ANNUAL REPORT, 1978
E.L 1731, WELLTREE.
PROJECT 821.

MINES BRANCH
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M. Flook.

CR79/86
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<td>Geology.</td>
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1. INTRODUCTION

E.L 1731 (Welltree) is located on the Western margin of the Pine Creek Geosyncline within a tectonic unit named the Litchfield Complex and covers an area of approximately 154 square miles. The precise location, latitudes and longitudes is shown on the attached 1:100,000 topographic map. The area is very flat. Lying and about 30% is covered by the black soil swamps and waterlogged areas associated with the Reynolds River. Sands and clays overly much of the remaining area. Laterite developments are common over these higher areas. Access is possible only during the dry season and the area can be reached by bitumen road from Darwin to Jumbling waters and via a well-graded road from Jumbling Waters south west across the Finnis River to Kerri homestead (157 kms). The land is Leased by members of the Townsend family. E.L application 1731 was lodged at the Mines Branch Darwin on the 11th December, 1977 and was granted on the 8th March, 1978 for a term of 12 months with a minimum expenditure covenant of $20,000. Subsequent renewal of the licence for a further 12 months has been approved by the minister for Mines and Energy, Ian Tuxworth. Due to commitments in Western Australia and the onset of the wet season only a limited amount of field work was accomplished in 1978. Two field crews each comprising a geologist and a field assistant equipped with a four wheel drive vehicle were engaged. Work involved rock chip sampling, surveying an accurately levelled N - S baseline and a magnetometer survey.
2. **GENERAL GEOLOGY**

The currently available 1:250,000 Geological map (B.M.R) indicates the area to be dominated by Quaternary alluvium. Minor outcrops of the Litchfield Granitic Complexes are present in the northern parts of the area. Since the discovery of stratabound uranium deposits in the Alligator River region and detailed mapping by B.M.R the latest concepts of the Pine Creek Geosyncline have departed considerably from those advanced by Walpole et al. (B.M.R Bulletin B 2- 1968). It is now considered that the area was an intracratonic basin. The emphasis on the major tectonic activities have been shifted from a medium ridge to the anatectic granites of the Nimbuwah Complex. The latest concepts are shown on the preliminary 1:500,000 map of the Katherine Darwin area. (The first completed edition to be released in June, 1979). The revised mapping indicates that most of the area is covered by undifferentiated Proterozoic schist and gneiss. The exact stratigraphic position is uncertain at present but it is considered to be possibly an equivalent of the Koolpin Formation or Nourlangie schist. The eastern quarter of the area has been mapped as Cambrian sediments (Daly River Basin sediments) overlying the granites? of the Litchfield complex.
The initial geological reasoning in favour of the area was as follows:

1. The Tectonic setting of the Litchfield complex is in many respects similar to that of the Alligator River Region. Both are situated near the margins of an area of Proterozoic sedimentation. Both are composed of anatctic granitic masses separated by areas of metasediments.

2. The lithologies are similar to the Alligator River region. Both areas consist of granites granitic gneiss and tonalites. They contain numerous xenoliths and intrusive basic rocks and are intruded by pegmatitic dykes. Both have contacts with metasediments, and common accessories include apatite, flourite, zircon, magnetite and epidote.

3. Gravity patterns indicate the presence of a series of basement highs connecting the Rum Jungle Complex with those of the Litchfield Complex and trending in a N.N.E-S.S.W direction. Variations within this regional pattern could indicate the presence of metasediments.

4. Magnetic patterns from (B.M.R and B.H.P) suggest the possibility of magnetite or Fe sulphide bearing horizons and bear a resemblance to the patterns around the Rum Jungle Complex.

5. Reconnaissance near Litchfield H.S (August, 1977) located mica schists at the margins of the Litchfield Complex. Rock chip sampling within E.L 1731 located graphitic chiastolite schist and graphitic mica schist.
4. PREVIOUS SURVEYS

The only detailed work carried out in the area was by B.H.P between 1973 - 1975. Initially a detailed combined aerial spectrometer / magnetometer survey was flown on east-west lines every 400 metres at an altitude of 90 metres. The results were compiled into magnetic and uranium channel contour maps at a scale of 1:84,000 (air photo scale). These maps have been redrawn from the B.H.P reports (CR 75/143) to a scale of 1:50,000 and are shown in figures 9 and 10. An I.P survey was carried out to delineate targets for sulphide mineralisation. Nearly all the work carried out was to the north of E.L 1731 in an area now covered by the Wagait Aboriginal Reserve. A total of 8 diamond holes were drilled to test I.P and magnetic anomalies. Typical intersections were Quartz - biotite - magnetite schists (pyritic) with interbedded amphibolites. Only one hole was drilled in the northern part of E.L 1731 and intersected 20 metres of ferruginous calcceous siltstone underlain by chloritic, quartz, feldspar mica schist. An Assay of 50 ppm U was obtained at the siltstone / schist contact believed to be the unconformity between the Cambrian and Lower Proterozoic sediments. Many of the uranium anomalies located from the airborne survey were not followed up and from those that were investigated it was generally concluded they were due to minor accumulations of uranium in lateritic soils overlying Cambrian sediments. It appeared that most of the investigations involved very shallow augering 10 - 20 m. One interesting anomaly investigated within E.L 1731 (anomaly 50) showed a uranium rich horizon of 46 ppm in an iron stained quartz mica schist. Only a shallow hole was drilled (8.2 m) U increased with depth but apparently there was not follow up work. In 1975 the area was not considered prospective and was subsequently dropped.
## EXPENDITURE STATEMENT FOR THE YEAR

08.03.1978 TO 07.03.1979

### PROJECT: WELL TREE  A8-821

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6. INVESTIGATIONS AND RESULTS

6.1 GRIDDING

An accurately levelled N-S baseline was surveyed with survey pegs every 100 metres. Grid co-ordinates correspond with the Reynolds River 1:100,000 topographic survey sheet. Three (3) sidelines were also surveyed to intersect large magnetic anomalies located by B.H.P. The surveyed lines are shown in Figure 1.

6.2 SAMPLING

Due to the vast quarternary cover rock chip sampling was restricted to the areas of available outcrop. In the course of initial reconnaissance and gridding 8 samples were collected and dispatched to Pilbara Laboratories for assaying and to Central Mineralogical Laboratories for petrographic descriptions.

6.3 MAGNETOMETER SURVEY

The aim of the magnetometer survey was to pinpoint exactly on the ground the airborne anomalies found by B.H.P and B.M.R. Total magnetic profiles were taken along each of the three surveyed sidelines (figures 3, 4 & 5). The 3 magnetic anomalies have been referred to as the Northern, central and southern anomaly. Once the profiles were taken readings were then noted every 50 metres along north south lines each 2 km long. The instruments used was a Geometrics G816 portable proton precession magnetometer. The base value taken was 47,000. Once the anomaly was roughly located the grid was closed in and readings taken every 25 m's., traverses are shown in figure 2. The magnetic values were plotted and contoured at 10 m intervals at a scale of 1:5,000: (see figures 6, 7 & 8). The northern and
and to a lesser extent the southern anomaly proved the strongest and most well defined and indicates a strong N-S trend in the area.

6.4 PETROGRAPHY

South of the Reynolds River are scattered outcrops of Daly River Basin sediments (Cambrian) which are generally found at the base of the more steeply dissected creeks. The rocks are arkosic with silt size detrital grains and extensively iron stained. Chloritic material indicates a reducing depositional environment. The provenance was broadly granitic, (sample R R4). The only metasediments were found north of the Reynolds River and were restricted to an isolated laterized outcrop near the northern magnetic anomaly. The outcrop is heavily weathered and the foliation dips almost vertical and strikes N-S. In thin section the rock is a quartz muscovite schist with traces of graphite and is assigned to the greenschist facies of regional metamorphism, (sample R R8). A graphitic quartz chiastolite schist was found a few hundred metres south of the muscovite schist. The rock was lying on the surface with no visible outcrop, (sample R R7). The remaining rocks found were of igneous origin. These included a hornblende granulite (R R3 and R R2) an amphibolite and a tremolite antigorite rock of metasomatic origin, (see appendix 1 for petrographic descriptions). The granulites are possibly metamorphosed sediments around the margins of the granites of the Litchfield complex.
6.5 ANALYSES

The rock chip samples were all analysed for U, Th, Cu, Pb, Zn and Sn (See Appendix II). Samples 2 - 6 all had less than 3 ppm U. Samples 7 and 8 showed a relatively high U content 20 ppm and 10 ppm respectively, (23 and 25 ppm Th) with high Cu, Pb, and Zn values. The higher Th values are to be expected with such heavily ferruginised outcrops. The association of high U and base metals Cu, Pb, and Zn is similar to the mineralised graphitic schists around the margins of the Rum Jungle Complex.

6.6 SUMMARY

The results of the very limited investigations indicate that:

(1) A substantial portion of the area could contain subcrops of metamorphosed Koolpin equivalents.

(2) Metamorphic grades approach greenschist facies in the very few outcrops present. Granulite facies are present along the margins of outcropping granite.

(3) Carbonaceous schists are also present in outcrop.

(4) A similar regional setting to the Alligator River Region may be present ie. areas of metasediments (graphitic and pyritic) between granitic complexes.
APPENDIX 1

PETROGRAPHIC DESCRIPTION
Central Mineralogical Services

Mr. J. Thevissen
Senior Geologist
Urangesellschaft Aust. Pty., Ltd.
P.O. Box 40121
CASUARINA / H.T. 5792

13th October, 1973

REPORT CMS 7/10/73

YOUR REFERENCE: Order No. 0631
Project No. 521
Cost Code No. 601 220

DATE RECEIVED: 5th October, 1973

SAMPLE NOS.: RR 2 - RR 3

SUBMITTED BY: J. Thevissen

WORK REQUESTED: Petrology

Copy & Invoice to:
The Exploration Manager
Urangesellschaft Aust. Pty. Ltd.
608, St. Kilda Road
MELBOURNE / VIC. 3004

UGA
2 Oct 1973

H.W. Fander, M. Sc.
Seven samples were received for petrographic examination. Thin-sections were prepared in the usual way, and some offcuts were subjected to K-stain tests.

**RR 2** (T.S. 25644)
This is a fresh hornblende-granulite, and is assigned to the granulite facies of regional metamorphism; it is very probably of igneous origin, and resembles some charnockites.

The major mineral present is labradorite, comprising about 65% of the rock and occurring as clear, fresh subparallel laths and prismatic crystals. The ferromagnesian minerals (15%) occur interstitially, as granular to prismatic diopside and colourless, non-pleochroic hypersthene (this is unusual; hypersthene in granulites is generally markedly pleochroic), with porphyroblastic patches of brownish hornblende. In places, the hornblende rims pyroxene, having formed from them but belonging to the same metamorphic episode (i.e., not retrogressive). Small magnetite crystals and occasional Ti-biotite flakes are scattered through the rock.

**RR 3** (T.S. 25645) K-stain test negative.
This hornblende-granulite is compositionally very similar to RR 2, though finer-grained. There are no alkaline affinities.

Subparallel laths of fresh labradorite form the bulk of the rock, with interstitial granular to prismatic diopside and hypersthene, and porphyroblastic pale-brownish hornblende, which is more abundant than in RR 2. Oxide opaques are present. The rock is cut by veinlets along which the ferromagnesian minerals (the pyroxenes) have been replaced by actinolite needles; the hornblende is not affected.

**RR 4** (T.S. 25646) K-stain test positive.
This is a silty arkose, i.e., an arkose composed of slit-sized detrital grains; it is weakly micaceous and is extensively iron-stained.

The framework consists of subangular grains of fresh K-feldspar (orthoclase and microcline) and subordinate quartz, with random small flakes of muscovite and small sericite aggregates. The grains are closely packed and have an average size of 0.06 mm, very near the upper limit of the silt range.

Accessory minerals include detrital grains of tourmaline and small green glauconite-like pellets; regardless whether they are actually glauconite or a related chloritic mineral, they indicate a reducing depositional environment. The provenance was broadly granitic.
There are numerous interstitial limonitic patches which are thought to represent a leached carbonate cement. Small dendritic Mn O₂ patches have formed sporadically and probably postdate the leaching.

(T.S. 25647) K-stain test negative.
This is a fairly coarsely-crystalline amphibolite, contrasting with the other rocks (RR 2, RR 3) which are of distinctly higher metamorphic grade. It has no alkaline affinities, both sodic and potassic minerals being absent.

The dominant constituent (70-75 %) is hornblende as fairly large (up to 1 mm) prismatic, subhedral to euhedral crystals with more or less random orientation. The balance consists of small twinned and untwinned, subhedral to granular interstitial patches of labradorite. There are occasional granular aggregates of magnetite.

The fabric shows little or no preferred orientation, and is reminiscent of igneous fabrics; this suggests that the metamorphism was more thermal than regional, and the rock is probably a recrystallised gabbro.

(T.S. 25648)
This is a tremolite-antigorite rock, believed to be essentially of metasomatic origin and thus not strictly classifiable in terms of metamorphic grade.

The rock consists dominantly of small acicular to fibrous tremolite crystals, mostly with subparallel orientation, and interstitial antigorite flakes; there are patches of randomly-orientated tremolite intergrown with antigorite, representing pseudomorphs. Small grains of oxide opaque are scattered through the rock.

The rock is featureless and of simple composition; it is believed to be a tremolitised serpentinite or related ultramafic type; this mode of alteration is characteristic, and is common in the Eastern Goldfields region.

(T.S. 25649)
This rather altered rock was a graphitic quartz-chistollite schist; textures are well-preserved, enabling it to be interpreted with confidence, even though the rock is ferruginised and sericitised.

Sericitic pseudomorphs after chistollite porphyroblasts are common throughout, and contain characteristic carbonaceous inclusions with cruciform orientation. They are lineated in a schistose matrix of graphi and muscovite flakes and granular quartz; the muscovite generally contains minute carbon inclusions.
Abundant interstitial shapeless patches of goethite are present; it is suspected that they formed from the oxidation of indigenous pyrite but there is no actual textural evidence of this.

The mineral assemblage and fabric indicate greenschist-facies regional metamorphism; even though chiastolite is regarded as a contact-metamorphic mineral, it is clearly regional in this rock.

RR 8 (T.S. 25650)
This is a quartz-muscovite schist, possibly carnitiferous originally; part of the rock represents the weathered or C-horizon equivalent.

The rock consists of fairly evenly dispersed small parallel flakes of muscovite, and mosaic quartz; traces of graphite are present. There are occasional cavities, now filled with loose detritus of quartz and clays, which are thought to represent completely altered garnet porphyroblasts. Occasional micaceous lenses occur.

Part of the rock consists of heavily ferruginised fragments of schist, and there are pockets and channels filled with micaceous and quartzose detritus; some of the quartz is much coarser than in the less-altered rock, and probably has a different origin.

The rock is a metasediment assigned to the greenschist facies of regional metamorphism.

M.V. Fander, M.Sc.
APPENDIX II

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Results in ppm unless otherwise stated...