CONTENTS ENVELOPE 5259

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ASSESSMENT OF E.L. 1144
LAKE CARNANTO
SOUTH AUSTRALIA

Prepared for North Flinders Mines Ltd.

D. M. Ransom

April, 1984.

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FIGURE

Figure 1	Summary Map	1:250 000 Scale

* * *

SUMMARY

E.L. 1144 (Lake Carnanto) is located east of Lake Frome. It has been previously explored for sedimentary uranium in Quaternary sediments of the Frome Embayment and lies across the eastern margin of the Benagerie Ridge. Quaternary and Mesozoic sediments are underlain by a basement of Cambrian, Adelaidean and Carpentarian rocks. Drilling by government and exploration companies, and the regional airborne magnetic and gravity data suggest exploration potential may exist for base metal or uranium mineralization associated with shallow magnetic features in the western half of the E.L.. In this area, Carpentarian shales and volcanics are overlain by less than 50 metres of post-Palaeozoic cover.

Further exploration is of high risk, but a programme of ground magnetics and rotary/percussion drilling to elicit the nature of the shallow magnetic features is recommended. A decision to execute such a programme will depend on an assessment by North Flinders Mines Ltd. of its' priority relative to other areas.

* * *

INTRODUCTION

E.L. 1144 (Lake Carnanto) was granted to North Flinders Mines Ltd. on 27th May 1983. It is 588 square kilometres in area and is located east of Lake Frome (Figure 1). It was applied for on the basis of interest in magnetic anomalies in shallowly covered basement on the Benagerie Ridge.

This report is a summary of relevant geological and geophysical data in and surrounding the E.L. area, and an assessment of exploration potential.

PREVIOUS EXPLORATION

E.L. 1144 has been previously explored for sedimentary uranium as follows:

Company	Tenement	SADME Envelope No.
Mines Administration Pty. Ltd.	S.M.L.66	E2291
Sedimentary Uranium N.L.	E.L.513	E1546
" "	E.L.514	E1543
Marathon Petroleum Australia Ltd.	E.L.435	E4697
" " "	E.L.802	
Chevron Exploration Corporation	S.M.L.663	E2257
" " "	E.L.40	
Southern Ventures Pty. Ltd.	E.L.105	E2377
" " "	E.L.178	
" " "	E.L.334	E3058

Planet Mining N.L. reviewed the area for its gypsum and sulphur potential (E.L. 266, Envelope 1081).

GEOLOGY

(i) Tectonic Setting

E.L. 1144 lies across the eastern margin of the Benagerie Ridge (Figure 1), a basement high below the Frome Embayment extending north from the exposed Olary Province to east of Lake Frome. Outcrops in the Curnamona 1:250 000

sheet and drill holes through shallow post-Palaeozoic cover show that a variety of rock types compose the Benagerie Ridge. They vary from an acid volcanic suite similar to the Gawler Range Volcanics, to identified Adelaidean and Cambrian sequences, possible Willyama Complex rocks, and post-Willyama, pre-Adelaidean fine sediment sequences.

(ii) Surface Geology

E.L. 1144 is underlain by Quaternary, Tertiary and Cretaceous sediments of the Frome Embayment, of variable depth, overlying a pre-Mesozoic basement of variable affinity. Drilling indicates that depth to pre-Mesozoic basement varies from less than 20 metres in the west of the E.L. to greater than 120 metres in the east. Fine grained sediments, volcanics, and carbonate rocks have been intersected in various drilling programmes as described below.

(iii) Subsurface Geology

Subsurface geological data can be obtained from the following sources:

* water bores;
* drilling from sedimentary uranium programmes;
* drilling of basement targets.

The locations and geology of relevant drill holes in E.L. 1144 and the surrounding area is shown in Figure 1.

A brief review of drilling data in E.L. 1144 and the surrounding area shows the following geological features:

* acid porphyry and red-brown shale have been intersected at depths of less than 50m in water bores and exploration holes by Mines Administration and Sedimentary Uranium west of about 140° 35' longitude in E.L. 1144 and to the south. This line coincides with the interpreted eastern boundary of the Benagerie Ridge;

* north of about latitude 31° exploration drilling by Marathon, Chevron, Southern Resources and the S.A.D.M.E. has intersected pre-Mesozoic basement at depths greater than 200 metres (Yalkalpo 1; Figure 1);

* south of and within E.L. 1144 in the area east of about 140° 35' drill-

ing by Sedimentary Uranium intersected a post-Mesozoic section of greater than 150 metres in thickness overlying Cambrian limestones;

* Mulyungarie No.2 (MU-2, Figure 1), a deep hole drilled by Western Nuclear, Oilmin, Transoil, Petromin and Marathon about 15 km south-east of E.L. 1144 intersected the following sequence:

0-100m	Mesozoic and Quaternary sediments	
100-206m	Cambrian Limestone	
206-441m	Wilpena Group	Adelaidean
441-547m	Umberatana Group	Adelaidean
547-615m	25-30 degree dipping dark grey and red laminated siltstone	

The rocks from 547-615m were interpreted by Western Nuclear as low grade Willyama Complex, but are now thought to be Carpentarian (below).

MINERALIZATION

Minor concentrations of sedimentary uranium have been found in Cainozoic rocks by Chevron and Marathon within E.L. 1144, but are not of economic grade or size.

GEOPHYSICS

Regional airborne magnetics and gravity surveys of the Curnamona and Frome 1:250 000 sheets shows that the region surrounding E.L. 1144 is characterized by:

* a north-south trending magnetic low 10 to 15 km in width and about 100 km in length separating magnetically active areas to the east and west;

* gravity highs coinciding with the magnetic low east of E.L. 1142 and coinciding with the eastern magnetic zone in the area surrounding MU-2.

The magnetic zones are thought to represent a deep (greater than 1000 metres?) magnetic basement, probably Willyama Complex. The source of the gravity anomaly to the east of E.L. 1144 is problematical. Drilling suggests it is possibly a thick dense Cambrian and Adelaidean sedimentary sequence (a graben structure?). The gravity lows on the Benagerie Arch and the magnetic

zone to the east may be indicative of predominance of basement rocks of quartzofeldspathic mineralogy (below).

A further magnetic feature of significance is a north-east trending zone of shallow magnetic features, the north-eastern extremity of which occurs in E.L. 1144 (Figure 1). This zone is apparently superimposed on the deeper broader north-south Willyama structures described above. To the north-west of this zone magnetics are characterized by patterns similar to the Gawler Range Volcanics, and are interpreted as an acid volcanic pile.

EXPLORATION POTENTIAL

Assessment of pre-Mesozoic exploration potential in E.L. 1144 depends upon interpretation of the geology of the basement rocks, and their likelihood of enclosing orebodies of magnetic character. The orebody type is non-specific but the geological environment superficially favours base metal or uranium deposits.

The area east of of E.L. 1144 is underlain by rocks of low magnetic susceptibility. Based on drill hole information to the south, this low magnetic zone seems to be underlain by 300 metres of Cambrian and Adelaidean sediments over pre-Adelaidean shales, interpreted in MU-2 by Western Nuclear as Willyama Complex (above). These rocks probably extend into the eastern part of E.L. 1144, hence potential for shallowly buried magnetic mineralization therein is low.

In the western half of the E.L. pre-Mesozoic basement is shallowly buried, generally at less than 50 metres. A series of shallow magnetic anomalies trending across the E.L. at about 045 degrees is described above. The source of these anomalies is uncertain, as is interpretation of the geological affiliation of the shales and volcanics intersected in the Sedimentary Uranium and Chevron drill holes. While the volcanics are almost certainly Middle Proterozoic in age, there are a number of possibilities for the shales, as follows:

* Adelaidean sediments;
* a Carpentarian or Middle Proterozoic shale sequence;
* low grade Willyama Complex.

Descriptions of these rocks from the sedimentary uranium programmes are of

red-brown or yellow brown shales or slate. In MU-2 similar rocks are grey and red-brown, variably carbonaceous, occurring below the Adelaidean unconformity. While fine grained carbonaceous sediments are characteristic of the Paragon Group of the Willyama Supergroup, they are generally non-magnetic. The broad magnetic anomalies of the region attributed to the Willyama Complex above are more logically signatures of the Thorndale Composite Gneiss and the Clevedale Migmatite, which are typically magnetic rocks in outcrop. These rocks are characteristic of the Macdonald Hill-Radium Hill-Cockburn area of the Olary Province, and the deep magnetic anomalies in the Curnamona 1:250 000 sheet are continuous with these rocks to the south. Therefore the writer favours the interpretation of the shales as a Middle Proterozoic or Carpentarian sequence of approximately similar age and stratigraphic relationships to the Middle Proterozoic sediments of the Gawler Craton, e.g. the Tarcoola Formation and the Wandearah Metasiltstone. They overlie the Willyama Supergroup at depth.

The potential of these rocks, which appear to underlie the eastern half of E.L. 1144 at shallow depth is difficult to assess. Emission spectrograph analyses of the shale sequence in MU-2 show zinc values of up to 250 ppm, and chalcopyrite has been recognized in thin-section together with disseminated pyrite. On the Gawler Craton, these rocks have been equated with the sedimentary sequence at Olympic Dam on the basis of reworked hematite content (Wandearah Siltstone), and their thin talus breccia deposits (Tarcoola Formation). It is doubtful that an ore deposit of the dimensions and geophysical character of Olympic Dam exists in the western half of E.L. 1144. However, the smaller, shallow magnetic features described above are not easily dismissed.

The Middle Proterozoic shale sequences of the Gawler Craton are generally non-magnetic. Magnetic features in the Gawler Craton usually have their source in mafic rocks or iron formation in the Lower Proterozoic basement, or in mafic intrusions in the Stuart Shelf sequence. Since magnetic basement seems to be deeply buried, it seems likely that these minor anomalies in E.L. 1144 are magnetic units or perhaps mafic intrusives in the siltstone sequence. The less likely alternative is that they are magnetic ore deposits. Of the drill holes penetrating the pre-Mesozoic sequence, none are located near the magnetic anomalies.

FURTHER EXPLORATION

Taking account of the above discussion, exploration potential in E.L. 1144 is defined by:

* a possible Carpentarian shale/siltstone sequence, with "anomalous" zinc values;

* shallow magnetic anomalies of unknown source.

While it is likely that the minor magnetic anomalies are mafic intrusions or shallow magnetic structures in the basement, this has not been established by the available drilling data. A pragmatic approach to the unknowns of the situation would be to undertake a programme to establish the source of these magnetic anomalies.

Obviously, such a programme is of high risk. Commitment to such an exploration programme will depend to a large extent on the priorities of North Flinders Mines outside E.L. 1144. However, judged in isolation, a programme of ground magnetics and rotary/percussion drilling to establish the nature of the shallow magnetic anomalies in E.L. 1144 is warranted.

CONCLUSIONS

1. E.L. 1144 is underlain by a cover of Mesozoic/Cainozoic rocks of variable depth overlying a pre-Mesozoic basement of Cambrian, Adelaidean, and pre-Adelaidean sediments.

2. In the western half of E.L. 1144 pre-Mesozoic basement is composed of Carpentarian shales and acid volcanics generally under less than 50 metres of cover. In the eastern half of the E.L., a thick cover of Mesozoic, Cambrian and Adelaidean sediments overlying the Carpentarian is likely to be present.

3. Exploration potential in E.L. 1144 is present only in the shallow magnetic anomalies within the Carpentarian shale sequence. Their source is unknown, but is either mafic intrusions or magnetic (possibly mineralized) sedimentary units within the Carpentarian. Present drilling is not definitive.

4. While of high risk, a programme of ground magnetics and rotary/percussion drilling to establish the source of these magnetic features is warranted. Any decision to undertake such a programme will depend upon the priorities of North Flinders Mines outside E.L. 1144.

RECOMMENDATION

It is recommended that a limited programme of ground magnetics and rotary/percussion drilling to establish the nature of shallow airborne magnetic anomalies in E.L. 1144 should be undertaken.

D. M. Ransom
April, 1984.

* * *

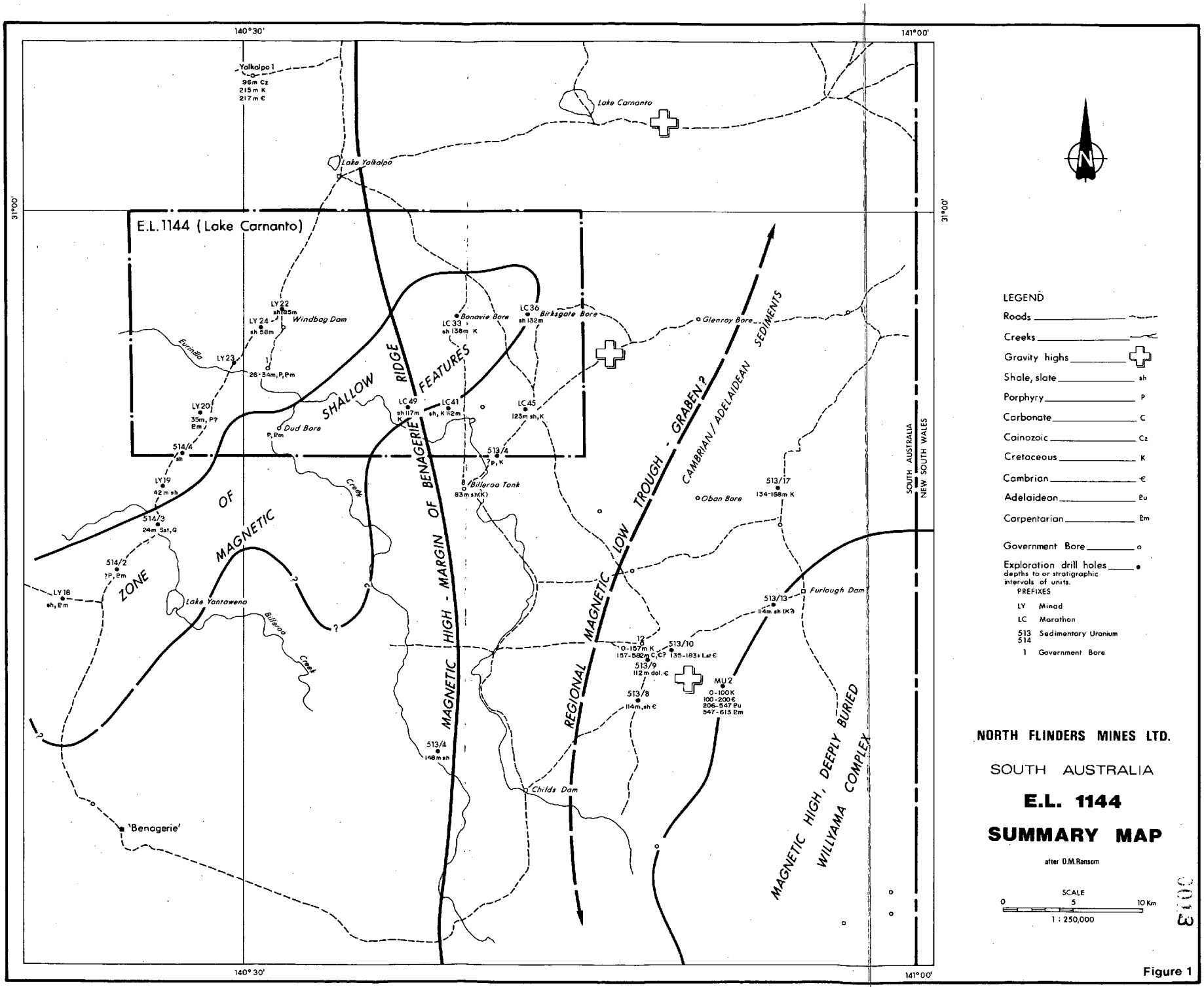

140°30'
141°00'
31°00'
E.L. 1144 (Lake Carnanto)
Yalkalpo 1
96m Cz
215m K
217m €
Lake Carnanto
Lake Yalkalpo
LY 22
sh 185m
LY 24
sh 58m
Windbag Dam
LY 23
26-34m, P, Pm
Eurinilla
LY 20
35m, P?
Pm
Dud Bore
P, Pm
514/4
sh
LY 19
42m sh
514/3
24m Sst, Q
514/2
?P, Pm
LY 18
sh, Pm
Lake Yantaweno
Billeroo Creek
'Benagerie'
SHALLOW RIDGE FEATURES
MAGNETIC HIGH - MARGIN OF BENAGERIE
ZONE OF MAGNETIC
Bonavie Bore
LC 33
sh 138m K
LC 36
sh 132m
Birksgate Bore
LC 49
sh 117m K
LC 41
sh, K 112m
LC 45
123m sh, K
513/4
?P, K
Billeroo Tank
83m sh(K)
513/4
148m sh
Childs Dam
Glenroy Bore
Oban Bore
513/17
134-168m K
CAMBRIAN / ADELAIDEAN SEDIMENTS
REGIONAL MAGNETIC LOW TROUGH - GRABEN?
513/13
114m sh (K?)
Furlough Dam
513/10
0-157m K
157-582m C, €?
135-183+ Lst €
513/9
112m dol. €
513/8
114m, sh €
MU 2
0-100K
100-200€
206-547 Pu
547-613 Pm
MAGNETIC HIGH, DEEPLY BURIED WILLYAMA COMPLEX
SOUTH AUSTRALIA
NEW SOUTH WALES
N
LEGEND
Roads
Creeks
Gravity highs
Shale, slate sh
Porphyry P
Carbonate C
Cainozoic Cz
Cretaceous K
Cambrian €
Adelaidean Eu
Carpentarian Em
Government Bore o
Exploration drill holes • depths to or stratigraphic intervals of units.
PREFIXES
LY Minad
LC Marathon
513 Sedimentary Uranium
514
1 Government Bore
NORTH FLINDERS MINES LTD.
SOUTH AUSTRALIA
E.L. 1144
SUMMARY MAP
after D.M. Ransom
SCALE
0 5 10 Km
1 : 250,000

Figure 1

EXPLORATION LICENCE 1144

Quarterly Report for periods to 26/8/83 and 26/11/83.

Introduction

The licence was granted on 27th May 1983, for a term of one year. It is located 130 km N of Olary, south-east of Lake Frome.

Work Program

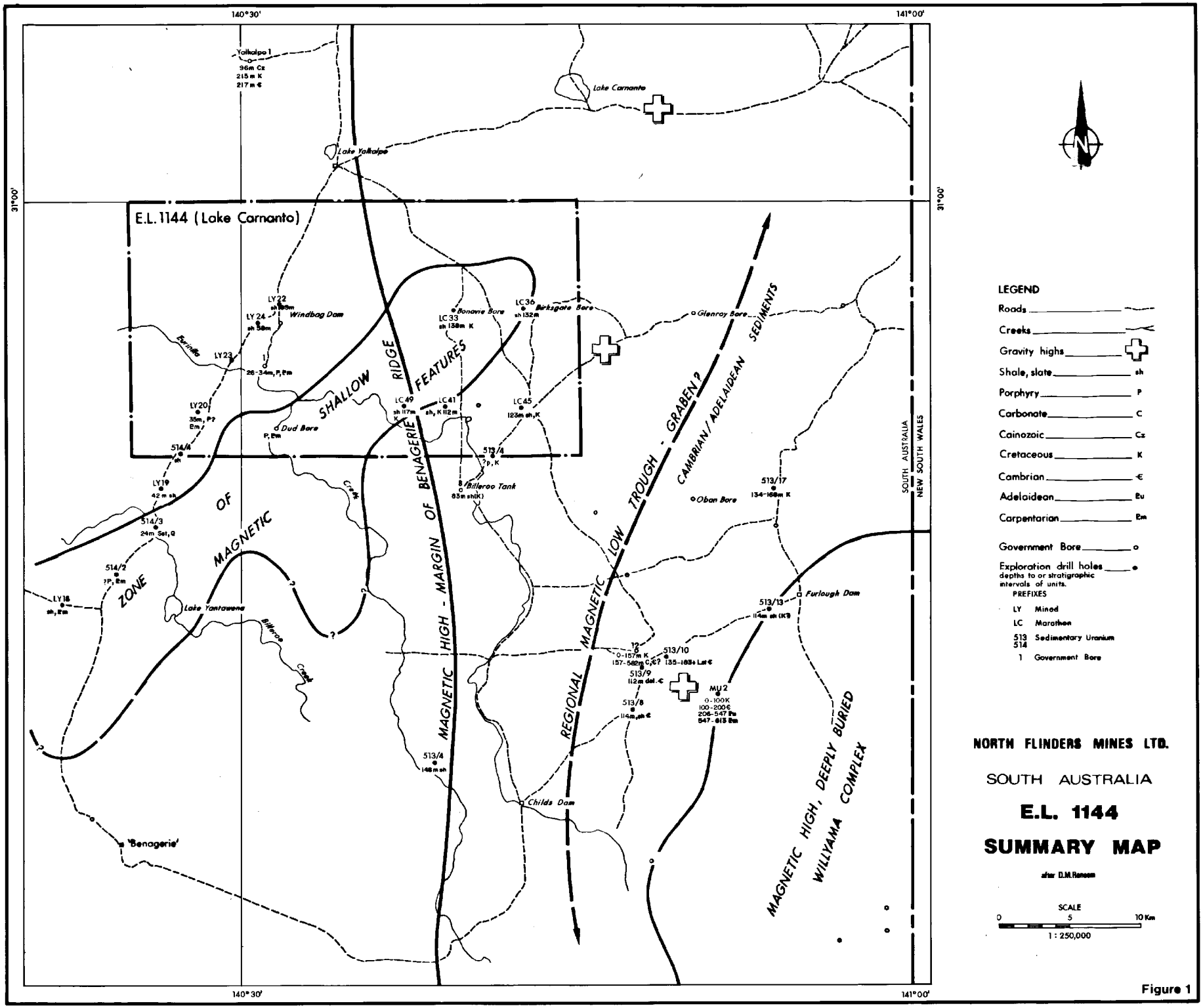
No field work was undertaken during the first two quarters. Literature and previous exploration records were researched.

Expenditure

Geology	$1000
Drafting	$ 500

T.J. IRELAND
Senior Geologist

20/12/83


140°30'
141°00'
31°00'
E.L. 1144 (Lake Carnanto)
Lake Carnanto
Lake Yalkalpo
Yalkalpo 1
96m Cz
215 m K
217 m €
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SOUTH AUSTRALIA
NEW SOUTH WALES
LY22
LY24
LY23
LY20
LY19
LY18
LC33
LC36
LC49
LC41
LC45
514/4
514/3
514/2
513/4
513/17
513/13
513/10
513/9
513/8
MU2
LEGEND
Roads
Creeks
Gravity highs
Shale, slate sh
Porphyry P
Carbonate C
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Carpentarian Cm
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