic origin, very localized, and extended to no more than about 1.5 m below ground level.

GROUP 3: OONAGALABI GROUP

A number of base-metal deposits associated with a distinctive group of rocks occur in the Harts and Strangways Ranges. The Oonagalabi prospect

appears to be the largest and will probably become the best known, but it does not possess all the characteristics of the group.

The group is characterized by a distinctive lithological assemblage with three distinct rock-types forming the ore horizon. First, forsterite marble is usually present, together with calcareous minerals such as diopside. The second rock-type is rich in magnesium and aluminium, and forms gneisses containing anthophyllite, phlogopite, cummingtonite-gedrite, Mg-Al spinel, enstatite, and sapphirine. Thirdly, quartz-magnetite rock occurs in all the deposits except Oonagalabi. Amphibolite, thought to be para-amphibolite, occurs in some of the deposits within the ore horizon. The three units are irregularly interlayered and lenticular or vein-like, except for the spinel-bearing gneiss which in all occurrences is situated close to the granulite country rock. All three major rock-types are mineralized. The main metals present are copper, lead, and zinc and the ratios of these vary from deposit to deposit. The two deposits drilled to the primary zone also contain pyrite.

The ore horizon lies adjacent to, but is discordant with, felsic and mafic granulites. The felsic unit is generally a cordierite-microcline-quartz gneiss, but no cordierite is present at Oonagalabi. Mafic granulite makes up a highly variable but minor proportion of the sequence.

56. Oonagalabi Prospect (lat. 23°07'S, long. 134°52'E)

The Oonagalabi Prospect occurs in high-grade metamorphic rocks in the Harts Range. The rocks in the vicinity of the orebody are tightly folded about axial planes which dip south at about 70°; fold axes plunge 30° east.

The ore-bearing horizon lies between two distinct units of metamorphic rock. To the south, discordant with the ore horizon, the rocks are highly deformed felsic gneisses with small pods of basic granulite. To the north, concordant with the ore horizon, the country rocks are finely layered gneisses with leucocratic felsic layers alternating with dark (biotite-rich?) mafic layers.

The ore horizon contains two of the three lithological units characteristic of this group of deposits. Close to the discordant felsic gneisses the rocks are rich in magnesium and aluminium, and consist primarily of anthophyllite-gedrite amphibole, spinel, and phlogopite. The calcareous horizon is represented by forsterite marble which contains disseminated chalcopyrite and sphalerite, and hornblende amphibolite. Spinel-rich rock forms pods within the marble. Both the marble and the amphibolite contain visible copper minerals.

At the time of writing (June 1973), development consists of three costeans and several percussion holes.

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57. Johnnie's Reward (after Shaw, 1970) (lat. 23°08'S, long. 134°13'E)

Johnnie's Reward lies 1 km north-northwest of Southern Cross Bore. The prospect consists of prominent quartz-magnetite lenses which crop out discontinuously over a distance of 180 m in a low ridge of amphibole gneiss, garnet-biotite gneiss, and minor calcareous gneiss and pyroxenite. Oxidized copper minerals stain the quartz-magnetite rock, amphibole gneiss, and pyroxenite. To the west the country rock is garnet-feldspar gneiss with minor amphibolite; layers of the felsic gneiss cross the mineralized area. Outcrop to the east is poor, but a metabasic rock is exposed about 75 m east of the lode. Quartz veins and pegmatites occur in the area of the lode but postdate it. A deformed tourmaline-quartz rock occurs near the southern end of the ridge. The lode is cut off at its northern end by a flexure in the country rock, and at its southern end by a pegmatite which appears to have been emplaced along a fault.

From geophysical surveys the lode is interpreted as a shallow ellipsoid body dipping steeply east (Haigh, 1971); two slanted diamond-drill holes east of the lode passed under the main mineralized zone and encountered only traces of copper. Analysis of surface samples indicates the presence of copper, lead, and zinc. Surface minerals include azurite and possibly smithsonite.

Johnnie's Reward is different from all the other deposits of the Pinnacles Field, and many of its features indicate that it belongs to the Oonagalabi Group. The economic minerals occur in quartz-magnetite and carbonate rock, although only one magnesium-rich mineral, anthophyllite, has until now been identified (Brown, 1973). The quartz-magnetite rock is very similar to that at Edwards Creek and Harry Bore Prospects. The pyroxenite resembles some of the para-pyroxenites which accompany various members of the Oonagalabi Group. The country rocks are similar in composition and metamorphic grade to those at Harry Bore.

58. Edwards Creek Prospect (lat. 23°01'S, long. 134°01'E)

The Edwards Creek Prospect is situated about 5 km south of where the Plenty River Road crosses Edwards Creek; it is undeveloped.

The country rocks are mafic and felsic granulites, but there is considerable disruption by faulting and much of the surrounding area is occupied by schistose rocks. One outcrop of finely layered gneiss is similar to the upper unit at Oonagalabi, but the outcrop is fault-bounded.

The visible economic minerals consist of copper staining of quartzite forming a ridge, and at the southern end of this ridge galena in diopside-garnet marble.

All three lithological units of the Oonagalabi group are present. The calcareous unit consists of forsterite marble and diopside-garnet marble. The magnesium-aluminium unit is represented by enstatite-spinel gneiss, accompanied in places by phlogopite gneiss with sapphirine and corundum-anthophyllite-spinel gneiss. Anthophllite-rich rock crops out over nearly the whole length of the prospect, and in one place contains oxidized copper minerals. The third unit, quartz-magnetite rock, is the most abundant rock-type in the prospect, and has a remarkable resemblance to gossan. Malachite and (?)smithsonite coat joints and fractures in the quartz-magnetite rock.

59. Harry Bore Prospect (after Fruzzetti, 1969b) (lat. 23°12'S, long. 133°56'E)

This prospect has been variously known as Harry's Creek, Harry's Bore, Snake Well, Baldissera's Prospect, and the Iona. It lies 6 km northwest of Harry Bore in the southern foothills of the Strangways Range. The deposit comprises intermittent malachite stains on magnetite-hematite-quartz rock along a strike-length of about 200 m. The country rock consists mainly of cordierite-feldspar gneiss; amphibolite, gneisses containing cummingtonite, grunerite, enstatite, and phlogopite, diopside marble, and diopside gneiss occur next to the quartz-magnetite rock.

Development consists of small pits and one iamond drill hole. Copper and lead values have been very low, but zinc has ranged up to 9.5% both in surface samples and in drill core.

Additional references: Adams, 1967; Dallwitz, 1966; Thomson, 1950b; Tipper, 1966.

60. Red Rock (Coles Hill) Prospect (after Fruzzetti, 1969c)
(lat. 23°03'S, long. 133°46'E)

Red Rock or Coles Hill Prospect is situated 3 km northeast of Red Rock Bore, at the western end of the Strangways Range. Two small copper showings occur in quartz-magnetite rock along a northwest-trending fault in gneiss. A regional survey detected a magnetic anomaly over the outcrop (Tipper 1969), and three holes diamond-drilled into the anomaly found disseminated pyrite, sphalerite, galena, and chalcopyrite in biotite-amphibole-quartz rock with a bluish tint suggesting the presence of cordierite also. Analysis of the core found averages of 1.62% zinc, 0.69% lead, and 0.25% copper over 16.5 m.

Additional references: Dodson, 1966, 1967; Faulks, 1966.

61. Woolanga Bore Prospect (lat. 23°07'S, long. 134°13'E)

Finely disseminated galena is present in poorly exposed forsterite marble about 6 km south of Woolanga Bore. The grade has not been determined.

62. Johannsen's Phlogopite Mine (lat. 23°14'S, long. 134°05'E)

Johannsen's Phlogopite Mine was opened around 1940 to exploit veins of very coarse phlogopite in coarse-grained cordierite-feldspar gneiss with minor mafic granulite. During the mining operations, zinc, copper, and lead minerals were also encountered. The material on the dump beside the mine indicates that these minerals were coarse-grained and massive, and were associated with a para-peridotite with minor calcite. Three diamond drill holes were put down by the Mines Branch of the Department of the Northern Territory but only one intersected significant metal values, mainly zinc, which ranged up to 3.3% (Morlock, 1971). Analysis for platinum was unrewarding, which is consistent with a metasedimentary origin of the peridotite.

Additional reference: Jensen, 1944.

GROUP 4: MINERAL DEPOSITS MOSTLY FORMED DURING THE ALICE SPRINGS OROGENY

The northern margin of the Amadeus Basin is marked by a severely deformed zone of faults, shearing, and greenschist facies metamorphism. The zone was activated in the Devonian and Carboniferous by the Alice Springs Orogeny, but appears to follow an old Precambrian deformation zone.

Several small mineral deposits occur in this zone. First to attract the attention of miners in 1887 were the gold lodes in the Arltunga-White Range area and the Eastern MacDonnell Ranges, followe by the Winnecke Field farther to the west. Mining began to decline after 1905, and crushing at the Arltunga Battery ceased in 1920. A short and less spectacular episode of mining occurred in the 1930s, when a few miners worked several small veins in the Claraville area.

The gold lodes consist of quartz and gold-bearing pyrite, with minor chalcopyrite in places. Large bodies of white quartz in the country rocks and in the lodes between the iron-rich regions carried virtually no gold. The lodes occur in the Arunta basement, whether deformed or not by the Alice Springs Orogeny, and in deformed and metamorphosed Heavitree Quartzite and (rarely) schist of the Bitter Springs Formation (Ciccone Mine). The most productive area was the White Range Field, where the lodes occupied

tension fractures in strongly deformed Heavitree Quartzite.

The origin of the lodes is not clear. The lodes in the metamorphosed Heavitree Quartzite are of Devonian to Carboniferous age, but those lying beyond the zone of intense deformation are not necessarily contemporaneous with them; two episodes of gold mineralization may have occurred, the second being a Devonian-Carboniferous mobilization of the first. The lodes are hypogene, with assemblages stable over a wide temperature range. If any of the lodes originated by mobilization of alluvial gold from the basal part of the Heavitree Quartzite, the assemblage shoul be gold-quartz, not auriferous pyrite-quartz.

The lead orebodies are small and occupy cross-cutting tension fractures near though not in the zone of intense deformation and metamorphism. They may have formed by mobilization of pre-existing lead lodes during the Alice Springs Orogeny.

63. Winnecke District (centred on lat. 23°19'S, long. 134°17'E)

Numerous quartz reefs were mined in the hills south of The Garden homestead along a zone that extended west from Georgina Gap for about 25 km. The gold occurred in cellular quartz, limonitic quartz, and pyritic quartz. The lodes were generally small, and, despite the optimism of early reports, unpayable at depth. Hossfeld (1940) considered that there had been considerable secondary enrichment near the surface, and the few shafts that exceeded 12 m, the depth at which pyrite appeared, encountered little payable material. Local prospectors report that very finely disseminated gold occurred in fine-grained kaolinic mica schist in at least one of the mines.

Records are available only for the period up to 1905, when Matthews (1905b) reported a total production of about 25 kg. Some time before Hossfeld's report in 1940 a pocket of ore in Garlands Claim produced 8.5 kg. The local prospectors have stated that much of the production, particularly that from alluvial sources, was not recorded.

Additional references: Matthews, 1905a; Brown, 1903; Hossfeld, 1936.

64. Glankroil Mine (after Hossfeld, 1937a) (lat. 23°18'S, long. 134°21'E)

The Glankroil (or Gander) Mine is about 6 km south of The Garden homestead. The lode is situated in two parallel shear faults striking north-northeast in the Arunta Complex, near the zone of Devonian-Carboniferous deformation. Mining was concentrated on the eastern line of lode, which

extends for about 300 m and ranges from a few centimetres to slightly over 1 m wide. The ore consisted of galena with minor copper carbonates beneath a cap of gossanous quartz. The galena contained considerable quantities of silver; analyses ranged up to 5000 g/tonne of silver, but generally were between 700 and 1200 g/tonne for selected samples. The copper carbonates do not appear to have been exploited. Brown (1903) regarded the mine as a gold prospect, but Hossfeld (1937a) reported only 3 g/tonne of gold as a maximum value. The limited production records available account for 47 tonnes of lead ore, but more may have been produced during the 1930s.

There are several shafts and open cuts, but none exceeds about 12 m and most are much shallower.

65. White Range Field (after Hossfeld, 1937b) (lat. 23°28'S, long. 134°46'E)

The White Range lodes were the major gold producers in the Arltunga area. The lodes occur on the north and northeastern sides of the White Range, a prominent mass of deformed Heavitree Quartzite (Fig. 4). Hossfeld described the lodes as quartz-pyrite-chalcopyrite bodies filling tension joints and fissures in a large-scale flexure in the quartzite. Near the surface the pyrite was converted to limonite with free gold, and the chalcopyrite was converted to oxidized copper minerals. Though reports do not mention secondary enrichment early reports mention 'the stone improving in depth', which suggests that some secondary enrichment had taken place.

The mines comprised small open-cuts and shafts which followed the quartz veins down on an underlay of 60° to a depth of about 20 m. Crushings at the Arltunga Battery up to 1913 produced 360 kg of gold from 6800 tonnes of ore treated. Hossfeld (1937b) sampled the mine dumps, and the results indicated that about 17 kg of gold was present in 7250 tonnes of ore.

Alluvial gold was obtained from the gullies and stream courses draining the White Range, but production was not recorded.

Additional references: Woolley & Rochow, 1963; Matthews 1905a, b; Hossfeld 1937c; Brown, 1896, 1902.

66. Wheal Fortune Group (lat. 23°25'S, long. 134°48'E)

The Wheal Fortune Mines are about 6 kms southeast of Claraville homestead, north of the White Range (Fig. 4). The mines exploited steeply dipping reefs consisting of quartz, calcite, siderite, and pyrite, and trending

a few degrees east of north parallel to a major fault nearby (Hossfeld, 1937c). In the oxidized zone pyrite is replaced by limonite. It is not certain whether the gold occurred in the quartz or in the pyrite; however the latter was probably the case, as reports mention that shallow workings were abandoned when pyritic ore was reached, as the latter could not be treated.

The country rocks consist of amphibolite, metapelite, and calc-silicate rock with an east-west strike, i.e. approximatealy perpendicular to the reefs.

None of the mines produced more than about 15 kg of gold from ore with a grade of about 4.5 g/tonne. Alluvial gold was obtained from creeks and gullies draining the area.

In the absence of evidence either way, these deposits are grouped with those that formed nearby during the Alice Springs Orogeny, but they may well be much older.

67. Wipe Out Group (lat. 23°24'S, long. 134°45'E)

Jenkins Mine and the Wipe Out Mine are included in this group (Fig. 4). They exploited quartz-calcite-pyrite reefs with an east-northeast trend in amphibolite country rocks. The veins were generally about 10 cm wide, and nowhere exceeded 30 cm. On the evidence of quartz rubble and calcrete, Hossfeld (1937c) suspected that more veins existed in the vicinity of Jenkins Mine. About 6 kg of gold were produced between 1935 and 1937.

The Wipe Out Mine was a long open-cut about 10 m deep. Minor amounts of copper carbonate were present in the reef, in addition to the major minerals.

68. Minor workings west of the Wipe Out Mine (lat. 23°24'S, long. 134°44'E)

Numerous quartz reefs occur west of the Wipe Out Mine (Fig. 4), but only a few carried enough gold to encourage mining. Hossfeld (1937c) considered that the abandoned workings in this area might include the No Name Mine and Standard Mine described by Brown (1903) and Matthews (1905). The reefs are unusual for the district in that pyrite is absent, the gangue consisting of quartz and calcite. In this case the gold should have been free milling below the water table, but the workings were no deeper here than elsewhere on the fields.

69. Round Hill Area (lat. 23°25'S, long. 134°45'E)

A number of narrow quartz-pyrite veins in dark grey meta-igneous gneiss were mined in the area west of Round Hill (Fig. 4). The gold occurred

in limonite which had replaced the pyrite. The veins were located on the walls of 'pseudo dykes', which Hossfeld (1937c) interpreted as indurated joints.

70. Claraville Mine (lat. 23°25'S, long. 134°43'E)

Little is known about the Claraville Mine, which appears to have been a small gold mine about 1 km northeast of Mount Gordon (Fig. 4). The ore occurred in narrow quartz veins in micaceous schist and sandstone.

71. Arltunga Lead Show (after Youles, 1964) (lat. 23°26'S, long. 134°42'E)

Galena and minor bismuthinite and pyrite occur in narrow discontinuous quartz veins up to 6 m by 60 cm in a shear zone about 2 km north of the old Arltunga Battery (Fig. 4).

72. Hale River Prospect (after Ruxton, 1963) (lat. 23°26'S, long. 135°01'E)

A small copper-gold prospect is situated about 24 km east-northeast of Atnarpa homestead. A network of quartz veins covering an area of about 1.5 km by 0.3 km crops out on both sides of the Hale River. Minor traces of copper carbonates occur at the margins of some of the veins and in the unoxidized part, very rare chalcopyrite can be seen. One vein has been gouged for a very small yield of copper ore. The veins strike east-northeast parallel to a zone of deformation, the Illogwa Shear Zone, that formed during the Alice Springs Orogeny.

Additional reference: Shaw & Milligan, 1969.

73. Tommy's Gap Copper Prospect (after Shaw, 1968b)
(lat. 23°37'S, long. 134°38'E)

The Tommys Gap prospect is about 0.5 km west of Tommys Gap itself. Ferruginous quartz veins stained with copper minerals crop out along a schistose zone in metapelite and calc-silicate rock; basic metavolcanic rocks crop out nearby. About 7 tonnes of ore was taken from a prominent quartz reef 300 m east of the gap. Traces of chalcocite and native copper also occur in fine-grained pelitic gneiss at the western end of the prospect. The veins may have been emplaced during the Alice Springs Orogeny, though the source of the minerals is probably the Arunta basement rocks.

Geophysical and geochemical sampling revealed minor anomalous zones associated with quartzite., but subsequent diamond drilling located only pyrite with minor arsenopyrite. Copper values were very low.

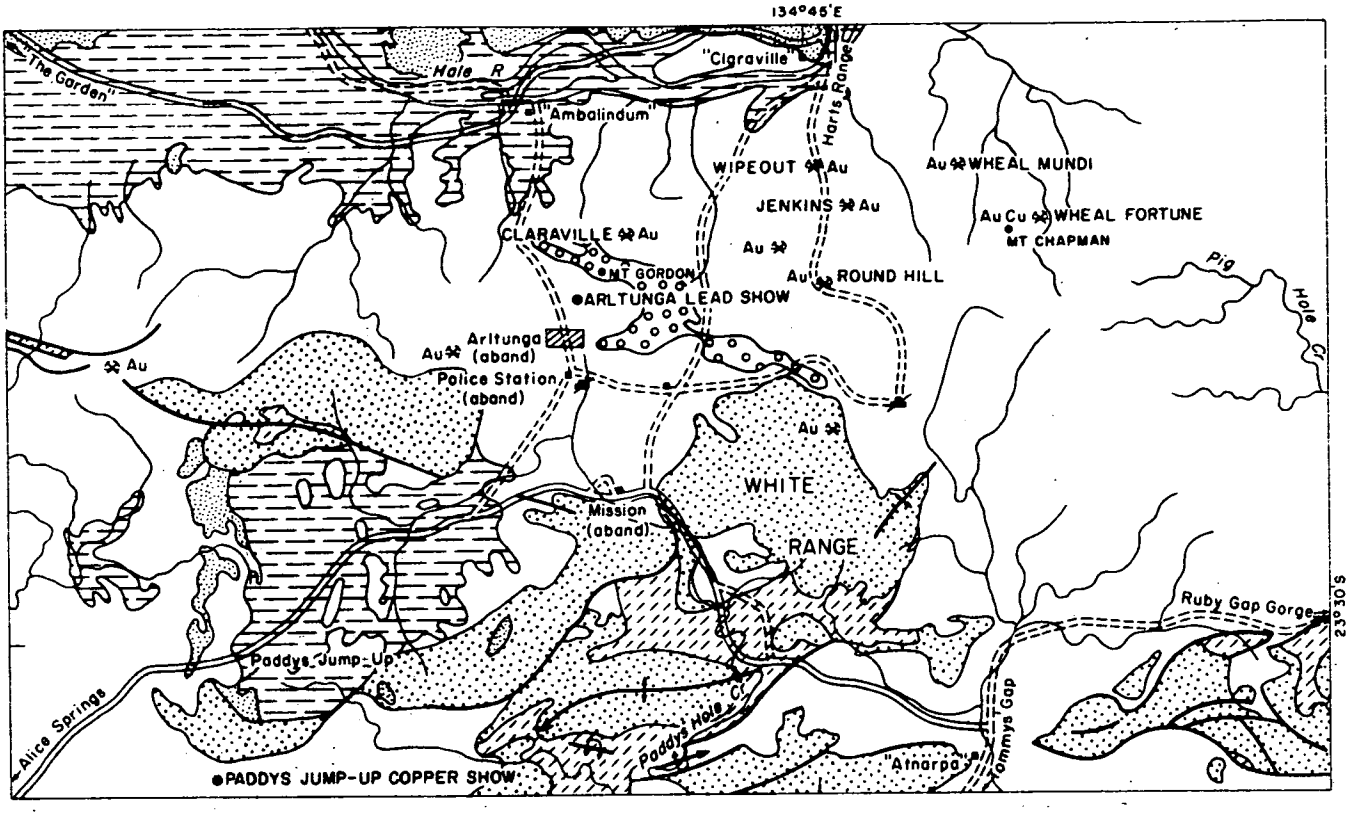

Fig. 4 Locality map for the Arltunga District

(Generalized from Alice Springs 1:250 000 Geological sheet (First Edition, 1968) published by Bureau of Mineral Resources)

GROUP 5: UNCLASSIFIED DEPOSITS

74. Inkamulla Dome ((a) lat. 23°05'S, long. 135°12'E: (b) lat. 23°03'S, long. 135°09'E)

(a) Coarse flakes of molybdenite occur in a horizon of the Entia Gneiss in the Inkamulla Dome at the eastern end of the Harts Range, but no mining has taken place (L.A. Johannsen, pers. comm.).

(b) Scheelite and rare earth minerals have been reported from a calc-silicate horizon in the hills west of Valley Bore (Anon, 1970b).

(c) Alluvial scheelite with traces of molybdenite and a bismuth mineral occur at the centre of the Dome, and at a locality about 5 km east of there (L.A. Johannsen, pers. comm.).

The following additional mineral deposits have been plotted on the map (Fig. 5) but are not individually described:

75. Ironstone on marble 5 km west-northwest of Mount Airy (lat. 22°29'S, long. 131°01'E)

76. Copper prospect 7 km west of Mount Strangways (lat. 23°02'S, long. 133°47'E)

77. Copper prospect 10 km west of Blackfellows Bones Bore (lat. 23°03'S, long. 134°24'E)

78. Copper prospect 5 km west of Blackfellows Bones Bore (lat. 23°04'E, long. 134°26'E)

79. Arltunga Goldfield (lat. 23°27'S, long. 134°39'E); (this is an administrative term only)

80. Yarraman Mine (Copper; lat. 22°39'S, long. 135°58'E)

81. King's Legend Mine (Copper; lat. 22°47'S, long. 136°06'E)

82. Ivy Mine (Tin; lat. 21°24'S, long. 133°57'E)

83. Tungsten prospect 1.5 km south of Ivy Mine (lat. 21°26'S, long. 133°55'E)

84. Tungsten prospect 2 km west of Neutral Junction homestead (lat. 21°31'S, long. 133°58'E)

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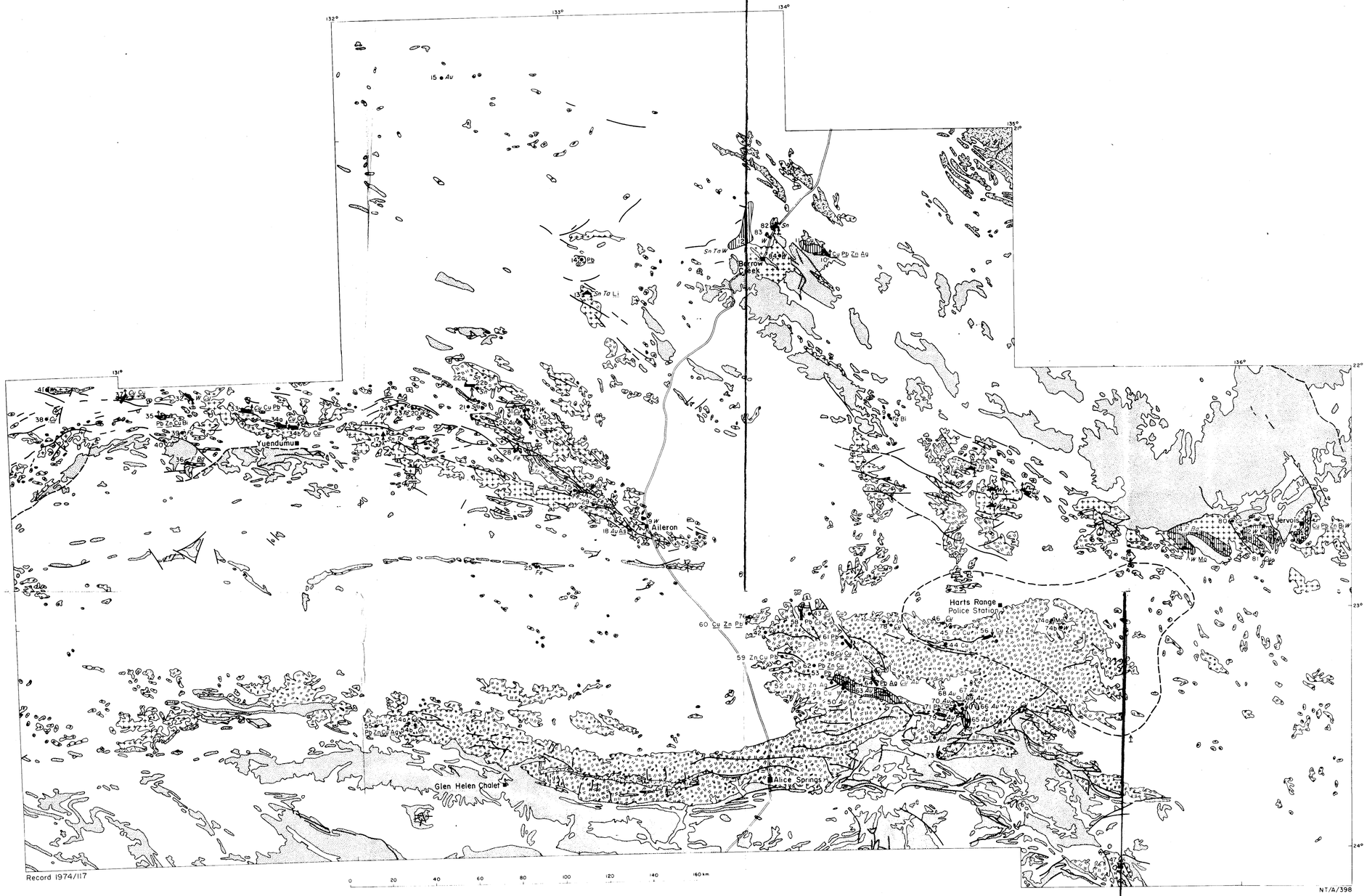

NUMBERED KEY TO MINERAL DEPOSITS

Number	Name	Latitude (S)	Longitude (E)
1.	Jervois Mining District	22° 40'	136° 16'
2.	Bonya Ore District	22° 43'	136° 05'
3.	Mobihil	22° 44'	135° 45'
4.	Iinka Ore District	22° 45'	135° 47'
5.	Perents Copper Prospect	22° 31'	135° 02'
6.	Delmore Downs Wolfram Lodes	22° 30'	134° 53'
7	Delney Wolfram Prospect	22° 34'	134° 53'
8.	Bundey River Tantalite Prospect	22° 25'	134° 48'
9.	Utopia Tantalite Prospect	22° 12'	134° 26'
10.	Home of Bullion Mine	21° 31'	134° 10'
11.	Home of Bullion District	21° 30'	134° 04'
12.	Barrow Creek District	21° 28'	133° 47'
13.	Annuigie Tin Field	21° 41'	133° 06'
14.	Mount Peake Lead Show (Griffith's Lead Show)	21° 31'	133° 05'
15.	Waldron's Hill	20° 45'	132° 29'
16.	Reward Copper Mine	22° 11'	132° 49'
17.	Mount Allan Tin Mine	22° 13'	132° 10'
18.	Aileron Gold Reefs	22° 39'	133° 17'
19.	Mount Boothby Wolfram Show	22° 37'	133° 20'
20.	Brookes Soak Wolfram Lodes	22° 07'	132° 19'
21.	Comston Tin Prospects	22° 07'	132° 34'
22.	Mount Stafford Tin Lodes	a. 22° 02' b. 22° 03'	132° 34' 132° 36'
23.	Double Dams Tantalite Deposit	22° 07'	132° 16'
24.	Double Dams Wolfram Prospect	22° 07'	132° 13'
25.	Patty Well and Stuart Bluff	22° 47'	132° 51'
26.	Pine Hill Gold-Copper Prospect	22° 11'	132° 47'
27.	Ingellina Gap Wolfram Show	22° 09'	132° 49'
28.	Barney's Ironstone	22° 19'	132° 46'
29.	Woodforde River Ironstones	22° 33'	133° 06'
30.	White Hill Yard Copper Show	22° 28'	133° 06'
31.	Lander Copper Prospects	22° 09'	132° 48'
32.	Wolfram Hill	22° 03'	131° 19'
33.	Mount Hardy Copper District	22° 07'	131° 33'
34.	Rock Hill Copper Prospects	22° 11'	131° 46'
35.	Jubilee Silver King Mine	22° 07'	131° 11'
36.	Vaughan Springs Fluorite Prospect	22° 11'	131° 12'
37.	Clark Copper Mine	22° 02'	131° 01'
38.	Bager Creek Copper Show	22° 07'	130° 40'
39.	Dingamara Banded Iron Formation	22° 12'	131° 17'
40.	Pattunupala Copper Prospect	22° 13'	131° 12'
41.	Wilson's Find (Mount Singleton Wolfram Mine)	21° 39'	130° 41'
42.	Tom Braun's Prospect	23° 05'	133° 52'
43.	Muller Creek Copper Prospect	23° 01'	134° 04'
44.	Copper Queen	23° 09'	134° 40'
45.	Selim's Deposit	23° 05'	134° 42'
46.	Virginia Prospect	23° 04'	134° 40'
47.	Arthur Pope's Prospect	24° 05'	135° 27'
48.	Pinnacles Lodes	23° 09'	134° 14'
49.	Sliding Rock Copper Prospect	23° 19'	134° 12'
50.	Turner's Prospect	23° 19'	134° 13'
51.	Paddy's Jump-Up Copper Show	23° 32'	134° 37'
52.	Gherko Prospect	23° 18'	134° 09'
53.	Rankin's Copper Prospect	23° 17'	134° 07'
54.	Glen Helen Prospects	a. 23° 26' b. 23° 27'	132° 15' 132° 17'
55.	Stokes Yard	23° 27'	132° 06'
56.	Oenagalabi Prospect	23° 07'	134° 32'
57.	Johnnie's Reward	23° 08'	134° 13'
58.	Edwards Creek Prospect	23° 01'	134° 01'
59	Harrys Bore Prospect	23° 12'	133° 56'
60.	Red Rock (Coles Hill) Prospect	23° 07'	133° 46'
61.	Woolanger Bore Prospect	23° 07'	134° 17'
62.	Johannsen's Phlogopite Mine	23° 14'	134° 05'
63.	Winnecke District	23° 19'	134° 17'
64.	Glankrol (Gander) Mine	23° 18'	134° 21'
65.	White Range Field	23° 28'	134° 46'
66.	Wheal Fortune Group	23° 25'	134° 48'
67.	Wipe Out Group	23° 24'	134° 45'
68.	Minor workings west of Wipe Out Mine	23° 24'	134° 44'
69.	Round Hill Area	23° 25'	134° 45'
70.	Claraville Mine	23° 25'	134° 43'
71.	Arltunga Lead Show	23° 26'	134° 42'
72.	Hale River Prospect	23° 26'	135° 01'
73.	Tommy's Gap Copper Prospect	23° 37'	134° 38'
74.	Inkamulla Dome	a. 23° 05' b. 23° 03'	135° 12' 135° 09'
75.	Ironstone 5 km WNW of Mount Airy	22° 29'	134° 01'
76.	Copper prospect 7 km W of Mount Stranguways	23° 02'	133° 43'
77.	Copper prospect 10 km W of Blackfellows Bones Bore	23° 03'	134° 24'
78.	Copper prospect 5 km W of Blackfellows Bones Bore	23° 04'	134° 26'
79.	Arltunga Goldfield	23° 27'	134° 39'
80.	Yarraman Mine	22° 39'	135° 58'
81.	King's Legend Mine	22° 47'	136° 06'
82.	Ivy Mine	21° 24'	133° 57'
83.	Tungsten prospect 1.5 km S of Ivy Mine	21° 26'	133° 55'
84.	Tungsten prospect 2 km W of Neutral Junction	21° 31'	138° 58'

ALPHABETICAL LIST OF MINERAL DEPOSITS

	Number
Aileron Gold Reefs	18
Annuigie Tin Field	13
Arltunga Goldfield	79
Arltunga Lead Show	71
Arthur Pope's Prospect	47
Barney's Ironstone	28
Barrow Creek District	12
Bonya Ore District	2
Brookes Soak Wolfram Lodes	20
Bager Creek Copper Show	38
Bundey River Tantalite Prospects	8
Claraville Mine	70
Clark Copper Mine	37
Coles Hill Copper Prospect	60
Comston Tin Prospects	21
Copper Prospect 7 km W of Mount Stranguways	76
Copper prospect 10 km W of Blackfellows Bones Bore	77
Copper prospect 5 km W of Blackfellows Bones Bore	78
Copper Queen	44
Delmore Downs Wolfram Lodes	6
Delney Wolfram Prospect	7
Djacamara Banded Iron Formation	39
Double Dams Tantalite Deposit	23
Double Dams Wolfram Prospect	24
Edwards Creek Prospect	58
Gander Mine	64
Gherko Prospect	52
Glankrol Mine	64
Glen Helen Prospects	54
Griffith's Lead Show	14
Hale River Prospect	72
Harrys Bore Prospect	59
Home of Bullion Mine	10
Home of Bullion District	11
Ingellina Gap Wolfram Show	27
Inkamulla Dome	74
Ironstone 5 km WNW of Mount Airy	75
Ivy Mine	82
Jervois Mining District	1
Iinka Ore District	4
Johannsen's Phlogopite Mine	62
Johnnie's Reward	57
Jubilee Silver King	35
King's Legend Mine	81
Lander Copper Prospects	31
Mount workings west of Wipe Out Mine	68
Mobihil	3
Mount Allan Tin Mine	17
Mount Boothby Wolfram Show	19
Mount Hardy Copper District	33
Mount Peake Lead Show	14
Mount Singleton Wolfram Mine	41
Mount Stafford Tin Lodes	22
Muller Creek Copper Prospect	43
Oenagalabi Prospect	56
Paddy's Jump-Up Copper Show	51
Pattunupala Copper Prospect	40
Patty Well	25
Perents Copper Prospect	5
Pine Hill Gold-Copper Prospect	26
Pinnacles Lodes	48
Rankin's Copper Prospect	53
Rankin's Reward	part of 36
Red Rock Prospect	60
Reward Copper Mine	16
Rock Hill Copper Prospects	34
Round Hill Area	69
Selim's Deposit	45
Sliding Rock Copper Prospect	49
Stokes Yard	55
Stuart Bluff	25
Tom Braun's Prospect	42
Tommy's Gap Copper Prospect	73
Turner's Prospect	50
Tungsten prospect 1.5 km S of Ivy Mine	83
Tungsten prospect 2 km W of Neutral Junction	84
Utopia Tantalite Prospect	9
Vaughan Springs Fluorite Prospect	36
Virginia Prospect	46
Waldron's Hill	15
Wheal Fortune Group	66
White Hill Yard Copper Show	30
White Range Field	65
Wilson's Find	41
Winnecke District	63
Wipe Out Group	67
Wolfram Hill	32
Woodforde River Ironstones	29
Woolanger Bore Prospect	61
Yarraman Mine	80

METALLOGENIC DATA

REFERENCE

- CAINOZOIC — Sand, alluvium, etc
- PROTEROZOIC-PALAEOZOIC — Sandstone, shale, dolomite, limestone, tillite
- Granite
- PRECAMBRIAN ARUNTA COMPLEX — Younger metamorphic rocks
- Older metamorphic rocks
- Geological boundary
- Fault

METALLOGENIC DATA

FORM OF DEPOSITS

- Veins: trend shown by symbol orientation
- Pipe
- Stratiform
- Irregular
- Unknown or minor
- Area of numerous deposits
- Harts Range and Plenty River Mica Field

GENESIS OF DEPOSITS

- Sedimentary (chemical)
- Hypogene
- Hypothermal
- Magmatic
- Pegmatitic

COMPOSITION OF DEPOSITS

- Cu — Sulphides
- Cu — Silicates
- Cu — Oxides, native metals, arsenic
- Cu — Carbonates, sulphates, arsenates
- Cu — Unknown

Ag - Silver; As - Arsenic; Au - Gold; Bi - Bismuth; Cu - Copper; F - Fluorine; Fe - Iron; Mo - Molybdenum; Pb - Lead; Sn - Tin; Ta - Tantalum; Zn - Zinc

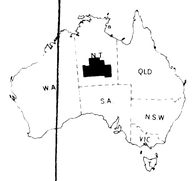

Fig 5 General geological map of Arunta Complex showing location of mineral deposits