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EL 1164

MANNA HILL

PROGRESS AND FINAL REPORTS FOR THE PERIOD 8/7/83 TO 27/11/84

Submitted by
Amax Australia (Gold) Pty Ltd
1984

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PRIMARY INDUSTRIES AND RESOURCES SA

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TENEMENT HOLDER: AMAX Australia (Gold) Pty. Ltd.

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QUARTERLY REPORT ON EXPLORATION LICENCE 1164 "MANNAHILL" FOR THE PERIOD ENDED 8th OCTOBER, 1983

Peter F. Bull

October, 1983

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1. INTRODUCTION

The Exploration Licence was applied for on 30th March, 1983 and was granted on 8th July, 1983 for a period of one year. The property was applied for in the course of regional studies of Telfer type stratabound gold occurrences.

2. LOCATION

The Exploration Licence is located in the Olary Province of South Australia and straddles the main road between Peterborough and Broken Hill (refer to Figure 1).

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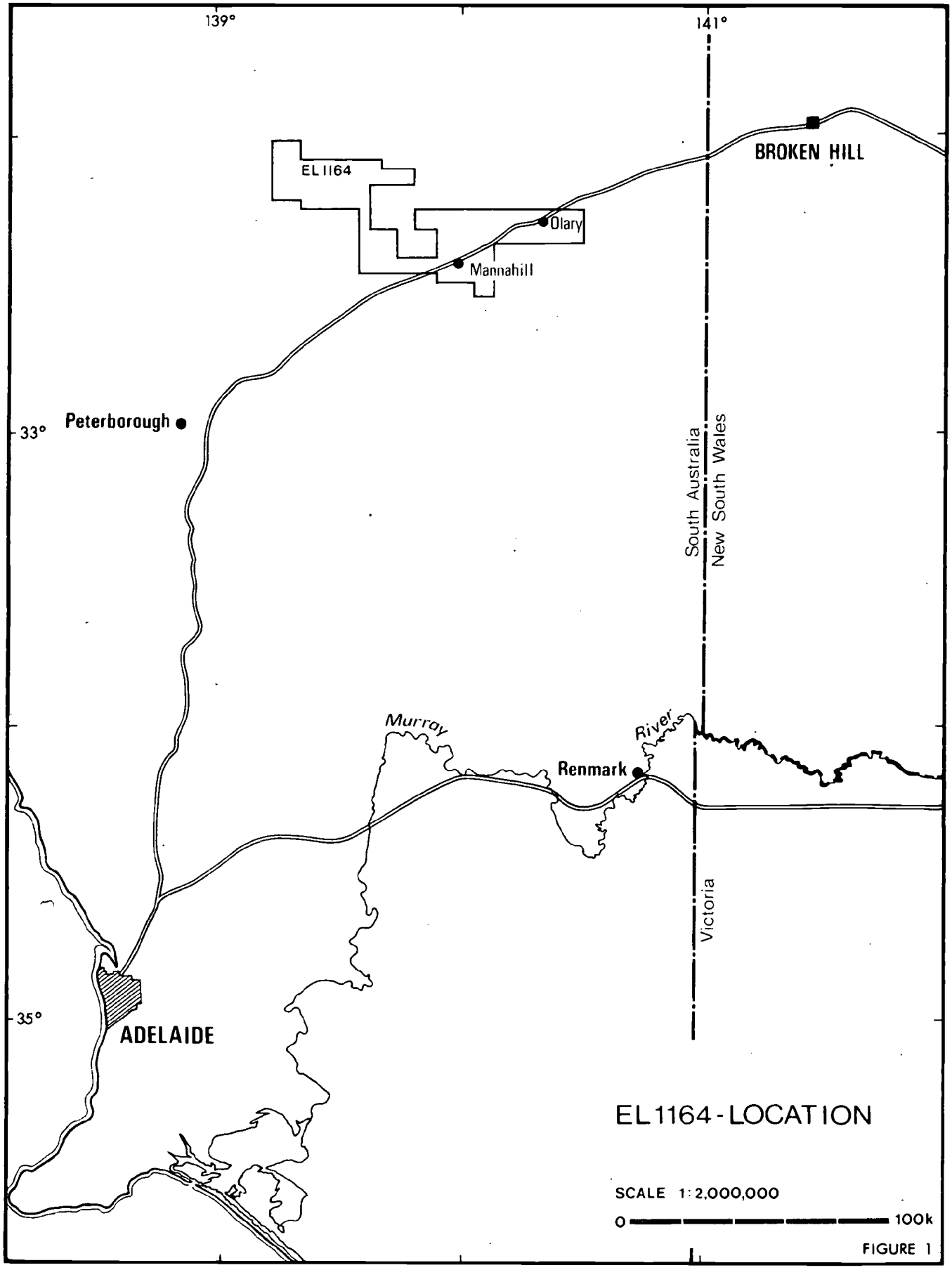
139°
141°
EL1164
BROKEN HILL
Olary
Mannahill
Peterborough
33°
South Australia
New South Wales
Murray
River
Renmark
Victoria
35°
ADELAIDE
EL1164 - LOCATION
SCALE 1:2,000,000
0
100k
FIGURE 1

3. WORK PROGRAMME

Following a search of available literature at the South Australian Department of Minerals and Energy, a compilation of aeromagnetic and gravity data was carried out and a reconnaissance sampling programme was initiated. An oblique aerial photographic reconnaissance survey has also been completed.

4. GEOCHEMICAL SURVEY

Rock Chip Sampling

Orientation geochemical sampling was carried out at the Kings Bluff, Mt. Grainger, Ajax, Waukaringa and Mannahill mines after obtaining permission from the respective tenement title-holders. Assay results and sample descriptions are contained in Table 1.

In addition, underground sampling was carried out at the Mt. Grainger mine and the Victoria shaft at the Waukaringa mine. The results of this work are recorded in Table 2.

Rock chip samples from selected sites (refer to Figure 2) visited during the helicopter survey have been submitted to Comlabs in Adelaide for analysis. Results of this work are not yet available.

Stream Sediment Sampling

Stream sediment samples were taken from streams draining areas of favourable structural and lithologic associations. Five kilogram samples were collected and sent to Western Australia for analysis. The locations of the samples are shown in Figure 3. Analytical results are not yet available.

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TABLE 1

RESULTS OF ROCK CHIP ORIENTATION GEOCHEMISTRY

analytical results in ppm

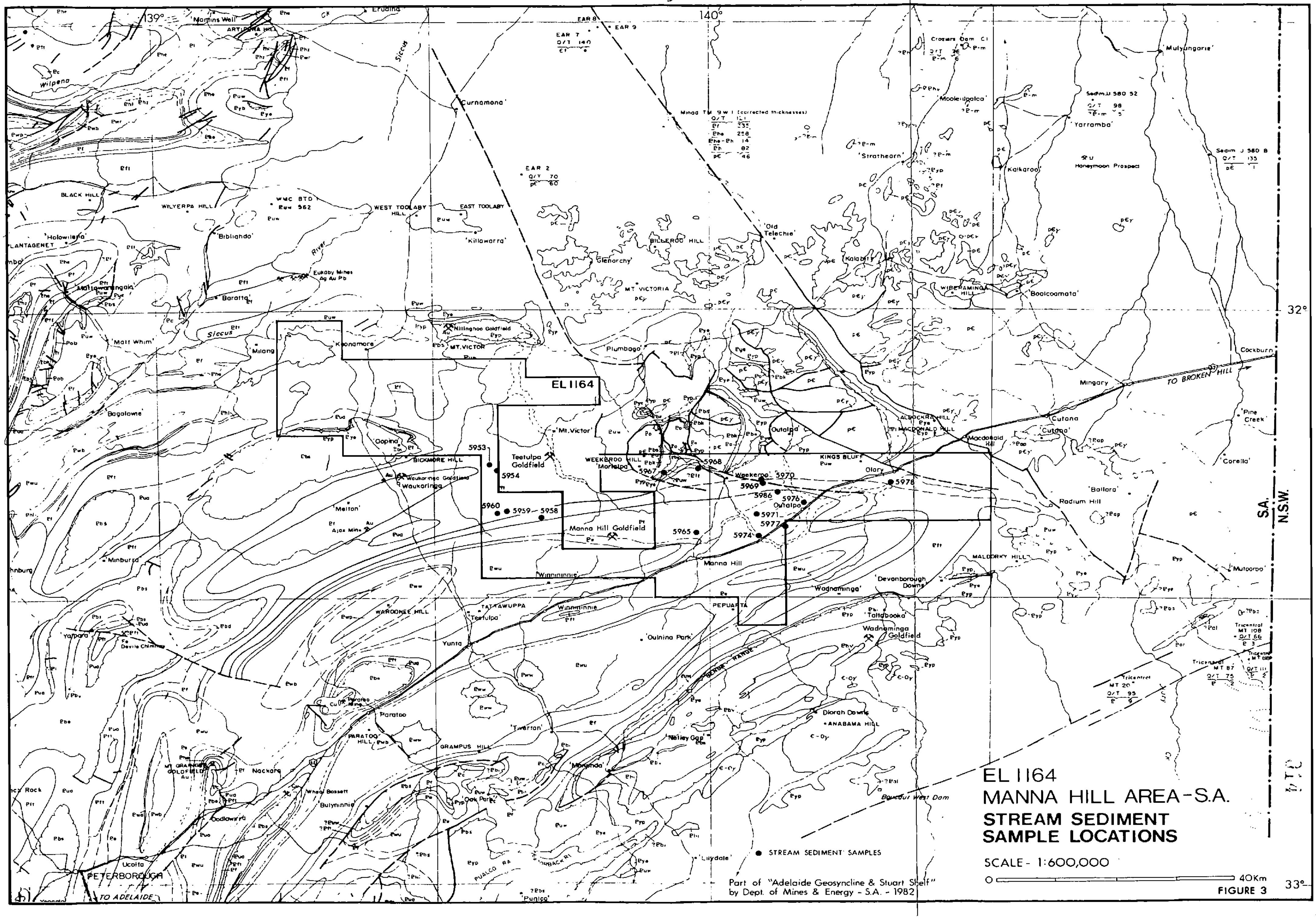
Sample	Cu	Pb	Zn	Ni	Co	Bi	Cd	As	Ba	Sn	U	Th	W	Se	Rb	Sr	Sb	Ga	Ge	% Fe	Mn	Ag	Mo	V	Au	Hp	Sc	Sample Description	Location
S 8801	520	220	540	12	4	<4	<1	75	30	<4	<4	<4	<10	<4	<2	26	20	<4	<4	5.80	330	<1	16	30	2.70	<0.05	<10	Brecciated quartz limonite gossan breccia	Kings Bluff
S 8802	18	20	38	12	10	<4	<1	<2	450	<4	<4	14	<10	<4	85	140	<4	8	<4	2.80	590	<1	6	50	<0.05	<0.05	<10	Basal channel conglomerate overlying Willyama Complex	Kings Bluff
S 8803	240	18	70	170	60	<4	<1	120	850	<4	<4	<4	<10	<4	24	125	14	8	<4	31.0	1.30%	<1	6	30	1.20	<0.05	<10	100% oxidised limonite & siderite in a concordant quartz reef 20cm thick	Waukaringa
S 8804	710	18	95	22	50	46	<1	1350	155	<4	24	<4	<10	10	34	270	<4	<4	<4	32.0	700	<1	<4	40	16.5	<0.05	<10	Channel sample of friable goethitic limonite from main reef	Ajax
S 8805	150	12	90	30	10	<4	<1	44	500	<4	<4	16	<10	<4	230	210	4	16	<4	5.70	230	<1	6	50	0.20	<0.05	<10	Laminated sideritic silty sandstone with quartz limonite veins (Footwall)	Ajax
S 8806	80	<4	20	16	14	<4	<1	95	600	4	<4	12	<10	<4	110	46	8	10	<4	3.30	470	<1	<4	40	0.30	<0.05	<10	Laminated sideritic silty sandstone wth quartz limonite veins (Hanging Wall)	Ajax
S 8807	105	14	18	8	20	<4	<1	38	570	<4	<4	10	10	<4	48	460	6	<4	<4	1.70	100	<1	4	40	0.70	<0.05	<10	Grab sample over 5 metres of caliche over Footwall contact	Ajax
S 8808	380	12	75	12	26	80	<1	1650	230	<4	14	4	20	<4	36	165	10	<4	4	38.0	600	<1	6	50	60.0	0.05	<10	Random grab of surface gossanous and ironstone rubble	Ajax
S 8809	1100	18	70	24	70	100	<1	2450	190	<4	20	4	20	12	34	125	6	8	<4	28.0	850	<1	4	20	55.0	<0.05	<10	Channel sample over 30cm of gossanous quartz limonite reef	Ajax
S 8812	16	8	18	16	8	<4	<1	18	820	<4	<4	14	10	<4	115	30	<4	12	<4	3.50	480	<1	<4	30	0.40	0.05	<10	Grey green laminated sideritic siltstone from the footwall of the Upper reef	Waukaringa
S 8813	26	10	14	26	10	<4	<1	28	570	4	<4	8	15	<4	65	120	4	6	<4	2.00	760	<1	6	50	0.30	<0.05	<10	Composite rock chip of hanging wall siltstone from the Upper reef	Waukaringa
S 8814	60	20	40	160	70	<4	<1	55	680	<4	<4	<4	<10	6	20	440	6	<4	4	4.70	5100	<1	6	90	0.50	0.10	<10	Caliche, weathered B soil profile indurated by calcrete	Waukaringa
S 8815	100	22	65	18	12	<4	<1	44	600	6	12	10	10	<4	60	190	<4	6	<4	11.0	1350	<1	6	50	0.10	0.55	<10	Yellow brown limonite in main reef	Waukaringa
S 8816	90	<4	4	<4	8	<4	<1	640	200	6	<4	<4	15	10	26	20	6	<4	<4	7.60	80	<1	8	30	1.80	0.35	<10	Composite rock chip sample of quartz limonite gossan (300' depth)	Waukaringa
S 8817	3000	330	16	<4	140	<4	<1	28	40	<4	<4	14	<10	22	14	3	4	<4	<4	40.0	1100	2	<4	10	0.40	<0.05	<10	Near massive sulphide pyrrhotite(?) & siderite TS > 50% (320' depth)	Waukaringa
S 8818	30	14	24	16	10	<4	<1	24	660	6	8	22	10	<4	80	210	10	12	<4	2.60	110	<1	4	70	0.10	<0.05	<10	Sideritic siltstone from hanging wall same location as 8815,16,17	Waukaringa
S 8819	40	12	20	12	6	<4	<1	30	1100	4	10	10	20	<4	210	120	<4	30	<4	2.60	260	<1	8	40	0.10	0.05	<10	Grey Green sandy siltstone with minor quartz stringers (Footwall)	Waukaringa
S 8820	490	22	100	26	50	<4	<1	600	330	<4	<4	12	35	<4	32	80	8	<4	<4	37.0	480	<1	6	40	6.30	0.05	<10	Surface gossan "lag" of goethitic limonite over 50m of main vein strike	Waukaringa
S 8821	410	16	50	38	60	<4	<1	1750	580	<4	6	<4	20	<4	28	360	10	4	<4	15.0	440	<1	6	50	0.90	0.05	<10	Caliche from line of lode to 10cm depth with gossanous fragments eliminated	Waukaringa
S 8828	520	170	140	18	50	<4	<1	4900	130	<4	12	<1	25	8	12	90	22	4	6	30.0	350	<1	6	100	0.30	<0.05	<10	Gossanous and ironstone scree from surface (Westward Ho!)	Mannahill
S 8829	80	22	60	30	18	<4	<1	44	430	4	<4	14	<10	<4	105	280	4	16	<4	3.00	560	<1	<4	50	<0.05	<0.05	<10	Laminated dolomitic siltstone with trace sulphide (Westward Ho!)	Mannahill
S 8830	600	520	160	14	12	<4	<1	960	60	10	<4	8	15	18	10	18	8	<4	<4	8.40	120	4	10	50	0.15	1.40	<10	Gossan with limonite and quartz (Westward Ho!)	Mannahill
S 8831	310	70	90	70	46	12	<1	4250	80	<4	<4	4	<10	6	14	40	24	<4	<4	31.0	170	<1	<4	60	0.20	0.05	<10	Silicified cherty gossan possibly ferricrete (Westward Ho!)	Mannahill
S 8832	1300	230	1.90%	60	120	<4	175	1.41%	30	12	<4	<4	<10	10	5	170	12	<4	<4	30.0	2600	<1	<4	20	2.00	0.05	<10	Banded stratiform oxidised "ore" horizon 30' down dip (Elsie May)	Mannahill
S 8833	2000	22	1900	26	24	<4	4	250	55	<4	<4	<4	10	<4	6	26	8	<4	<4	8.00	840	<1	<4	20	0.70	<0.05	<10	Oxidised "ore", banded quartz-feox with malachite (Elsie May dump)	Mannahill
S 8834	1050	420	130	100	110	80	<1	230	<10	4	<4	<4	<10	14	4	10	10	<4	<4	13.0	195	<1	8	20	1.60	<0.05	<10	Oxidised banded quartz siderite-limonite "ore" 100' down dip (Homeward Bound)	Mannahill
S 8836	280	100	280	160	90	<4	<1	12	115	<4	<4	<4	10	32	16	560	<4	<4	4	30.0	490	1	12	40	<0.05	<0.05	<10	Hematitic vein quartz with trace chlorite and minor limonite	Anomaly 82
S 8837	80	40	28	100	55	<4	<1	10	25	<4	<4	8	10	14	<2	105	12	<4	<4	22.0	340	1	10	30	<0.05	<0.05	<10	Rock float from old workings, white quartz with clasts of gossanous limonite	Anomaly 82
S 8842	38	34	60	60	28	<4	<1	22	500	<4	<4	<4	<10	<4	5	55	12	<4	<4	9.60	5200	<1	8	250	<0.05	<0.05	<10	Small sized float heavy mineral and quartz-limonite fragments	Mannahill
S 8843	600	6	44	80	140	<4	<1	<2	30	<4	<4	4	<10	24	<2	32	<4	<4	<4	28.0	48	<1	4	10	<0.05	<0.05	<10	Quartz-limonite gossan in Pfk near East Dam Well (Olary 1:250,000 sheet)	Mannahill
S 8845	560	400	340	180	120	20	<1	115	410	<4	6	8	<10	28	20	90	48	<4	<4	29.0	580	<1	20	170	<0.05	<0.05	<10	Feox stained, wind ablated dolomitic siltstone from nose of Waukaringa Syncline	Mannahill
S 8846	14	6	80	26	14	<4	<1	20	480	4	4	10	<10	<4	115	180	<4	14	<4	2.90	550	<1	<4	30	<0.05	<0.05	<10	Unmineralised dolomitic siltstone wallrock from within the Mannahill field	Mannahill
S 8847	18	6	70	28	14	<4	<1	16	390	6	<4	10	<10	<4	145	410	6	16	<4	2.80	800	<1	<4	10	<0.05	<0.05	<10	Fine grained part recrystallised dolomitic siltstone from fracture zones	Mannahill

TABLE 2

RESULTS OF UNDERGROUND SAMPLING AT
MT GRAINGER AND WAUKARINGA MINES

results in ppm

Sample	Au	As	Location
			Waukaringa Victoria Shaft
A 5909	<0.05	-	10m depth
A 5910	0.20	-	20m depth
A 5911	<0.05	-	30m depth
A 5912	<0.05	-	40m depth
A 5913	<0.05	-	50m depth
A 5914	5.90	-	quartz-iron oxide above sulphide zone
A 5915	0.75	320	sulphide ore
			Mt. Grainger
A 5919	2.60	-	5m depth
A 5920	1.30	-	20m depth
A 5921	<0.05	-	25m depth
A 5922	1.50	-	30m depth
A 5923	5.30	-	35m depth
A 5924	<0.05	-	40m depth
A 5925	<0.05	-	120' level
A 5926	<0.05	-	120' level
A 5927	0.25	-	240' level


EL 1164
MANNA HILL AREA-S.A.
STREAM SEDIMENT
SAMPLE LOCATIONS
SCALE - 1:600,000
0
40Km
FIGURE 3
● STREAM SEDIMENT SAMPLES
Part of "Adelaide Geosyncline & Stuart Shelf"
by Dept. of Mines & Energy - S.A. - 1982
EL 1164
139°
140°
32°
33°
S.A.
N.S.W.
TO BROKEN HILL
TO ADELAIDE
PETERBOROUGH
Manna Hill
Manna Hill Goldfield
Teetulpa Goldfield
Yunta
Paratoo
Oulnina Park
Winnininnie
Pepuarta
Olary
Mingary
Cockburn
Radium Hill
Wadnaminga Goldfield
Weekeroo
Outalpa
Mt. Victor
Koonamore
Waukaringa
5953
5954
5958
5959
5960
5965
5967
5968
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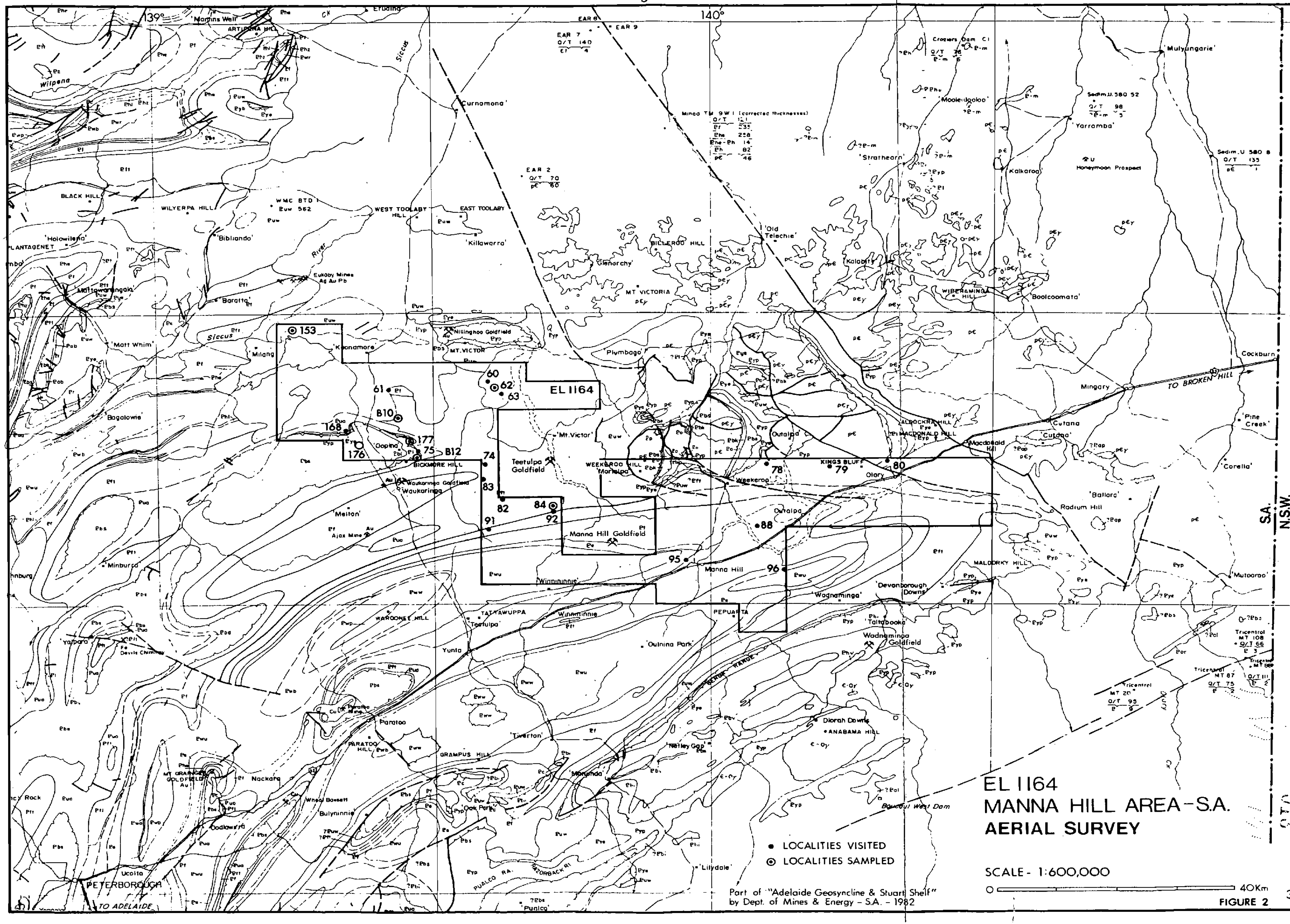
5971
5974
5976
5977
5978
5986


EL 1164
MANNA HILL AREA - S.A.
AERIAL SURVEY
• LOCALITIES VISITED
⊙ LOCALITIES SAMPLED
SCALE - 1:600,000
40Km
Part of "Adelaide Geosyncline & Stuart Shelf"
by Dept. of Mines & Energy - S.A. - 1982
FIGURE 2
139°
140°
32°
33°
S.A.
N.S.W.
EL 1164
Manna Hill Goldfield
Teetulpa Goldfield
Wadnaminga Goldfield
Manna Hill
Yunta
Olary
Mingary
Cockburn
TO BROKEN HILL
PETERBOROUGH
TO ADELAIDE
Curnamona
Koonamore
Waukaringa
Mt. Victor
Weekeroo
Kings Bluff
Oulnina Park
Paratoo
Tiverton
Wilpena
Honeymoon Prospect
153
60
61
62
63
B10
168
177
176
75
B12
74
83
82
84
92
91
78
79
80
88
95
96

5. GEOPHYSICAL SURVEY

Of the known gold mineralisation in close proximity to the licence area, the Waukaringa mineralised zone is known to have a surface magnetic expression probably due to its pyrrhotite content.

The possibility of reprocessing early BMR aeromagnetic data over the Mannahill area is being researched. BMR maps of the area are available with 20 gamma contour intervals, however the original analogue data format would allow contouring of the data down to approximately one gamma intervals.

6. AERIAL SURVEY

A fixed wing aerial reconnaissance survey has been carried out over the Exploration Licence to locate areas of interest which were subsequently visited on the ground as part of a helicopter survey carried out during September. The locations visited are shown on Figure 2.

7. PROPERTY STATUS

Exploration Licence 1164 was granted to Amax Australia (Gold) Pty. Ltd. over 2,365 square kilometres on 8th July, 1983 for a period of one year with an expenditure commitment of $70,000.

8. EXPENDITURE STATEMENT

PROJECT EXPENDITURE STATEMENT
AS AT 8th OCTOBER, 1983
A$

Legal Fees & Expenses	140
Publications, Maps, Reports & Airphotos	1,153
Drafting Services & Supplies	769
Assaying & Analysis	1,253
Telephone, Telex & Telegraph	101
Postage, Shipping & Freight	495
Field Materials	1,129
Car Hire & Taxis	487
Air Travel	2,079
Lodgings, Meals & Entertainment	4,191
Aircraft/Helicopter Charter	19,297
Vehicles - Maintenance	778
Vehicles - Lease	312
Field Equipment - Purchased	572
Misc Tenement Fees	1,811
Allocated Salaries	26,346
Gross Expenditure	60,913

QUARTERLY REPORT ON EXPLORATION LICENCE 1164 "MANNAHILL" FOR THE PERIOD ENDED 8th JANUARY, 1984

Amax Australia Limited

January, 1984

Project No: 606
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Commodity: Gold
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LIST OF PLATES

Plate 1	Sedimentary rocks of the Waukaringa Siltstone indurated by limonite envelopes surrounding thin near vertical fractures
Plate 2	Looking south along a near vertical fracture shown in Plate 1
Plate 3	Indurated calcareous sedimentary rocks with thin quartz limonite veins parallel to bedding adjacent to the fracture shown in Plates 1 and 2
Plate 4	Oblique aerial view looking east over part of the Waukaringa Siltstone

1. INTRODUCTION

Exploration Licence 1164 was applied for on 30th March 1983 and was granted on 8th July 1983 for a period of one year. The property was applied for in the course of regional studies of a number of stratabound gold occurrences in the Proterozoic basins of Australia, South Africa and Brazil.

2. LOCATION & ACCESS

The Exploration Licence is located in the Olary Province of South Australia and straddles the main road and railway line between Peterborough and Broken Hill (Figure 1). Access to the Licence area is by sealed road from Adelaide to Yunta and Mannahill and then by all-weather unsealed roads and station tracks to various parts of the Licence.

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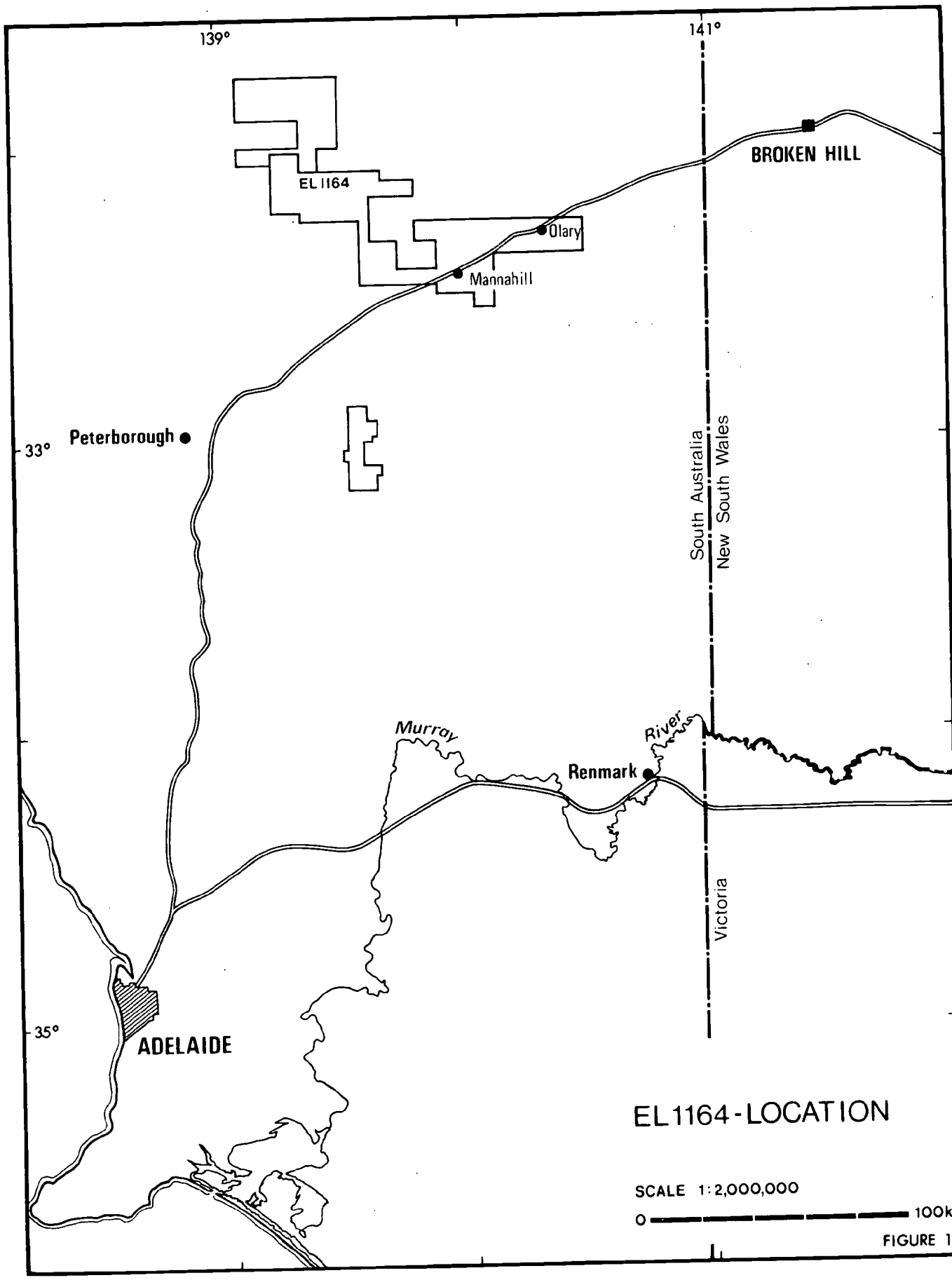

139°
141°
EL 1164
BROKEN HILL
Olary
Mannahill
Peterborough
33°
South Australia
New South Wales
Murray
River
Renmark
Victoria
35°
ADELAIDE
EL1164 - LOCATION
SCALE 1:2,000,000
0
100k
FIGURE 1

3. EXPLORATION CONCEPT

Three major gold occurrences, Telfer, Pilgrims Rest and Passagem, constitute a distinctive and recognisable class of deposit. They show a clear association with a predominantly marine shelf sedimentary environment, and are preferentially developed in the basal to middle formations of the Proterozoic sequence. In shape, they are sheet-like and follow the stratigraphy faithfully. As a group, the deposits show a number of compositional similarities consisting of quartz, carbonate and minor sulphides. They are characterised by the elemental association of iron, copper, arsenic, gold $\pm$ boron $\pm$ silver.

The deposits are generally regarded as syngenetic in origin, being deposited as chemical sediments in restricted basins within shallow marine seas. Basement faults may have provided suitable channel-ways for rising metal-bearing brines. Post-ore metamorphism and deformation has resulted in only local remobilisation of ore.

The relatively unexplored nature of the Proterozoic basins that form the Adelaide Geosyncline for this deposit type make them an attractive exploration target.

The ore environment of the Telfer gold deposit in Western Australia occurs in sedimentary rocks of Palaeozoic age elsewhere in the world. The

3. (Cont)

depositional environment is that of a marine shelf and the dominant lithologies represented are siltstones, carbonaceous shales and sandy to calcareous units. The Proterozoic basins which host Telfer style gold occurrences show a degree of correspondence in age and geological environment.

Frequently the gold occurrences occur in the lower portions of the Proterozoic pile. They occur in chemical sedimentary units (mostly carbonate + arenite) overlying basal volcanics and fluviatile-marine clastics. The latter, which rest unconformably on Archean basement, host the quartz pebble conglomerate Au/U deposits. In some cases, for example the Quadrilatero Ferrifero of Brazil, it is possible to have both types of gold environments developed in close proximity.

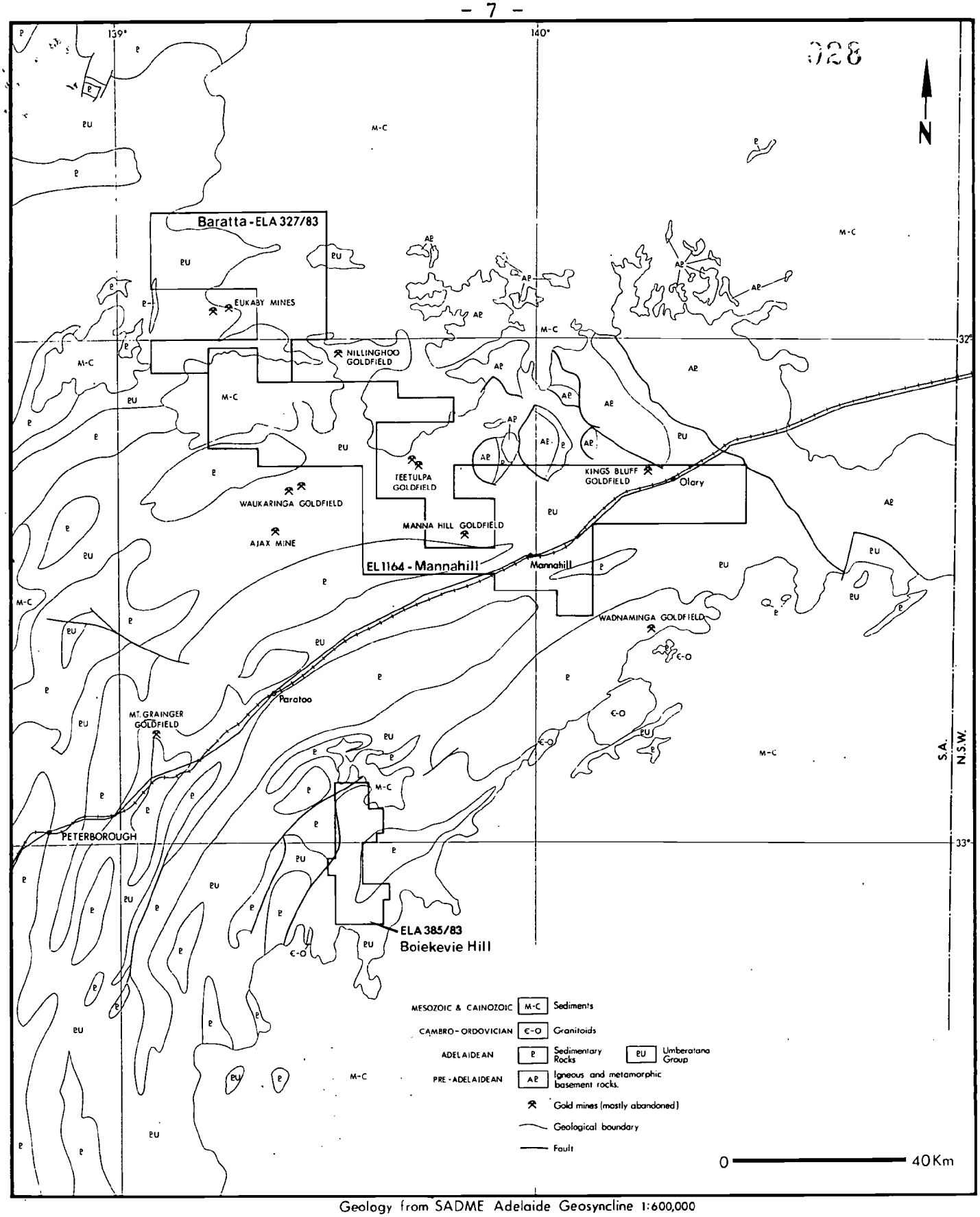
The age of the host rocks, styles of mineralisation and general stratigraphic and tectonic setting of the Adelaide Geosyncline show some similarities with like features in other Proterozoic basins that contain commercially viable stratabound gold deposits.

4. HISTORY OF EXPLORATION

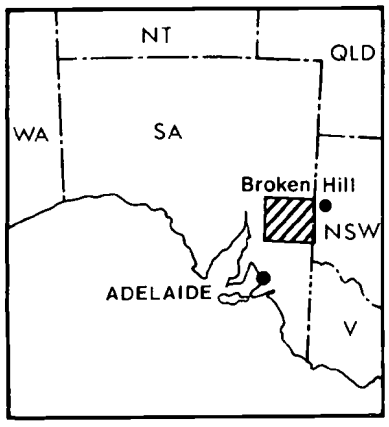
A review of previous exploration in the Olary area was undertaken at the South Australian Department of Mines and Energy in Adelaide and a review of other literature relating to pertinent styles of mineralisation and geological environments was carried out. A listing of all references is contained under References and Bibliography. Companies that are known to have been active in the search for Proterozoic stratabound gold deposits in the region include Newmont, Utah and CRA.

Mannahill: Newmont's exploration at Mannahill consisted of detailed chip channel sampling of surface and underground workings with gold content determined by duplicate fire assay (Verwoerd 1978). The location of the Mannahill field is shown in Figures 2 and 3.

Homeward Bound: The stratabound ore horizon at Homeward Bound extends over a strike length of 1.5 kilometres. Old workings extend to a maximum depth of 100 metres. The ore as mined averages 0.4 metres in thickness. Newmont assays indicated a grade of 4.3 grams gold per tonne however, assays were variable and individual assays were as high as 7 and 32 grams per tonne. It is apparent from the old stoping pattern that the higher values occurred in shoots of limited extent but the number, position and overall structural control of these shoots is uncertain.

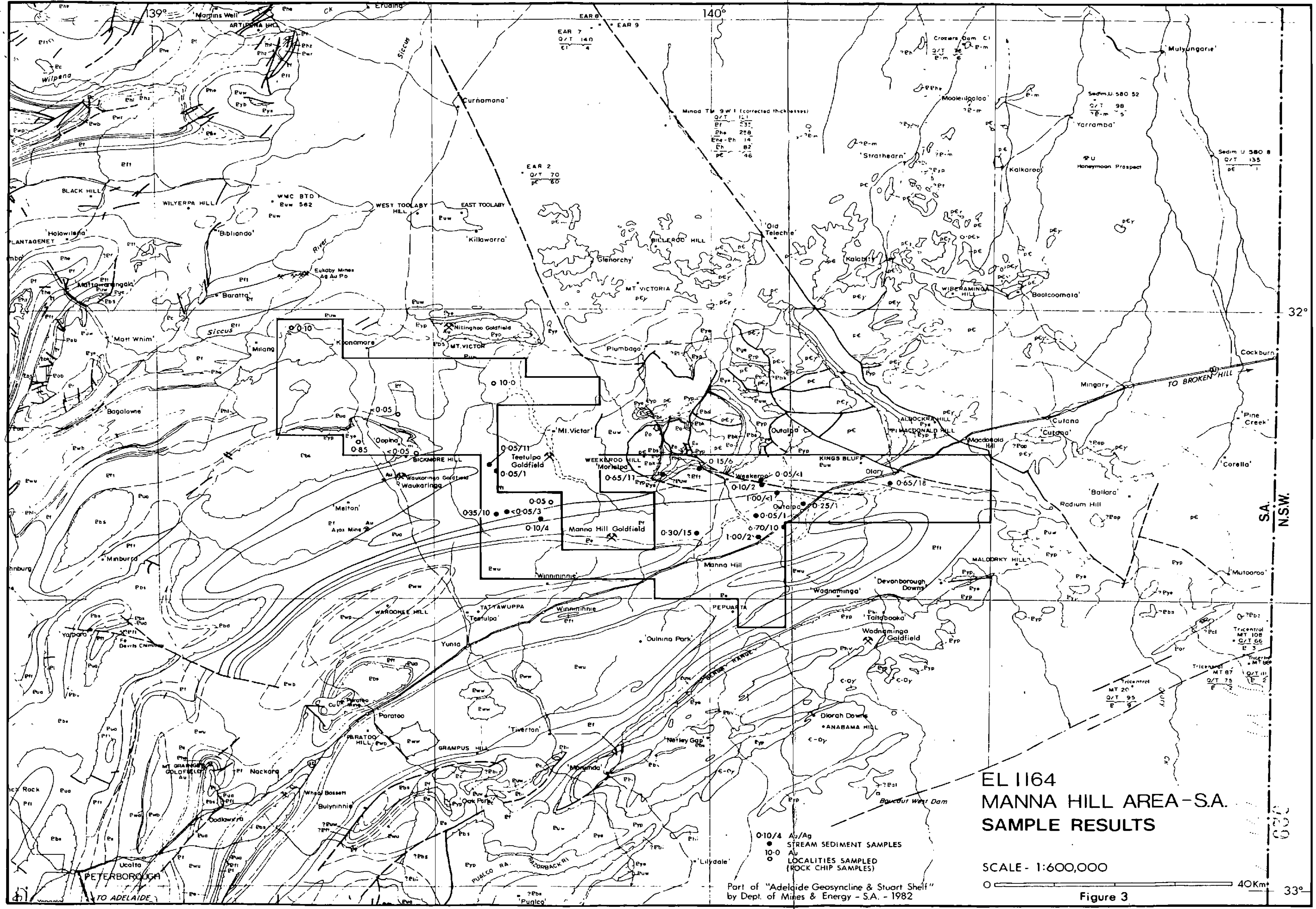


Geology from SADME Adelaide Geosyncline 1:600,000



BARATTA, BOIEKEVIE HILL AND MANNAHILL - S.A.

Figure 2


EL 1164
MANNA HILL AREA - S.A.
SAMPLE RESULTS
0·10/4 Au/Ag
STREAM SEDIMENT SAMPLES
10·0 Au
LOCALITIES SAMPLED (ROCK CHIP SAMPLES)
SCALE - 1:600,000
0
40Km
Part of "Adelaide Geosyncline & Stuart Shelf" by Dept. of Mines & Energy - S.A. - 1982
139°
140°
32°
33°
S.A.
N.S.W.
TO BROKEN HILL
TO ADELAIDE
PETERBOROUGH
Manna Hill
Manna Hill Goldfield
Teetulpa Goldfield
Waukaringa
Yunta
Olary
Cockburn
Mingary
Radium Hill
Wadnaminga Goldfield
Nackara
Koonamore
Kalabity
Weekeroo
Bickmore Hill
Wilpena
Curnamona
Kalkaroo
Mulyungarie
Honeymoon Prospect
Plumbago
Glenorchy
MT VICTORIA
Devonborough Downs
Oulnina Park
Tiverton
Paratoo
Oodlawirra
Bulyninnie
Ucolta
Yarpara
Minburra
Bagalowie
Pepuarta
Winnininnie
Tattawuppa
Oak Park
Dlorah Downs
Lilydale
Macdonald Hill
Cutana
Corella
Ballara
Mutooroo
0·10
10·0
<0·05
0·85
<0·05
0·05/11
0·05/1
0·05
0·35/10
<0·05/3
0·10/4
0·65/11
0·15/6
0·05/<1
0·65/18
0·10/2
1·00/<1
0·25/1
0·05/1
6·70/10
0·30/15
1·00/2
Figure 3

4. Homeward Bound (Cont)

Kingsway Minerals N.L. tested the occurrence with two diamond drill holes (HP1, HP2). Results of this reported in Foldessy (1975).

Eudunda Hope: The stratabound gold horizons here are fully exposed. Newmont rock chip samples varied from 5.5 to 20 grams per tonne over widths of up to 0.6 metres. The area of interest is exposed at the crests of two parallel anticlinal folds with shallow dips ranging from 5° to 10° and has some open pit potential.

Elsie May: Two sub-parallel stratabound horizons here can be followed by lines of shallow workings for a distance of 1 to 1.5 kilometres. Outcrop is poor, averaged sampled width of outcrop is 0.74 metres and average grade obtained by Newmont was 2.3 grams per tonne. Individual values of up to 5.1 grams per tonne are recorded.

Westwood Ho: This stratabound quartz siderite horizon was followed for a length of 1.5 kilometres. Samples taken from the wall of the stope indicate an average grade of 2.7 grams per tonne over a thickness of 1.5 metres. Incomplete mining records here suggest recovered grades of between 7 and 17 grams per tonne.

4. Westwood Ho (Cont)

The deeper workings of this mine are flooded and inaccessible. The main shaft is reported to extend to 77.7 metres on underlay which is only 15.2 metres below the surface. In 1971 Elviry Pty. Ltd. (Kennedy 1971, Kopcheff 1971) completed one vertical percussion drill hole, (WHP1) to test Westwood Ho. The hole intersected 1.52 metres at 20.6 grams per tonne at a depth of 13.7 metres. Kingsway Minerals N.L. completed four short diamond drill holes to test the occurrence and the results recorded by Foldessy (1975). Newmont drilled the ore horizon between Westwood Ho and Jacksons line of diggings. In 1978, 25 holes were completed at 200 metre centres for a total of 717 metres of percussion drilling. The lode horizon was intersected at every hole and had a thickness bearing from less than 0.5 metres up to 1.5 metres. The drill results showed an apparent thickening of the lode in a westerly direction towards the Westwood Ho Mine. The analytical results of this drilling showed values not exceeding 1 ppm.

All Newmonts samples were submitted to Telfer Gold Mine for gold screen fire assays. Eight individual assays exceeded 1 ppm and ranged up to 8 ppm. Newmont concluded that the area between the Eudunda Hope and Westwood Ho Mines was low and patchy and that rock chip samples of surface gossans showed considerably higher gold content than that in drill core. Relinquishment was recommended by Verwoerd (1978b).

4. (Cont)

CRA held an Exploration Licence (E.L. 530) over portions of Mannahill between 1977 and 1981 during which time they carried out orientation geochemistry and bedrock auger drilling over the Winnininnie and Waukaringa areas. However follow-up sampling of low order and base metal anomalies failed to define any suitable drilling targets. Comprehensive rock chip sampling of costeans excavated on the Waukaringa line of lode produced a maximum gold assay of 0.48 ppm. Bedrock drilling on the Winnininnie grid produced a maximum gold assay of 0.12 ppm.

CRA also examined the Boomerang Mine but came to the conclusion the orebody was of insufficient size to be of interest as it was too steeply dipping and too low grade. CRA was seeking a Telfer-style stratabound target at Waukaringa grid (Mayer 1981). The maximum gold assay from 600 auger samples was 0.095 ppm gold.

At the Boomerang Gold Mine adjacent to the Broken Hill road, 16 kilometres northeast of Mannahill, workings consist of two shafts and several costeans on a 1 metre thick transgressive quartz-arsenopyrite goethite vein. The dolomitic siltstone (Waukaringa siltstone) which hosts the mineralised vein, strikes 063^{o} magnetic and dips 18^{o} to the north. Select samples of oxidised iron-rich quartz breccia returned a gold assay 18.7 ppm gold which is of the same order as the recorded mine grade. A selected sample of unoxidised quartz arsenopyrite vein

4. (Cont)

returned 3.07 ppm gold. A single sample of spotted siltstone host rock returned a gold assay of 0.11 ppm gold. The relatively steep narrow vein striking 176° magnetic and dipping 70° to the east makes the Boomerang Mine unattrative for further exploration (Mayer 1981).

CRA noted similarities between the Mannahill region and the Telfer region of Western Australia and applied for E.L. 530 at Mannahill on 29.3.79 (subsequently granted on the 12.9.79). Licence area covered 2,137 square kilometres. and included the Mannahill, Waukaringa, Ajax, Teetulpa and Wadnaminga workings (for locations see Figures 2 and 3).

Similarities noted by Mayer (1979) between the Mannahill region of South Australia and the Telfer region of Western Australia included:

1. Geology: Siltstones, dolomitic siltstones and sandstones of low Proterozoic age at both locations.

2. Structure: Relatively gentle episodes of folding which have produced a series of domes and bases with shallow dips predominating.

3. Stratiform: and stratabound ferruginous quartz veins bearing gold.

4. (Cont)

The veins appear to be best developed as drapes over anticlinal structures. They are generally extensive along strike but less extensive down dip. Vein thickness is variable but thickness sought is of the order of 1 metre. Telfer Mine in Western Australia, and the Westwood Ho Mine in South Australia exhibits strong similarities in these regards, however, Newmont's exploration work (Verwoerd, 1978a and 1978b) has demonstrated that grade at Westwood Ho is too low to support a large scale mining operation. Mayer (1979) considered that there was potential for ore bodies of the Telfer-type to exist in the Mannahill area. These may occur hinge zones of anticlines particularly alluvial cover rendered discovery by past prospectors unlikely. Mineralised veins may be continuous of outcropping veins or occur in an en-echelon pattern. Various mineralised veins within the Mannahill area fit the Telfer model less well but generate other types of exploration targets.

Stratiform gold bearing veins occur at Waukaringa on the northern limb of the Waukaringa syncline. Similar veins occur at the same stratigraphic position on the southern limb at the Ajax Mine of workings. The more shallowly dipping northeast and southwest closures of the Waukaringa syncline may contain mineralised veins of economic interest.

At Wadnaminga mineralised veins are transgressive but their considerable strike extent and shallow dips demonstrate the potential of this area.

4. (Cont)

Orientation Geochemistry

The principal conclusions drawn from CRA's orientation work (McConachy & Mayer 1980) were:

1. Some secondary dispersion is associated with the weathering mineralisation.

2. Gold can be detected geochemically in soil/weathered bedrock samples.

3. Auger sampling is a viable exploration tool in this environment.

4. The best indicator elements for gold mineralisation are gold and arsenic. Copper, lead and zinc may or may not be useful.

Analyses of mineralised grab samples from seven old workings within the CRA Mannahill E.L. showed that the most commonly elements were gold, arsenic, copper, lead and bismuth. Other elements which sometimes occur in elevated concentrations included zinc, molybdenum, strontium, uranium, cobalt and manganese. Similar work by the SADME substantiates these results.

4. Orientation Geochemistry (Cont)

1. At the Ajax workings mineralised is defined by coincident gold, arsenic and copper anomalies over approximately a 30 metres wide zone. Gold values are up to 0.2 ppm (background 0.1 ppm), arsenic up to 42 ppm (background 10 ppm) and copper up to 40 ppm (background 15 - 25 ppm).

2. At Westwood Ho! anomalous arsenic values of up to 320 ppm (background 30 to 90 ppm) occur in a 45 to 50 metre wide zone. Gold, lead, zinc and copper form a coincident spot anomaly about 4 metres stratigraphically below the lode horizon.

3. At Homewood Bound anomalous gold values of up to 1.8 ppm (backgound 0.1 ppm) occur in a 60 metres wide zone. Arsenic forms a more limited halo of 30 metres with values up to 24 ppm (backgound 10 ppm). Copper is erratic and non-definitive.

Summary of CRA Exploration

Following a literature survey and orientation geochemistry, CRA established three grids at Winninninnie, Florina and Waukaringa (Mayer 1981). Bedrock augering over these grids produced several low order gold and base metal anomalies, follow-up sampling enhanced one anomaly at the Florina prospect. Close spaced auger drilling at Florina prospect and Nectar prospect adjacent to the Nectar Mine and No Gammon adjacent to the No Gammon was

4. Summary of CRA Exploration (Cont)

followed by percussion drilling, with the best intersection of 3.5 ppm gold over 1 metre at the Nectar prospect. Comprehensive rock chip sampling of costeans excavated on the Waukaringa line of lode produced a maximum gold assay of 0.48 ppm.

The following review of other gold fields in the Olary area is taken from Martins (1978).

Waukaringa: Gold is located along the south dipping northern limb of the Waukaringa syncline where 2 or 3 south dipping quartz ironstone reefs occur in sandy siltstone beds at the top of the Tapley Hill formation. Henley (1977), reported that no gold was visible in or thin and polished sections in samples from the underground workings. However assays indicate relatively pure gold with 7.9 ppm gold and lppm silver. The ironstone consists of quartz and sulphide partly to completely to altered to limonite and goethite.

Ajax: The workings are located on the southern limb of the Waukaringa syncline with gold and quartz ironstone reefs in sandy siltstone at the top of the Tapley Hill formation. Henley (1977), reported several grains of native gold about 15 microns in size in iron oxide in samples from underground workings. The gold is yellow, indicative of low silver content, which confirmed by analysis of gold

4. Ajax (Cont)

15.8 ppm gold and 1 ppm silver. The anticline south of the Ajax Mine exposes massive Appila Tillite with narrow sandstone/quartz interbeds. A few shallow workings are located on quartz reefs along the axis of this anticline.

Teetulpa: The majority of gold here was won from alluvium from northerly draining creeks, however, some reef gold was also mined. East-west and north-south quartz veins intersect in this area. Most of the reef gold in localised in the northerly trending reefs at or near the intersection with the east-west reefs. The only sample examined by Henley (1977), showed no visible gold in thin or polished section despite an assay of 1.2 ppm gold. The gold bearing reefs lie within the Tapley Hill formation but stratigraphically lower than the host rocks at Waukaringa and Ajax. From Teetulpa several quartz reefs extend westwards towards Waukaringa.

King's Bluff Goldfield: The goldfield is located 7 kilometres west of Olary. Thin, vertically dipping quartz veins have been mined within a felspathic, blocky quartzite. Quartz veins are transgressive and probably relate to tension joints of a broad shallow dipping anticline. Many of the workings are confined to the base of this 20 metres thick quartzite which forms a prominent scarp and dip slope. The footwall consists of sericitic

4. King's Bluff Goldfield (Cont)

siltstones and psammitic rocks. Sericite is common. A pebble conglomerate outcrops in places. Workings here include the Eringa Mine and the Copperlinca Mine (McConachy & Mayer 1980).

Kirkeek's Treasure Mine: This mine is situated on the northern limb of the anticline near its eastern closure. Mineralisation occurs within transgressive quartz, limonite, pyrite, hematite gold veins hosted by a felspathic quartzite unit of the Burra Group. The quartzite unit is overlain by siltstones and shales and underlain by a thick dolomitic siltstone unit. Various orientations of mineralised quartz veins are observable within the mine area. The veins are interpreted as tension gashes within the competent quartzite unit. Generally the veins do not penetrate the less competent overlying and underlying siltstones. This mine has been diamond drilled by CRA Exploration (Mayer 1980).

5. WORK PROGRAMME

During the quarter a survey of available literature was completed and analysis of samples carried out. Landsat images and aerial photographs were acquired and photo interpretation of selected areas of follow-up was undertaken. Further interpretive work was carried out on regional aeromagnetics.

6. GEOLOGY

The Exploration Licence covers part of a sequence of sedimentary rocks that form the Adelaide Geosyncline.

TABLE

Subdivisions of Adelaidean Sequences

Age	Rock Units
Marinoan	Wilpena Group
Sturtian	Umberatana Group
Torrensian	Burra Group
Wirrouran	Callana Beds

The Licence area predominantly covers lithologies of the Umberatana Group. This Group has recorded thicknesses of up to 6,000 metres and is dominated by cycles of marine sedimentation associated with tillites.

Within the Umberatana Group gold mineralisation is more commonly found contained by particular beds and/or lithologies. The majority of occurrences visited are confined to the middle and lower part of the Group as shown below:

042

6. (Cont)

Umberatana Group	Gumbowie Arkose	
	Waukaringa Siltstone	* Dusthole ** Mannahill
	Tarcowie Siltstone	** Waukaringa-Ajax
	Tapley Hill Formation	* Teetulpa
	Willyerpa Quartzite	* Kings Bluff
	Appila Tillite	* Mt. Grainger
	?	* Kirkeeks Treasure

* gold occurrences

Host rocks of various occurrences are variable ranging from dolomitic siltstone to arkosic tillite. Mineralisation is commonly associated with thinly bedded, sideritic siltstones. Identification of this rock type may be a useful guide in regional prospecting.

Surface Expression of Gold Mineralisation: The majority of occurrences inspected form subdued to prominent strike ridges reflecting the more resistant, siliceous nature of the reefs. On close examination, however, the surface expression of mineralisation is very meagre. The calcreted soils have tended to cement and coat the weathered reef material when it reaches surface. Consequently only a few scattered quartz and limonite fragments mark the surface position of the reefs. Soil tones may be subtly darker brown or reddish brown along the line of mineralisation. White tones reflecting underlying calcrete are present, but are also associated with unmineralised stratigraphy throughout the district.

6. (Cont)

Sets of cross-cutting fractures have been noted both associated with known mineralised areas and in prospective stratigraphy where mineralisation has not yet been recorded. These fracture sets, shown in Plates 1 to 4 are considered to represent brittle fracture along a NNW trending corridor possibly related to tectonic movement in the basement rocks. Individual fractures have been found to be mineralisation often containing quartz-siderite-limonite as vein infilling.

7. GEOCHEMICAL SURVEY

A total of 14 stream sediment samples were collected from streams draining sedimentary rocks of the Umberatana Group. Approximately five kilogrammes of material was collected after allowing for moisture content and sieving to 6 millimetres. The samples were sent to Griffith Laboratories in Perth and processed by a modified cyanide treatment prior to analysis by atomic absorption spectrometer for gold, silver and copper. The results (Figure 3) obtained are qualitative only and do not represent grade.

As a result of orientation samples taken outside the Exploration Licence from streams draining known occurrences and work by Amax in gold provinces elsewhere, a result of 0.30 gold is considered to represent a threshold value. Threshold values have not been established for silver and gold.

8. AERIAL SURVEY

A systematic aerial survey was flown over the Exploration Licence using a Cessna 210 flying east-west lines at approximately kilometre line spacing. The purpose of this survey was to visually locate and inspect previous workings, current workings and prospective structural/stratigraphic situations. Localities of interest were recorded on aerial photographs and later inspected and sampled by a helicopter reconnaissance follow-up team.

9. PROPERTY STATUS

The Mannahill Exploration Licence covering approximately 2,365 square kilometres applied for by Amax on 10th March, 1983 was offered by the South Australian Department of Mines and Energy on 9th May, 1983 for acceptance. The Department was advised of Amax's acceptance of the Licence and related conditions on 23rd May, 1983.

A condition of Schedule C provides that the company liase with the Aboriginal Heritage Section of the Department of Environment and Planning prior to commencing operations. Initial contact with this section was made on 31st May, 1983 with a telephone call to Tom Power who advised that the Olary area is regarded as a high priority for preservation of Aboriginal sites. The Aboriginal Heritage Section has requested of the South Australian Department of Mines and Energy that an area around AMG grid reference 408000 mE, 6416000 mN be deleted from the Licence area as it is the location of Aboriginal engravings of significance.

10. EXPENDITURE STATEMENT

PROJECT EXPENDITURE STATEMENT
AS AT 8TH JANUARY, 1984
A$

Legal Fees & Expenses	0
Publications, Maps, Reports & Airphotos	196
Drafting Services & Supplies	645
Assaying & Analysis	2,166
Telephone, Telex & Telegraph	0
Postage, Shipping & Freight	35
Field Materials	22
Car Hire & Taxis	0
Air Travel	558
Lodgings, Meals & Entertainment	111
Aircraft/Helicopter Charter	0
Vehicles - Maintenance	11
Vehicles - Lease	522
Field Equipment - Purchased	0
Misc. Tenement Fees	0
Allocated Salaries	14,596
Gross Expenditure	18,862

PLATES

PLATE 1 Sedimentary rocks of the Waukaringa Siltstone indurated by a limonite envelopes surrounding thin (1 to 2mm) near vertical fractures striking north north-west. Photo looking east.

PLATE 2 Looking south along a near vertical fracture shown in Plate 1.

PLATE 3 Indurated calcareous sedimentary rocks with thin quartz limonite veins parallel to bedding adjacent to the fracture shown in Plates 1 & 2. Photo looking east.

PLATE 4 Oblique aerial view looking east over part of the Waukaringa Siltstone towards the Mannahill Goldfield.

Photo: J.E. Thompson

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AMAX AUSTRALIA (GOLD) PTY LTD
MINERALS EXPLORATION DIVISION

QUARTERLY REPORT ON
EXPLORATION LICENCE 1164
"MANNA HILL", SOUTH AUSTRALIA
FOR THE THREE MONTH PERIOD ENDED 8 APRIL 1984

by

D. H. Wyatt

June 1984

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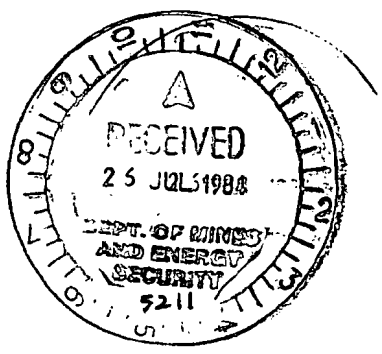

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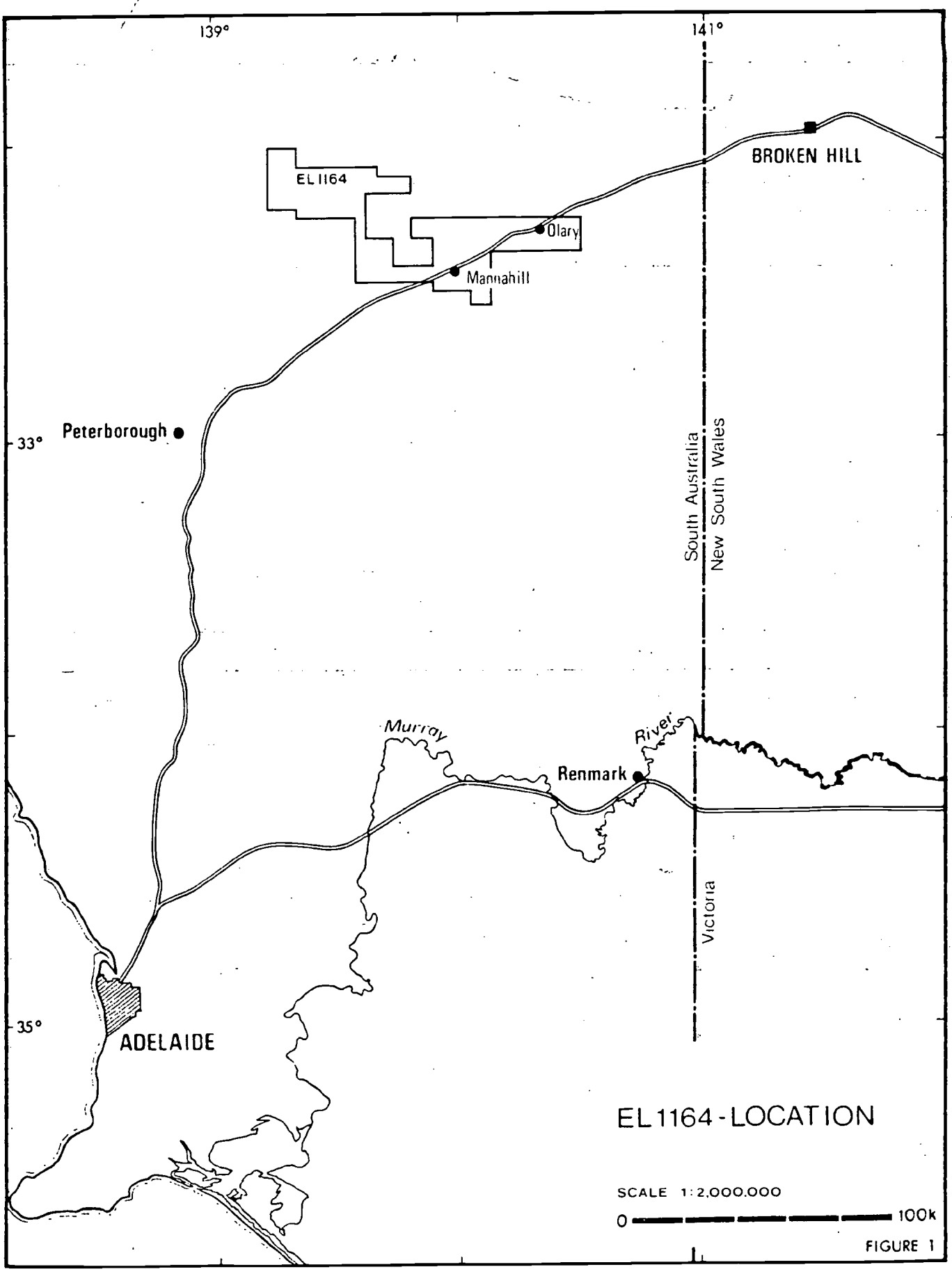
2.	WORK PROGRAMME	2
3.	EXPENDITURE STATEMENT	3

FIGURES

FIGURE 1. MANNA HILL EXPLORATION LICENCE AREA

FIGURE 1


139°
141°
BROKEN HILL
EL 1164
Olary
Mannahill
Peterborough
33°
South Australia
New South Wales
Murray
River
Renmark
Victoria
35°
ADELAIDE
EL 1164 - LOCATION
SCALE 1:2,000,000
0
100k
FIGURE 1

070

1. INTRODUCTION

This report describes the work programme on this project during the period 9 January 1984 to 8 April 1984.

As the Regional Geology, Location & Access, History of Exploration and Rationale for the Exploration Effort have all been described in previous reports (see list below), these topics will not be repeated here.

1.1 Previous Reports

* Quarterly Report on Exploration Licence 1164 "Mannahill" for the period ended 8th October 1989. Peter F. Bull, October 1983.

* Quarterly Report on Exploration Licence 1164 "Mannahill" for the period ended 8th January 1984. AMAX Australia Limited, January 1984.

2. WORK PROGRAMME

In the initial part of the period, very little work was carried out on the area because of staff commitments to other projects.

Late in the period, a local contract geologist was engaged to undertake bulk stream and soil sampling in an area southeast of Olary and north of Highway 32 where some anomalous gold values (Anomaly 88, see First Quarterly Report) had been recorded in previous sampling. This sampling was still in progress at the close of the period and no assay results are yet to hand. The results will be included with the next quarterly report.

Six man-days were spent in the field.

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3. EXPENDITURE

PROJECT EXPENDITURE STATEMENT
AS AT 8 APRIL 1984

	A$
Publications, Maps, Reports and Airphotos	28
Drafting Services and Supplies	60
Vehicles - Maintenance	523
Allocated Salaries	53
Office overheads	122
GROSS EXPENOITURE	786

AUSTAMAX GOLD PTY LIMITED
(Formerly AMAX Australia (Gold) Pty Ltd)
MINERALS EXPLORATION DIVISION

QUARTERLY REPORT ON
EXPLORATION LICENCE 1164
"MANNA HILL", SOUTH AUSTRALIA
FOR THE THREE MONTH PERIOD ENDED 8 JULY 1984

by

D. H. Wyatt

July 1984

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FIGURES

Figure 1 Manna Hill Exploration Licence Area

Figure 2 Manna Hill Aerial Survey Anomaly Points

Figure 3 Outalpa Sample Sites

Figure 4 Reduced Manna Hill Exploraton Licence Area

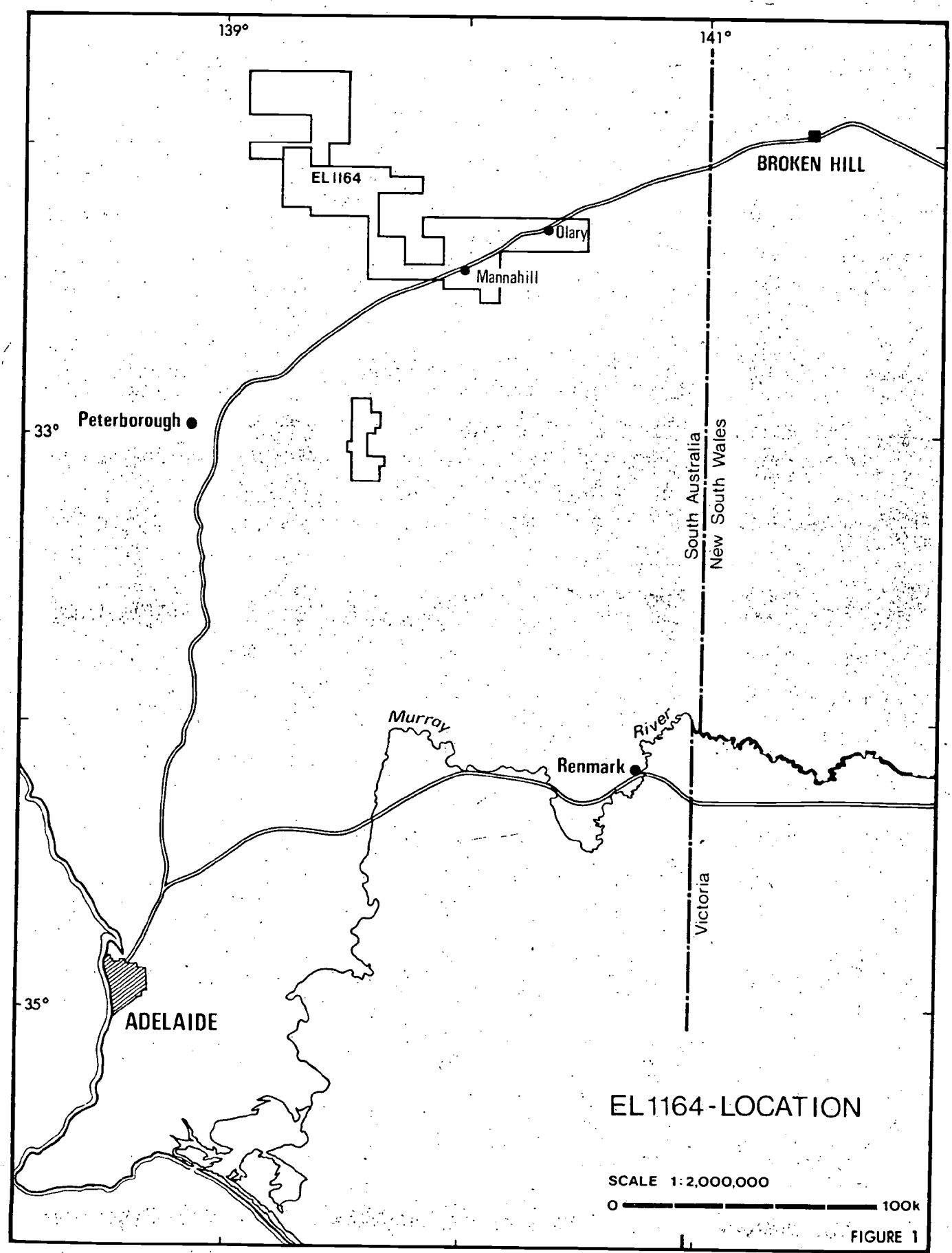
139°
141°
EL 1164
BROKEN HILL
Olary
Mannahill
33°
Peterborough
South Australia
New South Wales
Murray
River
Renmark
Victoria
35°
ADELAIDE
EL1164 - LOCATION
SCALE 1:2,000,000
0
100k

FIGURE 1

1. INTRODUCTION

This report describes the work programme on this project during the period 9 April 1984 to 8 July 1984.

As the Regional Geology, Location and Access, History of Exploration and the Rationale for the Exploration Effort have all been described in previous reports, these topics will not be repeated here.

1.1 Previous Reports

* Quarterly Report on Exploration Licence 1164 "Mannahill" for the period ended 8th October 1989. Peter F. Bull, October 1983.

* Quarterly Report on Exploration Licence 1164 "Mannahill" for the period ended 8th January 1984. AMAX Australia Limited, January 1984.

* Quarterly Report on Exploration Licence 1164 "Mannahill" for the three month period ended 8 April 1984. D. H. Wyatt, AMAX Australia (Gold) Pty Ltd, June 1984.

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2. WORK PROGRAMME

During the period, two geologists - one senior and one junior - were employed for a total of 20 man-days on the licence area.

Several areas of interest noted during an earlier aerial reconnaissance were revisited.

Two small mine workings, apparently on the same stratigraphic horizon, were visited and sampled in the area of alluvial flats approximately 10 kilometres southeast of Mount Victor.

Quartz veins near Anomaly 95, southwest of Florina Station, were inspected.

Further sampling was carried out in the Outalpa area, southwest of Manna Hill, in order to try and localise the area of anomalous gold values previously recorded.

2.1 Aerial Anomalies Visited

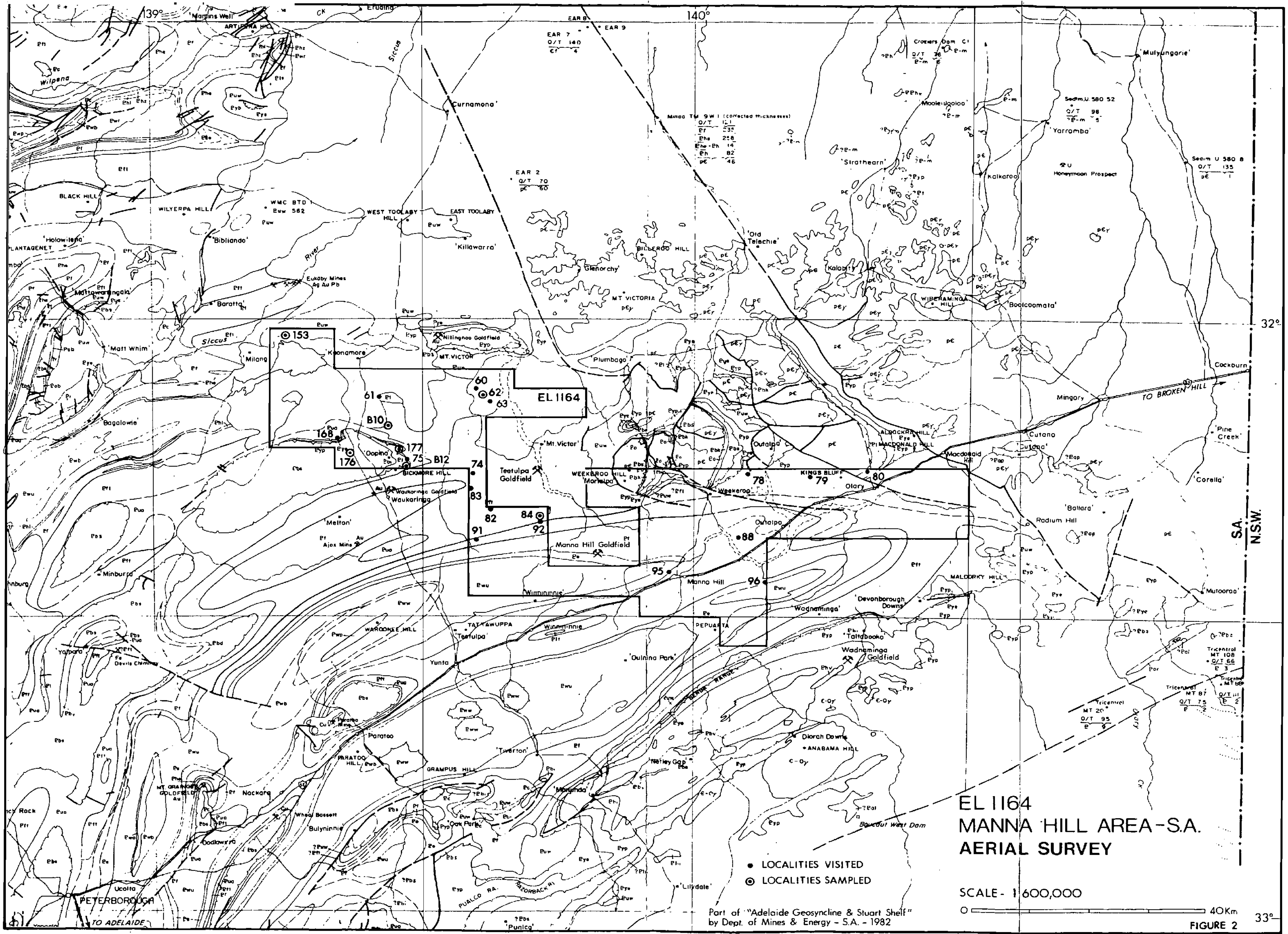
Anomaly locations are shown on Figure 2.

- Anomaly 79:

Ground inspection in this area failed to locate any geological features worthy of sampling and no further work was considered necessary following the "border-line" results of previous sampling.

- Anomaly 95:

An area of red ferruginous feldspathic quartz sandstones was inspected but was not found to exhibit any unusual features on the ground. Nearby quartz veins on the hill slopes to the south showed no signs of mineralisation.


EL 1164
MANNA HILL AREA - S.A.
AERIAL SURVEY
LOCALITIES VISITED
LOCALITIES SAMPLED
SCALE - 1:600,000
0
40Km
Part of "Adelaide Geosyncline & Stuart Shelf" by Dept. of Mines & Energy - S.A. - 1982
EL 1164
Manna Hill Goldfield
Teetulpa Goldfield
Manna Hill
Olary
Yunta
PETERBOROUGH
TO ADELAIDE
TO BROKEN HILL
Cockburn
S.A.
N.S.W.
139°
140°
32°
33°
Curnamona
Mt. Victor
Weekeroo
Kings Bluff
Radium Hill
Waukaringa
Bickmore Hill
Koonamore
Wadnaminga Goldfield
Mingary
Cutana
Macdonald
Oulnina Park
Peterborough
Ucolta
Mt Grainger Goldfield
Pualco Ra.
Lilydale
Honeymoon Prospect
Kalkaroo
Strathearn
Billeroo Hill
Mt Victoria
Glenorchy
Bimbowrie Hill
153
61
60
62
63
B10
168
177
176
75
B12
74
83
82
84
92
91
78
79
80
88
95
96
FIGURE 2

- Anomaly 62:

This is the site of a small working situated within an alluvial flat which shows no other outcrop except that at the entrance of a shallow inclined shaft. The shaft follows a quartz vein dipping south at 20° to 22° conformable with the enclosing grey siltstones. The quartz vein is up to 30 cm thick at the surface but is covered lower down the shaft (about 8 metres deep) by rill. The shaft is 2.5 to 3.0 metres wide and at least 1.1 metres high above the rill.

Previous sampling here, from quartz vein material, gave an assay result of 10 grammes per tonne (g/t) Au. During the present visit, highly ferruginous material from the dump, maybe of seconds material, was sampled which gave the following assay result (Comlabs Pty Ltd, Adelaide):

Sample Number 23499:

Cu	Pb	Ag	Au	As	Sb
610	2.52%	17	0.20	375	330

All results in ppm unless otherwise stated.

A bulk soil sample was collected over a length of 80 metres normal to the supposed strike of the quartz vein in an area of no outcrop but with prominent quartz and ironstone rubble 155 metres east of the shaft. This returned an assay (by bulk leaching methods) of:

Sample Number 23498:

Wt of Zn Precipitate	ppm Au (in precipitate)	ppm Ag (in precipitate)	Calculated ppb Au	Calculated ppb Ag
2.98 gm	2.60	25	3.8	37.2

Primary leach and precipitation by Perth Metallurgical Laboratory, Perth.
Assay of Zn precipitate by AMDEL, Perth.

Approximately two kilometres along strike from this working is a similar shallow working almost certainly sunk by the same person(s) again situated in an alluvial flat with no other outcrop except at the entrance of the shaft. This shaft was sunk on a quartz vein 50 to 60 cm thick conformable with the enclosing dense grey siltstones dipping 25° south. The shaft is presently no more than 5 metres deep but the bottom is not exposed because of rill and fallen roof material. A sample from ferruginous (limonitic) material on the seconds(?) ore dump gave the following results (Comlabs Pty Ltd, Adelaide):

Sample Number 23496:

Cu	Pb	Ag	Au	As	Sb
860	3400	1	0.15	8050	20

All results in ppm unless otherwise stated.

A bulk soil sample taken over 150 metres normal to the strike of the quartz vein 90 metres east of the working gave:

Sample Number 23497:

Wt of Zn Precipitate	ppm Au (in amalgam)	ppm Ag	Calculated ppb Au	Ag
3.02 gm	0.05	11	0.07	16.6

Primary leach and precipitation by Perth Metallurgical Laboratory, Perth.
Assay of precipitate by AMDEL, Perth.

It would appear that both quartz occurrences are anomalous in lead-silver but that gold values are erratic. The fact that both occurrences appear to be on the same stratigraphic horizon separated by a poorly exposed, alluviated area in which a small folded flexure is vaguely exposed on air photos suggests that the intervening area may be worthy of further investigation.

- Near Anomaly 95:

Silica Analysis - Two samples of vein quartz collected near Anomaly 95 gave the following results:

Sample No	SiO_2	Comments
MHQ 1	96.3%	Sample chipped free of iron oxide coatings.
MHQ 2	95.8%	Sample submitted as collected

Comlabs Pty Ltd, Adelaide, Method COL 9.

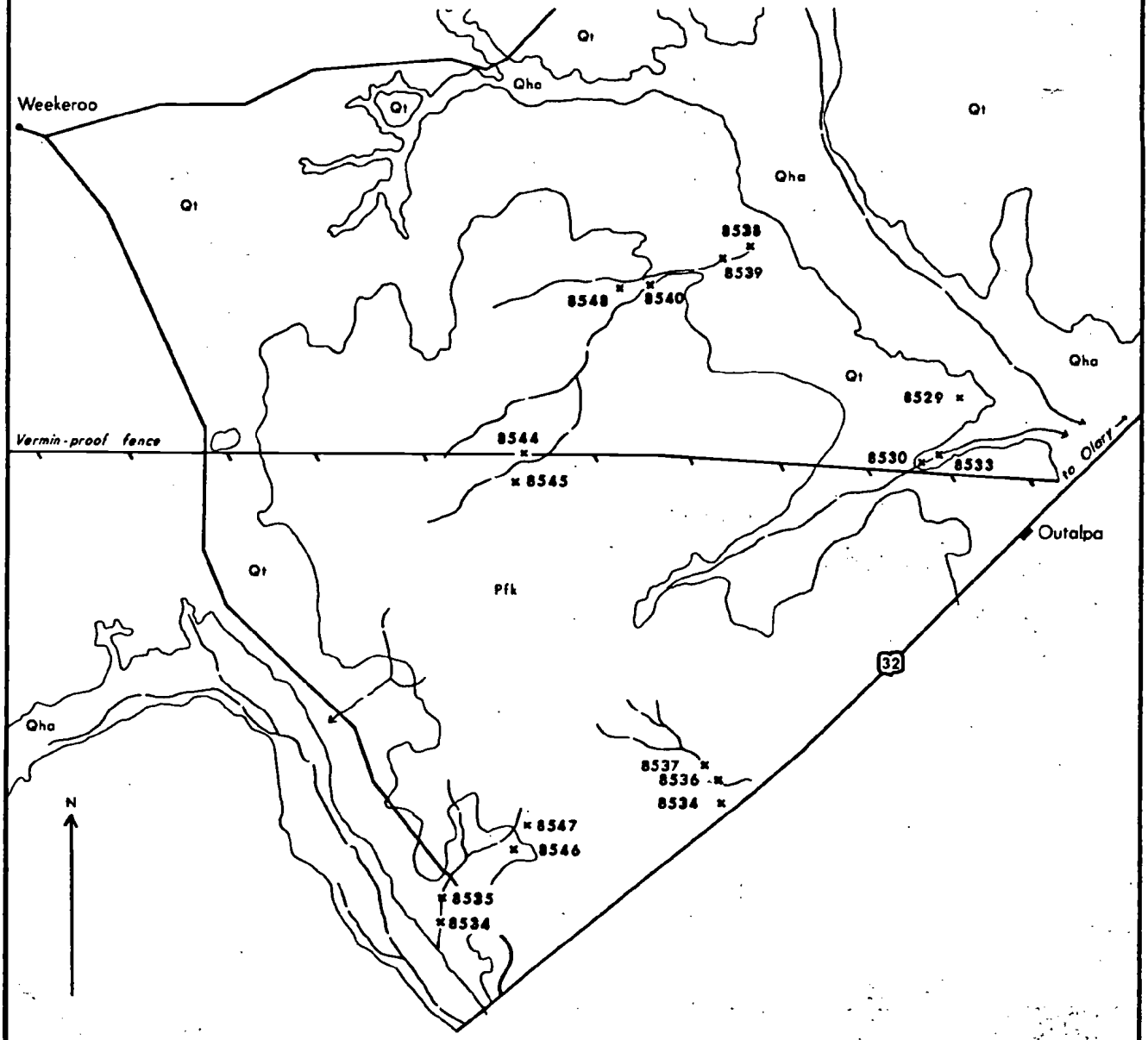
2.2 Outalpa Area

The sample localities west of Outalpa are shown in Figure 3. The results of bulk leaching analysis for gold are given in the following table:

Sample Number	Zn Precipitate Weight (gms)	ppm Precipitate Au	ppm Precipitate Ag	Calculated ppb# Au	Calculated ppb# Ag
8529	3.49	0.30*	28	0.5	48.8
8530	3.04	0.05	2	0.07	3.04
8531	2.86	0.05	4	0.07	5.74
8532	2.69	0.30*	21	0.40	28.2
8533	2.65	0.05	2	0.06	2.6
8534	3.07	0.05	3	0.07	4.6
8535	2.76	0.05	3	0.07	4.1
8536	2.75	0.65*	7	0.90	19.8
8537	2.76	0.30*	4	0.41	5.5
8538	3.20	0.05	1	0.08	1.6
8539	3.02	0.10	2	0.1	3.0
8540	3.04	0.10	2	0.15	3.0
8544					
8545					
8546					
8547					
8548					

\# Fine, free soluble gold.
* All gold values of 0.30 or better have been regarded as anomalous

Primary leaching and precipitation by Perth Metallurgical Laboratory, Perth.
Assay of Zn precipitates by AMDEL, Perth



Qha Holocene stream channel deposits

Qt Quaternary gravel & soil overlay

Pfk Proterozoic Waukaringa Siltstone

SAMPLE LOCALITY SITES - OUTALPA AREA

E.L 1164, MANNAHILL, S.A.

Approximate scale
1 : 85 000

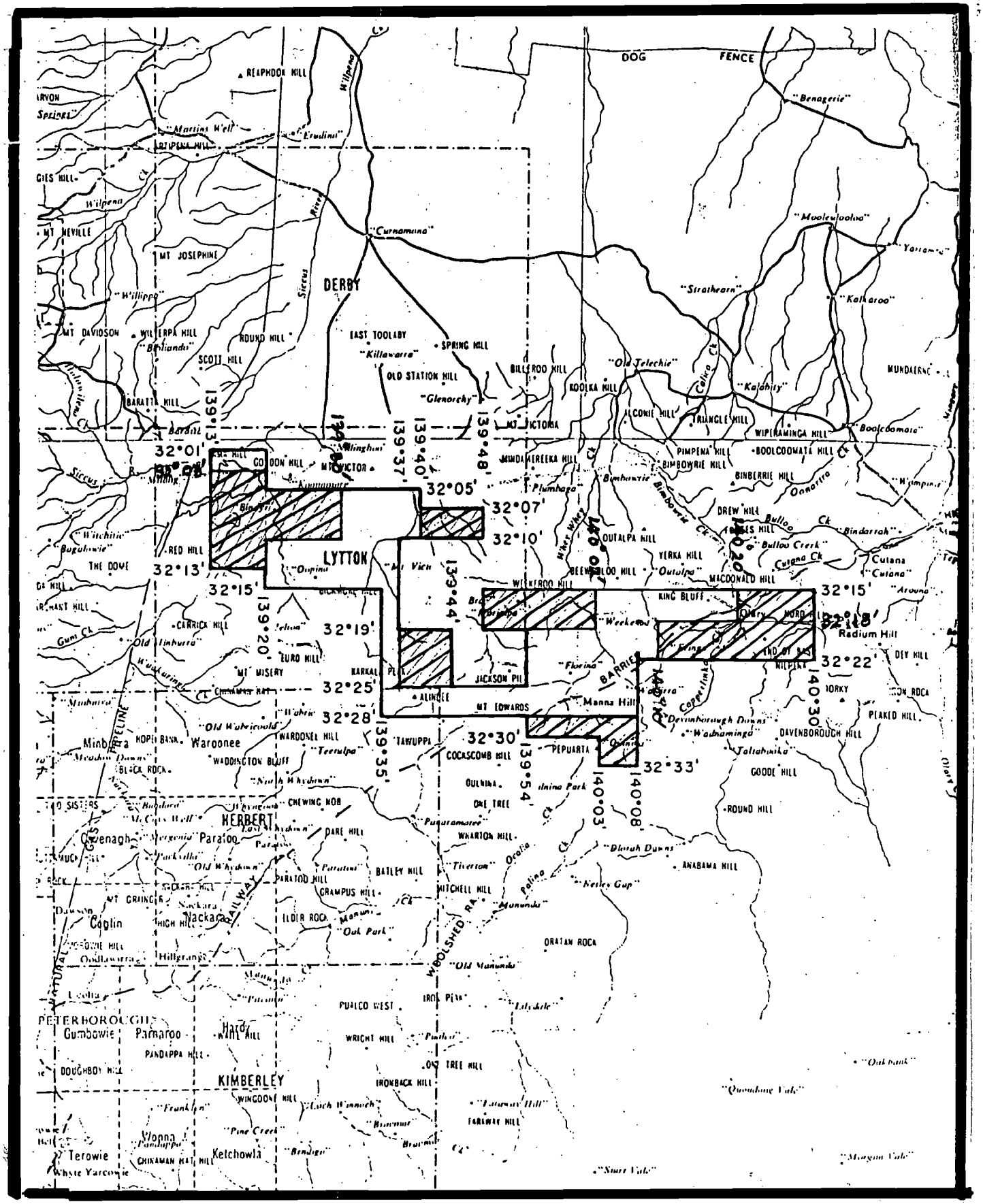
AUSTAMAX GOLD Pty. Ltd.

JULY 1984

FIGURE 3

3. TENEMENT SITUATION

On 26 June 1984, an application was submitted to the Director General, Department of Mines & Energy, for renewal of a portion of the licence area for a further twelve (12) months. At the same time, application was made to relinquish about half the licence area (see Figure 4).



SCALE 1:1 000 000

10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 KILOMETRE

FIGURE: 4

4. EXPENDITURE

PROJECT EXPENDITURE STATEMENT
AS AT 30 JUNE 1984

	A$
Legal Fees and Expenses	462
Publications, Maps, Reports	23
Contractors (except Drilling)	1,428
Drafting Services and Supplies	-
Assays and Analyses	323
Telephone, Telex, Telegraph	4
Postage, Shipping and Freight	3
Field Materials	19
Lodgings, Meals and Entertainment	71
Vehicles (Maintenance)	249
Allocated Salaries	1,223
Office Overheads	446
Airfares	178
GROSS EXPENDITURE	4,419

AUSTAMAX GOLD PTY LIMITED
(Formerly AMAX Australia (Gold) Pty Ltd)
MINERALS EXPLORATION DIVISION

QUARTERLY REPORT ON EXPLORATION LICENCE 1164 "MANNA HILL", SOUTH AUSTRALIA FOR THE THREE MONTH PERIOD ENDED 8 OCTOBER, 1984

by
D.H. WYATT

October, 1984

Property	:	Manna Hill
Location	:	South Australia
Sheet Index	:	SI.54-01/02
Commodity	:	Gold
Project No	:	606

Distribution:
Central Library (1)
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FIGURES

FIGURE 1. E.L. 1164 Location

FIGURE 2. Location Map of Gridded Area about Anomaly 62

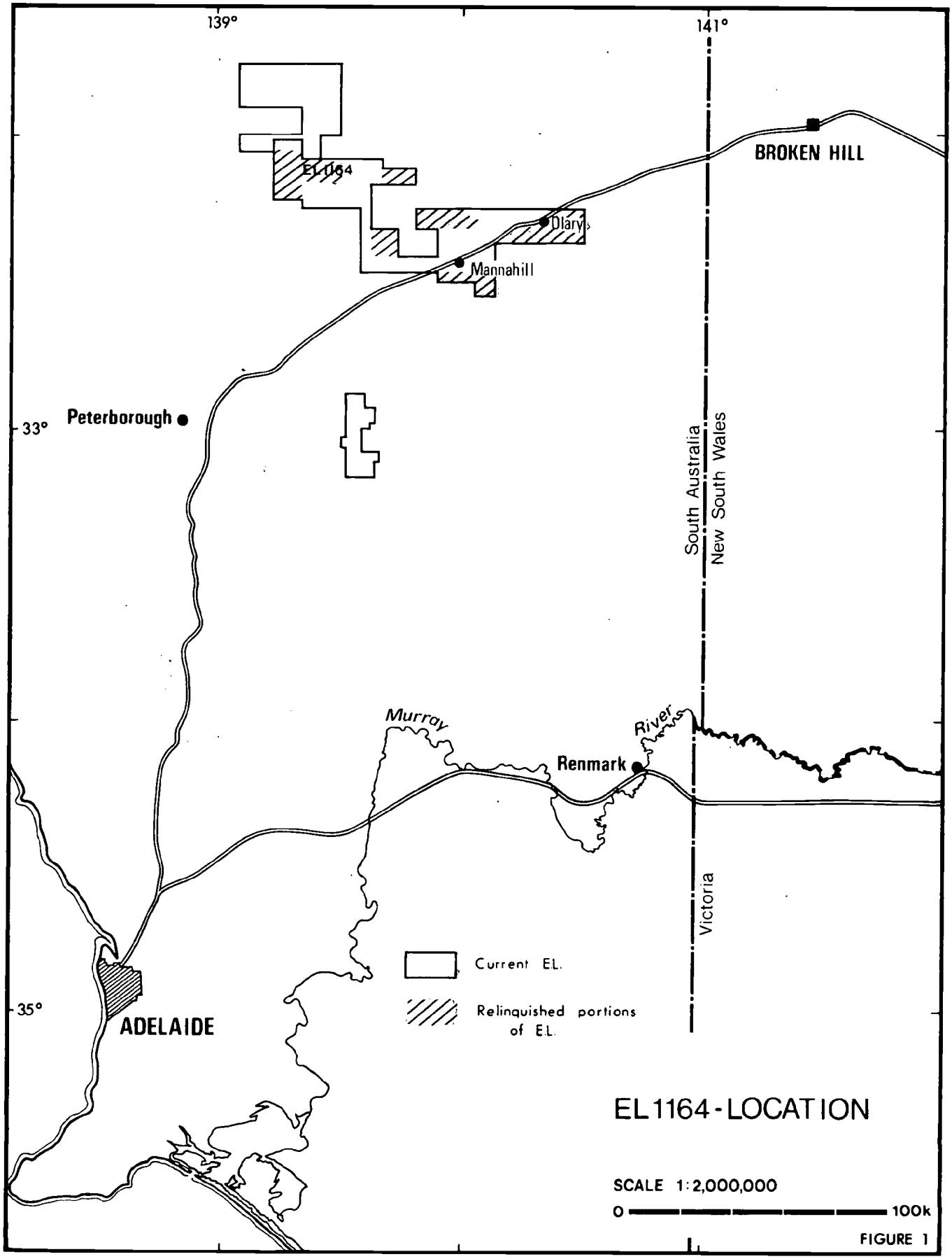
139°
141°
EL 1164
Diary
Mannahill
BROKEN HILL
Peterborough
33°
South Australia
New South Wales
Murray
River
Renmark
Victoria
Current EL.
Relinquished portions of EL.
35°
ADELAIDE
EL 1164 - LOCATION
SCALE 1:2,000,000
0
100k

FIGURE 1

089

1. INTRODUCTION

This report describes the work programme on this project during the period 9 July 1984 to 8 October 1984.

The Regional Geology, Location and Access, History of Exploration and the Rationale for the Exploration Effort have all been described in previous reports.

1.1 Previous Reports

* Quarterly Report on Exploration Licence 1164 "Manna Hill" for the period ended 8th October 1983. Peter F Bull, October 1983.

* Quarterly Report on Exploration Licence 1164 "Manna Hill" for the period ended 8th January 1984. AMAX Australia Limited, January 1984.

* Quarterly Report on Exploration Licence 1164 "Manna Hill" for the three month period ended 8 April 1984. D H Wyatt, AMAX Australia (Gold) Pty Ltd, June 1984.

* Quarterly Report on Exploration Licence 1164 "Manna Hill" South Australia for the three month period ended 8 July 1984. D H Wyatt, AUSTAMAX Gold Pty Ltd, July 1984.

2. WORK PROGRAMME

During the period two geologists - one senior and one junior - were employed for a total of 12 man-days on the licence area.

Detailed sampling was carried out at Anomaly 62 in an area of alluvial flats approximately 10 kilometres southeast of Mount Victor.

A final inspection was made of the Outalpa area.

2.1 Anomaly 62 - 10km S.E. Mt Victor

During July seven days were spent in laying out a grid and sampling soils between two old mine workings in an area of alluvium and eroded "calcrete cemented" aeolian sands. The alluvium and sands overlie sedimentary rocks of the Farina Sub-group, and more specifically, possibly the Tarcowie Siltstone. Eleven lines approximately 400 metres apart and 600 metres long were sampled every 20 metres and these samples were combined over 200 metre intervale (Figure 2). These soil samples were collected for the bulk leaching of fine gold. The sampled lines are shown in Figure 2. The results are given in Table 1.

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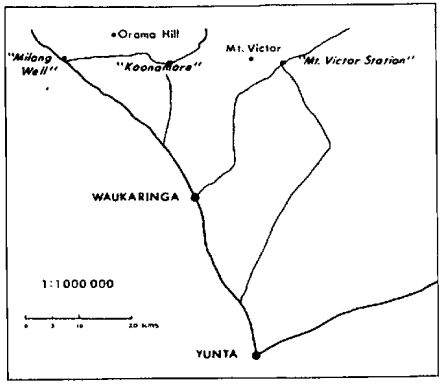
TABLE 1.

ASSAY RESULTS FOR BULK LEACHING OF SOIL SAMPLES FOR FINE FREE GOLD

SAMPLE NO.	WEIGHT OF ZN PRECIPITATE	ppm Au on Zn	ppm Ag on Zn
7518	3.08	0.55	10
7519	3.30	0.60	9
7520	3.11	1.15	20
7521	3.06	1.30	15
7522	3.20	1.85	18
7523	2.80	1.40	19
7524	2.90	1.35	16
7525	3.28	1.45	11
7526	3.33	0.65	17
7527	3.16	1.00	14
7528	3.14	0.95	11
7529	3.19	1.60	17
7530	3.26	1.25	16
7531	3.16	1.30	13
7532	2.81	1.35	23
7533	2.89	2.40	18
7534	3.25	1.45	10
7535	3.49	1.30	11
7536	3.50	1.35	11
7537	3.16	0.55	12
7538	3.25	0.80	11
7539	3.01	1.80	13
7540	3.39	1.35	10
7541	3.05	0.75	7
7542	2.99	1.70	14
7543	3.20	1.15	12
7544	3.16	1.20	13
7545	3.31	1.35	12
4546	3.35	1.35	10
7547	3.11	1.00	15
7548	3.30	0.95	13
7549	3.17	1.10	13

FIGURE 2



POSITION OF SAMPLES
located about Anomaly 62 and a small mine approx. 3 kms. N.E of Anomaly 62.

0 500 metres

1 : 10 000

N

7519
7522
7518 Run 1
7525
7521 Run 2
Mine near fence.
7524 Run 3
7520
7549
7523
7548 Run 4
7546
7547
7545 Run 5
7543
7544
7542 Run 6
7540
7541
7539 Run 7
7537
7538
7536 Run 8
7534
7535
7533 Run 9
7528
7532
7531
7527 Run 10
ANOMALY 62
7530 Run 11
7526
7529

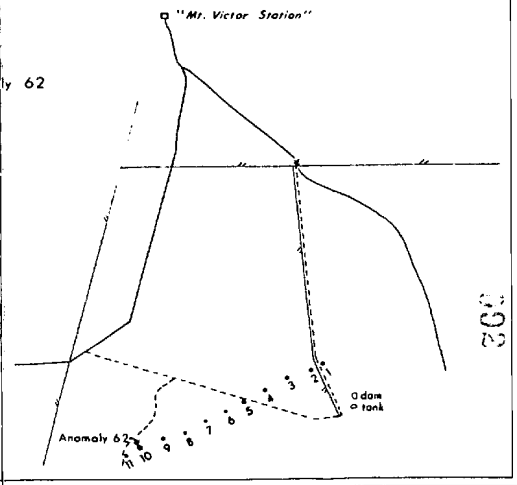
△ MT. VICTOR

LOCATION MAP
of
gridded area about Anomaly 62

1 : 85 000

(Olary : Run 1, Photo 43)

N



2.2 Outalpa Area

Stream sediment samples collected from the Outalpa area during a previous survey returned several anomalous gold results (Quarterly Report on E.L. 1164 8th January, 1984). The highest of these, 6.70 ppm Au 10 ppm Ag was found to be associated with the Outalpa mine workings where a thin (5 cm to 30 cm) ferruginous quartz vein occurs parallel to regional strike. Elsewhere north and north-east of Outalpa thin stringers of ferruginous quartz were observed in a broad zone of complex folding, however no areas observed showed any indications of significant width or strike length.

3. PROPERTY STATUS

The Minister approved an extension of the term of Exploration Licence 1164 of 24 months. The area was reduced from 2365km^2 to 1219km^2.

4. EXPENDITURE

PROJECT EXPENDITURE STATEMENT
FOR THE PERIOD 8 JULY 1984 TO 8 OCTOBER 1984

Publications, Maps, Reports, Airphotos	$ 68
Assays	165
Telephone, Telex, Postage	11
Vehicles, Lease & Maintenance	1,415
Air Travel	550
Lodgings & Meals	427
Geological Contractor	460
Salaries plus fringe	4,942
Tenement Fees	2,083
Office Overheads	796
	$10,917

AUSTAMAX RESOURCES LIMITED

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FINAL REPORT

EL 1164, MANNAHILL, SOUTH AUSTRALIA

by

D. H. Wyatt

October 1984

Property	: Manna Hill
Location	: South Australia
Sheet Index	: SI.54-1/2
Commodity	: Gold
Project No	: 606
Document No	: 01950

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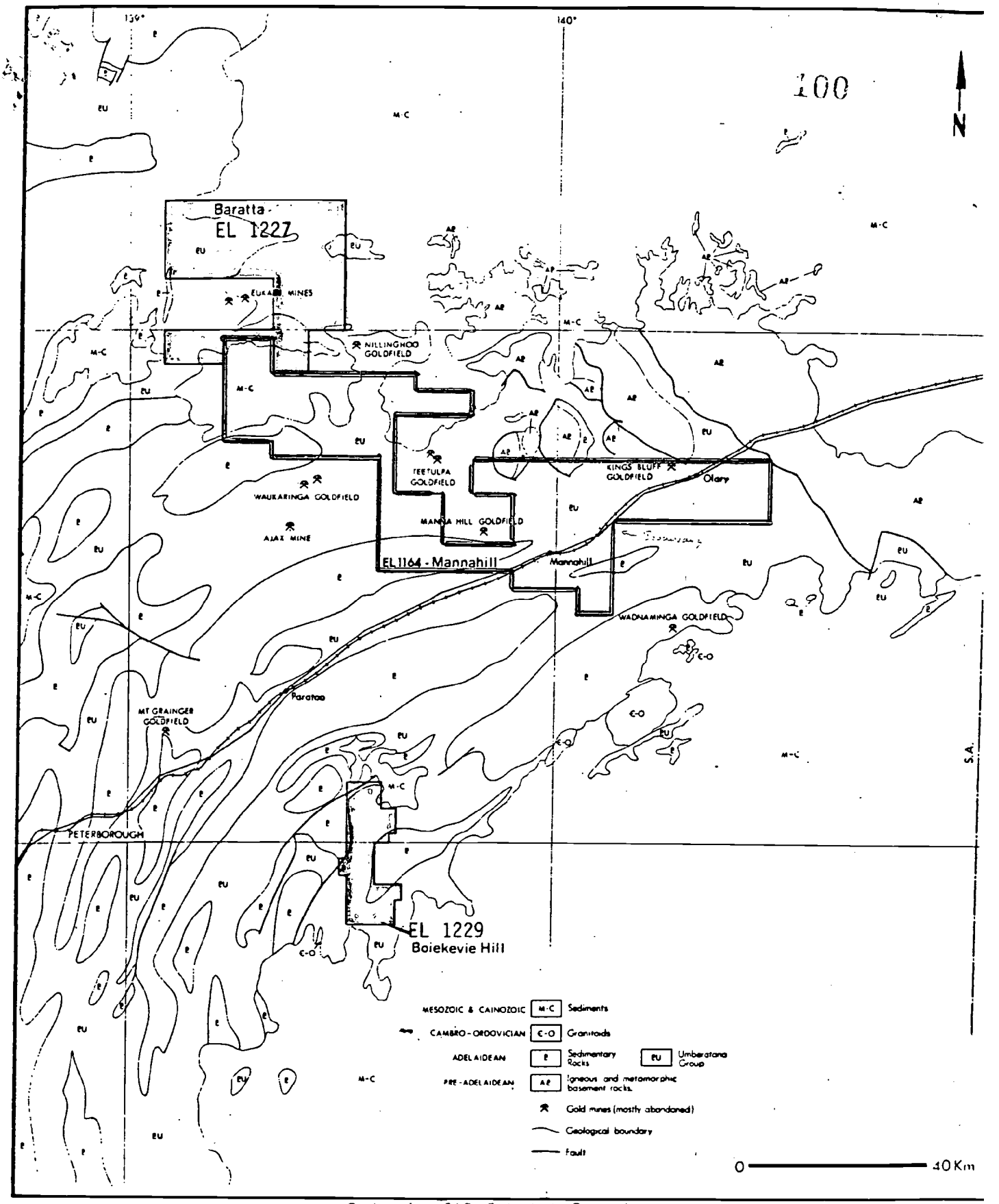
1. INTRODUCTION

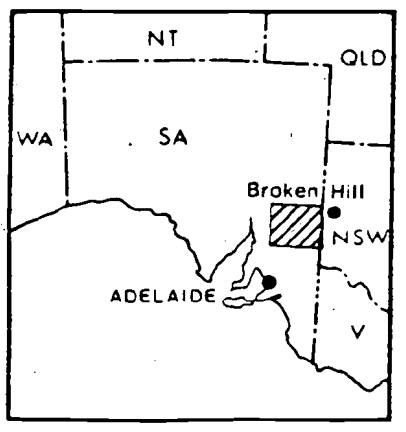
The Exploration Licence was applied for on 30 March 1983 and was granted as EL 1164, Mannahill, on 8 July 1983 for a period of one (1) year.

On 26 June 1984, application was made to the Director General, Department of Mines & Energy for extension of portion of the licence area for a further twelve (12) months. This extension was granted for a period of twenty-four (24) months on 4 July 1984 (Figure 1).

Two other nearby Exploration Licences were held at various periods throughout the tenure of EL 1164. These were EL 1227, Baratta, and EL 1229, Boiekevie Hill (Figure 1), which were worked conjointly with the Mannahill licence during some of their exploration stages.



Geology from SADME Adelaide Geosyncline 1:600,000



LOCATION MAP

FIGURE 1

2. LOCATION

The Exploration Licence is located in the Olary Province of South Australia and straddles the main road, Highway 32, between Peterborough and Broken Hill (Figure 1). The settlement of Mannahill is approximately 390 kilometres from Adelaide.

3. EXPLORATION CONCEPT

The licence area was acquired in order to search for stratabound gold deposits.

Three major gold occurrences - Telfer in Western Australia, Pilgrims Rest in the Republic of South Africa and Passagem in Brazil - constitute a distinctive and recognisable class of deposit. They show a clear association with a predominantly marine shelf sedimentary environment and are preferentially developed in the basal to middle formations of the Proterozoic sequence. In shape, they are sheet-like and follow the stratigraphy faithfully. As a group, the deposits show a number of compositional similarities consisting of quartz, carbonate and minor sulphides. They are characterised by the elemental association of iron, copper, arsenic, gold $\pm$ boron $\pm$ silver.

The deposits are generally regarded as syngenetic in origin, being deposited as chemical sediments in restricted basins within shallow marine seas. Basement faults may have provided suitable channelways for rising metal-bearing brines. Post-ore metamorphism and deformation has resulted in only local remobilisation of ore.

The age of the host rocks, styles of mineralisation and general stratigraphic and tectonic setting of the Adelaide Geosyncline show some similarities with like features in other Proterozoic basins that contain commercially viable stratabound gold deposits.

The relatively unexplored nature of the Proterozoic basins that form the Adelaide Geosyncline for this deposit-type make them an attractive exploration target.

4. HISTORY OF EXPLORATION

A review of previous exploration in the Olary area was undertaken at the South Australian Department of Mines & Energy in Adelaide and a review of other literature relating to pertinent styles of mineralisation and geological environments was carried out. A listing of all references is contained under References and Bibliography. Companies that are known to have been active in the search for Proterozoic stratabound gold deposits in the region include Newmont, Utah and CRA.

Mannahill (32°24'S, 139°50'E): Newmont's exploration at Mannahill consisted of detailed chip channel sampling of surface and underground workings with gold content determined by duplicate fire assay (Verwoerd 1978).

Homeward Bound (Mannahill Goldfield): The stratabound ore horizon at Homeward Bound extends over a strike length of 1.5 kilometres. Old workings extend to a maximum depth of 100 metres. The ore as mined averaged 0.4 metres in thickness. Newmont assays indicated a grade of 4.3 grams gold per tonne. However, assays were variable and individual assays were as high as 7 and 32 grams per tonne. It is apparent from the old stoping pattern that the higher values occurred in shoots of limited extent but the number, position and overall structural control of these shoots is uncertain. Kingsway Minerals NL tested the occurrence with two diamond drill holes (HP1 and HP2). Results of this were reported in Foldessy (1975).

Eudunda Hope (Mannahill Goldfield): The stratabound gold horizons here are fully exposed. Newmont rock chip samples varied from 5.5 to 20 grams per tonne over widths of up to 0.6 metres. The area of interest is exposed at the crests of two parallel anticlinal folds with shallow dips ranging from 5° to 10° and has some open pit potential.

Elsie May (Mannahill Goldfield): Two sub-parallel stratabound horizons here can be followed by lines of shallow workings for a distance of 1 to 1.5 kilometres. Outcrop is poor; averaged sampled width of outcrop is 0.74 metres and average grade obtained by Newmont was 2.3 grams per tonne. Individual values of up to 5.1 grams per tonne are recorded.

Westward Ho (Mannahill Goldfield): This stratabound quartz siderite horizon was followed for a length of 1.5 kilometres. Samples taken from the wall of the stope indicate an average grade of 2.7 grams per tonne over a thickness of 1.5 metres. Incomplete mining records here suggest recovered grades of between 7 and 17 grams per tonne.

The deeper workings of this mine are flooded and inaccessible. The main shaft is reported to extend to 77.7 metres on underlay which is only 15.2 metres below the surface. In 1971, Elviry Pty Ltd (Kennedy 1971, Kopcheff 1971) completed one vertical percussion drill hole (WHP1) to test Westward Ho. The hole intersected 1.52 metres at 20.6 grams per tonne at a depth of 13.7 metres. Kingsway Minerals NL completed four short diamond drill holes to test the occurrence and the results are recorded by Foldessy (1975). Newmont drilled the ore horizon between Westward Ho and Jacksons line of diggings. In 1978, 25 holes were completed at 200 metre centres for a total of 717 metres of percussion drilling. The lode horizon was intersected in every hole and had a thickness ranging from less than 0.5 metres up to 1.5 metres. The drill results showed an apparent thickening of the lode in a westerly direction towards the Westward Ho Mine. The analytical results of this drilling showed values not exceeding 1 ppm.

All Newmont's samples were submitted to Telfer Gold Mine for gold screen fire assays. Eight individual assays exceeded 1 ppm and ranged up to 8 ppm. Newmont concluded that values in the area between the Eudunda Hope and Westward Ho Mines were low and patchy and that rock chip samples of surface gossans showed considerably higher gold content than samples from drill core. Relinquishment was recommended by Verwoerd (1978b).

CRA held an Exploration Licence (EL 530) over portions of Mannahill between 1977 and 1981 during which time they carried out orientation geochemistry and bedrock auger drilling over the Winnininnie and Waukaringa areas. However, follow-up sampling of low order and base metal anomalies failed to define any suitable drilling targets. Comprehensive rock chip sampling of costeans excavated on the Waukaringa line of lode produced a maximum gold assay of 0.48 ppm. Bedrock augering on the Winnininnie grid produced a maximum gold assay of 0.12 ppm.

CRA also examined the Boomerang Mine (32°23'S, 140°06'E) but came to the conclusion the orebody was of insufficient size to be of interest. CRA was seeking a Telfer-style stratabound target at Waukaringa grid (Mayer 1981). The maximum gold assay from 600 auger samples was 0.095 ppm gold.

At the Boomerang Gold Mine adjacent to the Broken Hill road, 16 kilometres northeast of Mannahill, workings consist of two shafts and several costeans on a 1 metre thick transgressive quartz-arsenopyrite goethite vein. The dolomitic siltstone (Waukaringa siltstone) which hosts the mineralised vein, strikes 063° magnetic and dips 18° to the north. Select samples of oxidised iron-rich quartz breccia returned a gold assay 18.7 ppm gold which is of the same order as the recorded mine grade. A selected sample of unoxidised quartz arsenopyrite vein returned 3.07 ppm gold. A single sample of spotted siltstone host rock returned a gold assay of 0.11 ppm gold. The relatively steep narrow vein striking 176° magnetic and dipping 70° to the east makes the Boomerang Mine unattractive for further exploration (Mayer 1981).

CRA noted similarities between the Mannahill region and the Telfer region of Western Australia and applied for EL 530 at Mannahill on 29 March 1979 (subsequently granted on 12 September 1979). The licence area covered 2,137 square kilometres and included the Mannahill, Waukaringa, Ajax, Teetulpa and Wadnaminga workings.

Similarities noted by Mayer (1979) between the Mannahill region of South Australia and the Telfer region of Western Australia included:

- Geology: Siltstones, dolomitic siltstones and sandstones of low Proterozoic age at both locations.

- Structure: Relatively gentle episodes of folding which have produced a series of domes and bases with shallow dips predominating.

- Stratiform: Stratabound ferruginous quartz veins bearing gold.

The veins appear to be best developed as drapes over anticlinal structures. They are generally extensive along strike but less extensive down dip. Vein thickness is variable but thickness sought is of the order of 1 metre. Telfer Mine in Western Australia and the Westward Ho Mine in South Australia exhibit strong similarities in these regards. However, Newmont's exploration work (Verwoerd 1978a and 1978b) has demonstrated that grade at Westward Ho is too low to support a large scale mining operation. Mayer (1979) considered that there was potential for ore bodies of the Telfer-type to exist in the Mannahill area. These may occur along the hinge zones of anticlines, particularly where alluvial cover rendered discovery by past prospectors unlikely. Mineralised veins may be continuous or occur in an en echelon pattern. Various mineralised veins within the Mannahill area fit the Telfer model less well but generate other types of exploration targets.

Stratiform gold bearing veins occur at Waukaringa on the northern limb of the Waukaringa syncline. Similar veins occur at the same stratigraphic position on the southern limb at the Ajax line of workings. The more shallowly dipping northeast and southwest closures of the Waukaringa syncline may contain mineralised veins of economic interest.

At Wadnaminga, mineralised veins are transgressive but their considerable strike extent and shallow dips demonstrate the potential of this area.

Orientation Geochemistry:
The principal conclusions drawn from CRA's orientation work (McConachy & Mayer 1980) were:

- Some secondary dispersion is associated with the weathering mineralisation.

- Gold can be detected geochemically in soil/weathered bedrock samples.

- Auger sampling is a viable exploration tool in this environment.

- The best indicator element for gold mineralisation is arsenic. Copper, lead and zinc may or may not be useful.

Analysis of mineralised grab samples from seven old workings within the CRA Mannahill Exploration Licence showed that the most common elements were gold, arsenic, copper, lead and bismuth. Other elements which sometimes occur in elevated concentrations included zinc, molybdenum, strontium, uranium, cobalt and manganese. Similar work by the SADME substantiates these results.

Ajax (32°23'S, 139°22'E): At the Ajax workings, mineralisation is defined by coincident gold, arsenic and copper anomalies over approximately a 30 metre wide zone. Gold values are up to 0.2 ppm (background 0.1 ppm), arsenic up to 42 ppm (background 10 ppm) and copper up to 40 ppm (background 15 to 25 ppm)

Westward Ho (Mannahill Goldfield): Anomalous arsenic values of up to 320 ppm (background 30 to 90 ppm) occur in a 45 to 50 metre wide zone. Gold, lead, zinc and copper form a coincident spot anomaly about 4 metres stratigraphically below the lode horizon.

Homeward Bound (Mannahill Goldfield): Anomalous gold values of up to 1.8 ppm (background 0.1 ppm) occur in a 60 metre wide zone. Arsenic forms a more limited halo of 30 metres with values up to 24 ppm (background 10 ppm). Copper is erratic and non-definitive.

Summary of CRA Exploration

Following a literature survey and orientation geochemistry, CRA established three grids at Winninninnie, Florina and Waukaringa (Mayer 1981). Bedrock augering over these grids produced several low order gold and base metal anomalies. Follow-up sampling enhanced one anomaly at the Florina prospect. Close spaced auger drilling at Florina prospect and Nectar prospect adjacent to the Nectar Mine and No Gammon prospect adjacent to the No Gammon Mine was followed by percussion drilling with the best intersection of 3.5 ppm gold over 1 metre at the Nectar prospect. Comprehensive rock chip sampling of costeans excavated on the Waukaringa line of lode produced a maximum gold assay of 0.48 ppm.

The following review of other goldfields in the Olary area is taken from Martins (1978).

Waukaringa (32°35'S, 140°17'E): Gold is located along the south-dipping northern limb of the Waukaringa syncline where 2 or 3 south-dipping quartz ironstone reefs occur in sandy siltstone beds at the top of the Tapley Hill formation. Henley (1977) reported that no gold was visible in either thin or polished sections of samples from the underground workings. Assays indicate values of 7.9 ppm gold and 1 ppm silver - the gold being relatively pure. The ironstone consists of quartz and sulphide partly to completely altered to limonite and goethite.

Ajax (32°23'S, 139°22'E): The workings are located on the southern limb of the Waukaringa syncline with gold and quartz ironstone reefs in sandy siltstone at the top of the Tapley Hill formation. Henley (1977) reported several grains of native gold about 15 microns in size in iron oxide in samples from underground workings. The gold is yellow, inidicative of a low silver content. Assays of the ironstone indicate 15.8 ppm gold and 1 ppm silver. The anticline south of the Ajax Mine exposes massive Appila Tilite with narrow sandstone/quartz interbeds. A few shallow workings are located on quartz reefs along the axis of this anticline.

Teetulpa (32°15'S, 139°44'E): The majority of gold here was won from alluvium from northerly draining creeks; however, some reef gold was also mined. East-west and north-south quartz veins intersect in this area. Most of the reef gold is localised in the northerly trending reefs at or near the intersection with the east-west reefs. The only sample examined by Henley (1977) showed no visible gold in thin or polished section despite an assay of 1.2 ppm gold. The gold-bearing reefs lie within the Tapley Hill Formation but stratigraphically lower than the host rocks at Waukaringa and Ajax. From Teetulpa several quartz reefs extend westwards towards Waukaringa.

King's Bluff Goldfield (32°16'S, 140°17'E): The goldfield is located 7 kilometres west of Olary. Thin, vertically-dipping quartz veins have been mined within a blocky, felspathic, quartzite, approximately 20 metres thick which forms a prominent scarp and dip slope. Quartz veins are transgressive and probably relate to tension joints of a broad shallow-dipping anticline. Many of the workings are confined to the base of this quartzite unit. The footwall consists of sericitic siltstones and psammitic rocks; sericite is common. A pebble conglomerate outcrops in places. Workings here include the Eringa Mine and the Copperlinca Mine (McConachy & Mayer 1980).

Kirkeek's Treasure Mine (32°02'S, 139°32'E): This mine is situated on the northern limb of the anticline near its eastern closure. Mineralisation occurs within transgressive quartz, limonite, pyrite, hematite gold veins hosted by a felspathic quartzite unit of the Burra Group. The quartzite unit is overlain by siltstones and shales and underlain by a thick dolomitic siltstone unit. Various orientations of mineralised quartz veins are observable within the mine area. The veins are interpreted as tension gashes within the competent quartzite unit. Generally the veins do not penetrate the less competent overlying and underlying siltstones. This mine has been diamond drilled by CRA Exploration (Mayer 1980).

5. GEOLOGY

The Exploration Licence covers part of a sequence of sedimentary rocks that form the Adelaide Geosyncline.

Subdivisions of Adelaidean Sequences

Age	Rock Units
Marinoan	Wilpena Group
Sturtian	Umberatana Group
Torrensian	Burra Group
Wirrouran	Callana Beds

The Licence area predominantly covers lithologies of the Umberatana Group. This group has recorded thicknesses of up to 6,000 metres and is dominated by cycles of marine sedimentation associated with tillites.

Within the Umberatana Group gold mineralisation is more commonly found by particular beds and/or lithologies. The majority of occurrences visited are confined to the middle and lower part of the Group as shown below:

Umberatana Group	Gumbowie Arkose	
		* Dusthole
	Waukaringa Silstone	** Mannahill
	Tarcowie Siltstone	
		** Waukaringa-Ajax
	Tapley Hill Formation	* Teetulpa
	Willyerpa Quartzite	* King's Bluff
	Appila Tillite	* Mount Grainger
	?	* Kirkeeks Treasure

* gold occurrence

The host rocks of these various occurrences are variable ranging from dolomitic siltstone to arkosic tillite. Mineralisation is commonly associated with thinly bedded, sideritic siltstones. Identification of this, often spotted, rock type may be a useful guide in regional prospecting.

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6. WORK PROGRAMME

During the tenure of the licence, the following work programme was undertaken:

* Literature survey
* Ground and aerial orientation surveys:
  - Aerial Orientation Survey
  - Ground Orientation Survey
* Ground follow-up
* Landsat and aerial photograph interpretation
* Bulk stream sediment/soil sampling of selected areas

Details of this work programme are set out in the following sub-sections.

6.1 LITERATURE SURVEY

A search of available relevant literature was made at the South Australian Department of Mines & Energy. The results of this search have already been discussed in this report and are incorporated in Section 4 History of Exploration.

6.2 GROUND AND AERIAL ORIENTATION SURVEY

Both ground and aerial orientation surveys were carried out in the vicinity of AUSTAMAX's Mannahill EL 1164 in South Australia.

A fixed wing aircraft was chartered out of Broken Hill to familiarise Messrs J. E. Thompson and M. J. Spadafora (AUSTAMAX) with the surface expression of gold mineralisation. Following this, ground reconnaissance, involving geological inspection of old mine workings, rock chip and stream sediment sampling were carried out by Messrs P. F. Bull and D. Z. Royle (AUSTAMAX). These inspections were made with the permission of the relevant tenement holders where necessary.

6.2.1 AERIAL ORIENTATION SURVEY

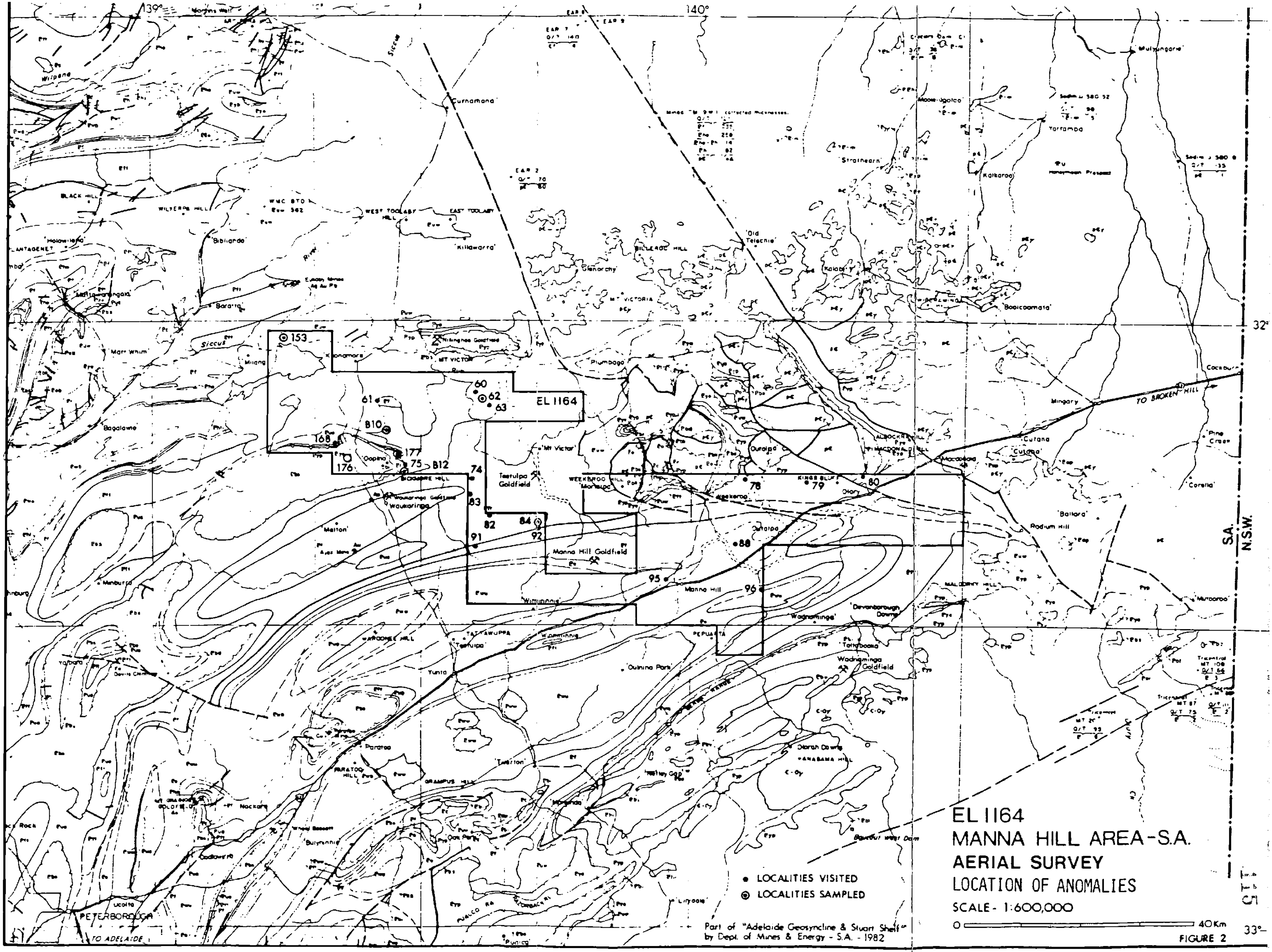
Before commencing the aerial survey, company geologists were apprehensive as to their ability to detect surface evidence of the type of gold and other mineralisation for which the area is best known. They were aware that the known mineralisation had both stratigraphic (favouring thin beds) and structural (usually cross-jointing) controls and, further, that at none of the known localities (except possibly Wadnaminga) was there any direct evidence of an igneous origin for either the mineralisation or the jointing and fracturing with which the mineralisation was often seen to be associated. It was further noted during the orientation reconnaissance that the abundance of carbonate (mainly dolomite) in the Upper Proterozoic sediments tended to localise and suppress the visual aspects of oxidising sulphide mineralisation so that extensive gossan cappings and adjacent large bleached areas could not be expectd from weathering sulphides. Further, the recurrence of banded iron formations in both the Adelaidean succession and in the Willyama Complex would tend to mask sulphide gossans should they occur in proximity to the banded iron beds.

The greater part (85% approximately) of the area flown, which covered also the Baratta and Boikevie Hill Exploration Licences, contains unmetamorphosed Upper Proterozoic sediments which lie unconformably on Lower Proterozoic/(?) Archaean high grade metamorphics of the Willyama Complx which occur on the southern part of the Curnamona Sheet and extend into the north-eastern part of the Olary sheet. In these older metamorphic rocks, normal ferruginous gossans are not common and weathering sulphide masses are usually expressed as prominent siliceous cappings with associated manganiferous and/or ferruginous oxide impregnations and coatings.

The known gold mineralisation in the Adelaidean rocks is in thin beds which often weather recessively and whose only surface manifestation is a trail of thin ferruginous "lag" either as discrete biscuit-like gossanous fragments in the soil, as calcrete coated fragments or as aggregations with other "lag" rock detritus "cemented" into superficial calcrete crusts. In any case they are difficult to detect and sample (collect) particularly on a rapid reconnaissance such as a helicopter follow-up. Where this type of mineralisation is suspected, selective sampling of ferruginous lag, bulk (5 to 10 kg) sampling of loam (on down hill side of suspect mineralised formation), or bulk stream sediment sampling was considered and the method most appropriate to local physiographic conditions was then chosen.

Because of the absence of visible intrusive and hydrothermal effects on most of the Adelaidean sediments and the subdued nature of ferruginous gossans because of "carbonate suppression", most of the "anomalies" photographed were structural, stratigrahic or lithological situations with possible indirect mineralisation implications.

Thus, on this survey there were more anomalies than usual; most of the anomalies being given a "low" or "very low" priority rating. In all, 23 "anomalies" were defined as being worthy of follow-up on the Mannahill Licence area (Figure 2).


EL 1164
MANNA HILL AREA - S.A.
AERIAL SURVEY
LOCATION OF ANOMALIES
SCALE - 1:600,000
0
40 Km
FIGURE 2
• LOCALITIES VISITED
⊙ LOCALITIES SAMPLED
Part of "Adelaide Geosyncline & Stuart Shelf" by Dept. of Mines & Energy - S.A. - 1982
139°
140°
32°
33°
S.A.
N.S.W.
EL 1164
153
60
61
62
63
B10
168
176
177
75
B12
74
83
82
84
91
92
78
79
80
88
95
96
Manna Hill Goldfield
Manna Hill
Teetulpa Goldfield
Wadnaminga Goldfield
Waukaringa Goldfield
TO BROKEN HILL
TO ADELAIDE
PETERBOROUGH
Curnamona
Mingary
Cockburn
Radium Hill
Olary
Yunta
Pardoo
Mulyungarie
Yarramba
Kalkaroo
Glenorchy
Wilpena
BLACK HILL
WILTERPE HILL
WEST TOOLABY HILL
EAST TOOLABY
MT VICTORIA
Plumbago
Oulnina Park
Tarlton
Melton
Minburra
Yarbara
Devils Creek
Bibliando
Baratta
Matt Whim
Bagalowie
Oopina
Wawkaringa
Wiawinnie
Pepuarta
Cutana
Corellia
Boolcoomata
Kalabity
Strathearn
Balfour West Dam
Oldrah Downs
Grampus Hill
Paratoo Hill
Wombat Hill
Canowie
Nackara
Bulyannie
Ucolta
Oakbank
Siccus
Wadnaminga
Devonborough Downs
MALDORKY HILL
TATTAWUPPA
WARCOWIE HILL
WEEKAROO HILL
KINGS BLUFF
ALBOCKRE HILL
Pine Creek
Ballara
Tiparoo
Wilkinson Hill
FIGURE 2

6.2.2 GROUND ORIENTATION SURVEY

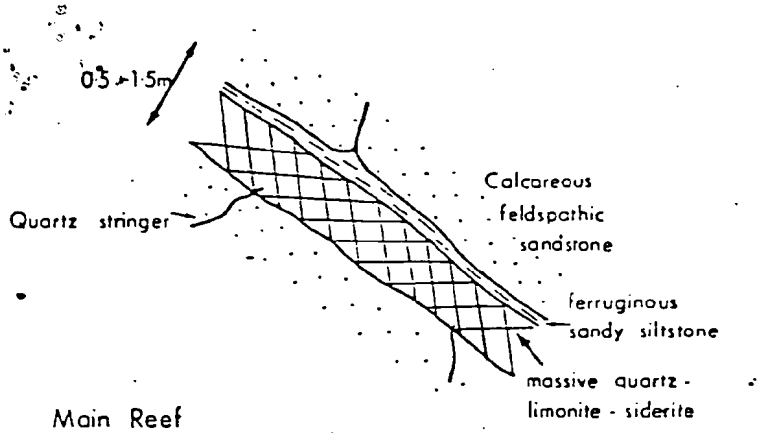
- Form and Setting of Gold Occurrences: 116

The orientation work confirmed the stratabound nature of the gold mineralisation although, on close inspection, the form of the gold-bearing quartz-limonite (sulphide) veins is highly variable. In some cases the mineralisation is genuinely stratiform on a small scale - eg, Waukaringa, Ajax and Mannahill. The limonite, quartz and sometimes siderite appear to occur as beds that may be finely laminated and extend over 0.2 to 1.0 metres. In other cases the quartz and oxides form small cross-cutting veins, linings of cavities and cementing material of breccias - eg, Kirkeeks Treasure, King's Bluff. Mount Grainger appears to be a combination of the two contrasting forms - ie, a hanging wall bedded quartz limonite reef is underlain by a discordant stringer quartz zone extending over 8.0 to 10.0 metres. Gold-bearing quartz veins at Wadnaminga and Teetulpa are largely discordant and of fissure-filling type. They show no clear relationship to stratigraphy.

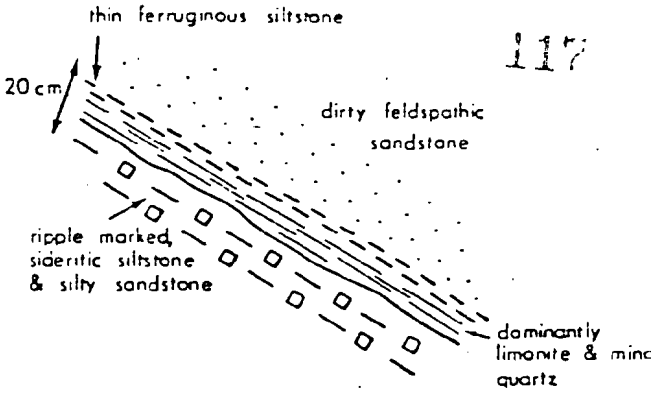
Schematic drawings of the styles of gold mineralisation occurring in the Olary Province are given in Figures 3, 4 and 5.

- Surface Expression of Gold Mineralisation:

The majority of occurrences inspected form subdued to prominent strike ridges reflecting the more resistant, siliceous nature of the reefs. On close examination, however, the surface expression of mineralisation is very meagre. The calcreted soils have tended to cement and coat the weathered reef material when it reaches surface.

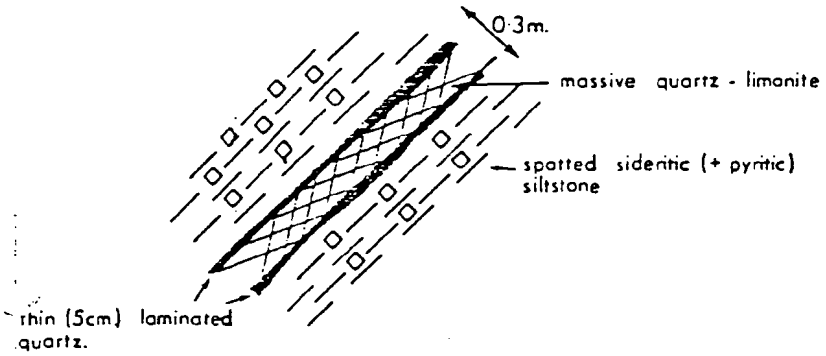


Main Reef
(looking east)

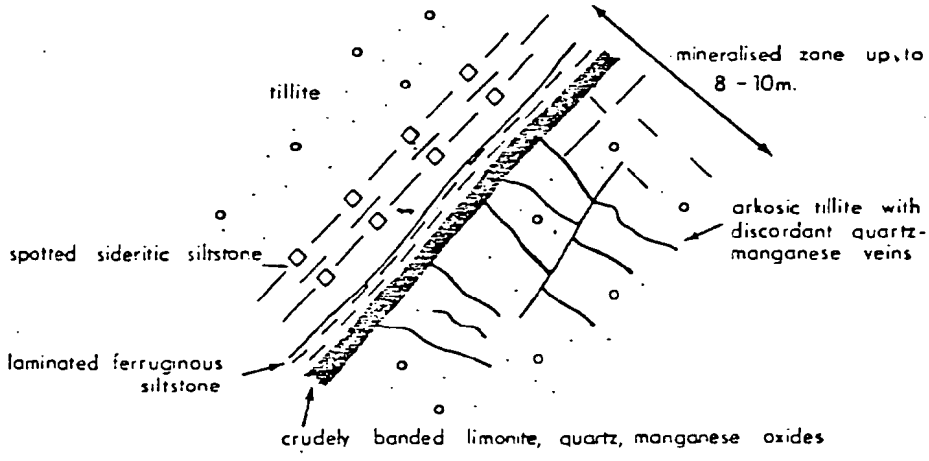


Upper Reef
(looking east)

WAUKARINGA



AJAX
(looking east.)

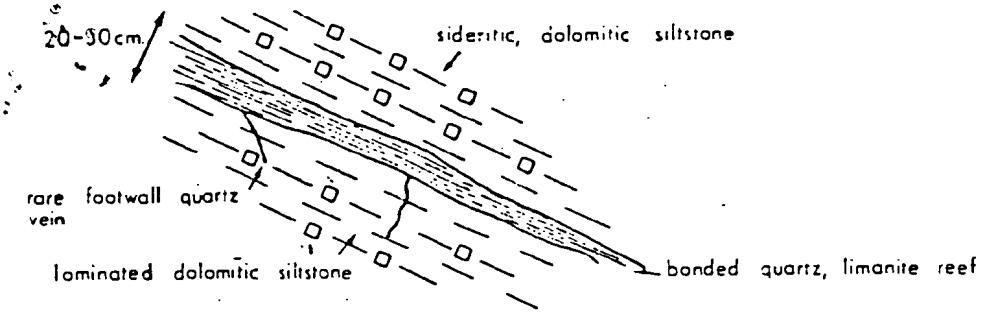


MT. GRAINGER
(looking northeast)

SCHEMATIC GEOLOGICAL SECTIONS OF GOLD MINERALISATION IN THE OLARY PROVINCE SOUTH AUSTRALIA

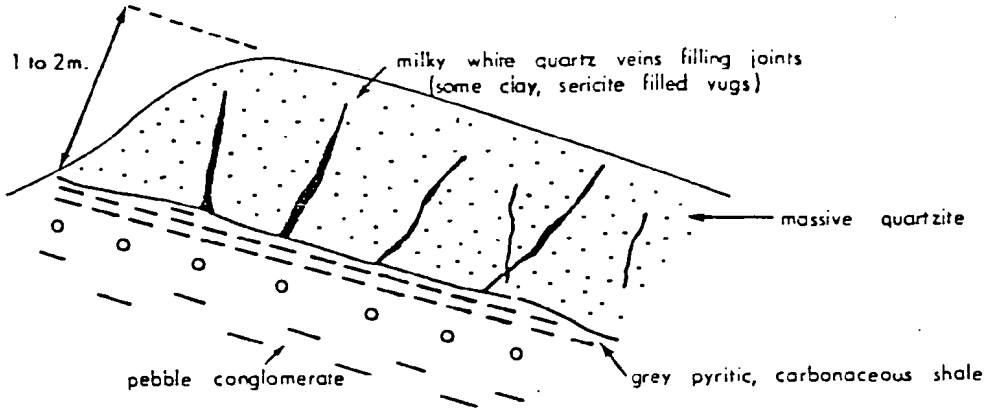
(NOT TO SCALE)

FIGURE 3

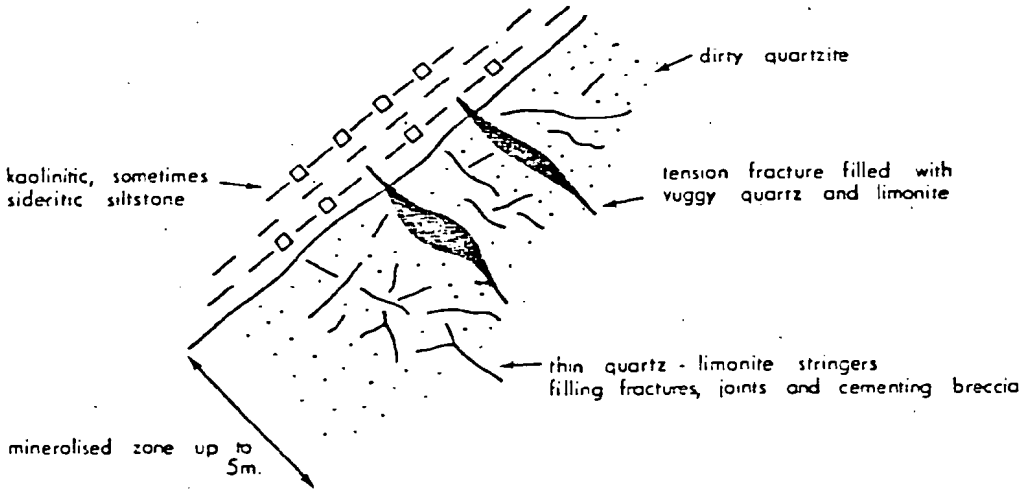


Homeward Bound (looking east)

MANNA HILL



KINGS BLUFF
(looking east)



KIRKEEKS TREASURE
(looking east)

SCHEMATIC GEOLOGICAL SECTION

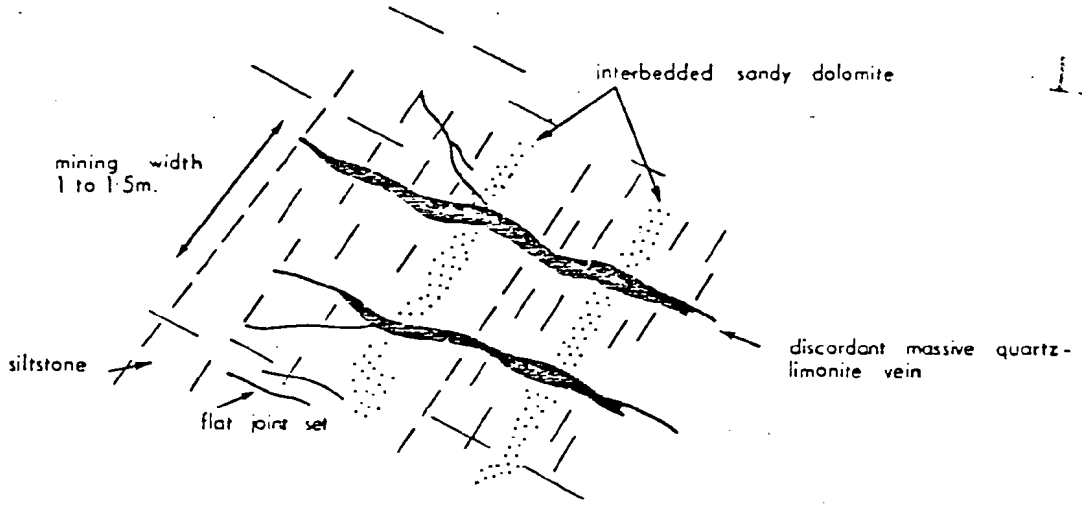
OF GOLD MINERALISATION IN

THE OLARY PROVINCE

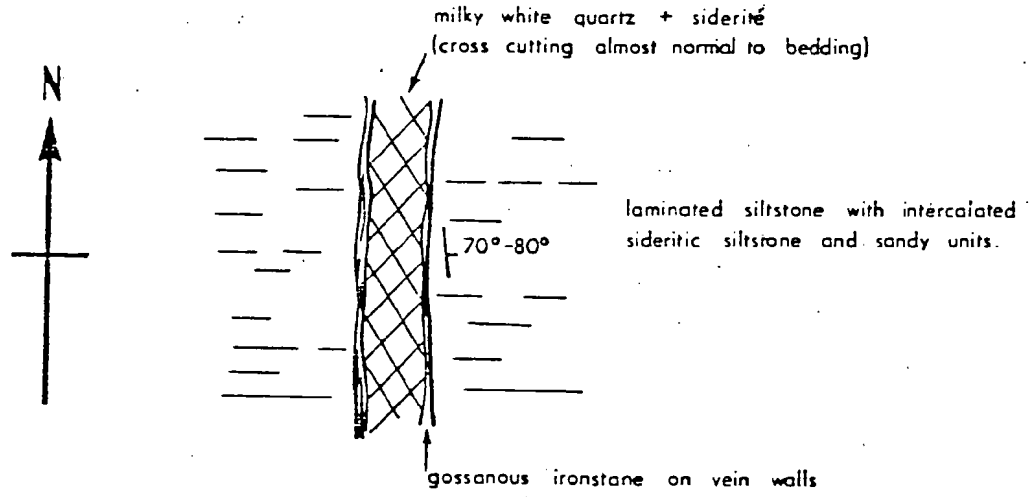
SOUTH AUSTRALIA

(NOT TO SCALE)

FIGURE 4



WADNAMINGA
(looking east)



TEETULPA
(plan view)

SCHEMATIC GEOLOGICAL SECTIONS

OF GOLD MINERALISATION IN

THE OLARY PROVINCE

SOUTH AUSTRALIA

(NOT TO SCALE)

FIGURE 5

Consequently only a few scattered quartz and limonite fragments mark the surface position of the reefs. Soil tones may be subtly darker brown or reddish brown along the line of mineralisation. White tones reflecting underlying calcrete are present but are also associated with unmineralised stratigraphy throughout the district. Surface expression of ore is extremely subtle and requires extremely diligent prospecting and mapping for identification.

- Orientation Sampling:

Limited rock chip sampling was undertaken around known mineralisation, particularly Waukaringa and Ajax. Both ore and wall rocks were sampled together with near-surface calcreted gossan and surface gossan (ironstone) float. Bulk stream sediment sampling including, in some cases, both biased and representative collections, was carried out at Ajax, Waukaringa and Mannahill. Samples were submitted to Comlabs, Adelaide, and the results are shown in Table 1. Minus 20 mesh sampling of panned concentrates carried out by the Department of Mines & Energy in 1977 about Waukaringa and Mannahill failed to locate areas of known mineralisation.

Some underground sampling was carried out at the Mount Grainger Mine (32°47'S, 139°06'E) and in the Victoria shaft at the Waukaringa Mine. The results of this work are shown in Table 2.

Sampling of wind transported soils appears to have little or no applicability. Previous exploration by competitors suggests C horizon soil sampling is useful on a prospect scale.

The fine grained nature of the gold and its apparent erratic distribution has resulted in considerable problems in determining meaningful gold values - eg, Mount Grainger and Waukaringa. Unfortunately best reproducability is obtained only by bulk sampling.

TABLE I

RESULTS OF ROCK CHIP ORIENTATION GEOCHEMISTRY

analytical results in ppm

Sample	Cu	Pb	Zn	Ni	Co	Bi	Cd	As	Ba	Sn	U	Th	W	Se	Rb	Sr	Sb	Ga	Ge	% Fe	Mn	Ag	Mo	V	Au	Hg	Sc	Sample Description	Location
S 8801	520	220	540	12	4	<4	<1	75	30	<4	<4	<4	<10	<4	<2	26	20	<4	<4	5.80	330	<1	16	30	2.70	<0.05	<10	Brecciated quartz limonite gossan breccia	Kings Bluff
S 8802	18	20	38	12	10	<4	<1	<2	450	<4	<4	14	<10	<4	85	140	<4	8	<4	2.80	590	<1	6	50	<0.05	<0.05	<10	Basal channel conglomerate overlying Willyama Complex	Kings Bluff
S 8803	240	18	70	170	60	<4	<1	120	850	<4	<4	<4	<10	<4	24	125	14	8	<4	31.0	1.30A	<1	6	30	1.20	<0.05	<10	100% oxidised limonite & siderite in a concordant quartz reef 20cm thick	Waukaringa
S 8804	710	18	95	22	50	46	<1	1350	155	<4	24	<4	<10	10	34	270	<4	<4	<4	32.0	700	<1	<4	40	16.5	<0.05	<10	Channel sample of friable goethitic limonite from main reef	Ajax
S 8805	150	12	90	30	10	<4	<1	44	500	<4	<4	16	<10	<4	230	210	4	16	<4	5.70	230	<1	6	50	0.20	<0.05	<10	Laminated sideritic silty sandstone with quartz limonite veins (Footwall)	Ajax
S 8806	80	<4	20	16	14	<4	<1	95	600	4	<4	12	<10	<4	110	46	8	10	<4	3.30	470	<1	<4	40	0.30	<0.05	<10	Laminated sideritic silty sandstone wth quartz limonite veins (Hanging Wall)	Ajax
S 8807	105	14	18	8	20	<4	<1	38	570	<4	<4	10	10	<4	48	460	6	<4	<4	1.70	100	<1	4	40	0.70	<0.05	<10	Grab sample over 5 metres of caliche over Footwall contact	Ajax
S 8808	380	12	75	12	26	80	<1	1650	230	<4	14	4	20	<4	36	165	10	<4	4	38.0	600	<1	6	50	60.0	0.05	<10	Random grab of surface gossanous and ironstone rubble	Ajax
S 8809	1100	18	70	24	70	100	<1	2450	190	<4	20	4	20	12	34	125	6	8	<4	28.0	850	<1	4	20	55.0	<0.05	<10	Channel sample over 30cm of gossanous quartz limonite reef	Ajax
S 8812	16	8	18	16	8	<4	<1	18	820	<4	<4	14	10	<4	115	30	<4	12	<4	3.50	480	<1	<4	30	0.40	0.05	<10	Grey green laminated sideritic siltstone from the footwall of the Upper reef	Waukaringa
S 8813	26	10	14	26	10	<4	<1	28	570	4	<4	8	15	<4	65	120	4	6	<4	2.00	760	<1	6	50	0.30	<0.05	<10	Composite rock chip of hanging wall siltstone from the Upper reef	Waukaringa
S 8814	60	20	40	160	70	<4	<1	55	680	<4	<4	<4	<10	6	20	440	6	<4	4	4.70	5100	<1	6	90	0.50	0.10	<10	Caliche, weathered B soil profile indurated by calcrete	Waukaringa
S 8815	100	22	65	18	12	<4	<1	44	600	6	12	10	10	<4	60	190	<4	6	<4	11.0	1350	<1	6	50	0.10	0.55	<10	Yellow brown limonite in main reef	Waukaringa
S 8816	90	<4	4	<4	8	<4	<1	640	200	6	<4	<4	15	10	26	20	6	<4	<4	7.60	80	<1	8	30	1.80	0.35	<10	Composite rock chip sample of quartz limonite gossan (300' depth)	Waukaringa
S 8817	3000	330	16	<4	140	<4	<1	28	40	<4	<4	14	<10	22	14	3	4	<4	<4	40.0	1100	2	<4	10	0.40	<0.05	<10	Near massive sulphide pyrrhotite(?) & siderite TS > 50% (320' depth)	Waukaringa
S 8818	30	14	24	16	10	<4	<1	24	660	6	8	22	10	<4	80	210	10	12	<4	2.60	110	<1	4	70	0.10	<0.05	<10	Sideritic siltstone from hanging wall same location as 8815,16,17	Waukaringa
S 8819	40	12	20	12	6	<4	<1	30	1100	4	10	10	20	<4	210	120	<4	30	<4	2.60	260	<1	8	40	0.10	0.05	<10	Grey Green sandy siltstone with minor quartz stringers (Footwall)	Waukaringa
S 8820	490	22	100	26	50	<4	<1	600	330	<4	<4	12	35	<4	32	80	8	<4	<4	37.0	480	<1	6	40	6.30	0.05	<10	Surface gossan "lag" of goethitic limonite over 50m of main vein strike	Waukaringa
S 8821	410	16	50	38	60	<4	<1	1750	580	<4	6	<4	20	<4	28	360	10	4	<4	15.0	440	<1	6	50	0.90	0.05	<10	Caliche from line of lode to 10cm depth with gossanous fragments eliminated	Waukaringa
S 8828	520	170	140	18	50	<4	<1	4900	130	<4	12	<1	25	8	12	90	22	4	6	30.0	350	<1	6	100	0.30	<0.05	<10	Gossanous and ironstone scree from surface (Westward Ho!)	Mannahill
S 8829	80	22	60	30	18	<4	<1	44	430	4	<4	14	<10	<4	105	280	4	16	<4	3.00	560	<1	<4	50	<0.05	<0.05	<10	Laminated dolomitic siltstone with trace sulphide (Westward Ho!)	Mannahill
S 8830	600	520	160	14	12	<4	<1	960	60	10	<4	8	15	18	10	18	8	<4	<4	8.40	120	4	10	50	0.15	1.40	<10	Gossan with limonite and quartz (Westward Ho!)	Mannahill
S 8831	310	70	90	70	46	12	<1	4250	80	<4	<4	4	<10	6	14	40	24	<4	<4	31.0	170	<1	<4	60	0.20	0.05	<10	Silicified cherty gossan possibly ferricrete (Westward Ho!)	Mannahill
S 8832	1300	230	1.90%	60	120	<4	175	1.41%	30	12	<4	<4	<10	10	5	170	12	<4	<4	30.0	2600	<1	<4	20	2.00	0.05	<10	Banded stratiform oxidised "ore" horizon 30' down dip (Elsie May)	Mannahill
S 8833	2000	22	1900	26	24	<4	4	250	55	<4	<4	<4	10	<4	6	26	8	<4	<4	8.00	840	<1	<4	20	0.70	<0.05	<10	Oxidised "ore", banded quartz-feox with malachite (Elsie May dump)	Mannahill
S 8834	1050	420	130	100	110	80	<1	230	<10	4	<4	<4	<10	14	4	10	10	<4	<4	13.0	195	<1	8	20	1.60	<0.05	<10	Oxidised banded quartz siderite-limonite "ore" 100' down dip (Homeward Bound)	Mannahill
S 8836	280	100	280	160	90	<4	<1	12	115	<4	<4	<4	10	32	16	560	<4	<4	4	30.0	490	1	12	40	<0.05	<0.05	<10	Hematitic vein quartz with trace chlorite and minor limonite	Anomaly 82
S 8837	80	40	28	100	55	<4	<1	10	25	<4	<4	8	10	14	<2	105	12	<4	<4	22.0	340	1	10	30	<0.05	<0.05	<10	Rock float from old workings, white quartz with clasts of gossanous limonite	Anomaly 82
S 8842	38	34	60	60	28	<4	<1	22	500	<4	<4	<4	<10	<4	5	55	12	<4	<4	9.60	5200	<1	8	250	<0.05	<0.05	<10	Small sized float heavy mineral and quartz-limonite fragments	Mannahill
S 8843	600	6	44	80	140	<4	<1	<2	30	<4	<4	4	<10	24	<2	32	<4	<4	<4	28.0	48	<1	4	10	<0.05	<0.05	<10	Quartz-limonite gossan in Pfk near East Dam Well (Olary 1:250,000 sheet)	Mannahill
S 8845	560	400	340	180	120	20	<1	115	410	<4	6	8	<10	28	20	90	48	<4	<4	29.0	580	<1	20	170	<0.05	<0.05	<10	Feox stained, wind ablated dolomitic siltstone from nose of Waukaringa Syncline	Mannahill
S 8846	14	6	80	26	14	<4	<1	20	480	4	4	10	<10	<4	115	180	<4	14	<4	2.90	550	<1	<4	30	<0.05	<0.05	<10	Unmineralised dolomitic siltstone wallrock from within the Mannahill field	Mannahill
S 8847	18	6	70	28	14	<4	<1	16	390	6	<4	10	<10	<4	145	410	6	16	<4	2.80	800	<1	<4	10	<0.05	<0.05	<10	Fine grained part recrystallised dolomitic siltstone from fracture zones	Mannahill

TABLE 1

TABLE 2

RESULTS OF UNDERGROUND SAMPLING
AT MOUNT GRAINGER AND WAUKARINGA MINES
(all results in ppm)

Sample	Au	As	Location
		Waukaringa - Victoria Shaft	
A 5909	0.05	-	10 metres depth
A 5910	0.05	-	20 metres depth
A 5911	0.05	-	30 metres depth
A 5912	0.05	-	40 metres depth
A 5913	0.05	-	50 metres depth
A 5914	5.90	-	Quartz-iron oxide above sulphide zone
A 5915	0.75	320	Sulphide ore
		Mount Grainger	
A 5919	2.60	-	5 metres depth
A 5920	1.30	-	20 metres depth
A 5921	0.05	-	25 metres depth
A 5922	1.50	-	30 metres depth
A 5923	5.30	-	35 metres depth
A 5924	0.05	-	40 metres depth
A 5925	0.05	-	120 foot level
A 5926	0.05	-	120 foot level
A 5927	0.25	-	240 foot level

- Economic Potential:

Of the prospects inspected, Mount Grainger and Waukaringa appear to hold the best hard rock potential.

Mount Grainger has a resource potential of 3.5 million tonnes (ie, 1,000 x 200 x 8 x 2.2 [SG]). The grade of this volume is unknown but is probably in the region of 3.0 to 4.0 grams per tonne gold. Approximately one-third of this material may be amenable to open pit extraction depending on reef dip angles.

At Waukaringa, gold grades are marginally better, with an average possibly greater than 5 grams per tonne gold. It is suggested that there is an underground resource potential at Waukaringa of 1.1 million tonnes (ie, 1,500 x 300 x 1.0 x 2.5 [SG])

6.3 GROUND FOLLOW-UP

Results of the anomaly inspection are summarised below; the anomalies are shown in Figure 2.

Anomaly	Geology	Sample No	Assay
60	Barren buck quartz vein	No sample	
61	Shallow dipping dark grey coated with minor calcrete	No sample	
62	Inclined shaft sunk parallel to bedding (10° dip) in sideritic siltstone	R62B	10ppm Au
63	Dark beds of grey dolomite with manganese coating	A5961	0.25ppm Au 475ppm Cu 25ppm Ag
74	Quartz veins (barren) in quartzite unit apparently found by redistribution of silica from quartzite	No sample	

Anomaly	Geology	Sample No	Assay
75	Hematitic quartz outcrop with interbedded mustard-coloured shale strongly cleaved and topographically repressed. Minor calcrete	No sample	
78	Red outcrop of ironstained dolomite. Barren quartz veins adjacent in Wilyerpa Formation	No sample	
79	Dolomite in creek bed overlain by quartzite. Scree of ironstone on surface. Numerous east-striking quartz veins	R79B	3.6ppm Au
80	Quartzite units in Willyama Formation with minor "sweat veining" and some minor disseminated boxworks often pyrite	No sample	
84	Blue-grey strongly cleaved (N-S) dolomitic siltstone with indurated fractures. Minor calcrete on outcrop. Fractures only 1-2mm wide. Sample consists of smear of quartz, iron oxide and carbonate in fracture vein. Minor quartz occurs in float in area	R84B	0.05ppm Au
88	Sideritic siltstone with indurated fractures. Large unmineralised quartz vein in Waukaringa Siltstone trending SW-NE	No sample	
91	No outcrop observable on what is probably a carbonate-rich bed which erodes recessively	No sample	
92	Area of red soils on Waukaringa Siltstone cut by unmineralised N-S fractures	No sample	
95	Red bed in nose of flatly SW-plunging anticline of quartzite and siltstone of the Waukaringa Siltstone. No evidence of mineralisation	No sample	
96	"Dirty" quartz sandstone bed with disseminated hematite in Gampas Quartzite. Minor white vein quartz afloat in soils	No sample	

Anomaly	Geology	Sample No	Assay
153	Ferruginous hematitic quartzite giving rise to some large lumps of ferruginised lateritic material on nose of west-plunging anticline. Minor milky quartz in float	A5946	0.05ppm Au 150ppm Cu 2ppm Ag
		R153B	0.10ppmAu (Bulk Leach)
168	Dark coloured bed of ironstone in Holowilena Ironstone near Appila. Tillite in poorly vegetated area of grey siltstone and quartz scree. Minor calcrete developed	No sample	
176	Excavation of gossanous material from lenticular (?) fault zone in Burra Group. Lenticule 20m long by 3m wide. Fault has a stockwork selvage of quartz and limonite veining (R176C). Central part is massive hematite and goethite (R176B).	R176B	0.8ppm Au
		R176C	0.85ppm Au
177	A coarse arkosic sandstone with abundant disseminated iron oxide staining cut by white quartz veins up to 12cm wide and containing minor amounts of iron oxide. The veins occur both parallel and normal to the strike and dip approx 45°. They are Kings Bluff-type quartz veins. The sandstone is overlain by a dark shaly banded iron formation with minor calcrete and white quartz in the surface rubble. The sandstone is underlain by tillite.	A5949	0.20ppm Au 135ppm Cu 2ppm Ag
B10	Unlisted working of one old shaft about 4m deep. Brecciated quartz vein with siderite and minor limonite. Host is a non-calcareous, finely banded grey-green siltstone. Siderite-bearing quartz veins occur in nearby creek exposure	B10B	0.05ppm Au
B12	Unlisted workings or prospecting pits consisting of trenches and a shaft in strongly limonitic quartz vein with malachite in sandy tillite(?). Vein is 6cm wide and dips 75°E.	B12B	0.05ppm Au

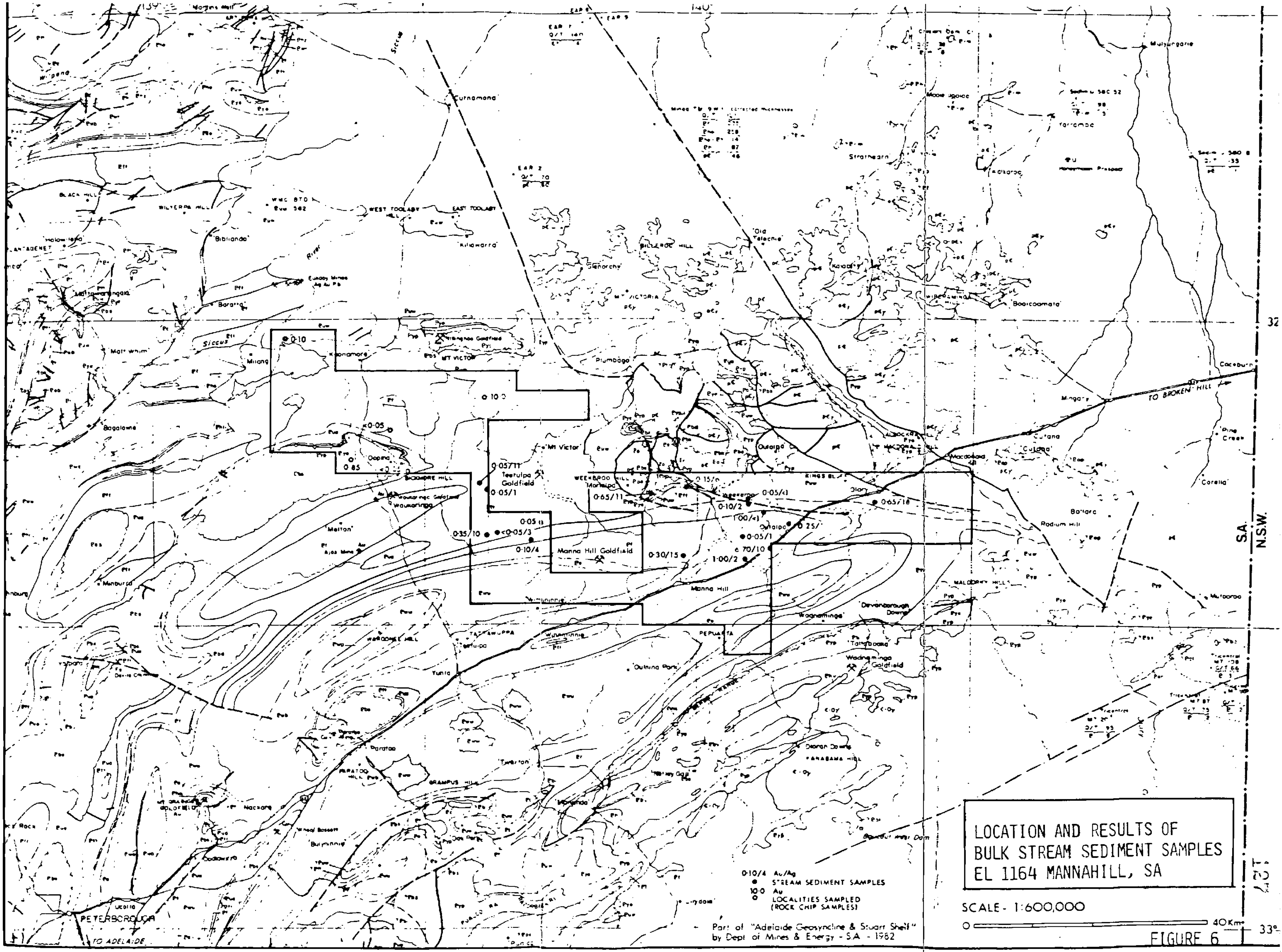
6.4 LANDSAT AND AERIAL PHOTOGRAPH INTERPRETATION

Prior to ground follow-up of the aerial photographic anomalies, considerable time was spent in studying Landsat images and normal 1:85,000 aerial photographs looking for structural and/or sedimentary/ stratigraphic features which could be of value in interpreting the anomalous areas. No formal interpretive maps were produced as a result of this work.

6.5 BULK STREAM AND SOIL SAMPLING

As the result of studies of favourable structural and lithological associations, 16 initial stream sediment samples were collected in the eastern part of the Licence area. These samples, each weighing approximately 5 kilograms, were collected for the bulk leaching of fine, free gold at Perth Metallurgical Laboratory and AMDEL Perth. Their locations and assay results are shown in Figure 6. These results do not represent the total gold values but represent parts per million gold or silver per aliquot of zinc precipitate.

From orientation sampling undertaken outside the Licence area on streams draining known gold occurrences and, as a result of work carried out by AUSTAMAX in gold provinces elsewhere, a figure of 0.3 grams per tonne gold was considered a threshold value and anything higher was considered anomalous. Anomalous results therefore occurred north-west and south-west of Outalpa and, one sample only south-southwest of Olary.


LOCATION AND RESULTS OF
BULK STREAM SEDIMENT SAMPLES
EL 1164 MANNAHILL, SA
SCALE - 1:600,000
40Km
0·10/4 Au/Ag
STREAM SEDIMENT SAMPLES
10·0 Au
LOCALITIES SAMPLED
(ROCK CHIP SAMPLES)
Part of "Adelaide Geosyncline & Stuart Shelf"
by Dept of Mines & Energy - S.A. - 1982
Manna Hill Goldfield
Teetulpa Goldfield
Manna Hill
Peterborough
TO ADELAIDE
TO BROKEN HILL
Yunta
Cockburn
Mingary
Radium Hill
Curnamona
Plumbago
Mt Victor
Wadnaminga Goldfield
Waukaringa
S.A.
N.S.W.
32°
33°
140°
FIGURE 6

On later re-examination of the area near Olary, no rocks suggestive of mineralisation could be located and the assay results could not be repeated. In the area near Outalpa, a further 12 samples were collected. Their locations are shown in Figure 7 and their assay results in Table 3.

TABLE 3

BULK STREAM SEDIMENT SAMPLING - OUTALPA AREA

Sample Number	Zn Precipitate Weight (gms)	ppm Precipitate Au	Ag	Calculated ppb# Au	Ag
8529	3.49	0.30*	28	0.5	48.8
8530	3.04	0.05	2	0.07	3.04
8531	2.86	0.05	4	0.07	5.74
8532	2.69	0.30*	21	0.40	28.2
8533	2.65	0.05	2	0.06	2.6
8534	3.07	0.05	3	0.07	4.6
8535	2.76	0.05	3	0.07	4.1
8536	2.75	0.65*	7	0.90	19.8
8537	2.76	0.30*	4	0.41	5.5
8538	3.20	0.05	1	0.08	1.6
8539	3.02	0.10	2	0.1	3.0
8540	3.04	0.10	2	0.15	3.0

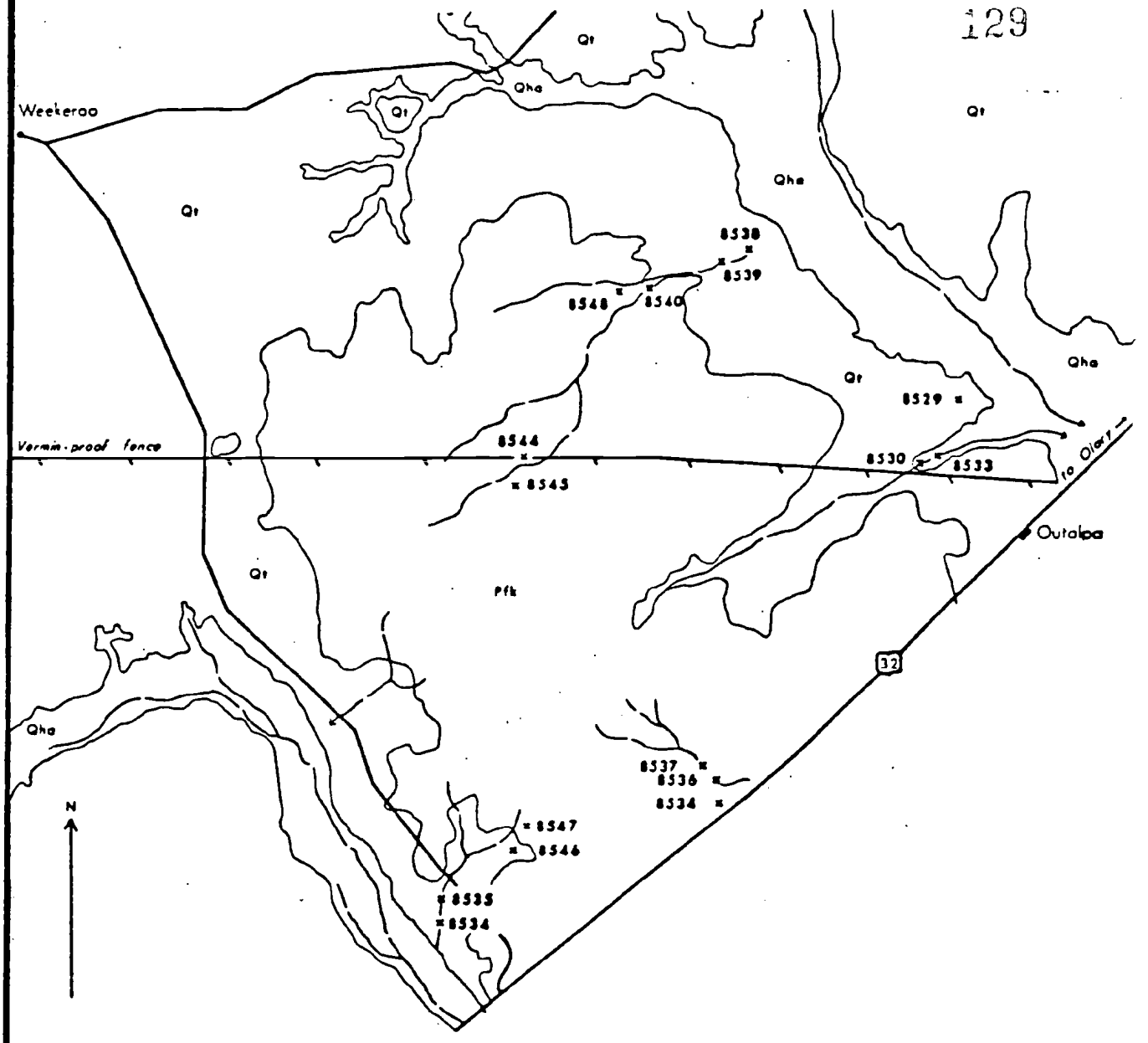
\# Fine, free soluble gold

* All gold values of 0.30 or better have been regarded as anomalous

Primary leaching and precipitation by Perth Metallurgical Laboratory, Perth

Assay of Zn precipitates by AMDEL, Perth

Detailed inspection of the area failed to locate any source rocks for the anomalous results. It is presumed that they derive from sporadic concentrations of vein quartz rubble distributed through the soils and wash of the area.



E.L 1164, MANNAHILL, S.A.

Approximate scale
1 : 85 000

LOCATION OF BULK STREAM SEDIMENT SAMPLES - OUTALPA AREA

AUSTAMAX GOLD Pty. Ltd.

JULY 1984

FIGURE 7

During the course of a helicopter-borne follow-up of the oblique aerial photograhic reconnaissance, rock chip samples were collected from various anomaly sites. These sites are shown in Figure 6 together with the gold assay results.

One sample, located at Anomaly 62, returned an assay of 10 grams per tonne gold and the following further work was undertaken.

Anomaly 62 is the site of a small working situated within an alluvial flat which shows no other outcrop except at the entrance of a shallow inclined shaft. The shaft follows a quartz vein dipping south at 20° to 22° conformable with the enclosing grey siltstones. The quartz vein is up to 30 centimetres thick at the surface but is covered by rill lower down the shaft (about 8 metres deep). The shaft is 2.5 to 3.0 metres wide and at least 1.1 metres high above the rill.

Previous sampling from quartz vein material gave an assay result of 10 grams per tonne gold. During the present visit, highly ferruginous material from the dump, maybe of seconds material, was sampled which gave the following assay result:

Sample No	Cu	Pb	Ag	Au	As	Sb
23499	610	2.52%	17	0.20	375	330

All results in ppm unless otherwise stated
Comlabs Pty Ltd, Adelaide

A bulk soil sample was collected over a length of 80 metres normal to the supposed strike of the quartz vein in an area of no outcrop but with prominent quartz and ironstone rubble 155 metres east of the shaft. This returned an assay (by bulk leaching methods) of:

Sample Number	Zn Precipitate Weight (gms)	ppm Precipitate Au	ppm Precipitate Ag	Calculated ppb Au	Calculated ppb Ag
23498	2.98	2.60	25	3.8	37.2

Primary leach and precipitation by Perth Metallurgical Laboratory, Perth
Assay of Zn precipitate by AMDEL, Perth

Approximately two kilometres along strike from this working is a similar shallow working almost certainly sunk by the same person(s) again situated in an alluvial flat with no other outcrop except at the entrance of the shaft. This shaft was sunk on a quartz vein 50 to 60 centimetres thick conformable with the enclosing dense grey siltstones dipping 25° south. The shaft is presently no more than 5 metres deep but the bottom is not exposed because of rill and fallen roof material. A sample from ferruginous (limonitic) material on the seconds(?) ore dump gave the following results:

Sample No	Cu	Pb	Ag	Au	As	Sb
23496	860	3400	1	0.15	8050	20

All results in ppm unless otherwise stated
Comlabs Pty Ltd, Adelaide

A bulk soil sample taken over 150 metres normal to the strike of the quartz vein 90 metres east of the working gave:

Sample Number	Zn Precipitate Weight (gms)	ppm Precipitate Au	ppm Precipitate Ag	Calculated ppb Au	Calculated ppb Ag
23497	3.02	0.05	11	0.07	16.6

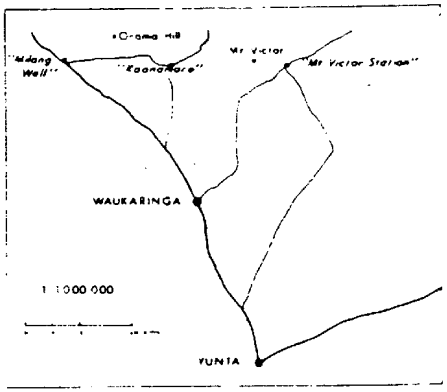
Primary leach and precipitation by Perth Metallurgical Laboratory, Perth
Assay of Zn precipitate by AMDEL, Perth

It would appear that both quartz occurrences are anomalous in lead-silver but that gold values are erratic. As both occurrences appear to be on the same stratigraphic horizon of the Tarcowie Siltstone, it was decided to bulk soil sample the intervening area covered by alluvium and "calcretised" aeolian sands. Eleven lines, approximately 400 metres apart and 600 metres long, were sampled every 200 metres by taking increments every 20 metres. These samples were collected for the bulk leaching of fine free gold. The sample sites are shown in Figure 8 and the results in Table 4.

TABLE 4

BULK SOIL SAMPLING - ANOMALY 62 AREA

Sample Number	Zn Precipitate Weight (gms)	ppm Precipitate Au	Ag	Calculated ppb Au	Ag
7518	3.08	0.55	10	0.84	15.4
7519	3.30	0.60	9	0.99	14.8
7520	3.11	1.15	20	1.78	31.1
7521	3.06	1.30	15	1.99	22.9
7522	3.20	1.85	18	2.96	28.8
7523	2.80	1.40	19	1.96	26.6
7524	2.90	1.35	16	1.95	23.2
7525	3.28	1.45	11	2.78	18.0
7526	3.33	0.65	17	1.08	28.3
7527	3.16	1.00	14	1.58	22.1
7528	3.14	0.95	11	1.49	17.2
7529	3.19	1.60	17	2.55	27.1
7530	3.26	1.25	16	2.03	26.0
7531	3.16	1.30	13	2.05	20.5
7532	2.81	1.35	23	1.89	32.3
7533	2.89	2.40	18	3.48	26.1
7534	3.25	1.45	10	2.35	16.2
7535	3.59	1.30	11	2.33	19.7
7536	3.50	1.35	11	2.36	17.5
7537	3.16	0.55	12	0.87	18.9
7538	3.25	0.80	11	1.3	17.8
7539	3.01	1.80	13	2.78	20.1
7540	3.39	1.35	10	2.29	16.9
7541	3.05	0.75	7	1.14	10.6
7542	2.99	1.70	14	2.54	20.9
7543	3.20	1.15	12	1.84	19.2
7544	3.16	1.20	13	1.89	20.5
7545	3.31	1.35	12	2.23	19.8
7546	3.35	1.35	10	2.26	16.7
7547	3.11	1.00	15	1.55	23.3
7548	3.30	0.95	13	1.56	21.4
7549	3.17	1.10	13	1.74	20.6



POSITION OF SAMPLES
located about Anomaly 62 and a small mine approx 3 kms N.E of Anomaly 62

0 500 metres
1 10 000

N

7519
7522
7518 Run 1
7525
7521 Run 2
Mine near fence
7524 Run 3
7520
7549
7523
7548 Run 4
7546
7547
7545 Run 5
7543
7542 Run 6
7544
7540
7541
7537
7539 Run 7
7534
7536 Run 8
7538
MT VICTOR
7535
7533 Run 9
7528
7531
7527 Run 10
ANOMALY 62
7532
7530 Run 11
7526
7529

LOCATION MAP
of
gridded area about Anomaly 62
1 85 000

(Diary Run 1, Photo 43)

N

LOCATION OF BULK SOIL SAMPLES - ANOMALY 62

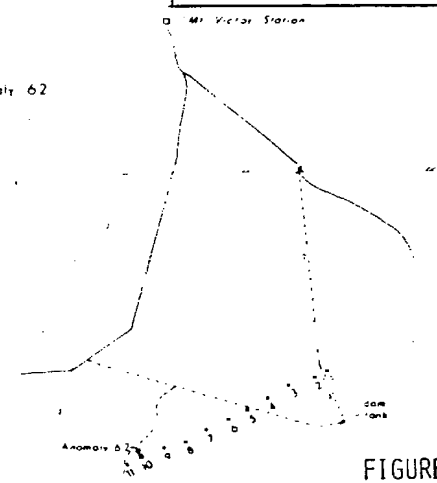


FIGURE 8

All assay results were of the same order of magnitude and not noticably related to the two known mineralised sites. They also confirmed the gold values given during the initial sampling. It must be assumed that the superficial cover of the area interferes with any direct correlation between the present day surface soils and the underlying rock or subcrop.

7. EXPENDITURE

SUMMARY OF EXPENDITURE
FROM INCEPTION TO 30 SEPTEMBER 1984

MANNAHILL EL 1164, SOUTH AUSTRALIA

	A$
Salaries and Wages - Temporary	53
Legal Fees and Expenses	732
Publications, Maps, Reports and Memberships	2,855
Contractors - Except Drilling	1,556
Drafting Services and Supplies	2,242
Assaying and Analysis	5,041
Telephone, Telex and Telegraph	422
Postage, Shipping and Freight	1,132
Field Materials	3,051
Car Hire and Taxis	1,150
Air Travel	5,587
Lodging, Meals and Entertainment	8,761
Aircraft/Helicopter Charter	38,859
Vehicles - Maintenance	3,097
Vehicles - Lease	2,430
Field Equipment - Purchased	1,144
Miscellaneous Tenement Fees	5,705
Allocated Salaries - Permanent	45,219
Allocated Fringe - Permanent	33,850
Allocated Office Overheads	16,580
Allocated Salaries - Temporary	1,367
Allocated Fringe - Temporary	410
TOTAL	$181,243

CONCLUSIONS

Past activities, as well as present investigations, have established that there are a number of small stratabound gold occurrences in the region. Within the Exploration Licence area, none of the known occurrences are large enough to warrant their reopening or further development. The present exploration programme did not locate any gold (or other) mineralisation of economic significance. Investigations for alluvial gold on the adjoining Baratta Exploration Licence 1227 did not suggest any possibilities for this type of deposit on the Mannahill Licence area.

In view of these discouraging results, it is recommended that the licence be relinquished as soon as possible.

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