ANNUAL REPORT
EXPLORATION LICENCE
No. 1389

CR 78/15

Australian Ores & Minerals Limited
CONTENTS

SUMMARY

INTRODUCTION

TENURE

GEOLOGY

DETAILS OF GEOPHYSICAL SURVEY AND REDUCTIONS

OUTLINE OF RESULTS

DISCUSSION

CONCLUSIONS AND RECOMMENDATIONS

REFERENCES

APPENDIX I E.L. Boundaries

APPENDIX II Airborne Survey Specifications

Figure 1a Locality Map

Figure 1b Legend for area within E.L.'s 1386, 1388 and 1389

Figure 2a Magnetic Contours. Part of E.L. 1389

Figure 2b Magnetic Stacked Profiles. Part of E.L. 1389
ILLUSTRATIONS

<table>
<thead>
<tr>
<th>Plate</th>
<th>Description</th>
<th>✓</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate 1</td>
<td>Geology E.L. 1389</td>
<td></td>
</tr>
<tr>
<td>Plate 2</td>
<td>Stacked Profiles, Total Scintillometer</td>
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</tr>
<tr>
<td></td>
<td>Counts E.L. 1389</td>
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</tr>
<tr>
<td>Plate 3</td>
<td>Stacked Profiles, Total Magnetic Force</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E.L. 1389</td>
<td></td>
</tr>
<tr>
<td>Plate 4</td>
<td>Contour Plans, Total Scintillometer</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Counts E.L. 1389</td>
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<tr>
<td>Plate 5</td>
<td>Contour Plans, Total Magnetic Force</td>
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INTRODUCTION

This annual report of Exploration Licence 1389 contains numerous references to Exploration Licences 1386 and 1388 because the three Exploration Licences were explored by us as one area.

Exploration Licences 1386, 1388 and 1389 were granted to Australian Ores & Minerals Limited (AOM) in late 1976. These Exploration Licences lie slightly north of Tennant Creek, N.T., in what is locally known as the Centre Field (Fig. 1). The Centre Field is traditionally prospective for copper, gold and bismuth, and contains the major Tennant Creek mines. The Warrego, Gecko and Orlando are all close to these Exploration Licences and the Ivanhoe leases are within the boundary of E.L. 1389.

We consider these Exploration Licences are prospective for copper, gold, bismuth and uranium mineralisation.

During 1977 AOM carried out an airborne magnetic and radiometric survey over the Exploration Licences. The data was converted to stacked profiles and contour plans by AOM personnel with a saving of 50% of the contract price. Consequently the expenditure on the Exploration Licences represents thrifty exploration.

Expenditure on Exploration Licence 1389 for the year was $7,436.
TENURE:

The exact boundaries of the Exploration Licence is given in Appendix I.

Within the boundaries, however, are some pre-existing leases which are exempt from the Exploration Licences. With the exception of a few quarry leases, they are held by Geopeko or Nobelex (Australian Development). The approximate locations are shown on the geology map (Plates 1).

The Exploration Licence has to be renewed each year; commencing at the end of 1978, and subsequent years, reduced by half with final relinquishment in 1981.
GEOLOGY:

The most recent account of the geology of the Tennant Creek field is given by Crohn, 1975.

The major outcropping rocks in the Centre Field are the Lower Proterozoic Warramunga Group. According to Crohn these comprise "mainly interbedded grewacke and shale with a major intercalation of tuffs and acid volcanic rocks." These are overlain unconformably by the Hatches Creek Group and Tomkinson Creek Beds.

The copper-gold-bismuth mineralisation occurs in varying associations with magnetite, haematite, jasper and dolomite. A combination of any or all these minerals may constitute an ore body within the Warramunga Group. The bodies are normally discrete pod-like and, at times, pipe-like. They tend to lie just below magnetite or haematite shale bands so a unique magnetic signature is produced. The classic anomaly, in plan form, is a small closed anomaly adjacent to a linear magnetic anomaly. There are many variations of this model. The important point is that the magnetic model has been so useful and well accepted that it has formed the basis of most exploration of the Field. In other words, economic mineralisation not associated with magnetic anomalies would only be found if it outcrops or, is intersected by accident in a drill hole designed for a different target.

One other factor of importance is the depth of oxidation. This is generally in the order of 100 metres. As a general rule ironstones are haematitic above this depth, but may contain magnetite below it.
DETAILS OF GEOPHYSICAL SURVEY & REDUCTIONS:

An airborne spectrometer and magnetometer survey was carried out over the three Exploration Licences by Geometrics in June 1977. Flying height was 90 metres, spacing was 500 metres and the four channel spectrometer was connected to 2000 cu ins. of crystal (full details in Appendix II).

Data was presented to us in the form of flight path recovery and analogue charts, and subsequently mini-plots. These mini plots are a Geometrics option whereby six profiles per flight line are provided with scale corrections (but not with tie line corrections). The six channels provided here were magnetics, total counts, uranium, thorium, potassium and a uranium-thorium ratio.

The magnetic and total count profiles were then stacked by us as shown in Plates 2 & 3. Generally this stacking was accomplished by locating a recovered fiducial near the centre of each profile and using this to overlay the profile along the average flight path. From these stacked profiles, contour maps of total counts and total magnetic force were produced. They suffer from the limitation that the tie lines were not utilised. In cases of herring-boning (e.g., E.L. 1389) careful checks of fiducial plots were made and it can only be assumed to be due to the fact that the tie lines were not taken into consideration.

The contour maps must be studied with this limitation in view. The advantages were considerable savings in cost over computer maps, and the fact that every anomaly has been closely studied when producing contours from profiles.

Notes: No attempt has been made to tie in the contours between E.L.'s 1388 and 1389 because they were flown in different directions.
OUTLINE OF RESULTS:

The results of the airborne survey are presented as both stacked profiles and contour plans. Contour plans show the areal location of anomalies more clearly than stacked profiles, but they often change the apparent nature of an anomaly. This is clearly indicated in Figures 2a and 2b. Referring to the contour plan (Figure 2a), the anomalies marked A and B appear discrete and perhaps completely unrelated to anomaly C. The peaks causing these "discrete" anomalies are marked on the stacked profiles in Figures 2b. It now appears that anomalies A and B are part of a linear trend AA'BB'. Not so clear perhaps is whether this trend continues through CC'C", but one limitation of contours has been illustrated. The effect has arisen, of course, because one anomaly is superimposed on another. The example also shows the difficulties one can encounter in locating stacked profile peaks. The important point is that people should study both forms of their personal preference.

The following summary of the results requires constant reference to the geological map and legend (Figure 1).

Scintillometer Results

Most anomalies (Plate 4) coincide with mapped geology (Plate 1). The exception is a very strong point source anomaly near the Ivanhoe Mine on line 37. This is a thorium anomaly and is probably due to the ore dump near the mine, although a grab sample only assayed 14 ppm Th. However, this anomaly must be located on the ground with certainty. Because of location problems, it could be in a non-outcrop area (due to some other source).

As would be expected, the granites are quite radioactive and it should be noted that some intermediate contours have been omitted.
Practically all outcropping units register a fair response, but the outstanding one is Pw₆ which is quite strong. The Gecko volcanics are also quite responsive and similar to the Bernborough Formation at the Queen of Sheeba. The volcanics northeast of Bishops Bore may be more extensive than mapping indicates. The lack of response over an outcrop of Whippett sandstone north of Bishops Bore may be mainly a function of flight spacing.

**Magnetic Results**

Pw₆ is the most outstanding magnetic unit and its extent in the south of the E.L. illustrates beautifully the advantages of magnetic data for mapping purposes. The Ivanhoe Mine (Geopeko leases) is within this unit and quite prominent within this unit are numerous prospective magnetic anomalies, not the least being those illustrated in Figure 2. Virtually all magnetic anomalies along the Ivanhoe line (Plate 5) need further investigation. The belt of west-northwest trending anomalies in the centre of the E.L. also warrant follow-up work. Nobelex hold most of the interesting anomalies about Bishops Bore. However, there is a very interesting magnetic feature northeast of Bishops Bore, i.e. near Flynn's Monument, in an area of non-outcrop. This has similar characteristics of the Pw₆ within which lies the Ivanhoe.

The granites are essentially non-magnetic, as are the Gecko volcanics.
The previous outline of results is, of necessity, brief and presupposes a general knowledge of the field. Because of the reconnaissance nature of the survey, anomalies have been referred to in general terms in respect of location. Reference to external leases has been vague because their precise locations have yet to be established. Specific references to stacked profiles have been limited but it must be accepted that these show geological trends more clearly than the contour maps. The importance of these should become more clear in the following chapter.

Finally, it has not been possible to categorise all scintillometer anomalies according to the spectral response of the uranium-thorium or potassium channels. There are no outstanding uranium only anomalies. The thorium only anomalies have been mentioned. In general, the granites gave a response on all channels, and the sediments on potassium and thorium. The thorium channels were stronger around the Ivanhoe and Queen of Sheeba.
REFERENCES:


SECOND SCHEDULE

DESCRIPTION OF AREA

ALL THAT piece or parcel of land in the Northern Territory of Australia containing an area of 88.47 square miles, more or less, the boundaries of which are described as follows -

Commencing at the intersection of latitude 19 degrees 25 minutes with longitude 134 degrees 05 minutes thence proceeding to the intersection of latitude 19 degrees 25 minutes with longitude 134 degrees 10 minutes thence proceeding to the intersection of latitude 19 degrees 35 minutes with longitude 134 degrees 10 minutes thence proceeding to the intersection of latitude 19 degrees 35 minutes with longitude 134 degrees 02 minutes thence proceeding to the intersection of latitude 19 degrees 28 minutes with longitude 134 degrees 02 minutes thence proceeding to the intersection of latitude 19 degrees 28 minutes with longitude 134 degrees 05 minutes thence proceeding to the intersection of latitude 19 degrees 25 minutes with longitude 134 degrees 05 minutes, subject to all applications for mining tenements and excluding therefrom all mining tenements granted or registered and all reserves included within the definition of 'reserve' in Section 7 of the Mining Ordinance.

This is the Second Schedule to Exploration Licence No. 1389 dated: 30 NOV 1976
b) Survey Instruments

(i) GeoMetrics airborne proton magnetometer Model G-803 which will provide the following sensitivity/readout rates:

<table>
<thead>
<tr>
<th>Sample Interval</th>
<th>Sensitivity (Gamma)</th>
<th>Analog Recorder Full Scale Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.8 seconds</td>
<td>0.5</td>
<td>50 and 500 gammas</td>
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</tbody>
</table>

All data are digitally recorded in terms of actual total field values using time base control.

(ii) Exploramum DiGRS-3001 digital, four channel, gamma ray spectrometer with G.R.900 spectrum stabiliser and detector interface.

(iii) 2 - DET 1024 ex-square crystal detectors providing a volume of 2,048 cubic inches.

(iv) Recording Altimeter - Honeywell YG.7600 radar altimeter

(v) A Hulcher 35mm tracking camera with wide angle lens and continuous strip.

(vi) An Integrated Navigation System comprising:
  a) Decca Radar Doppler - Type 72
  b) Sperry C-9 Gyro Stabilised Compass

(vii) Exploramum MARS-6 multi-channel analog recorder for recording on a common time base:
  a) Magnetometer
b) Radar Altimeter

c) Total Count (corrected or uncorrected)

d) K-40 (corrected or uncorrected) Potassium

e) Bi214 (corrected or uncorrected) Uranium

f) Th.208 (corrected or uncorrected) Thorium

(viii) A GeoMetrics Digital Acquisition System, Model G.704 recording

the following:

a) Magnetometer

b) Camera fiducial number

c) Manually inserted information, i.e. survey area, flight line

number and line direction

d) Radar Altimeter (by analog-to-digital conversion)

e) Gamma Ray Spectrometer data (uncorrected)

(ix) Synchronisation of all data gathered in the course of a flight

is achieved by sequential imposition of fiducial or event marks

on all records simultaneously.

(x) A GeoMetrics Recording Base Station Magnetometer, Model G.806,

will be used as a Diurnal Monitor and run continuously during

survey periods.

8. REJECTION CRITERIA

Line Spacings: GeoMetrics to refly or infill at its own expense when spacing

between adjacent lines exceeds 1.5 times the defined line separation for a

distance of 5 km or more.

Altitude: Safety.
Diurnal: Flying shall not be conducted during those periods when total magnetic intensity field variations, as recorded by the storm monitor station, exceed 5 gammas in five minutes (non-linear deviation).

CALIBRATIONS:
The following calibrations will be effected:

Magnetometer:
Heating errors corrected to ± 0.5 gamma prior to acquiring survey data.

Gamma Ray Spectrometer:
The spectrometer will be calibrated prior to, and at the completion of, each data collection flight, by using hand samples of uranium, thorium and potassium equivalents with the equipment set at a one second interval. Recording of these calibrations will be made in analog mode.

A background check will be made prior to each data collection sortie by flying a test line at a barometric altitude of 1000 meters. This test will be approximately ten kilometers long, and located in an area of low radioactivity.

A test line of 5km will be flown before and after each data collection sortie in order to determine the repeatability of the total radiation counts.
LEGEND FOR AREA WITHIN E.L.'s 1386, 1388 and 1389
FOR FULL DETAILS OF TENNANT CREEK AREA SEE BMR 1:250,000 SERIES
Figure 2a
MAGNETIC CONTOURS
- PART OF E.L. 1389
Figure 2b
MAGNETIC STACKED PROFILES
- PART OF E.L. 1389