NORTHERN TERRITORY GEOLOGICAL SURVEY

ANNUAL REPORT 1980

(TO NORTHERN TERRITORY DEPARTMENT OF MINES AND ENERGY)

FOR

E.L. 1600


October, 1980

Agip Australia pty. ltd.
NORTHERN TERRITORY
GEOLoGICAL SURVEY

ANNUAL REPORT 1980

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FOR

E.L. 1600

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1. SUMMARY

The programme from August, 1979, to July, 1980, consisted primarily of additional geological mapping and ground geophysical surveys to consolidate and extend the knowledge of potentially attractive lithological units defined by previous work, and to define promising drilling targets within the favourable units.

Results from the above geological and geophysical programme have delineated two situations for drill hole testing in the Surprise Creek area.
2. INTRODUCTION

E.L. 1600 was granted to Nord Resources on the 8th of August, 1977. Activities in 1977/78 by Nord Resources consisted of literature research, survey gridding, radiometrics, geological mapping and shallow bedrock drilling and geochemistry.

In late 1978 Agip Australia entered into a joint venture agreement with Nord Resources and became project operators.

A work programme of additional geological mapping, ground magnetic survey, trial ground E.M. survey, and extension of ground radiometric surveying was carried out by the operators in the year to 10th August, 1980. In addition, some drilling samples from the previous year's exploratory work were submitted for petrological examination.
3. DESCRIPTION OF AREA

The area for which a reapplication was submitted for the period 10.8.80 to 9.8.81 is as follows:

1. (2.57 square miles)

Commencing at the intersection of latitude 13 degrees 15 minutes S with longitude 130 degrees 44 minutes E thence proceeding to the intersection of latitude 13 degrees 15 minutes S with longitude 130 degrees 45 minutes E thence proceeding to the intersection of latitude 13 degrees 17 minutes S with longitude 130 degrees 45 minutes E thence proceeding to the intersection of latitude 13 degrees 17 minutes S with longitude 130 degrees 44 minutes E thence proceeding to the point of commencement.

2. (28.28 square miles)

Commencing at the intersection of latitude 13 degrees 18 minutes S with longitude 130 degrees 47 minutes E thence proceeding to the intersection of latitude 13 degrees 18 minutes S with longitude 130 degrees 48 minutes E thence proceeding to the intersection of latitude 13 degrees 30 minutes S with longitude 130 degrees 48 minutes E thence proceeding to the intersection of latitude 13 degrees 30 minutes S with longitude 130 degrees 46 minutes E thence proceeding to the intersection of latitude 13 degrees 20 minutes S with longitude 130 degrees 46 minutes E thence proceeding to the intersection of latitude 13 degrees 20 minutes with longitude 130 degrees 47 minutes E thence proceeding to the point of commencement.

Refer also to figure 1.
4. CLIMATE, WATER SUPPLY AND HYDROLOGY

Climate in the area of E.L. 1600 is monsoonal. Mobility for field activities is limited to the "dry season" from April to December.

Water supply is largely from permanent billabongs and perennial streams in the area.

The hydrology of the area is dominated by the Reynolds River which flows north north westerly across the southern part of the exploration licence.
5. LOCATION AND ACCESS

E.L. 1600 is located in the Reynolds River area of the Northern Territory. (See Figure 2).

Access to the area is by road from the Stuart Highway, 45km along the Daly River road. Access within the area is by graded track.
6. REGIONAL GEOLOGY

E.L. 1600 is situated on the western side of the Pine Creek Geosyncline and comprises mainly various schists of the Lower Proterozoic Burrell Creek Formation wedged between the Giant's Reef Fault to the east and the Litchfield Complex to the south west.

Much of the Proterozoic geology is obscured by either Cambrian sediments or black soil swamp cover common to the region.

The present recorded mineralization consists of some small pegmatitic tin prospects.

Although the stratigraphic nomenclature of the Pine Creek Geosyncline has recently been revised, in the interests of conformity this report retains the stratigraphy of Walpole et. al., 1968.
7. EXPLORATION ACTIVITIES

7.1 Geology

The detailed geology of E.L. 1600 was previously given in the Annual Report for the period ended 9.8.1979.

Additional mapping was carried out in the northern part of the Surprise Creek area as an aid to the interpretation of a haematitic quartz-mica schist which is exposed in a hill at the eastern end of crossline 1,000S and appears to contain the anomalous intersections in 1979 drill holes RR12P and RR13P further to the north-north west. A continuation of the unit, further northwest, into the area of recent survey gridding is now apparent.

Other rock units mapped in the extended grid area comprised meta-arkose, with pegmatite and quartz reefs, and limonitic quartz-mica schist, which is slightly coarser grained than the haematitic quartz-mica schist type.

Structural relationships of the three major rock types in the area are complex. Meta-arkose is known to the east and west of the projected zone occupied by the haematitic quartz-mica schist unit. A difference in strikes, between those of the meta-argillite, schistose units and those of the meta-arenite, is evident, with the former being mainly northwest-southeast and the latter being north to north-east.

Four samples from outcrops and previous drill hole RR13P consisted of similar types of muscovite – rich schist of upper greenschist to lower amphibolite facies metamorphic grade (refer to appendix I).
A pegmatitic tin prospect, 4km north of Prospect Hill, proved, on examination and sampling by joint venture partner Nord Resources, to be too small with erratically distributed tin values (see appendix II).

7.2 Geophysics

7.2.1. Ground Magnetic Survey

A ground magnetic survey was completed over about 2.4 square kilometres of the northern extension of the "Surprise Creek" survey grid by proton precession magnetometer.

The survey indicated a weak magnetic anomaly trend to the N.E., parallel to the unconformity between Burrell Creek Formation and Tolmer Sandstone.

7.2.2. Ground E.M. Survey

An electromagnetic survey was carried out covering the entire Surprise Creek grid using an E31 instrument loaned to the joint venture courtesy of Geoex Adelaide for the purpose of assessing the utilisation of such instrument.

The Geonics EM31 provides a measurement of terrain conductivity without ground contact using an inductive electromagnetic technique. The penetration depth of the instrument is approximately 6 metres. Some difficulty was encountered in obtaining results in the sand covered area of the central southern Surprise Creek grid. Perusal of results indicates some anomaly trends in the north near the Upper Proterozoic/lower Proterozoic unconformity. Other areas of conductivity occur near drill holes RR13P and RR11P.
7.2.3. Ground Radiometric Survey

A ground radiometric survey was carried out on the extended northern grid at Surprise Creek. An area of high background in the western part of the grid area, from 200N to 800N, was delineated.

7.3 Surveying

In preparation for ground geophysical surveys, a survey grid of 13 line-kilometres was hand cleared and surveyed over an area immediately north of the existing grid in the Surprise Creek area.

The base line was extended along magnetic north for a distance of 2050 metres and cross lines surveyed in at 200 metre intervals.

7.4 Other Work

Minor hand clearing and grading of approximately 2.2km of drilling access road was completed in June, 1980, in anticipation of a drilling programme later in the year.
### 8. EXPENDITURE

A statement of the expenditure incurred on E.L. 1600 for the 12 months period to 9th August, 1980, follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour</td>
<td>$25,054.17</td>
</tr>
<tr>
<td>Purchases</td>
<td>3,797.42</td>
</tr>
<tr>
<td>Services: Dozing</td>
<td>895.60</td>
</tr>
<tr>
<td>Other</td>
<td>4,732.95</td>
</tr>
<tr>
<td>Sundry</td>
<td>5,384.17</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$40,488.76</strong></td>
</tr>
<tr>
<td>Alice Springs Office</td>
<td>2,173.95</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$42,488.76</strong></td>
</tr>
</tbody>
</table>
9. REFERENCES

APPENDIX I
PETROLOGICAL DESCRIPTIONS
PETROLOGY OF FOUR CHEVRON-FOLDED SCHISTS

1. SUMMARY

Four samples (2230-3) submitted for petrological examination by Agip Australia Pty Limited all consist of mica-rich schists with well developed chevron folding. In all of these schists, muscovite is the major mica present but samples 2230 and 2233 also contain biotite. Samples 2231 and 2232 do not contain any biotite, but do contain interstitial concentrations of translucent, reddish-brown limonitic material which is believed to represent altered biotite. Both these samples, as well as sample 2233, show extensive limonitic staining in the hand specimen, which is considered to represent a weathering feature.

2. INTRODUCTION

Four rocks were submitted by Agip Australia Pty Limited for petrological examination with an emphasis on comparison of metamorphic grade. It was also queried whether one of the samples could be a fresher equivalent of the other three samples.
3. PETROGRAPHIC DESCRIPTIONS

Sample: 2230; TS43371 E.L. 1600 RR13P

Rock Name: Mica-quartz schist

Hand Specimen:
This sample consists of several small, angular fragments up to about 2 cm long which appear to be percussion drill chips. All of the fragments have a pale grey colour and a well developed, schistose foliation which, at least locally, shows fine chevron folding.

Thin Section:
An optical estimate of the constituents gives the following:

<table>
<thead>
<tr>
<th></th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartz</td>
<td>45</td>
</tr>
<tr>
<td>Muscovite</td>
<td>40</td>
</tr>
<tr>
<td>Biotite</td>
<td>10</td>
</tr>
<tr>
<td>Tourmaline</td>
<td>Trace-1</td>
</tr>
<tr>
<td>Titanium mineral</td>
<td>2</td>
</tr>
<tr>
<td>Opaques</td>
<td>2</td>
</tr>
</tbody>
</table>

The thin section was cut from approximately six chips, all of which are very similar, comprised mainly of well developed muscovite flakes intergrown with granular quartz. The muscovite flakes exhibit a very strong lepidoblastic foliation, and even the quartz grains tend to have somewhat elongate shapes oriented parallel to this foliation direction. In some of the fragments the foliation has a relatively straight, unfolded character but in other fragments the foliation has a kinked, chevron-like texture. The quartz grains range between 0.1 and 0.2 mm in length while the muscovite flakes are generally about 0.4 mm long.

Biotite is present in all of the fragments as interstitial flakes approximately 0.3 mm in size which have a pleochroic, brown colour. The biotite is not evenly distributed through the rock and some fragments contain more abundant biotite, or zones with more abundant biotite. Opaques and a translucent, brown titanium mineral (possibly rutile) also form uneven disseminations within some fragments. Minor tourmaline forms disseminated prismatic crystals up to 0.2 mm in length which have a pleochroic, green colour.

This rock represents a metamorphosed, fine-grained sediment of upper greenschist to lower amphibolite facies grade. It was queried whether this sample could represent a fresher equivalent of samples 2231-3 and that is considered a very likely possibility. This sample is similar to the other three schists of this suite, all consisting of well-foliated mica-quartz schists which exhibit chevron folding. The chevron folding in the next three samples is generally on a coarser scale and would not be readily evident in the size of chips comprising this sample, although even some of these chips show a finer chevron folding.
Sample: 2231; TS43372

Rock Name: Muscovite-quartz schist

E.L. 1600 500 N, 250 W

Hand Specimen:
A reddish-brown, limonite-stained rock with a well developed, schistose foliation exhibiting chevron folding.

Thin Section:
An optical estimate of the constituents gives the following:

<table>
<thead>
<tr>
<th></th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartz</td>
<td>50</td>
</tr>
<tr>
<td>Muscovite</td>
<td>40</td>
</tr>
<tr>
<td>Tourmaline</td>
<td>1</td>
</tr>
<tr>
<td>Limonite</td>
<td>10</td>
</tr>
</tbody>
</table>

This rock consists of granular quartz intergrown with well developed muscovite flakes which exhibit a strong lepidoblastic foliation. The quartz has a typical grain size of 0.1 mm and a recrystallized, granular character. The muscovite forms well developed flakes up to 0.2 mm long, some of which penetrate into the recrystallized quartz grains. Overall, the rock has a well developed foliation and the foliation exhibits an undulose, chevron folding.

Translucent, reddish-brown limonitic material is disseminated through the rock as interstitial fillings up to 0.2 mm in size. This limonitic material has the same textural characteristics as the biotite in samples 2230 and 2233, suggesting that it represents biotite which has been completely replaced by secondary iron oxides.

Tourmaline is disseminated through the rock as pleochroic, green crystals up to 0.1 mm in length, many of which have an elongate, tabular shape. Some of the disseminated tourmaline crystals have a zoned colouration with darker coloured cores and paler coloured margins.

This rock is believed to be a mica-quartz schist similar to sample 2230 whose original biotite has been replaced by limonitic material under weathering conditions.
Sample: 2232; TS43373

Rock Name: Muscovite-quartz schist

Hand Specimen:
A well foliated, schistose rock with chevron folds on a scale of 1-2 cm. The sample shows pervasive, reddish-brown limonitic staining along cleavage traces to produce a mottled, reddish-brown to pale tan colour.

Thin Section:
An optical estimate of the constituents gives the following:

\[
\begin{array}{c|c}
\text{ Constituent } & \text{%} \\
\hline
\text{Muscovite} & 45 \\
\text{Quartz} & 45 \\
\text{Tourmaline} & \text{Trace} \\
\text{Limonite} & 10 \\
\end{array}
\]

This rock is basically the same as sample 2231 (TS43372), consisting of a well foliated intergrowth of granular quartz and muscovite flakes. The quartz has a typical grain size of 0.1 mm and the muscovite flakes are generally about 0.3 mm in length. As with sample 2232, the muscovite flakes define a well developed lepidoblastic foliation which has a kinked, chevron-folded character. The sample shows some variation in the relative proportions of quartz and muscovite in different bands oriented parallel to the foliation direction, which probably represents some inhomogeneities in the original sediment.

Translucent, reddish-brown limonitic material is located interstitially between the muscovite flakes and most likely represents altered, interstitial biotite. Some of this limonitic-stained material still contains vague, birefringent remnants with a weak pleochroism representing highly degraded remnant biotite.

Traces of tourmaline are disseminated through the rock as small crystals up to 0.1 mm in size which have a pleochroic, green colour. Locally, opaques are also disseminated through the rock as interstitial fillings up to 0.1 mm in size.

This is a mica schist similar to sample 2231 whose biotite has also been replaced by limonitic material under weathering conditions, although this sample still retains traces of remnant biotite.
Sample: 2233; TS43374

Rock Name: Mica-quartz schist  E.L. 1600 1,000s, 200E

Hand Specimen: A well foliated, schistose rock with well developed chevron folding and localised pervasive limonitic staining which is particularly well developed along foliation planes. Where the rock is unstained it has a very pale greenish-grey colour.

Thin Section: An optical estimate of the constituents gives the following:

<table>
<thead>
<tr>
<th></th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muscovite</td>
<td>50</td>
</tr>
<tr>
<td>Quartz</td>
<td>25</td>
</tr>
<tr>
<td>Biotite</td>
<td>20</td>
</tr>
<tr>
<td>Tourmaline</td>
<td>Trace-1</td>
</tr>
<tr>
<td>Limonite</td>
<td>2</td>
</tr>
<tr>
<td>Opaques</td>
<td>1</td>
</tr>
</tbody>
</table>

This is a well foliated rock consisting mainly of well developed muscovite flakes intergrown with biotite and granular quartz. The well developed lepidoblastic foliation is defined mainly by the muscovite and, to a lesser extent, by the biotite, and this foliation has a kinked, chevron-folded texture. Muscovite flakes are up to 0.4 mm long while the quartz generally has a grain size between 0.1 and 0.2 mm. At least locally the muscovite penetrates into the crystallized quartz grains. The biotite flakes are generally between 0.3 and 0.4 mm in length and tend to occur interstitially between the muscovite. The biotite is very fresh and has a pleochroic, brown colour.

Traces of tourmaline are disseminated through the rock as small crystals up to 0.1 mm in size which have a pleochroic, green colour. Opaques are also disseminated through the rock as anhedral grains and granular aggregates up to 0.1 mm in size. Translucent, reddish-brown limonitic material is concentrated along cleavage traces as very narrow fillings.

This sample is similar to the previously described schists although, unlike samples 2231 and 2232, the biotite in this rock is completely unaltered. The rock does show limonitic staining, but this is concentrated as very fine fillings along cleavage traces.
APPENDIX II
PROSPECT HILL TIN PROSPECT
<table>
<thead>
<tr>
<th>SAMPLE No.</th>
<th>Sn</th>
</tr>
</thead>
<tbody>
<tr>
<td>21490</td>
<td>5100</td>
</tr>
<tr>
<td>91</td>
<td>310</td>
</tr>
<tr>
<td>92</td>
<td>1850</td>
</tr>
<tr>
<td>93</td>
<td>140</td>
</tr>
<tr>
<td>94</td>
<td>150</td>
</tr>
<tr>
<td>21495</td>
<td>200</td>
</tr>
<tr>
<td>Element</td>
<td>Result</td>
</tr>
<tr>
<td>---------</td>
<td>--------</td>
</tr>
<tr>
<td>110</td>
<td>EL 1620</td>
</tr>
</tbody>
</table>

Results in ppm unless otherwise specified:
- T: element present; but concentration too low to measure
- X: element concentration is below detection limit
- -: element not determined
EL 1600

KETCH TO ACCOMPANY RENEWAL
APPLICATION
DATED 1ST JULY, 1980

Scale: 1:100,000

Figure 1
LEGEND

185 — Point reading of magnetic intensity, to obtain total field, add (±1000) gammas.

200 — 200 gamma contour