

DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
ENVIRONMENT AND RESOURCE DIVISION

FLUORITE DEPOSIT, MUTOOROO

Client: Mrs. T.V. Alfonzi

by

J.G. OLLIVER
SENIOR GEOLOGIST
NON METALLICS SECTION

Rept.Bk.No.73/236
G.S. No. 5237
DM. No. 812/73

12th December, 1973

<u>CONTENTS</u>	<u>PAGE</u>
ABSTRACT	1
INTRODUCTION	1
LOCATION	2
MINING TENEMENTS	2
GEOLOGICAL SETTING	4
FLUORITE MINERALISATION	5
QUALITY AND RESERVES	6
CONCLUSIONS	8
REFERENCES	9

- APPENDIX A - Petrological Examination
AMDEL Report MP.768/74 by
R.S. Cooper.
- APPENDIX B - Chemical Analyses
AMDEL Report AN.769/74 by
A.B. Timms.
AMDEL Report AN.807/74 by
A.B. Timms.

PLANS ACCOMPANYING REPORT

<u>Plan No.</u>	<u>Title</u>	<u>Scale</u>
S10589	Mutooroo Fluorite Deposit, M.L. 3599. Locality Plan.	1:250 000
73-789	Mutooroo Fluorite Deposit, M.L. 3599. Regional Geology Plan. Detailed Geology Plan.	1:50 000 1:2 000

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Rept.Bk.No.73/236
G.S. No. 5237
DM. No. 812/73

FLUORITE DEPOSIT, MUTOOROO

ABSTRACT

On ML.3599, 7.2 kilometres south of Mutooroo Homestead, Precambrian schists of the Adelaide System have been intruded by a series of north-easterly trending veins containing quartz, fluorite, calcite and barytes.

A total of 54.8 tonnes of fluorite ore has been extracted from shallow pits. Effective calcium fluoride content probably exceeded the minimum 60% required for metallurgical grade fluorite.

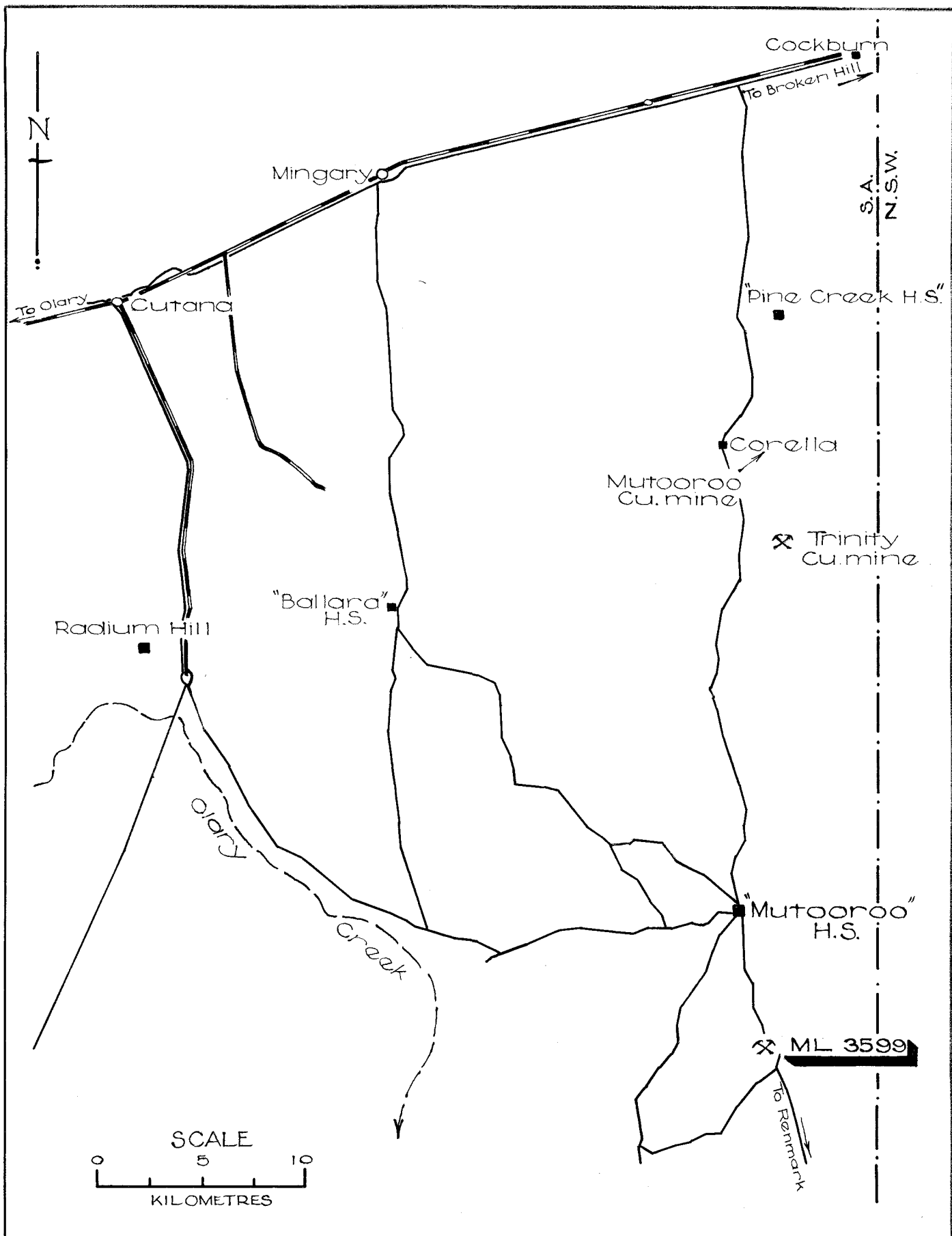
Barytes is not present in payable quantities.

No fluorite ore remains on ML.3599 and no other significant fluorite mineralisation has been located on the Mutooroo Ridge.

INTRODUCTION

Following a request from the leaseholders, Mineral Lease 3599 was inspected on 30th July, 1973 and the abandoned open pits were surveyed by stadia theodolite. The accompanying plan No. 73-789 is based on this survey supplemented by mapping of Tricentrol Australia Limited (Longreach Metals N.L., 1972).

Six rock samples were submitted to the Australian Mineral Development Laboratories for petrological examination and chemical analyses. These reports are attached as Appendix A and B respectively.



		DEPARTMENT OF MINES – SOUTH AUSTRALIA	Scale: 1:250 000
Compiled, J.G.O.		MUTOOROO FLUORITE – BARYTES DEPOSIT MINERAL LEASE 3599 T.V. ALFONZI LOCALITY PLAN	Date: 22 NOV. 1973
Drn. R.B.	Ckd. A.F.		Drp. No. S10589 FI

LOCATION

Mineral Lease 3599 lies outside of counties on OLARY, 56.3 kilometres (35 miles) south of Cockburn (see locality plan No. S10589.)

Access from the main Adelaide - Broken Hill road is via the mail road to Renmark through Mutooroo Homestead. This unsurfaced graded track is passable to all types of traffic except after heavy rain at least from the main road to the deposit, 7.2 kilometres (4.5 miles) south of the Homestead.

The area investigated occupies the southeastern flank of the "Mutooroo Ridge" near the northeastern end. This ridge is a southwesterly trending elongated topographic high about 8 kilometres (5 miles) long rising 61 metres (200 ft.) above plain level.

Vegetation comprises sparse bluebush and saltbush and occasional mulga trees. The ridge is drained by numerous ephemeral stream channels southerly and easterly into the Murray Basin.

MINING TENEMENTS

(1) Mineral Claims and Leases

The area containing fluorite mineralisation has been held intermittently since 1948 as detailed in Table 1.

TABLE I

Mineral claims, Mutooroo

<u>No.</u>	<u>Holder</u>	<u>Registered</u>	<u>Acres</u>	<u>Cancelled</u>
MC.1236	Pearce, W.R.	15/5/48	40	16/5/49
MC.1237	Pearce, W.J.H.	15/5/48	40	7/7/50
MC.1871	Pearce, W.R.	16/12/53	40	15/12/59
MC.1872	Pearce, W.J.H.	16/12/53	40	15/12/59
MC.5007	Pearce, W.R.	29/8/66	40	28/10/69
MC.5596	Pearce, W.R.	18/11/69	40	Transferred
	Alfonzi, T.V.	20/4/70	40	1/4/71

An application for a mineral lease was lodged on 5th March 1971, by Mrs. T.V. Alfonzi. Subsequently, Mineral Lease 3599 was granted on 1st April, 1971 for three years; actual area is 13.2 hectares (about 33 acres).

The location of ML.3599 in relation to Exploration Licence 21 is shown on accompanying plan No. 73-789.

The only production recorded from the above tenements is detailed in Table 2. All figures refer to fluorite ore.

TABLE 2
Production of Fluorite Ore, Mutooroo

<u>Year</u>	<u>Operator</u>	<u>Tenement</u>	<u>Tonnes (tons)</u>	<u>Value</u>
1970	T.V. Alfonzi	M.C.5596	15.2 (15)	\$ 326
1971	"	ML.3599	39.6 (39)	\$1180
TOTAL			54.8 (54)	\$1506

The bulk if not all of this tonnage was obtained from the shallow pits adjacent to station A (see plan No. 73-789).

Fluorite rich veins were mined at two localities near Plumbago 56 kilometres north of Mannahill in 1932-36 and 1956-58 (Campana & King, 1958). Output of 700 tonnes (691 tons) is the only other production recorded in the state.

(2) Special Mining Leases and Exploration Licences

The region surrounding the "Mutooroo Ridge" has been held almost continuously by Longreach Metals N.L. from 1st March 1969 until 1st November, 1973. Details are listed in Table 3.

TABLE 3

S.M.L. and EL. Mutooroo

<u>No.</u>	<u>Granted</u>	<u>Expired</u>	<u>Comment</u>
SML.274	1/3/69	28/2/71	
SML.551	11/2/71	10/9/71	
SML.627	11/9/71	10/9/72	Joint venture with Tricentrol Aust. Ltd.
EL.21	2/11/72	1/11/73	Joint venture with Tricentrol Aust. Ltd.

The pegs shown on plan No. 73-789 are part of a grid laid out by Longreach Metals N.L. over the ridge for survey control of exploration programmes.

GEOLOGICAL SETTING

Regional geology outlined on the accompanying plan No. 73-789 has been compiled from preliminary draft copies of Mutooroo and Ballara prepared by G. Pitt (Regional Surveys Division).

Bedrock is obscured over much of the area by Quaternary deposits of sandspread, alluvium and incipient calcrete (see plan No. 73-789).

Granite gneisses and concordant amphibolite of the Willyama Complex crop out north of ML.3599, near Mutooroo Homestead.

Host rocks for fluorite mineralisation are Adelaidean meta-sediments tentatively assigned to the Burra Group. However, the presence of volcanic rocks on the southwestern portion of the Mutooroo Ridge may require correlation with the Woollana Volcanics of the Lower Callana Beds. Copper, barytes and manganese mineralisation have been recorded previously (Hiern, 1958 a & b).

Within ML.3599, the metasediments have been differentiated into two types:

- Chloritic schists - dark grey green friable schists, thinly laminated consisting mainly of chlorite and biotite.
- Gritty arkosic schists - lighter in colour, consisting of fine to coarse grained quartz with muscovite and biotite.

The foliation of the schistose bedrock strikes northeasterly to north-northeasterly and dips at moderate to steep angles to the northwest. Crumpling and small scale drag folding are common. Younger tillites and associated sediments of the Yudnamutana Sub-Group outcrop northwest of ML.3599.

FLUORITE MINERALISATION

A swarm of veins and stringers containing quartz, fluorite, calcite and barytes are aligned generally parallel to foliation. The veins are represented graphically on plan No. 73-789 as many are too narrow to be otherwise shown.

The following four types have been recognised, the first three being gradational into each other.

- (1) Quartz veins - almost entirely light grey to milky quartz. These are the largest and most abundant of the veins.
- (2) Quartz-fluorite veins - mainly quartz with lesser amounts of pale to dusky purple fluorite and variable carbonate. Samples OA.14/73 and OA.15/73 are representative.
- (3) Quartz-calcite veins - light grey quartz and white calcite in varying proportions. In places, calcite has been altered to brown siderite. Minor amounts of dolomite have been detected (see Appendix A).

Samples OA.13/73, OA.16/73 and OA.17/73 represent transitional types between (2) and (3).

- (4) Barytes veins - mainly mottled white to brown and grey coarsely crystalline barytes. Sample OA.12/73 which assayed 91.6% BaSO₄ was collected from a stockpile of about one tonne.

Fluorite is always associated with quartz, either as small disseminated grains or as relatively pure zones up to 2 centimetres wide.

The following order of events is based on petrological examination of six samples as detailed in Appendix A.

- (1) Quartz-fluorite - carbonate mineralisation.
- (2) Shearing and associated barytes mineralisation.
- (3) Minor shearing and fracturing with remobilisation of carbonate in several stages which overlaps stage (4).
- (4) Alteration of carbonate with introduction of iron oxides.

Much of the fluorite, quartz and calcite is foliated in texture and the veins contain relict lenses of quartzose metasediments.

QUALITY AND RESERVES

Fluorite

Mapping by Tricentral Australia Ltd. in 1971 defined 23 fluorite bearing veins. The largest individual vein was reported to be 6 metres long and 40 centimetres wide.

There is now no trace of the 13 veins in the main workings apart from those represented by samples OA.16/73 and OA.17/73, and minor stringers and blebs of no significance. Much of the excavations have been backfilled.

The veins apparently lensed rapidly down dip as the pits are no deeper than 3 metres below surface and no veins are visible in the floor.

Details of the five fluorite-bearing samples are summarized in Table 4.

TABLE 4
Fluorite Content of Samples

Sample No.	%CaF ₂	%SiO ₂	Source	Dimensions
OA.13/73	28.6	43.1	Dump	-
OA.14/73	65.4	15.1	Dump	-
OA.15/73	16.9	60.0	Dump	-
OA.16/73	48.3	29.5	Vein, eastern wall.	1.5 metres x 20 cms
OA.17/73	27.7	50.1	Vein, eastern wall.	1.2 metres x 20 cms

Metallurgical grade fluorite is the lowest marketable grade with a minimum requirement of 60% effective calcium fluoride. Ceramic and acid grades should contain 95% and 97% CaF₂ respectively.

The effective value is calculated by subtracting 2.5 times the silica content from the calcium fluoride content. Hence, the richest sample OA.14/73 has an effective value of:

$$\begin{aligned}
 &65.4 - 2.5 \times 15.1 \\
 &\# 65.4 - 37.8 \\
 &= 27.6\% \text{ effective CaF}_2
 \end{aligned}$$

A sample collected by Tricentrol Aust. Ltd. assayed 86.3% CaF₂. Although no details of this sample are available it is assumed to represent the ore mined during 1971. Silica content was not determined but should not have exceeded 10% SiO₂, resulting in an effective calcium fluoride value close to 60% CaF₂.

Rigorous hand sorting would have been necessary to ensure that material removed was suitable for metallurgical purposes.

Beneficiation of the lump ores would have been difficult due to the intergrowth of both quartz and calcite with fluorite.

Two other samples collected by Tricentrol Aust. Ltd. from the shallow trench, 80 metres south of the road, assayed 10.0 and 21.3% CaF_2 .

Barytes

The stockpile of 1-2 tonnes of hand picked barytes is suitable for oil drilling purposes having a Specific Gravity of 4.34. (American Petroleum Institute Standard 13A specifies a minimum S.G. of 4.20 for barytes for oil well drilling fluid).

Total barium and strontium sulphate content is 93.5%.

CONCLUSIONS

A swarm of veins containing quartz, purple fluorite and calcite in varying proportions and barytes have intruded Adelaidean metasediments near Mutooroo.

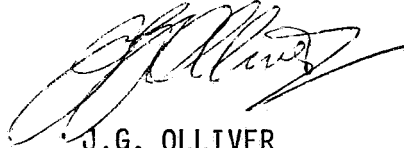
The veins are mainly conformable to the foliation of the enclosing schists and lens out both laterally and vertically over several metres.

During 1970 and 1971, 54.8 tonnes of fluorite ore valued at \$1506 was mined from bulldozer trenches. Grade was probably 80-90% CaF_2 and should have satisfied metallurgical grade specifications although the presence of silica may have reduced effective calcium fluoride value to near the lower limit of 60% CaF_2 .

A small parcel of barytes, which meets oil drilling specifications, has been stockpiled on site.

No significant copper mineralisation was observed within ML.3599.

No payable fluorite ore remains and insufficient barytes exists to justify further mining activity.



J.G. OLLIVER
SENIOR GEOLOGIST
NON-METALLICS SECTION

JGO:FdeA
12/12/73

REFERENCES

- Campana, B. and King, D., 1958. Regional Geology and Mineral Resources of the Olary Province. Bull. Geol. Surv. S.A. 34, p. 114-116.
- Hiern, M.N., 1958a. Copper Prospect - Mutooroo Station. Min. Rev. Adelaide, 105 pp. 101-102.
- _____ 1958b. Copper, Barite and Manganese Occurrences - Mutooroo Station. Min. Rev., Adelaide, 105 pp. 103-105.
- Longreach Metals N.L., 1972. EL.21 - Mutooroo Homestead Progress Reports. Dept. Mines Envelope 2300 (unpublished).

APPENDIX A

Petrological Descriptions

by

R.S. Cooper

AMDEL Rept. No. MP768/74

EXAMINATION OF SIX SAMPLES FROM THE MUTOOROO

FLUORITE-BARITE DEPOSIT ML.3599

1. SUMMARY AND INTRODUCTION

Six samples were submitted by Mr. J.G. Olliver of the Mines Department from the Mutooroo Fluorite-Barite Deposit for petrological description. It was requested that the minerals present be identified, their proportions determined and comments made about the genesis of the deposit.

The first sample P431/73, consists of barite, with minor impurities, whereas the other five samples, P432/73-P436/73, consist of varying proportions of fluorite, quartz, and carbonate, with trace amounts of opaques and phyllosilicates. No barite was detected in these latter samples. All the samples are foliated and fractured and all the minerals show signs of recrystallization which makes interpretation difficult. However, the following sequence of events appears plausible:

1. Quartz/fluorite/carbonate mineralization of a quartz/muscovite metasedimentary host rock.
2. Shearing, possibly before, during, and after subsequent mineralization with barite.
3. Further minor shearing and fracturing, with minor remobilization and veining by the carbonate.
4. Weathering/alteration of the carbonate and introduction of iron oxides/hydroxides.

A list of the samples described in this report is as follows:

Location: Mutooroo Fluorite-Barite Deposit

Sample	Rock Name		Analytical Data*			%Carbonate
			%CaF ₂	%BaSO ₄	%SiO ₂	
OA12/73 P431/73	Barite	A348/73	2.35	91.6	Tr	3.8
OA13/73 P432/73	Foliated fluorite-quartz altered carbonate rock	A341/73	28.6	2.30	43.1	21.6
OA14/73 P433/73	Coarse-grained fluorite	A345/73	65.4	0.44	15.1	18.5
OA15/73 P434/73	Quartz with bands of fluorite	A343/73	16.9	0.20	60.0	20.5
OA16/73 P435/73	Foliated quartz-fluorite-carbonate rock	A342/73	48.3	1.46	29.5	19.7

0A17/73 P436/73 Foliated quartz- A344/73 27.7 0.20 50.1 17.8
fluorite- car-
bonate rock

*The analytical work was carried out separately and the full analyses are reported in Amdel Report AN 769/74.

** As $\text{CaCO}_3 + \text{MgCO}_3$

2. PETROGRAPHIC DESCRIPTIONS

Specimen P431/73, 0A12/73, TS 30883:

Location:

Out of Hundreds. Mutooroo Fluorite-Barite Deposit ML.3599.

Rock Name:

Barite

Hand Specimen Description:

The specimen consists principally of off-white coloured, coarsely crystalline barite. What appears to be crystal faces several mms across are apparent although there is also a pronounced foliation in the rock. Also present are a few patches of opaques, 1-2 mms across, and a few lense-like patches of a brown-coloured mineral that are up to 5 mm long.

Thin Section Description:

A visual estimate of the constituents gave the following:

	<u>Vol %</u>
Barite	>90
Carbonate	<10
Opagues	Trace
Quartz	Trace

The rock consists dominantly of barite in which there is a well-developed mortar texture. There is also a minor amount of calcite.

Lenticular crystals of barite, up to 4 mm long, are surrounded by fine granular barite, with a grainsize of approximately 0.05 mms. Undulose strain extinction is visible in many of the larger crystals which also have well-developed cleavage traces and a few narrow simple twin lamellae.

The carbonate in the sample occurs in elongate patches extending for several millimetres. A chemical staining technique gave a positive result for calcite.

Associated with the calcite are small patches of opaques. A few grains of quartz, the largest 0.2 mm in diameter are also present, generally in the barite.

This is a sample of barite, with minor calcite, and trace amounts of quartz and opaques, which has a foliated texture.

Specimen P432/73, 0A13/73, TS 30884:

Location:

Out of Hundreds. Mutooroo Fluorite-Barite Deposit ML 3599.

Rock Name:

Foliated fluorite, quartz, altered carbonate rock.

Hand Specimen Description:

This specimen is strongly foliated, and composed of irregular lense-like masses, of purple fluorite, white quartz, and dark brown, altered, iron oxide rich carbonate. The grain size of the fluorite appears to be 1-2 mm and patches of this mineral extend for several centimetres.

Thin Section Description:

A visual estimate of the constituents gave the following:

	<u>Vol %</u>
Fluorite	25-35
Quartz	40-50
Altered patches of iron oxides and carbonate	20-30
Phyllosilicate; ?mica	2-4

In thin section the specimen is seen to consist essentially of fluorite quartz, and iron oxide/carbonate, and to have a foliated texture.

The fluorite occurs in strongly foliated lenses up to several centimetres long which are composed of aligned elongate crystals, ranging in size between 0.2 and 0.5 mm.

Interspersed with the lenses of fluorite are patches and lenses of quartz. These are made up of interlocked polygonal quartz grains which are typically about 0.1 mm across. Minute flakes of muscovite are present with the quartz; they have a preferred orientation and indicate that the original rock was a muscovite-quartz schist.

Other lenses consist of a dark-brown coloured, iron-rich, altered carbonate. In places the carbonate occurs as shapeless masses up to 1 cm across but elsewhere it has sharply defined, idiomorphic, outlines. Carbonate, dolomite, also occurs as a network of narrow veins, all less than 0.1 mm thick, which criss-cross the sample. These lack the iron oxide/hydroxide of the larger patches of carbonate and appear to be later formed.

A few small lenses or foliae of muscovite are present. These extend for distances of 1-2 cm and are composed of flakes up to 0.1 mm long.

This is a strongly foliated rock containing major amounts of fluorite, quartz and carbonate.

Specimen P433/73, OA14/73, TS 30885:

Location:

Mutooroo Fluorite-Barite deposit. ML.3599.

Rock Name:

Coarse-grained fluorite.

Hand Specimen Description:

The sample consists principally of purple coloured fluorite with minor amounts of quartz and carbonate. There is a strong foliation in the sample and the fluorite is fractured at intervals of 1-2 mm.

Thin Section Description:

A visual estimate of the constituents gave the following:

	<u>Vol %</u>
Fluorite	55-65
Calcite	15-25
Quartz	15-25

The sample consists of fluorite, which is veined by calcite, and contains patches of quartz.

The fluorite is massive and isotropic as seen in thin section. The calcite veins range in size up to 1.5 mm and criss-cross and truncate each other in a complex fashion that indicates that the veining has occurred in several stages.

The quartz occurs in patches, some of which are several centimetres across. Each patch is made up of polygonal grains which are individually between 0.05 and 0.1 mm across.

This is a strongly foliated and somewhat fractured sample composed largely of purple-coloured fluorite. Relict lenses of the original quartzose metasediment remain.

Specimen P434/73, OA15/73, TS 30886:

Location:

Mutooroo Fluorite-Barite deposit. ML.3599.

Rock Name:

Quartz with bands of fluorite.

Hand Specimen Description:

The rock consists mainly of milky coloured quartz. In this there are irregularly shaped bands or patches of fluorite which are up to 1 cm thick and extend for several centimetres. Thin layers of carbonate are present on two broken surfaces.

Thin Section Description:

A visual estimate of the constituents gave the following:

	<u>Vol %</u>
Quartz	55-65
Fluorite	15-25
Calcite	10-20
Dolomite	4-8

The rock consists mostly of coarse granular quartz, the other minerals, fluorite and carbonate, occurring either interstitially or in veins, and rarely in larger patches.

The quartz occurs as polygonal crystals typically in the size-range 0.2 to 1 mm. These are interlocked and constitute the bulk of the rock.

Carbonate occurs as small grains between the quartz crystals and in veins the largest of which is several millimetres wide in places. Both calcite and another carbonate, probably dolomite, are present. They were distinguished with the aid of a microchemical test.

Fluorite occurs as small grains but more typically in veins and patches, the largest patch seen being at least 1 cm across.

This is a strongly foliated sample, composed mainly of quartz, with minor lenses of fluorite, and some carbonate.

Specimen P435/73, OA16/73:

Location:

Mutooroo Fluorite-Barite deposit. ML.3599.

Rock Name:

Foliated quartz-fluorite-carbonate rock.

Hand Specimen Description:

This sample is foliated and consists of interleaved bands or lenses of quartz and fluorite, which typically are each about 1 cm thick and can extend for many centimetres. There are also veins and patches of carbonate in the rock the largest of which are at least 2 mm thick and extend throughout the hand specimen.

Thin Section Description:

A visual estimate of the constituents gave the following:

	<u>Vol %</u>
Fluorite	20-30
Quartz	50-60
Calcite	5-15
?Dolomite	2-4

The sample consists of fluorite, quartz, calcite and ?dolomite and has a foliated texture.

The fluorite occurs as elongate crystals, typically about 0.15 mm by 0.4 mm, which are aggregated in lenses up to 1 cm thick. These lenses are relatively free of the other minerals present in the rock.

The quartz also occurs in lenses, and these are made up of polygonal grains in the size range 0.2 to 0.6 mm. However, unlike the fluorite, there is considerable interstitial and vein carbonate intermingled with the quartz.

Both calcite and ?dolomite are present in the rock, the calcite having been identified with the aid of a microchemical test. As mentioned the carbonate occurs interstitially to the quartz and in veins and patches, some of the latter being up to 0.4 mm in size.

This sample is similar to P432/73, with the difference that the carbonate is not altered and replaced by iron oxides/hydroxides to any extent.

Specimen P436/73, OA17/73, TS 30888:

Location:

Mutooroo Fluorite-Barite deposit. ML.3599.

Rock Name:

Foliated quartz-fluorite-carbonate rock.

Hand Specimen Description:

This sample consists of lenses and patches of quartz, fluorite and carbonate each up to 2 cms thick, and is strongly folded and contorted.

Thin Section Description:

A visual estimate of the constituents gave the following:

	<u>Vol %</u>
Fluorite	~ 20
Quartz	~60
Calcite	~15
Dolomite	< 5
Opakes	Trace

The sample consists of quartz, calcite, fluorite, opaques and ?dolomite and is foliated, contorted and veined by the carbonate minerals. The quartz occurs in irregular to polygonal grains, of varying size up to 4 mm. Larger grains show pronounced undulose (strain) extinction.

The fluorite occurs in lenses, that are 1-2 cm across, and as smaller patches in quartz, which are typically less than 0.4 mm across. The lenses of fluorite contain some dispersed quartz crystals and several narrow bands of carbonate.

In this sample the carbonate is virtually all calcite, calcite having been distinguished from the small amount of other carbonate present by a microchemical test. The carbonate occurs in patches and veins, some of the latter being 0.2 mm wide and extending throughout the sample. Dislocations in the carbonate veins is evidence that minor tectonic movement has occurred after the mineralisation.

There are rare grains and patches of opaques in this sample, the largest being just over 1 mm in diameter.

This is foliated, banded, quartz-fluorite-carbonate rock.

APPENDIX B
Chemical Analyses

by

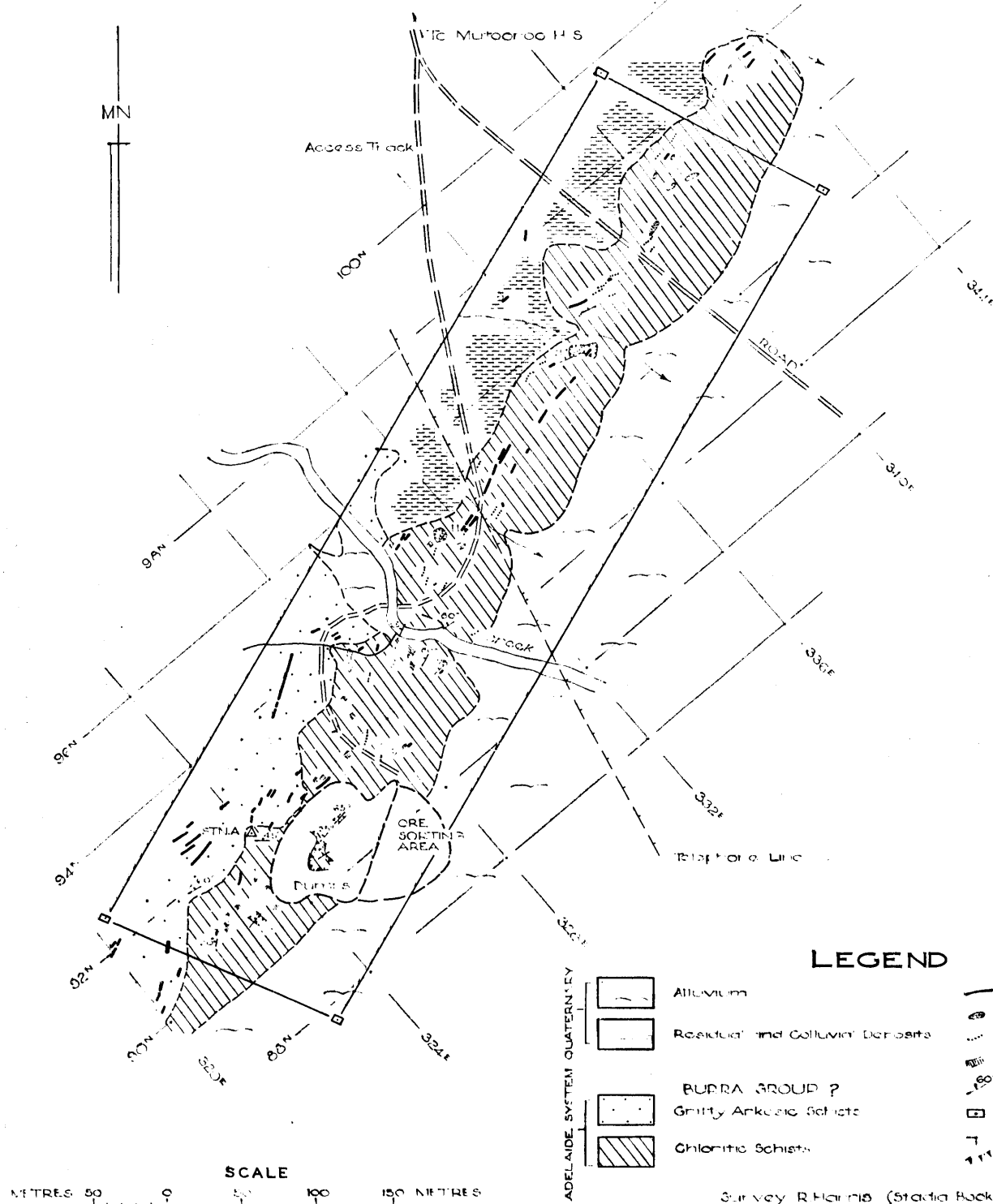
A.B. Timms

AMDEL Rept. Nos. AN769/74
AN807/74

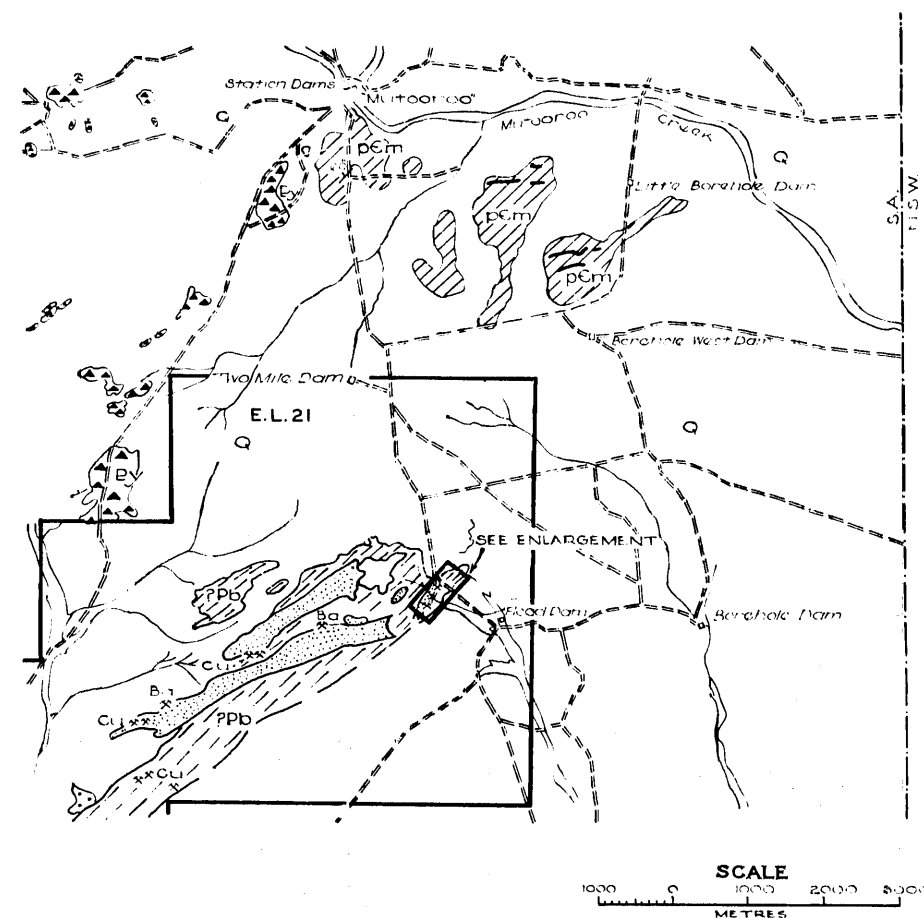
PERCENTAGE

Sample No.		0A12/73	0A13/73	0A14/73	0A15/73	0A16/73	0A17/73
Dept. of Mines		A348/73	A341/73	A345/73	A343/73	A342/73	A344/73
Calcium fluoride	CaF_2	2.35	28.6	65.4	16.9	48.3	27.7
Barium sulphate	BaSO_4	91.6	2.30	0.44	0.20	1.46	0.20
Strontium sulphate	SrSO_4	1.86	0.06	0.02	0.01	0.05	0.01
Silica	SiO_2	Tr	43.1	15.1	60.0	29.5	50.1
Alumina	Al_2O_3	0.05	0.56	0.19	0.77	0.49	1.28
Ferric oxide	Fe_2O_3	0.19	2.70	0.21	0.86	0.35	1.40
Calcium carbonate	CaCO_3	3.7	12.4	18.4	20.4	19.5	17.7
Magnesium carbonate	MgCO_3	0.1	9.20	0.09	0.08	0.18	0.12
S as sulphide		-	0.03	0.05	0.03	0.05	0.02
Copper (ppm)	Cu	70	80	5	35	35	440

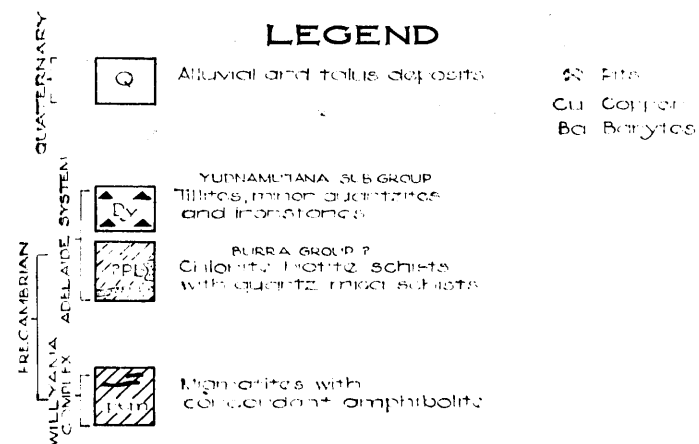
M.L. 3599
DETAILED GEOLOGICAL PLAN



REGIONAL GEOLOGICAL PLAN



LEGEND



DEPARTMENT OF MINES — SOUTH AUSTRALIA

MUTOOROO FLUORITE DEPOSIT

MINERAL LEASE 3599 T.V. ALFONZI

LOCATION AND REGIONAL GEOLOGICAL PLAN

MINERAL LOCATION	SECTION	Dm.	SCALE
		Tcd. 1:100	73-789
		Ckd. 1:1	FI
		Exd.	DATE: 10/10/1973

Director of Mines

Survey R.H. 1110 (Stadia Book 480)

N.B. Vein Symbols-Graphical Representation Only