DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
METALLIC MINERALS SECTION

REPORT ON INVESTIGATIONS OF MINERAL CLAIM 3493 - BILLEROO MINE

Glenorchy 1:63 360 sheet

by

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Rept.Bk.No. 73/233
G.S. No. 5235
D.M. No. 1395/61

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ABSTRACT

The Billeroo Mine, last worked for copper in 1909, is situated about 60 km from Manna Hill. A limited amount of copper ore has been raised and treated. The copper occurs as malachite, azurite and some chalcocite, as veins and infillings along fractures in pegmatite, quartz veins and schists within a narrow steeply dipping shear zone.

Much of the near surface copper ore has been removed and mining the remainder of the narrow steeply dipping mineralized zone is thought to be a doubtful economic proposition. Sorting of the mullock heap could recover up to 200 tonnes of copper carbonate rich rock suitable for treatment.

INTRODUCTION

This report records observations made on a visit to Mineral Claim 3493, following a request for advice received from the claim holder Mr. R.J. O'Connell.

The claim covers an area of about 15 hectares, and includes the Billeroo Mine that has been worked for copper (Brown 1908).

LOCATION AND ACCESS

The location of the mine is shown on Figs. 1 and 2. It is situated on the western slope of Billeroo Hill, about 60 km north of Manna Hill, on Plumbago Station. Manna Hill is about 360 km from Adelaide on the Barrier Highway and Commonwealth Railway line that connects Adelaide to Broken Hill. The Mineral Claim area is reached by an unsealed road leading north from the Barrier Highway near Manna Hill, via Weekeroo and Plumbago Homesteads.

GENERAL GEOLOGY

The rocks in the area are Lower Proterozoic basement rocks, collectively referred to as the Willyama Complex (Mawson 1912). These rocks make up the Willyama Block that forms a promontory of the Basement Shield which extends from the Olary Province of South Australia into New South Wales, where it is host for the great Broken Hill silver-lead-zinc deposits (Campana and King 1958).

The rocks in the Province consist of high grade metamorphic sillimanite garnet gneisses, intrusive adamellites, pegmatites, granitoid rocks, basic plugs and sills, foliated schists, meta-arkoses, altered dolomites and limestones. The basement fold axes have an overall northeasterly trend, reflecting the major structure of the gneisses, which is that of a vast synclinorium trending and plunging northeasterly.

The Mineral Claim is on an area mapped as felspathised schists and quartzites, grading to banded gneisses with abundant pegmatites and granite lenses (Campana 1955).

The Billeroo Mine is situated on a northeasterly trending shear zone in foliated schists with some pegmatite and quartz veining along the zone.

PREVIOUS WORKINGS

The Billeroo Mine was first opened about 1874 and worked intermittently up to 1909. A total of about 200 tonnes of ore has been reportedly raised with an average grade of about 20% copper. Six lodes have been described; three parallel and bearing northeasterly, two cross-courses and a "blow" (Brown 1908). Three shafts were sunk, the deepest about 35 m with a 6 m long drive at the bottom.

An old digging exists on the southeastern side of Billeroo Hill. It consists of a pit about 1 m deep that could be the remains of a back filled shaft. There are small concentrations of copper carbonate and some minor chalcocite at the altered contact between near vertical northeasterly striking schists and a cross cutting pegmatite. No material worthy of treatment appears to have been raised here.

DESCRIPTION OF WORKINGS

No one was present at the mine at the time of the visit, but there seems to have been some recent prospecting activity, two costeans have been excavated to the southwest of the present shafts.

The mine workings are situated on a shear zone (about 10 m wide) containing a pegmetite dyke, striking at 40° and dipping about 85° to the southeast, parallel to the schistosity of the surrounding rocks. The shear zone cuts across the steep western

side of Billeroo Hill forming a distinct break in slope. The shear appears to extend for at least 150 m northeast of the present workings and from observations in the costeans it also extends to the southwest under alluvial cover.

The following are some observations made at the various localities shown on Figure 2.

1. There is a vertical shaft about 35 m deep with a windless mounted at the top at this locality. The shaft appears to have been sunk just to the east of the mineralized zone so that it intersects it down dip at depth. The underground workings were not examined as there was no rope or ladder to provide access.

2. A vertical shaft about 7 m deep has been sunk here at the northeastern end of a backfilled open cut that has been excavated into the side of the hill following the mineralized shear zone. This zone is exposed in the wall of the shaft and is up to 1 m wide, with veins of malachite, azurite and chalcocite (Appendix A) up to 5 cms wide, quartz veins and ferruginous material. The zone strikes about 40° and dips 80° to the southeast, it is parallel to the schistosity of the surrounding rocks. Some minor drag folding occurs, indicating the movement that has taken place along this shear zone.

   Extending from the shaft is a large mullock heap containing an estimated 1500 tonnes of rock, some of which is rich in malachite and azurite along schistosity and joint planes.

3. A vertical shaft about 6 m deep has been excavated here along the strike of the mineralized zone exposed in the shaft at Locality 2. However no copper mineralization is to be seen here.

4. A vertical shaft has been sunk here. It is filled with water to 9 m from the surface, but the extent of the mullock heap suggests that the shaft is about 12 m deep. It is unlikely that the shaft has intersected the water table, but the recent heavy rains in the area could account for the flooding. The rock is less fractured here than in the other shafts, perhaps explaining why this shaft is flooded and the others are dry. The shaft lies to the north of the mineralized zone that passes through localities 1, 2 and 3.

5. A costean has been excavated for about 30 m across the strike of the country rock. It is about 2 m deep with some foliated schist exposed. The shear zone is exposed at the southern end with someassociated jarosite staining, but no copper mineralisation was observed.

6. A costean has been excavated here for about 60 m across the strike of the country rock and foliated mica schists are exposed. At the southern end of the costean a sheared pegmatite with jarosite staining occurs. A smaller shear zone also occurs at the northern end. No significant copper mineralization was observed in the excavation.

7. A shallow pit about 2 m deep has been excavated here exposing a ferruginous quartz vein (about 60 cms wide), containing some copper carbonate, striking about 90° and dipping 80° to the south. This vein is parallel to the schistosity of the surroundin

schists which show some quartzite bands parallel with the foliation. A quartz vein (strike 15° dip 85°E) with abundant copper carbonate staining cuts across the schistosity and the ferruginous quartz vein.

8. This is the position of a shallow pit (60 cms) in the side of the hill along strike from locality 2. Sheared pegmatite is exposed with some jarosite staining. No copper mineralization was observed.

9. A shallow trench has been excavated here in sheared pegmatite with some malachite and jarosite staining.

CONCLUSIONS AND RECOMMENDATIONS

The copper mineralization appears to have originated from the pegmatite, which probably contained disseminated primary copper sulphides. The copper in these sulphides has later become dissolved under oxidising conditions in the ground water and dispersed along the more permeable areas of this shear structure to produce several secondary mineralized zones.

The mineralized zones are relatively narrow (up to 1 m) and dip steeply to the southeast. It is considered that the costs involved in mining these zones would be high. The prospects of finding sufficient copper mineralization to make it a viable proposition are doubtful.

It would appear that the present workings have been sunk on the richest part of the mineralized shear zone, as the amount of visible copper carbonate tends to decrease to the northeast and southwest of the workings. However some yellow jarosite and minor black neotocite staining tends to occur to the northeast and

southwest along the shear, indicating the migration of weakly mineralized waters along this permeable zone.

Approximately 1500 tonnes of excavated rock containing copper carbonate has been dumped at the surface. Sorting of this material could yield up to 200 tonnes of product sufficiently rich tin copper to be suitable for treatment at the Burra Mine.

It is recommended that enquiries be made at the Burra Mine to determine if the copper carbonate rich material would be acceptable for processing. The value per tonne of material would depend on the grade of copper and the estimated treatment and transport costs.

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BJM:JL
5.10.73

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Campana, B., 1955. Olary Province Map Sheet, Geol. Atlas of S. Aust. 1:170 000 special series. Geol. Surv. of S: Aust.

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Appendix A

(Amdel Report On Cupriferous Mineral Samples)

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Please address all correspondence to the Director
In reply quote: MP 1/15/01

17 September, 1973

The Director,
South Australian Department of Mines,
PO Box 38 Rundle Street Post Office,
ADELAIDE, SA 5000

REPORT MP 1015/74

YOUR REFERENCE:	Application dated 6/9/73
MATERIAL:	Two cupriferous mineral samples
LOCALITY:	Near Billeroo Hill, Glenorchy 1-mile sheet, about 12 miles north of Plumbago H.S.
IDENTIFICATION:	P472/73, P473/73
DATE RECEIVED:	7/9/73
WORK REQUIRED:	Identification of grey mineral in both specimens

Investigation and Report by: Dr R. N. Brown and Sylvia Whitehead

Officer in Charge, Mineralogy/Petrology Section: Dr K. J. Henley

K. J. Henley.

for F. R. Hartley
Director

EXAMINATION OF GREY MINERALS

1. INTRODUCTION

Two copper-bearing samples from Billeroo Hill (P472-3/73) were received from Mr B. J. Morris of the Mines Department. Each contained a dark greyish area, the mineralogy of which was to be investigated.

2. PROCEDURE

Portions of each of the dark grey regions were extracted, powdered, and used for X-ray diffraction photographs.

Polished sections including the dark grey areas were made in each case and examined using reflected light microscopy.

3. RESULTS

3.1. X-Ray Diffraction

In both cases the diffraction photographs showed the abundant presence of malachite. There were faint indications of the presence of chalcocite. An examination of polished sections was required to determine the cause of the dark colouration.

3.2. Polished Sections

The following are mineragraphic descriptions of the two samples.

Sample: P472/73 (B3): PS 21216:

Polished Section:

The area sectioned contains the following minerals (visual estimate):

	%
Chalcocite	2-3
Cuprite	Trace-1
Tenorite or delafossite	Trace-1
Carbonate (malachite)	96
Silicate and other non-opaques	Trace

Chalcocite occurs as very porous or spongy aggregates and groups of small grains generally less than 0.1 mm in size in areas 1-2 mm across. It is associated with, and may have been partly replaced by, malachite although some occurs surrounding radiating aggregates of malachite crystals. Some of these zones contain up to 30% chalcocite. Higher concentrations occur in small zones adjacent to small intersecting carbonate veinlets.

Cuprite occurs as scattered, irregular and locally elongate grains between 0.05 and 0.4 mm in size. Some cuprite has accumulated in interstices between micaceous mineral grains and other non-opaque grains and some occurs along discontinuous veinlets. It shows anomalous anisotropism and it has been partly replaced by fine-grained aggregates of tenorite or delafossite.

A few separate small patches of tenorite or delafossite have probably also replaced cuprite.

One cuprite grain, 0.4 mm long, contains a few small inclusions of native copper.

The section contains a few scattered grains of a titanium mineral.

Sample: P473/73 (B6): PS 21217:

Polished Section:

The area sectioned contains the following minerals (visual estimate):

	%
Chalcocite	5-7
Goethite	3-5
Covellite	Minute trace
Tenorite?	Minute trace
Malachite and other non-opaque minerals	90

Most of the section contains non-opaque carbonate showing patches of green colour (malachite). Throughout the malachite there are abundant, small irregular grains of chalcocite generally between 0.005 and 0.02 mm in size, but varying up to 0.05 mm in size where higher concentrations of chalcocite occur. Some zones contain up to 25% chalcocite and these may be described as 'chalcocite which has been extensively veined and replaced by malachite'.

Fine lines and networks of very fine-grained goethite occur throughout parts of the malachite and there are a few porous masses of goethite.

Covellite occurs as very small grains associated with some of the chalcocite.

In one zone where malachite is intergrown with, or has replaced a micaceous mineral, there are a few small elongate grains of (?)tenorite.

4. CONCLUSION

The grey mineral is chalcocite which is disseminated through much of the malachite and imparts a dark colour to it.

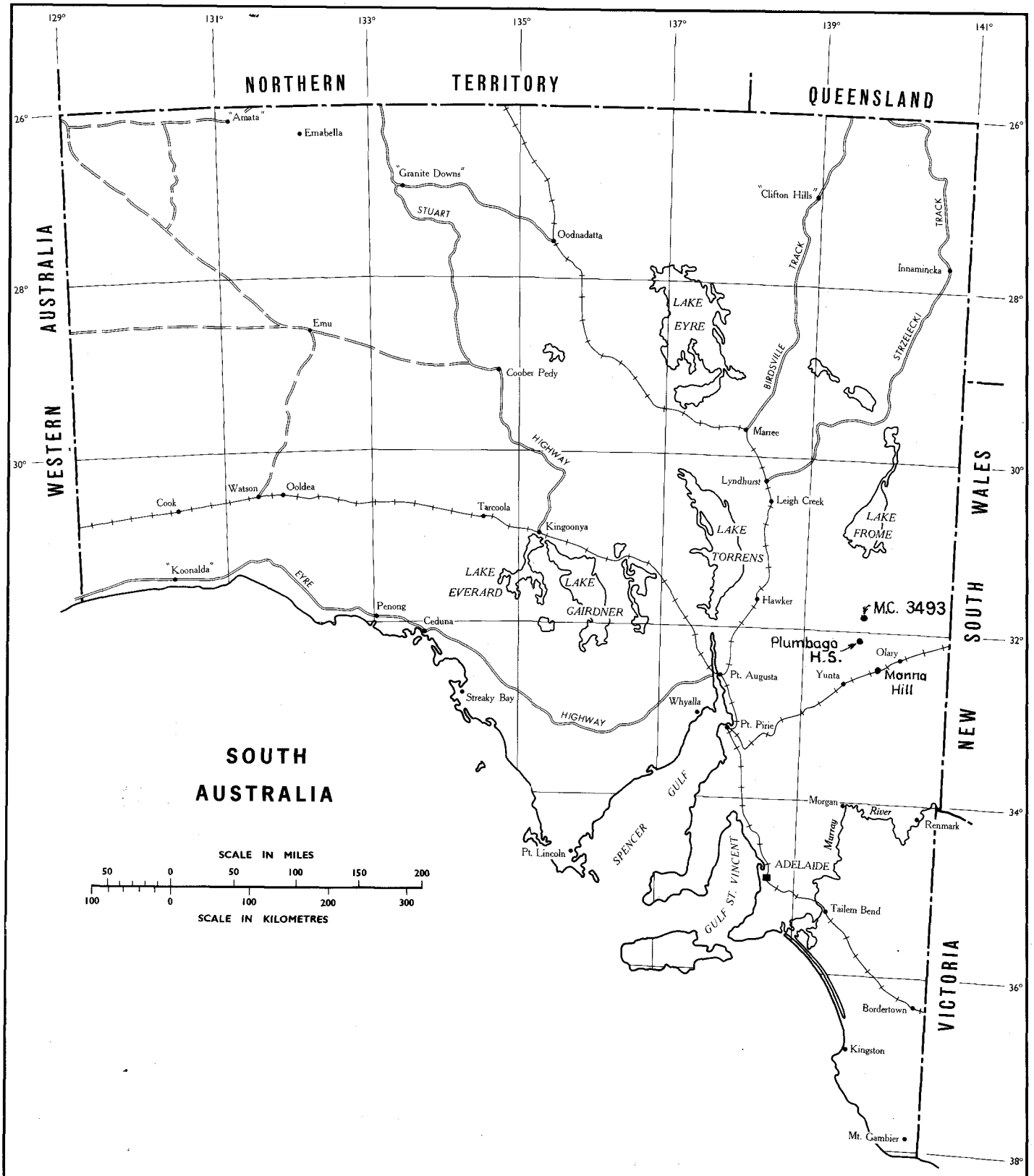
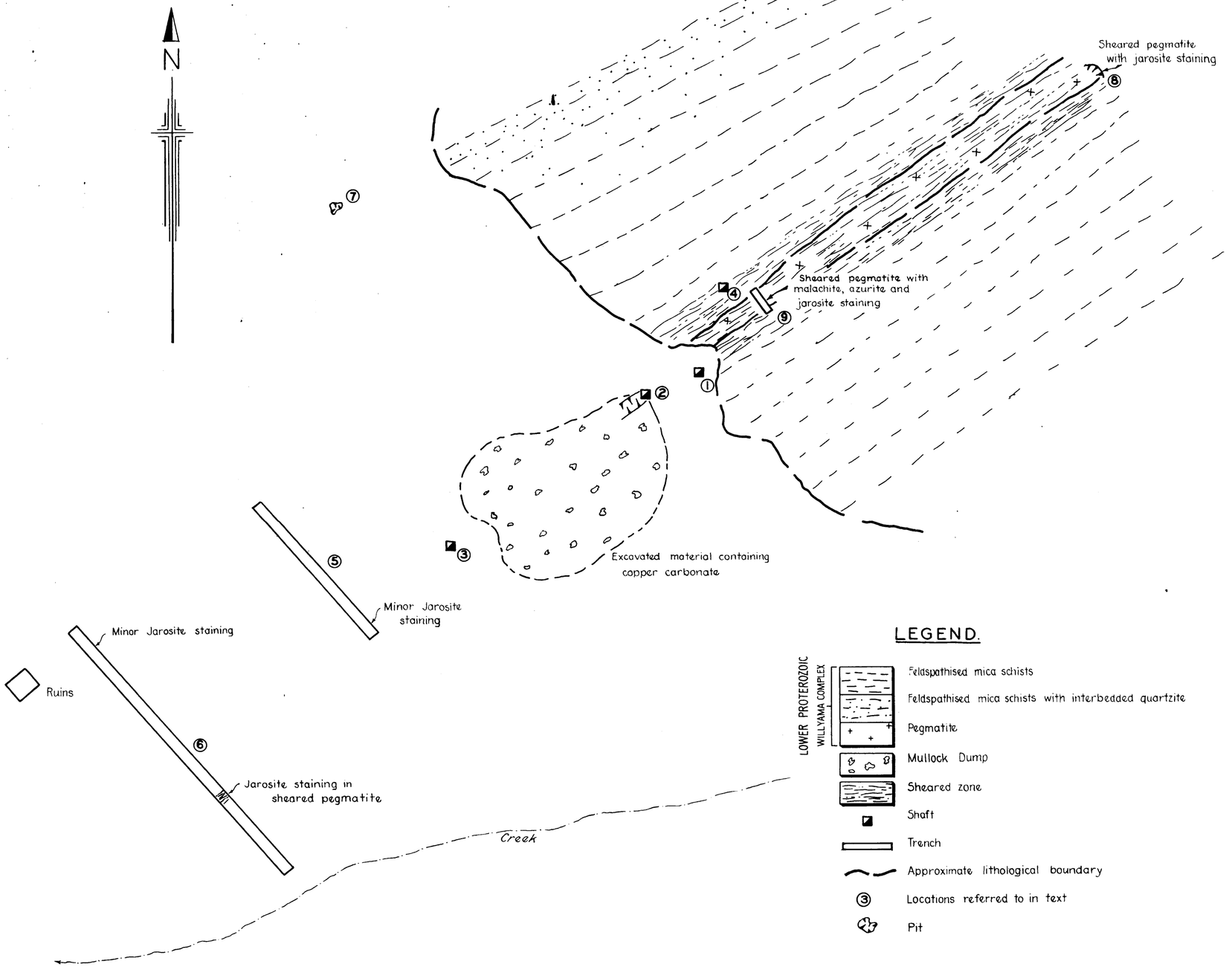


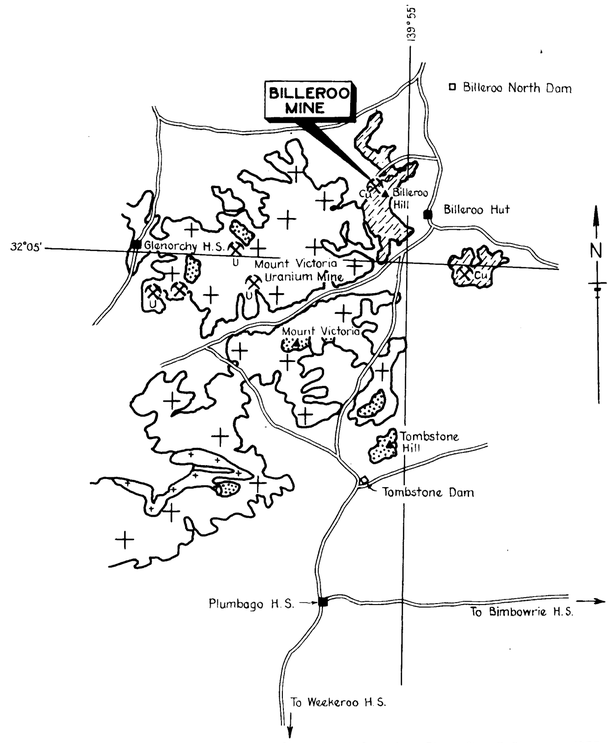
FIG. 1

DEPARTMENT OF MINES —— SOUTH AUSTRALIA

Compiled. B.J. Morris	MINERAL CLAIM 3493 BILLEROO MINE LOCALITY PLAN	Date: 18 Sept. 1973
Drn. TJE Ckd.		Drg. No. S 10486 Fl

P.F. No. S5850 994.2





LEGEND.

LOWER PROTEROZOIC WILLYAMA COMPLEX

- Feldspathised mica schists
- Feldspathised mica schists with interbedded quartzite
- Pegmatite
- Mullock Dump
- Sheared zone
- Shaft
- Trench
- Approximate lithological boundary
- ③ Locations referred to in text
- Pit

LEGEND.

LOWER PROTEROZOIC WILLYAMA COMPLEX

- Anatectic granite
- Major ademellite occurences
- Migmatites, granites, gneisses with pegmatites
- Feldspathised schists and quartzites with pegmatite and granite lenses
- U Uranium Mine
- Cu Copper Mine
- Fault zone

FIG. 2

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
MINERAL CLAIM 3493 – BILLEROO MINE SKETCH PLAN OF MINE AND REGIONAL GEOLOGICAL PLAN			
NON-METALLICS SECTION	B. J. Morris GEOLOGIST	Drn. BJM Tcd. TJE Ckd. Exd.	SCALE: 1:500 & 1:170000 73 – 655 FL DATE: 19th September 1973
Director of Mines			