DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

REPT.BK.NO. 81/86
NANKABUNYANA BARITE DEPOSIT, REPORT NO. 2 - GEOLOGICAL INVESTIGATIONS IN 1979. Out of Counties, Flinders Ranges.

GEOLOGICAL SURVEY

by

W.S. McCALLUM

MINERAL RESOURCES

DME.505/76

FRONTISPIECE: Nankabunyana Barite Deposit.

View west over Open Cut No. 2, the northeastern open cut. The loading ramp is to the left of the Land Rover, with Lake Torrens on the horizon.
June, 1978. Slide No. 22357

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DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Rept. Bk. No. 81/86
D.M. No. 550/76

NANKABUNYANA BARITE DEPOSIT, REPORT NO. 2
Geological Investigations in 1979

Out of Counties, Flinders Ranges

ABSTRACT

The Nankabunyana Barite Deposit is in a Class B Environmental Area in the western Flinders Ranges. Recorded production is 125 tonnes in 1978, from 2 open cuts in ML 4598.

Barite has formed in steep fracture zones which cut the bedding of the enclosing siltstone and carbonate rocks of the Wonoka Formation, part of the Wilpena Group of Adelaidean age. The white coarsely crystalline barite is iron rich, siliceous and calcareous in part.

The barite is suitable for oil drilling purposes. Selective mining is required to produce low grade industrial barite.

Indicated reserves total 2 250 tonnes, to approximately 5 m to 10 m below ground surface, with a further 2 400 tonnes inferred underlying this.

INTRODUCTION

During an inspection of barite deposits in the Flinders Ranges, Nakabunyana Barite Deposit was mapped on 26th June 1979. The accompanying geological plan and Lode Section (Fig. 4) is based on a plane table survey by the author, J.G. Olliver (Supervising Geologist), L.C. Barnes (Senior Geologist) and T. Papanikolas (Field Assistant).

Two chip samples from the north eastern open cut, and one chip sample from the south western open cut were submitted to the Australian Mineral Development Laboratories (AMDEL) for chemical

analysis and the determination of specific gravity and reflectance. Results are listed in Appendix A.

The deposit was mapped in 1975 by Scott and Olliver (1979), prior to open cut mining. This report updates that report to include subsequent open cut mining. Only the open cuts were mapped by plane table in 1979; the remainder of the geological plan (Fig. 4) is adapted from Scott and Olliver (1979). Results of analyses of 4 samples from Scott and Olliver (1979) are reproduced in Appendix A.

LOCATION

Nankabunyana Barite Deposit is located on Myrtle Springs Station, out of Counties, 16 km west of Copley and 8 km northwest from Mount Scott (see Fig. 2). The deposit lies within a Class B Environmental Area as defined in the Flinders Ranges Planning Area Development Plan (see Fig. 1), which states that:

> 'Any mining activities should be carried out so as to minimise their effects on the scenic and natural qualities of these areas'.

The site is below the southwestern flank of the range of hills containing Mount Scott, on the western margin of the Flinders Ranges and is of low scenic quality, remote from tourist roads, with gently undulating and sparsely vegetated terrain extending westwards for 40 km towards Late Torrens.

Access is northwards from Beltana, turning off to the west 14.5 km along the Hawker-Leigh Creek Road. A seldom used station track is followed west for 5.0 km, thence 15.6 km northwest to Nakabunyana Well and a further 1.9 km along a poorly defined track (see Access Plan Fig. 3). A four-wheel drive vehicle should be used due to the poor condition of these tracks.

MINERAL TENURE AND PRODUCTION

As reported by Scott and Olliver (1979), there was no record of mineral claims being pegged or leases granted over the deposit and no record of any production prior to 1975.

On 15/8/77, G.C. Spurling pegged the deposit and M.C. 848 of 5 ha was registered on 13/9/77. M.L. 4598 was granted on 9/2/78 for 7 years. On 16/10/79, an order was placed prohibiting further mining on ML 4598, because of non payment of the bond.

The recorded production by G.C. Spurling is as follows:

6 Months Ending	Tonnes
30/6/78	34
31/12/78	91
TOTAL	125

DESCRIPTION

Workings comprise two open cuts approximately 125 m apart, extending northeasterly and surrounded by dump material which has been pushed to the northeast and southeast of each cut (Fig. 4). The southwestern open cut (Open Cut No. 1) is 85 m long, 8 m wide, and up to 5 m deep. A short access ramp leads to the north from the open cut. The north eastern open cut (Open Cut No. 2) is 95 m long, 10 m wide and up to 10 m deep. A loading ramp has been built on dump material immediately to the south of the open cut. Both cuts were opened on the south eastern side, ie hanging wall side, of the north easterly striking barite veins. This work was completed in the first half of 1978 by M. Kuchel under contract to G. Spurling. Most of the recorded barite production was probably from Open Cut No. 2, and considerable amounts of barite are still left in the open cut face.

When mapped in 1975 (Scott and Olliver, 1979), workings comprised a small trench and two shafts. The 12 m long trench is between the two open cuts, and the two shafts are visible in the northwestern wall of Open Cut No. 2. Shaft 1 and Shaft 2 were 7 m and 2 m deep respectively. As shown on the Lode Section (Fig. 4), a small amount of barite was removed by gouging from Shaft 1.

Open Cut No. 1 corresponds to Zone C from Scott and Olliver 1979, Open Cut No. 2 to Zone A, and barite in between the two open cuts to Zone B.

GEOLOGICAL SETTING

The accompanying regional geology plan and stratigraphic table (Fig. 2) is based on part of COPLEY (Coats, 1973).

Barite has formed in southwesterly trending fault zones parallel to the major fault near Mount Scott which displaces the Adelaidean strata (see Fig. 2). The steeply dipping lodes are enclosed by interbedded siltstone, dolomite and limestone of the Wonoka Formation, a unit within the Wilpena Group, part of the sequence of Adelaidean sediments. The deposit is of the infilled fissure type originating from structural movement.

SITE GEOLOGY

Country rock comprises poorly outcropping, interbedded, purple and red micaceous shale and siltstone with occasional grey dolomite bands. Bedding is relatively consistent, with strike varying from 128^0 to 200^0, and dip to the east and northeast from 18^0 to 32^0.

Low outcrop of white barite extends intermittently for 450 m in a southwesterly direction. Dip varies from vertical to 80^0 to the southeast.

Width of the lode ranges from thin stringers, to a maximum of 2.6 m reported by Scott and Olliver (1979) at the south

eastern extremity within Open Cut No. 1. Barite visible in 1979 in Open Cut No. 1, was generally 0.6 m wide or less, comprising several discontinuous subparallel veins, while the barite in between Open Cuts No. 1 and 2, is one continuous vein, up to 0.6 m wide. In Open Cut No. 2, barite is a continuous vein, up to 2.5 m wide, but generally between 0.5 m and 1.2 m wide (Plate 1 and 2).

Barite crops out for another 150 m north east of Open Cut No. 2 beyond ML 4598 as a discontinous series of lenses and pods, generally up to 0.5 m wide. A subsidiary vein, 30 m long, and 0.5 m wide, is 70 m south east of the main line of lode.

Outcrop consists essentially of white barite. Barite to the south west of the small trench in between the two open cuts is black with iron and manganese oxides. Many of the lenses and pods northeast of Open Cut No. 2 are siliceous in part.

Terminations of the barite veins and junctions are expected to plunge northeasterly at 25^0 - 35^0, parallel to the dip of the country rock, which strikes approximately at right angles to the lode. The keel of the lode visible in the south west of Open Cut No. 1 appears to follow this trend.

QUALITY OF THE BARITE

The samples submitted for testing are described in Table 1. Locations are shown on Figure 4.

TABLE 1

Description of Samples

1) Samples from Scott and Olliver, 1979

Sample No.	Type	Description
P1835/75	Selected	Mottled white and pale pink barite, radiating, coarse platy crystals.
P1836/75	Selected	White, coarsely crystalline barite with minor brown patches and a black veneer or iron oxide and manganese on some faces.
A1887/75	Grab	From floor of trench in between Open Cuts 1 and 2.
A1888/75	Composite chip	From barite fragments scattered near Shafts 1 and 2, top of Open Cut No. 2

2) Samples Collected in 1979.

A2561/79	Chip	Base of Open Cut No. 2, from thickest barite.
A2562/79	Chip	Base of Open Cut No. 2, base of Shaft 1.
A2563/79	Chip	Top of Open Cut No. 1, from thickest barite.

The barite is generally coarsely crystalline, white and opaque with pink and brown patches. The non-transparent zones are due to minute voids and inclusions and scattered small grains of quartz and dolomite. Petrological reports on samples P1835/75 and P1836/75 are included in Scott and Olliver (1979).

Fractures and some cleavage faces are stained yellow-brown by limonite and occasionally black by vernadite (manganese hydroxide).

Results of laboratory testing are summarised in Table 2 from data in Appendix A.

TABLE 2

SUMMARY OF TEST RESULTS

Sample No.	(Ba + Sr) SO_4	SiO_2	CaO	Fe_2O_3	SG	Brightness
P1835/75	98.8	0.18	0.47	<0.01	4.41	83.4
P1836/75	97.8	1.24	0.27	0.10	4.40	64.3
A1887/75	95.5	1.58	1.53	<0.01	4.32	81.3
A1888/75	98.5	0.56	0.43	0.06	4.42	73.6
A2561/79	87.7	5.28	2.89	0.38	4.00	56.3
A2562/79	97.8	0.99	0.56	0.08	4.41	79.0
A2563/79	87.9	6.04	1.74	0.48	4.15	65.0

Five of the seven samples satisfy specification DFCP-3 of the Oil Companies Materials Association (U.K.) which requires barite for oil drilling purposes to:

- contain at least 92% $BaSO_4$
- have a specific gravity of at least 4.2
- contain less than 250 ppm soluble alkaline earth expressed as calcium
- several percent of iron oxides are permitted.

Samples A2561/79, A2563/79, from Open Cut No. 2 and No. 1 respectively, fail to meet oil drilling specifications, and have excessive silica with 5.28% and 6.04% SiO_2 respectively, and carbonate, with 2.89% and 1.74% CaO respectively. This results in low total sulphate (Ba SO_4 + $SrSO_4$) and hence low specific gravity. These two samples also have very high loss on ignition (LOI) reflecting the presence of carbonate.

Industrial grade specifications for glass manufacture, fillers and pigments as described in the American Society for Testing Materials Specification D602-42 for pigments, requires barite to be white and to contain:

- at least 94% $BaSO_4$
- not more than 0.05% Fe_2O_3
- not more than 0.2% soluble salts
- not more than 0.5% moisture and volatiles
- not more than 2% quartz, clays and foreign mateirals.

Samples A2561/79, A2563/79, which fail to meet oil drilling specifications fall far short of industrial grade specifications. Of the remaining five samples, four are marginally below industrial grade specifications, with samples A1836/75, A18888/75 and A2562/79, having excess Fe_2O_3, and sample A1887/75 having excess silica and carbonate. Sample P1835/75 meets specifications.

Industrial grade barite must be white, and this is generally accepted as a brightness in excess of 90 for A grade barite. Brightness for the 7 samples ranges from 56.3 to 83.4, with a higher brightness being related to lower Fe_2O_3 content.

RESERVES

Reserves outlined in Table 3 are based on the following data:

- a specific gravity of 4.3, reduced from sp. gr. of 4.4 for pure barite, to allow for impurities.
- lode lengths from the geological plan (Fig. 3) and estimated average widths.
- assumed keels and crowns of lodes dipping approximately 25^0 to the north east.

PLATE 1. Nankabunyana Barite Deposit. View south west in Open Cut No. 2, with remnants of barite exposed on north western wall.
June 1978.
Slide No. 22358

PLATE 2. Nankabunyana Barite Deposit. Open Cut No. 2, view up old Shaft I, with remnant barite in Wonoka Formation siltstone.
June, 1978
Slide No. 22359

Reserves have been calculated down to:

- 90m RL, ie 5-10 m below natural ground surface corresponding to the floor of Open Cut No. 2. These reserves are classed as indicated.
- From 90 m RL down to 85 m RL. These reserves are classed as inferred.

All reserves are geological, and do not allow for losses during mining.

No reserves were calculated for barite in Open Cut No. 1, as the vein is thin and discontinuous. No reserves were calculated for barite northeast of Open Cut No. 2, as the veins are intermittent, siliceous in places, and much is outside ML 4598. Reserves for Open Cut No. 2 and for the barite in between the two open cuts is summarised in Table 3.

TABLE 3

RESERVES OF BARITE

		In between Open Cuts 1 & 2	Open Cut No. 2	Total
Length of Lode	(m)	75	90	165
Average width	(m)	0.3	1.0	
Surface area	(m^2)	22	90	120
Barite to 90 m RL	(tonnes)	550	1700	2250
Barite from 90 m RL to 85 m RL	(tonnes)	500	1900	2400

To gain the reserves to 90 m RL in Open Cut No. 2, the open cut must be extended 50 m to the north east, for a total length of 140 m and an average depth of 10 m, with the removal of approximately 10 000 tonnes of country rock. Mining to 85 m RL would necessitate a north easterly extension of another 20 m requiring removal of another 10 500 tonnes of country rock.

These tonnages assume an average width of 7.5 m for the open cut, and specific gravity of 2.2 for siltstone.

Mining of barite to 90 m RL in between the two open cuts would require an open cut 95 m long and up to 8 m deep, ie the removal of 9 000 tonnes of country rock. Mining to 85 m RL, would involve extending the pit 20 m to the north east, and removal of an additional 9 000 tonnes of country rock.

CONCLUSIONS

Total recorded production of barite from the Nankabunyana Deposit, west of Copley in the Flinders Ranges in a Class B Environmental Area, is 125 tonnes, mined in 1978 by G.C. Spurling from ML 4598. This tonnage was produced from two open cuts up to 10 m deep.

The barite consists of one vein, up to 2.5 m thick, but averaging 0.5 m to 1.0 m, with numerous small offshoots and sub parallel veins and is discontinuous and poddy for much of its length. The barite strikes north east for a total length of 450 m, and dips steeply to the south east. These veins are considered to have formed by migration of barium sulphate from surrounding Wonoka Formation siltstone, with redeposition in open fracture zones. The keels and crowns of the lodes may dip 25^0 to the north east, parallel to the dip of the country rock.

Five of the seven samples tested meet specifications for oil drilling grade barite. Oil drilling grade barite could be produced by rejection of barite containing excess silica and carbonate, or by mixing. Careful selection of higher grade barite, could yield lower grade industrial barite. 'A grade' industrial barite requires a brightness of 90, and no samples achieved this.

Indicated reserves total 2 250 tonnes to an R.L. of 90 m, 5m to 10m below ground surface, with an inferred 2400 tonnes for a further 5m underlying this. Considerable earth moving would be required to gain this barite.

Wayne McCallum

WSMcC:RS

W.S. McCALLUM

GEOLOGIST

REFERENCES

Coats, R.P., 1973. COPLEY Sheet, Geological Atlas of South Australia, 1:250 000 series. Geol. Surv. S. Aust.

Scott, D.C., and Olliver, J.G., 1979. Nankabunyana Barite Deposit. Mineral Resour. Rev. S. Aust., 145: 98-103.

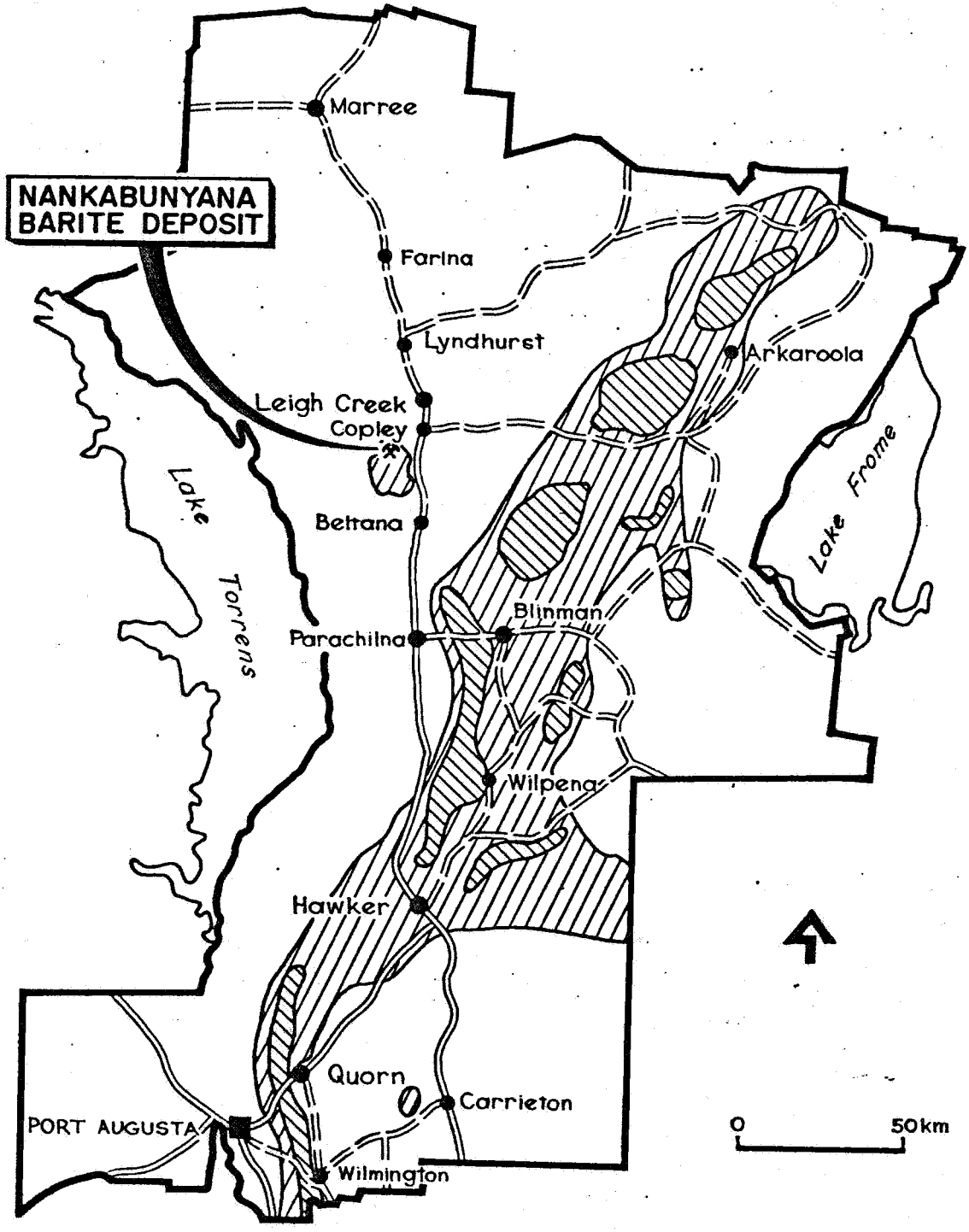
Wilson, R.B., 1958. Report on Inspection of Barytes Deposits in the Copley Area, South Australia. Report by Geosurveys of Australia Ltd. for Minerals (S.A.) Ltd. (unpublished).

APPENDIX A

PHYSICAL AND CHEMICAL ANALYES

Extracted from AMDEL Report MT 148/76 and MT 149/76
by A.W.G. Spencer, and AMDEL report MD 263/80 by L.J Day

Sample No.	P1835/75	P1836/75	A1887/75	A1888/75	A2561/79	A2562/79	A2563/79
Chemical Content (%)							
$BaSO_4$	96.3	93.7	93.4	95.2	85.5	95.0	86.0
$SrSO_4$	2.50	4.06	2.10	3.30	2.24	2.78	1.94
SiO_2	0.18	1.24	1.58	0.56	5.28	0.99	6.04
Al_2O_3	<0.01	0.09	0.01	<0.01	0.03	<0.02	0.33
Fe_2O_3	<0.01	0.10	<0.01	0.06	0.38	0.08	0.48
CaO	0.47	0.27	1.53	0.43	2.89	0.56	1.74
K_2O	<0.01	0.02	<0.01	<0.01	0.15	0.07	0.03
LOI	0.62	0.53	1.33	0.43	3.20	0.40	3.35
Soluble Alkaline Earths as Ca ppm	50	30	55	40	89	54	54
Physical Properties							
Specific Gravity	4.41	4.40	4.32	4.42	4.00	4.41	4.15
Brightness (R457)	83.4	64.3	81.3	73.6	56.3	79.0	65.0
Yellowness (R57-R457)	7.1	10.6	6.8	8.0	15.8	10.4	16.7
Staining	-	-	medium	low	-	-	-



ENVIRONMENTAL AREAS

- Class A
- Class B
- Class C

- Country Township
- Special Township
- Main road
- Secondary road

FIG.1

DEPARTMENT OF MINES — SOUTH AUSTRALIA

INDUSTRIAL MINERALS SECTION	Drn. J.G.O.	FLINDERS RANGES PLANNING AREA	SCALE: 1:2 000 000
	Tcd. A.R.	NANKABUNYANA BARITE DEPOSIT	S12433
J.G. Olliver	Ckd.	LOCALITY PLAN	
	Exd.		DATE: 21ST. OCT. 1976

500—2.69 665

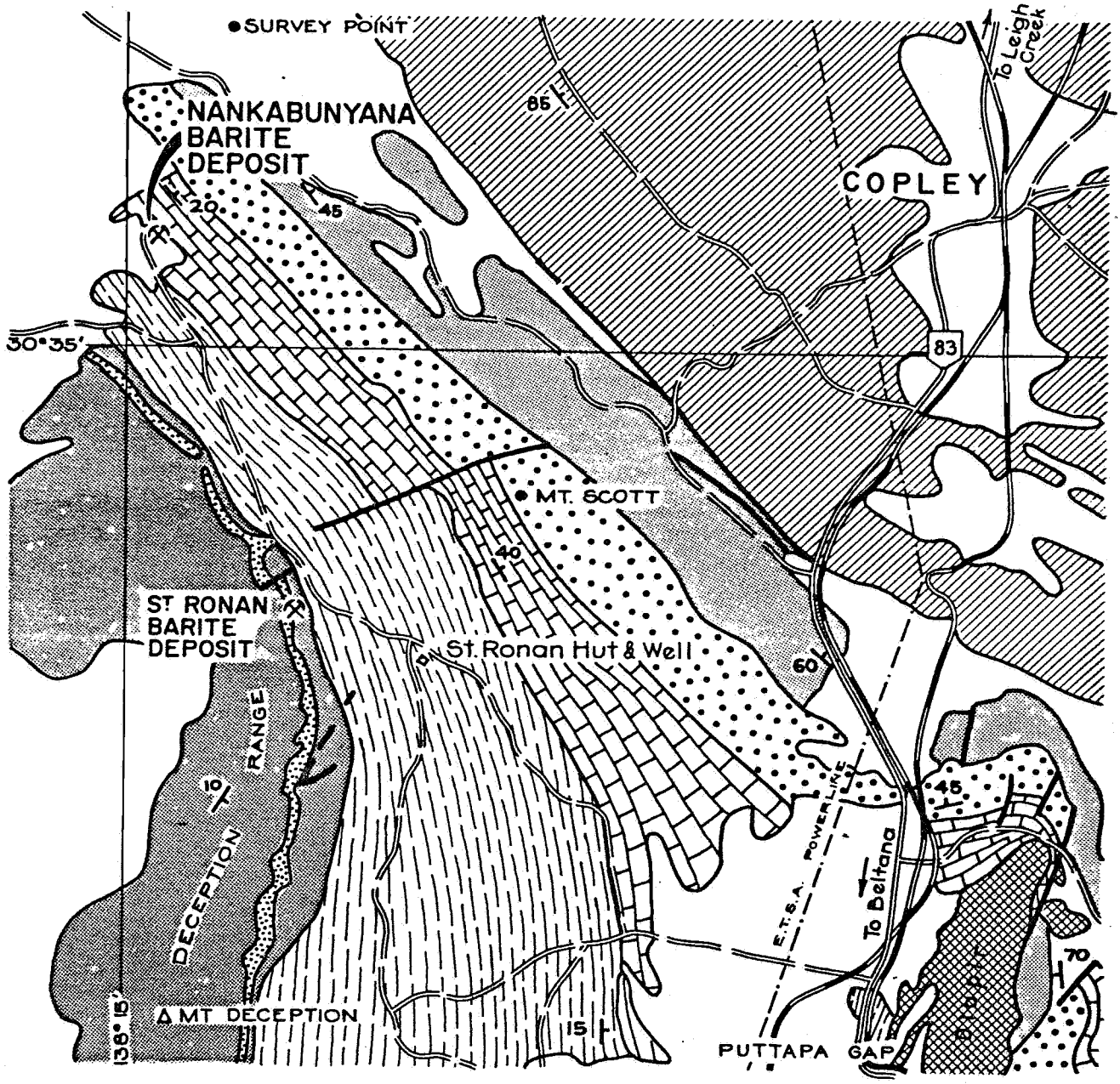
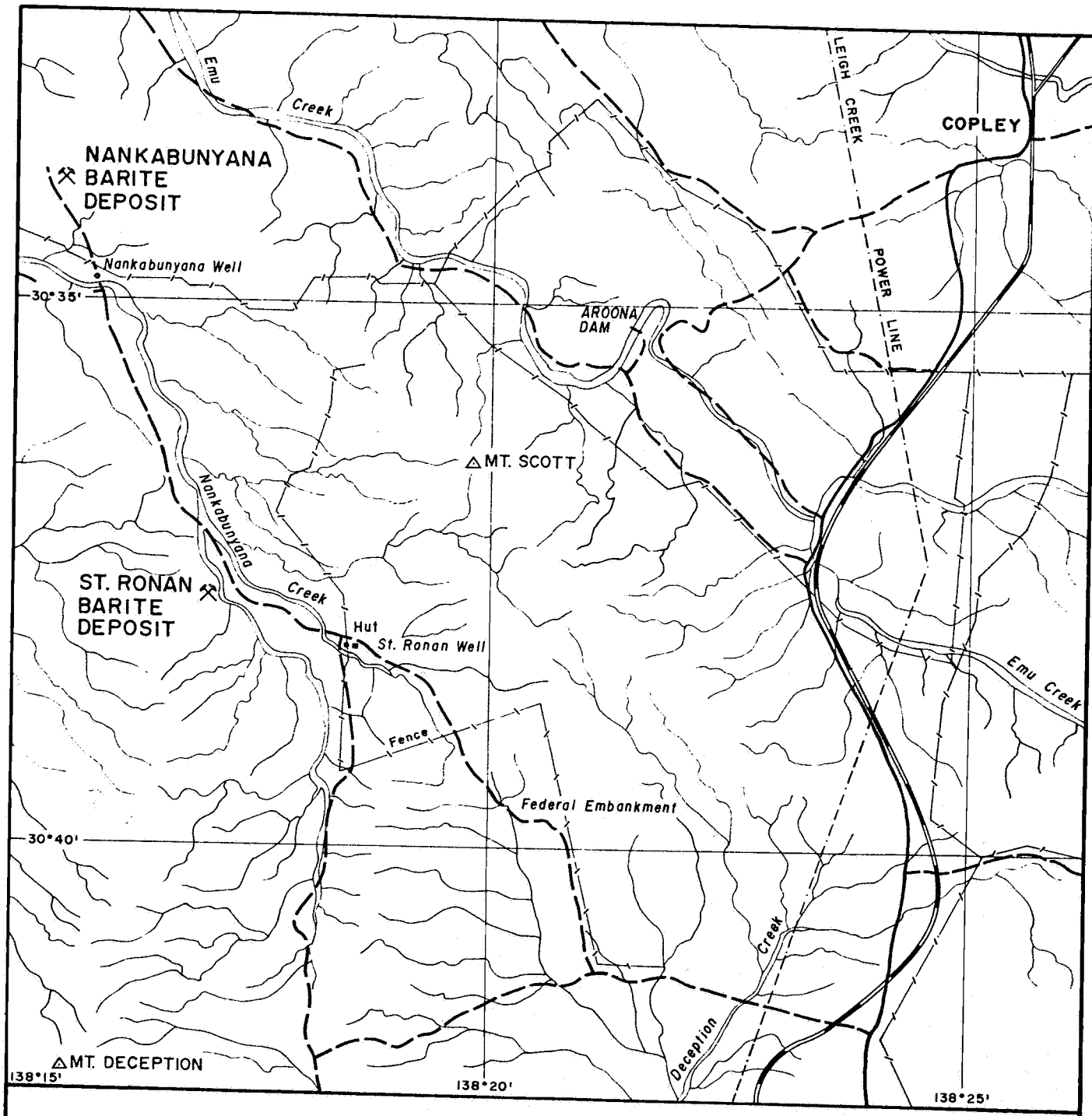


FIG. 2

INDUSTRIAL MINERALS	DEPARTMENT OF MINES – SOUTH AUSTRALIA	SCALE: 1:25,000
COMPILED: J.G. Olliver.	NANKABUNYANA BARITE DEPOSIT WESTERN FLINDERS RANGES REGIONAL GEOLOGY	DATE: 3RD. NOV. '76
DRN: A.R. CKD.		PLAN NUMBER: S12434



SCALE

KILOMETRES 2 0 2 4 6 8 10 KILOMETRES

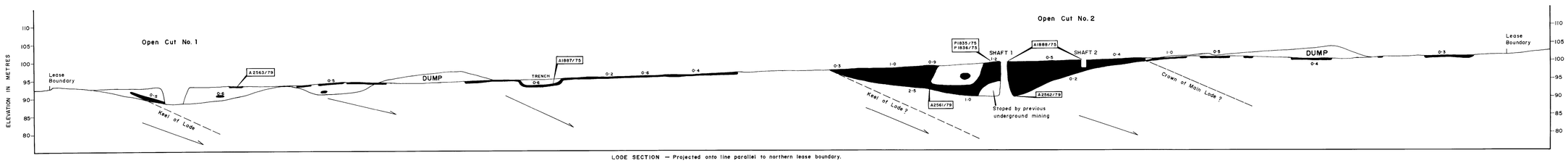
Fig. 3

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

NANKABUNYANA BARITE DEPOSIT
WESTERN FLINDERS RANGES
ACCESS PLAN

COMPILED W. S. M.	C.D.O. DATE
DRAWN M. B.	SCALE 1 : 100 000
DATE 9-9-81	PLAN NUMBER
CHECKED	S15757

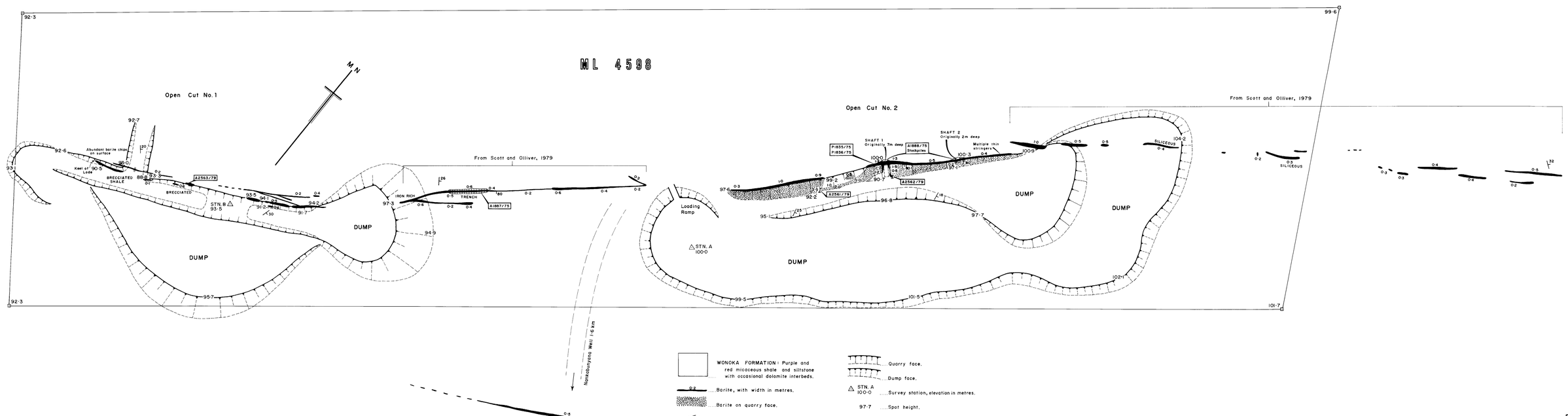
2578



LODE SECTION — Projected onto line parallel to northern lease boundary.

Horizontal Scale, Vertical Scale = 1:500

ML 4598



NOTE : Geology within quarries mapped by plane table, by W.S.M., L.C.B., J.G.O., 26-6-79. Remaining geology adapted from Scott and Olliver, 1979.

WONOKA FORMATION : Purple and red micaceous shale and siltstone with occasional dolomite interbeds.

0·2 ..... Barite, with width in metres.

..... Barite on quarry face.

80 ..... Dip of Barite.

26 ..... Strike and dip of country rock.

A2561/79 ..... Sample location, number.

..... Quarry face.

..... Dump face.

STN. A 100·0 ..... Survey station, elevation in metres.

97·7 ..... Spot height.

..... Lease peg.

..... Dip of country rock in cross section.

ARBITRARY DATUM

SCALE

METRES 10 0 10 20 30 40 50 METRES

Fig. 4

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

NANKABUNYANA BARITE DEPOSIT

WESTERN FLINDERS RANGES

GEOLOGICAL PLAN AND LODE SECTION

COMPILED	W.S.M.
DRAWN	M.B.
DATE	9-9-81
CHECKED	5·10·81 C.O.O. DATE
SCALE	1:500
PLAN NUMBER	81-626

5626