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GEOLOGICAL ASSESSMENT

F.L.A. 4081

TAWALLAH POCKET

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Mt. Isa Mines Ltd. (Carpentaria Exploration Company Pty. Limited), has carried out large scale field geological investigations during 1975 and onwards. All of the remainder of this area was relinquished by C.E.C. in 1982.

The large base metal deposit H.Y.C. is situated 65 kms south-east of the E.L.A. Broken Hill Proprietary Minerals Limited, Shell Company of Australia Limited, Conzinc Riotinto of Australia Exploration Pty. Limited and Western Mining Corporation have also been actively exploring this region and have adjacent E.L.'s to E.L.A. 4081.

During 1965-1966 Geopeko Ltd. held a prospecting authority No. 1438 situated within the Nathan River Station and containing an area of about 1490 sq. kms.

During 1968 Lamadec Exploration Ltd. carried out a radiometry survey. A four channel D.G.R.S. -1000 Exploration instrument was used with a 91.5m terrain clearance, 400m line spacing and a recording of the total counts. No radioactive anomalies were recorded.

Kratos Uranium N.L. in joint venture with Pechiney Australia Exploration Pty. Ltd. carried out airborne magnetometer and radiometric surveys from 1970 till 1972; and ground studies including some diamond drilling in an area centering 40 kms south-west of Bauhinia Downs to the south-west of E.L.A 4081.

During 1971 Australian Geophysical Pty. Ltd. carried out an airborne and ground spectrometer survey over E.L. 86 in the Mt. Young Sheet area and delineated three anomalies. However, further investigations in the area were not considered worthwhile by the company.

The data produced by Australian Geophysical Pty. Ltd. and Lamadec Ltd. were obtained with the same instrument. The anomalies defined were subsequently considered by AFMECO Pty. Ltd. to correspond with a variation in the lithology.

Agip Nuclear Australia Pty. Ltd. held the E.L.'s 535, 536 and 537 covering a total of 508 sq. kms from 1972 till 1974. The area corresponds with the section of E.L.A. 4081 on the Bauhinia Downs Sheet. An airborne radiometric and magnetic survey was carried out in 1972, followed by a preliminary ground follow-up. A further follow-up, radiometric and geological ground traverses, together with some shallow pitting, was carried out in 1973. In 1974 a detailed geological radiometric grid survey of the 2 airborne anomalies and a heli-borne scintillator survey followed by a ground check-up were completed. Agip's conclusions of the investigations were negative so the E.L.'s were relinquished.

1980

AFMECO Pty. Ltd. relinquished several E.L.'s part of which included E.L.A. 4081. AFMECO explored exclusively for uranium. It is considered that certain anomalies were not sufficiently examined and explained properly. The reason for relinquishment was not due to the economic potential of the area but due to a change in policy within the Company.
Geological observations by AFMECO showed that:

- The Scrutton Volcanics have a high uranium background, and no reconcentration has been discovered on fracture zones.

- The contact zone between these volcanics and the overlying sandstone showed sharp contrast in the radiometric values; no enrichment was found.

- The basal units of the sandstone contain in general very little volcanic elements; no sedimentary contrast exists; the rocks are very oxidised; and the uranium background is very low.

- The middle and top units of the sandstone are very homogeneous; sharp sedimentary contrasts are virtually non existent; channelling on a small scale is not abundant; and the mature elements (mainly quartz) and a complete oxidation suggest very little potential for these sandstones.

- The contact with the Seigal Volcanics is sharp and even in brecciated fault zones higher radioactive values occur.

- No lineament showed any higher radioactivity either on the ground or during the airborne survey.

- No radiometric anomalies are related to the contact between the Seigal Volcanics and the overlying Sly Creek Sandstones.

- Anomalies occur associated with a basic sill (contemporaneous with the Seigal Volcanics?) in the Yiyintyi Sandstone. No activity occurs in the sandstone itself. The anomaly is very small and outcropping in a small creek (SE section of E.L.A. 4081). Values remained constant (750 c/s SPP2) in the shallow hole which was dug (540 ppm U). (Fig. 2)

The topographic expression of this sill - an elongated valley, shows no higher radioactivity elsewhere.

It may be concluded that no new anomalies were discovered. The geological observations in the area indicate a very low potential for economic uranium mineralisation. A possible manganese potential in the Cretaceous sediments concealed by soil cover has not been tested. AFMECO Pty. Ltd. concluded that no further work for uranium exploration should be carried out in these areas and the exploration licences should be relinquished. The work completed by C.E.C. is discussed later.

TOPOGRAPHY AND CLIMATE:

The annual rainfall of 500 - 750 mm falls mainly in January to March. The average temperature is about 29.5°C (up to 45°C) in summer and 24°C (up to 32°C) in winter.

The headwaters of Little Rosie Creek, Eastern Creek and Pine Creek are situated in the ELA and drain towards the Gulf.
The Tawallah Range consists of resistant sandstone ridges, above steep-sided valleys formed by erosion of softer beds. The range has a uniform elevation of 180 m. The shape and distribution of the valleys are irregular due to extensive faulting.

Away from the Range at lower elevation is hill country of dissected rocks named the Gulf Fall.

**GEOLOGY:**

The McArthur Basin of Carpentarian age extends from the Queensland border along the southern shores of the Gulf of Carpentaria and across to Arnhem land.

A sequence of Proterozoic age sediments and volcanics is exposed in the Mount Young Sheet and Bauhinia Downs Sheet area and unconformably overlies the Lower Proterozoic age Scrutton Volcanics. The sequence is divided into three groups:- The Tawallah (oldest), McArthur and Roper (youngest), the latter not being present in E.L.A. 4081. Basement rocks are exposed as small inliers (Scrutton Volcanics) in horst blocks in the Tawallah Range. The stratigraphy is complex and will not be discussed in this preliminary report. The following units are present on ELA 4081 (youngest to oldest):-

**Cainozoic Czs:**

Soil, sand, ferruginous, cemented detritus.

**Lower Cretaceous Kl:**

Friable, yellow, clayey sandstone, massive white quartz sandstone and conglomerate, and siltstones.

Erosion has only left patchy remains in the southern part of E.L.A. 4081 but in the centre and northern parts several outcrops have been observed. It seems likely that these mesa-type sediments, which covered the palaeo-relief, are also present under the large non-exposed areas covered by soil. The sediments may be deposited under conditions (shallow marine in shelter of an island) very similar to the ones on Groote Eylandt. Drilling by Northern Resources Pty. Ltd. in the Tawallah Pocket, which forms a southern extension of the area covered by soil, showed a thickness of 20-50 m of Cretaceous age sediments under the soil cover.

**Lower Proterozoic:**

McArthur Group - Mallapunyah Formation Pml;

Purple siltstone, ferruginous quartz sandstone, dolomite, chert, oolitic chert, algal chert, flaggy white siltstone. Halite casts are common. Thin beds contain rare lenses that appear to have an enterolithic texture or cauliflower chert texture. The dolomitic silts are overlain by silty dolomites, flaggy dolomites with undulating bedding and occasional small algal bioherms.
Above lies the "Ovoid Beds" bituminous dolomitic siltstones with 50% ovoid dolomitic concretions, which decrease in size upwards. Variable proportions of sandsilt and dolomite have been laid down in a hypersaline environment above the "Ovoid Beds".

Tawallah Group - Wollogorang Formation Pto;

Laminated dolomitic siltstone and shale, flaggy dolomitic silty and sandy dolomite, dolarenite, dolomitic sandstone.

Tawallah Group - Rosie Creek Sandstone Pgr;

Flaggy, purple and white, very coarse to fine quartz sandstone, ferruginous feldspathic and glauconitic sandstone and siltstone.

Tawallah Group - Sly Creek Sandstone Ptl;

Blocky, white to pink, medium grained quartz sandstone.

The Sly Creek and Rosie Creek Sandstone are shallow water marine sands which become glauconite rich and silt rich towards the top, grading into the dolomitic, silts and dolomites of the Wollogorang Formation. Halite casts and sideritic cement indicate hypersaline conditions. A regular influx of homogenate material has occurred.

These sandstones overlie the Seigal Volcanics with a sharp (often faulted) contact. In some areas a 0.5-3m thick conglomerate can be observed. This unit contains fine to medium grained, homogeneous isogranular, well sorted, well bedded sandstones. It distinguishes itself from the Yiyintyi Sandstone by its more regular bedding.

Small scale cross bedding and ripple marks, are common in this series. Fine grained, sub-rounded, isogranular quartz grains form the main element in this sandstone. Local faulting, brecciating and small scale folding are common in these sandstones.

Tawallah Group - Seigal Volcanics Ptp;

Amygdaloidal basalt. This volcanic series overlies the Yiyintyi Sandstone. The contact is often faulted and brecciated or not exposed.

This unit is mainly composed of amygadaloidal, vesicular basalt. The rock is extensively altered and characterised by abundant amygdales (up to 1 cm) of chlorite, epidote, quartz, and microcline. The brown coloured outcrops form small low-lying hills in the elongated shaped valleys, due to a differential weathering pattern.

Quartz veins, and ferruginous concentrations and coatings are very common along the faulted contacts and common shear zones.

Tawallah Group - Yiyintyi Sandstone Pty;

Blocky, white medium to coarse quartz sandstone, minor arkose and pebble to boulder conglomerate.
Between the Scrutton Volcanics and the medium grained Yiyintyi Sandstone a conglomerate 100m thick is sometimes locally developed. It has been observed at the contact between the two series in the northern part of E.L.A. 4081.

It is composed of conglomerates, very friable sandstone and volcanic detritus and is often very sheared with numerous quartz veins. The sandstone is inhomogeneous, medium - coarse grained, unsorted, dirty and contains ~15% volcanic and quartz pebbles. Mica has been observed in the shear zones.

Elsewhere the base of the Yiyintyi Sandstone is formed in a much lower energy environment. It consists of an iron-rich medium to coarse grained sandstone, sub-rounded, homogeneous with minor beds of conglomerate (volcanic and quartz). The presence of channels up to 10 m width, crossbedding, and ripple marks, indicate near shore marine environment. The presence of channels has mainly been observed in the basal units of the Sandstone in Yiyintyi Range.

The presence of some iron oxides (under these very oxidising conditions) may suggest that originally the sandstone was rather reduced. The highly resistant Yiyintyi Sandstone is often very silicified and forms ridges exceeding 100 m above the ground level and has numerous creeks and waterfalls flowing along master-joints/faults. Local folding faulting and brecciating are very common in the whole outcropping series.

**Scrutton Volcanics Pls;**

These rocks are the oldest rocks exposed in this area. They are considered by the B.M.R. to be an equivalent of the Clifflade Volcanics in the Westmoreland area.

Topographically they form valleys and are often covered by younger sediments and/or soil. They appear to be mainly porphyritic, dacitic in grain size and contain intercalations of chert siltstones, some feldspathic sandstones and volcanic breccias. The presence of some volcanic pipes in the outcropping zone in E.L.A. 4081 is likely. Numerous shear zones can be observed in those volcanic rocks.

**STRUCTURE:**

In E.L.A. 4081, the Yiyintyi Sandstone of Lower Proterozoic age underlain by the Scrutton Volcanics and overlain by the Seigal Volcanics and the Sly Creek Sandstone forms a broad, south-plunging anticlinal structure. This anticlinal structure is complicated by the presence of numerous faults, the most important ones trending N-S or NW-SE. The dips are varying from slight to steep. The central part of the anticlinal structure is filled by younger geological units.

The Y shaped (in plan) anticlinal structure forms two well separated arms, extending northwards.
The eastern arm shows minor outcropping of Scrutton Volcanics, and a large outcropping zone of Yiyintyi Sandstone overlain (sometimes faulted) by the Seigal Volcanics and the Sly Creek Sandstone. The western arm includes the whole series from the well outcropping Scrutton Volcanics to the Sly Creek Sandstone. The surface of the outcropping zone is much smaller than in the eastern arm.

One of the reasons for selecting the area for application was the strong fracturation of the Tawallah Group sediments.

The main faults are orientated NNW-N/SSE-S. On the western side of E.L.A. 4081 the Tawallah Group is in direct contact with the sediments of the Roper Group. This faulted contact along the Tawallah Fault is very sharp. The fault planes are very steep and show in general a normal fault system with strong vertical and horizontal (?) movements. The anticlinal structure is limited on its western side, and along the open centre, by faults oriented NNW-SSE. The displacements are mainly vertical (up to 2000 m) with some horizontal displacement (200-800 m) and tilting.

The sediments of the Yiyintyi Sandstone and the Sly Creek Sandstone (less so) form very rigid blocks, which were completely fractured during the faulting and folding stages. The anticlinal structure (Y-shaped) shows three principal fault zones. The main fault is the Tawallah Fault, which shows a dextral movement in this area.

The folded structure is accompanied by many associated joints. The diagonal joints have the same direction as the main fault. Zones of brecciation and silicification mark the faults. A closely spaced set of subsidiary faults is developed, which makes angles of about 30° with the major faults. The sandstones of the Tawallah Group have a well developed pattern of joints which parallels these subsidiary fault. The numerous joints originated by different tectonic phenomena do not appear to contain any mineralisation. Only quartz and tourmaline infills have been observed.

ECONOMIC GEOLOGY:

Regional:

Large base metal deposits occur to the south east in the McArthur River Homestead Area. The H.Y.C. deposit alone to the south east of E.L.A. 4081, contains the biggest published reserves in the world of base metals and is the largest open cut reserve in the world ever, i.e., 277 Mt (possibly 300 Mt) of 10% zinc, 4% lead, 44 g/t silver, 0.12% copper.

Several copper, lead, barite prospects are known from the immediate vicinity of E.L.A. 4081.
E.L.A. 4081:

This area applied for has potential for lead-zinc-copper-silver, uranium and diamonds. Although these commodities are outside the guidelines of minerals sought by Nationwide, the area presented targets of dimensions too encouraging to ignore.

The E.L.A. contains the Apollo lead-copper prospect previously explored by C.E.C. The ELA also contains possible extensions of the Mariner Lead Prospect which is to the southwest of this area. Follow up of the work done by C.E.C. will proceed by Nationwide. The targets sought by C.E.C. were copper-lead-zinc in vein deposits and stratiform lead-zinc-silver deposits in sedimentary rocks of the mid-proterozoic McArthur and Tawallah Groups. Uranium anomalies located by both AFMECO and Agip have not been adequately followed up as yet. These companies apparently withdrew from this area prematurely.

Diamond exploration in this region is being increased by certain companies.

BASE METALS:

ELA 4081 has potential for "red-bed" style copper mineralisation in the Mallapunyah Formation and stratiform base-metal mineralisation in the Wollogorang Formation. Another exploration target is the possibility of an unexposed stratiform lead-zinc deposit in the same stratigraphic position as the H.Y.C. deposit east of the Tawallah Fault.

C.E.C. by means of a detailed heli supported stream sediment sampling programme with a sample density of about 10 per km discovered the Apollo prospect on what is now E.L.A. 4081. The effectiveness of the detailed stream sediment sampling is shown by this discovery as it represents a new style of mineralisation for the area. The larger areas of sandstone outcrops were not covered. The samples were sieved to -80 mesh and assayed for copper, lead and zinc by AAS.

The following-up of other stream geochemical anomalies in 1979 failed to find any other significant mineralisation. Results of this work are given in Logan's (Jan. 1980) report. BHP carried out additional stream sediment sampling (160 samples) in the reduced area of E.L. 1372 in 1981. The -80 mesh size was assayed for copper, lead and zinc but no new anomalies were found. Results are given in BHP's 1981 report.

It was also considered that extensions to the Mariner Prospect (lead silver) to the southwest, occur in ELA 4081.

During the 1977 field season, follow up by C.E.C. of stream sediment anomalies in the south-western corner of the Tawallah Pocket (ELA 4081) resulted in the discovery of lead and copper mineralisation. Additional outcrops were later discovered. Surface rock chip samples of the mineralised outcrop ranged from 0.3% Pb to 37.3% Pb. A strongly leached surface rim of the galena rich cherts implied that the true grades were higher. Copper assays ranged up to 2500 ppm...
while zinc values of less than 50 ppm and silver assays less than 23 ppm were obtained.

Very fine disseminated bedded chalcopyrite was found in several beds, generally from outcrops not containing lead mineralisation. Lead and/or copper mineralisation was found in several isolated cherty outcrops in a soil and laterite covered region up to 900m west of the central part of the main area of mineralisation. Other nearby outcrops were barren. No distinctive surface features could be used to differentiate between barren and mineralised chert units. The mineralisation observed on the surface was not continuous, but this was thought to be a function of the poor outcrop and excessive leaching and silicification as the cracking of several large boulders revealed remnant galena-cerussite mineralisation in the centre.

Thin section studies made by C.E.C. of a number of cherts containing galena and cerussite indicated that the original rock type was a dolomite. In one case, the host rock appears to have originally been a flat laminated stromatolitic dolomite.

Pre 1978 one diamond drill hole (99.2m) and 27 percussion drill holes involving 800 m of drilling were sited to test the lead and minor copper mineralisation exposed at the Apollo prospect. The last four percussion holes (Apollo 25 - 28) were drilled to test a 500 ppm stream sediment anomaly 1.5 km south-east of the main Apollo mineralisation.

To obtain maximum geological information in this poorly outcropping region it was initially planned to diamond drill the area. Coring of the first hole gave problems in the strongly weathered zone resulting in very poor recovery for the important first 30 m. After trying unsuccessfully to core (excessive bit loss in chert rubble) at the bottom of the second hole which was pre-collared through the oxidised zone, it was decided to continue with percussion drilling only. Cavities and the very weathered nature of the upper 20 m to 40 m led to the majority of the holes being abandoned in the weathered zone. The only significant results were obtained from Apollo 2 RDH which was collared on the edge of a strongly mineralised chert outcrop.

The first eleven holes were drilled in the general vicinity of the major mineralised outcrops. Holes 12 to 22 were drilled on a north-south line 700 m west of the main mineralised outcrops. Apollo 15 RDH is adjacent to a chert outcrop containing minor cerussite, galena and malachite. Apollo 23 RDH was drilled 100 m west of Apollo 22 RDH with Apollo 24 RDH a further 200 m to the west. Holes were drilled on an approximate east-west line south of the main mineralised area to check the down dip extension of the sequence giving a stream sediment anomaly. The presence of the volcanic unit in Apollo 22 RDH is significant in terms of the silicification and mineralisation.

In the region 1.5 km south of the main Apollo area anomalous lead results (cerussite) were obtained from the weathered sequence in Apollo 25 - 28 RDH. The best results to 1978 obtained from drilling were:
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<th>Depth (m)</th>
<th>Results</th>
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<td>Apollo 2 RDH</td>
<td>42.0</td>
<td>0 - 15.0 m at 2.15% Pb, 5.6 g/t Ag, which includes 0 - 2.0 m at 8.4% Pb, 13 g/t Ag, 11.0 - 12.0 m at 5.6% Pb, 4 g/t Ag. Also - 24.0 - 25.0 m at 1.08% Pb, 38.0 - 39.0 m at 1.25% Pb.</td>
</tr>
<tr>
<td>Apollo 6 RDH</td>
<td>30.0</td>
<td>0 - 4.0 m at 3.35% Pb, 14 g/t Ag, which includes 1.0 - 2.0 m at 0.54% Pb, 16 g/t Ag.</td>
</tr>
<tr>
<td>Apollo 28 RDH</td>
<td>27.0</td>
<td>14.0 - 20.0 m at 0.66% Pb which includes 17.0 - 18.0 m at 1.96% Pb.</td>
</tr>
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</table>

With the very shallow dips the potential area of mineralisation is quite extensive. The western extension, which is bounded by a major fault (1.0 to 1.5 km west of the main surface mineralisation) was subject to a line of bedrock percussion drill holes by C.E.C. To the north, east, and possibly south, the potential mineralised sequence within the Mallapunyah Formation is masked by extensive soil, laterite or Cretaceous age sandstone cover.

Further follow up by C.E.C. of a stream sediment anomaly 1.5 km south of the main area failed to locate signs of mineralisation or features which could explain the anomaly. Thin section studies by C.E.C. indicated that the lead mineralisation is probably diagenetic and pre or contemporaneous with silicification. The possibility of silicification being a weathering phenomenon was discarded.

Several alternative suggestions were made by C.E.C. to explain the lack of significant galena/cerussite away from the isolated mineralised outcrops.

a) The mineralised horizon was only silicified in part with this zone being preserved, while the intervening sections have undergone extensive leaching and weathering.

b) If the silicification was controlled by the presence of sulphides, the present mineralised cherts would be the only significant zones of mineralisation.

c) With exposure to two weathering cycles (pre-laterite and Recent) the majority of a near horizonal mineralised bed has been eroded away leaving remnant mineralised outcrops. The anomalous results found between these outcrops would then be due to downward movement of lead during leaching. The small dips observed may be primary depositional slopes.
If alternative a) or c) prove to be correct, large untested areas of Mallapunyah Formation in the Tawallah Pocket area which are covered by soil, laterite or Cretaceous age sandstone still have potential for significant mineralisation. In the latter case, thickness of a mineralised horizon would be the deciding factor.

Five trial INPUT EM lines were flown by C.E.C. in 1978, three of them over the Apollo Prospect and two over the Eastern Creek lead Prospect. This method detected the mineralisation at Eastern Creek but not at Apollo.

In 1980, a further 21 INPUT EM lines were flown over the Apollo Prospect and surrounding areas, and five at the Eastern Creek Lead Prospect. The INPUT anomalies at the Apollo area were associated with haematitic sediments of Cretaceous age and a haematitic fault zone.

Induced Polarisation surveys using 125m dipole spacings were done on a 1500m x 1200m grid at Apollo. Neither survey detected any significant anomalies. The INPUT EM and IP Survey results are reported in Logan (Jan. 1980). During 1981 BHP did an Induced Polarisation survey at the Apollo Lead Prospect. Some anomalous responses on line 6000N were found but later drilling along this line did not reveal any corresponding mineralisation. This IP work is fully recorded in BHP's 1981 report. The known mineralisation at Apollo gave no response to an airborne INPUT E.M. survey. Drilling showed that there are not enough sulphides in this small region to give an anomaly but anomalies were found in areas to the south and east of Apollo. Several INPUT E.M. anomalies occur under Cretaceous age sandstone east of Apollo, while to the south of the areas tested, an anomaly is coincident with an area of white chert, similar in appearance to those at Apollo. These anomalies require further testing (C.E.C.).

In 1981, BHP carried out a shallow drilling programme (71 holes; total 1534 m) at the Apollo Lead Prospect. The holes were drilled along four east-west traverse lines, with the middle two following IP lines 5000N and 6000N. No significant zones of mineralisation were intersected in this programme, and no extension of the mineralisation in CEC's hole 2 RDH was found.

Details of this work are given in BHP's 1981 report. It was concluded that the galena mineralisation occurs bedded in cherty (silicified dolomite) rocks regarded by BHP as being the basal part of the Amelia Dolomite (McArthur Group). Grades of over one percent lead were found in only a few holes, and the pattern drilling results plus the fact that the strata are flat lying suggest that the mineralisation is patchy and not extensive.

The associated copper, zinc, barium and silver values are generally low, although grades in the outcrops are relatively richer. A degree of lithological control is apparent but the work done has not clearly established the origin of the mineralisation. Petrological study suggest that the mineralisation either predates or is contemporaneous with the silicification of the dolomite.
Possibly the mineralisation and the silicification here are related to the unconformity between the McArthur and the Roper Groups. Scattered chalcopyrite - pyrite mineralisation occurred in the Wologorang Formation. Logan's January 1980 report concluded that four styles of mineralisation were present. BHP's later work on the Apollo Prospect has not changed these interpretations.

Briefly, the mineralised or anomalous situations occur as follows:-

(i) At the McArthur Group-Roper Group unconformity, where a silicified sedimentary breccia (the Billengairah Formation - probably a pre-Roper Group regolith) often contains anomalous lead values. (not in E.L.A. 4081.)

(ii) Stratabound fracture filling base metal mineralisation in a stromatolite bed (the Great Scott Horizon) in the Toogalinie Dolomite. (not in E.L.A. 4081).

(iii) Regional geochemical copper anomalies associated with the Scrutton Volcanics and with the Wologorang Formation.

(iv) Shear or fault concentrated (mainly) copper mineralisation in the Amelia Dolomite, and probably also related to the Roper - McArthur unconformity.

It is observed that the mineralisation in many instances occurs at or near the surface and does not continue at depth. This may be due to original concentrations at the unconformity being remobilised and perhaps enriched during subsequent weathering and erosional cycles, as described in Nenke's 1979 report.

The styles of mineralisation described above are not considered likely to produce bodies of economic size and grade, although such a possibility cannot be altogether ruled out.

URANIUM:

There are a number of radiometric anomalies found by other companies in E.L.A. 4081 which have not been adequately followed up.

In this E.L.A. there are a number of lithological units of particular interest. The Scrutton Volcanics is most attractive in view of the high amplitude of recorded anomalies. The Yiyintyi Sandstone with several radiometric anomalies is equivalent to Westmoreland Conglomerate host to large uranium/gold deposits to the east of Pandanus Creek and Westmoreland. The uranium deposits in the Westmoreland Conglomerate appear to have several features in common with those at Roxby Downs, namely their tectonic setting and association with coarse clastic sediments and basic volcanics.

It is believed that favourable factors such as geological setting, stratigraphic succession and lithological characteristics of the Tawallah Group offer a possibility of locating uranium mineralisation of economic significance.
AIRBORNE RADIOMETRIC
ANOMALY LOCATIONS AND
GEOLGY, SE Corner E.L. 4801.
1:50,000
(from AGIP, 1972)
REFERENCE

LOWER PROTERZOIC

- Breccia zone.
- Sandstone, massive, ferruginous in places.
- Quartzitic sandstone - phyllitic.
- Quartzitic sandstone - massive.
- Geological boundary, approx.
- Anomaly 34A/1
- Radiometric contours in cps (SPARAT SPP 2)

PLATE 6
As a result of exploration activities carried out by AFMECO and Agip over a span of three field seasons, it was found that all radioactive peaks, with the exception of two located by both airborne and ground radiometric surveying and prospecting, were due to contrast between normal different levels of radioactivity in different formations. The radiometric highs found by Agip occur mainly over the Scrutton Volcanics and the basal conglomerate of the Yiyintyi Sandstone overlying the Volcanics. The basal conglomerate itself is largely composed of volcanic boulders and detritus. Higher than background values in the Yiyintyi Sandstone may be related to lateritized Mesozoic age patches or to laterite soil or gravel over parts of the plateau. Some peaks occur in the Seigal Volcanics and in lateritized beds within the Sly Creek Sandstone.

Higher than normal background values were found to occur in ferruginized levels within the Wollogorang Formation.

Analyses of samples collected from these radioactive peaks by Agip usually gave less than 20 p.p.m. U_3O_8, with very few showing uranium values in the range of 30-40 p.p.m. and only three between 64 and 78 p.p.m. U_3O_8.

Anomaly 34A/1 in the south eastern section of E.L.A. 4081 was reported by Agip to be related to a very small placer of Th-U minerals and samples assayed up to 174 p.p.m. U_3O_8 and 3796 p.p.m. ThO_2. This requires further follow up.

Anomaly 32/4 also in E.L.A. 4081 which assayed up to 274 ppm U_3O_8 was reported by Agip to be associated with ferruginous basal Mesozoic sediments in which it was concentrated, probably due to the scavenging action of iron. This requires further follow up.

The area extent of the Mesozoic age sediments at the anomaly is small and no other indications of uranium mineralisation have been found by AFMECO. Some samples were also assayed for Cu by Agip. The highest assay was 260 p.p.m. Cu but generally they showed only between 10 and 35 p.p.m. Cu.

One sample was assayed for several elements besides uranium and thorium. Ti showed up to 4000 p.p.m., Zn 300 p.p.m., V 250 p.p.m., Ni and Mn 200 p.p.m., Co and Cu 100 p.p.m.

DIAMONDS:

Several major companies are increasing their exploration for diamonds in this region. The structures described earlier in this report, namely the incidence of major faulting and cross faulting increases the favourability of this area for diamond potential. Basic dykes have been reported particularly near the uranium anomalous areas and these will be investigated initially. The south east corner of E.L.A. 4081 is of particular potential.
CONCLUSION:

This area E.L.A. 4081 has potential for base metals, uranium and/or diamonds. Several promising anomalies located by other companies require following up with more intense exploration and new ideas.

Initially, on conclusion of a comprehensive literature search, a stream sediment sampling programme will be carried out, following up work by AMECO 1981 and Agip 1974 done for uranium in the Scrutton Volcanics and Yiyintyi Sandstone.

Follow up of work done by C.E.C. 1976 - 1982 for base metals in the McArthur Group will be carried out. A heavy mineral programme for diamonds will be conducted also especially along the faults.
RELEVANT REFERENCES

APMRCO PTY. LTD. - Final Report Tawallah Range Dec., 1980

AGIP NUCLEARE AUSTRALIA PTY. LTD. - 1974/163.

Final Report CR 82/388

Harris, M.R., Bedford; I.V., Koerner, J. (1971)
Reports on Exploration within Prospecting Authority No. 1748
CEC Technical Report No. 213

Lord, J.R. (1969)
Steam Sediment Reconnaissance Geochemical Survey of the
Amelia Dolomite, West of the Tawallah Fault, McArthur River
District, Northern Territory.
CEC Technical Report No. 158.

E.L. 748 "Tawallah Range" and Eastern Creek Lead Prospect
Final Report.

Exploration Licence No. 1372 "Tawallah Range", N.T.,

Marlow, N.G. (1963)
Exploration in the "Carpentaria" Authority to Prospect
during 1962.
CEC Technical Report No. 20

Kenneth McMahon & Partners Pty. Ltd. (1968)
Final Report on the "Tawallah Range" (A to P 1976) Area, N.T.
for Amad No Liability, Open File Report

Nenke, J.A. (1979)
Exploration Licence No. 1372 "Tawallah Range" N.T., Annual
CEC Technical Report No. 619

Nenke, J.A. (1979)
Exploration Licence No. 1372 "Tawallah Range" N.T., Annual

Rawlins, R.J. et al (1972)
Report on Exploration within Prospecting Authority No. 3319
"Carpentaria", Northern Territory - Year Ended December, 31, 1971
Logan, R.G. (1980b)
Exploration Licence No. 1372 "Tawallah Range" Annual Report 1980
CEC Technical Report No. 877

BHP Minerals Limited (1982)
NATIONWIDE RESOURCES PTY LIMITED

SUMMARY REPORT

EL 4081 - APOLLO
NORTHERN TERRITORY

11th September 1983

Don F. Ward and Associates Pty. Ltd.
29 Binnari Road,
Hornsby Heights, N.S.W. 2077
INTRODUCTION:

After a study of possible areas for exploration of precious and base metals, uranium and diamonds in N.T., this Application for an Exploration Licence was lodged by Nationwide Resources Pty. Limited. E.L.A. 4081 covers an area of volcanics and sediments in the Tawallah Range.

This report summarizes the available information on the geology and mineralisation of the area.

LOCATION:

E.L.A. 4081 is centred 50 kms north west of McArthur River H.S. (Fig. 1). The area is approximately 950 kms by road from Darwin. It is situated on the Bauhinia Downs and the Mt. Young 1:250,000 Geological Sheets.

The only permanently inhabited settlement on the Mt. Young Sheet area is Bing Bong Station, on the coast of the Gulf of Carpentaria. It has a population of three Europeans and several aborigines. Population on the Bauhinia Downs Sheet is centred at Borroloola, and at Mallapunyah, McArthur River and O.T. Downs Homesteads. Good graded dirt roads serve the area with light aircraft access at most of the homesteads. Off road driving is severely restricted by the existing relief. The Apollo prospect is reached by bulldozed track, from the Nathan River road. During the wet season (Dec. to Apr.), the roads in the area become impassable.

TITLE DESCRIPTION:

E.L.A. 4081 of 411 sq. kms, which was lodged 14/10/82, has an initial expenditure commitment of $25,000 for the first twelve months. It consists of 92 one minute blocks, i.e.;

<table>
<thead>
<tr>
<th>Block Name</th>
<th>Block Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Young 29/5</td>
<td>1664 to 2664 inclusive</td>
</tr>
<tr>
<td></td>
<td>1670 to 2670 inclusive</td>
</tr>
<tr>
<td>Bauhinia Downs 35/2</td>
<td>2441 to 2641 inclusive</td>
</tr>
<tr>
<td></td>
<td>2445 to 2645 inclusive</td>
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</tbody>
</table>

PREVIOUS EXPLORATION IN THE IMMEDIATE AREA:

Geological mapping in the area was carried out by the B.M.R. The geology is described in the Bauhinia Downs N.T., and Mt. Young, N.T. Map Sheets at 1:250,000 scale. In 1977 the B.M.R. commenced a long term study of the McArthur Basin with the aim to up-date the geological knowledge of the area.
GEOLOGY

Geological mapping recently completed has delineated the stratigraphic and structural position of the Apollo Lead mineralisation.

The Pocket is divisible into three structural units consisting of an east-west horst block across the centre bordered by downthrown blocks to the north and south.

EL 4081 covers the northern downthrown block. The western half of the Pocket contains poorly outcropping Toogananie Formation flanked on the east and west by the underlying Tatool Sandstone. Dips are generally very shallow.

Much of the area is covered by thin Cambrian and Cretaceous sediments or Cainozoic ferricrete and sand.

The lead-barite copper mineralisation is contained within a zone of silicification of the carbonate horizons within the Toogananie Formation. Some at least of this silicification is of hydrothermal origin and genetically related to the lead mineralisation. Some of the silicification may be related to younger weathering surfaces as the Toogananie Formation does suffer surface silicification in this region.

This zone of silicification is about 5 kilometres long and about 2 kilometres wide. Minor fine grained disseminated chalcopyrite in chert and barite replacing gypsum occur throughout this zone. Lead mineralisation however is related to a north-northwest striking zone towards the east margin of the silicified zone about 3 km long and 700 metres wide. Lead mineralisation is sporadic within this zone and now occurs as fresh galena only in remnants of strongly silicified algal dolomite and as sparse pyromorphite and (?) plumbojarosite in less massive zones. It is impossible to estimate the amount of lead present before leaching, however it may have been economically significant.
The recent mapping shows that the host Tooganinie Formation does not extend below the base of oxidation within the zone of lead mineralisation and hence does not have the economic potential necessary in this remote area.

Fresh galena was intersected in RDH2 at two horizons before being abandoned in a third chert horizon. RDH2 was drilled on the margin of a chert-galena outcrop. All other holes were drilled between chert outcrops. This distribution suggests that the galena-chert lenses are small, 10 to 50m across, and vertically stacked as would be expected if hydrothermal solutions migrated up sub-vertical fractures. The mineralisation would be deposited preferentially in the bituminous algal dolomites which also contain abundant pseudomorphs after gypsum of diagenetic origin.

Previous mapping (BHP, 1981) has noted the occurrence of minor tuffs in both the Amelia Dolomite and the Tooganinie Formation in the Tawallah Pocket. Additionally, a number of shaley fragments collected during the field visit have a tuffaceous appearance and stain positive for potash feldspar.

These tuffs are of local occurrence in the Tooganinie Formation and may also be of local origin. There may therefore be a genetic connection between these tuffs and the abnormally large amounts of mineralisation present in the Tooganinie Formation at the Apollo Prospect.

ECONOMIC POTENTIAL

It is unlikely that a major lead deposit is preserved in the Tooganinie Formation in Tawallah Pocket. However, the apparent hydrothermal origin of the mineralisation suggests another potential site of mineralisation in the Apollo area, stratigraphically below the Apollo Lead deposit in the Amelia Dolomite.
Carpentaria Exploration Co. drilled one hole, Tawallah Pocket No. 1 in the southern portion of the Tawallah Pocket to test chalcopyrite mineralisation hosted by silicified algal dolomites, the style of mineralisation being similar to that at Apollo and to that at Gordons Copper and Sly Creek Copper.

Tawallah Pocket DH No.1 showed the carbonates of the Amelia Dolomite to be strongly carbonaceous and rich in evaporite pseudomorphs.

The Amelia Dolomite is probably strongly carbonaceous at depth below the Apollo Prospect and hence is favourable for base metal deposition.

RECOMMENDATIONS

To test this favourable zone a drill would have to penetrate 20 to 50 metres of Toogininie Formation followed by about 100 to 140 metres of Tatoolo Sandstone before entering the Amelia Dolomite which would be about 80 metres thick. The holes would have to penetrate into the upper Mallapunyah Formation which also carries carbonaceous horizons. Thus drill holes of the order of 250 metres depth would be required to test this zone. In addition, the mineralisation may be sporadic requiring multiple holes for an adequate test.

I feel the cost of drilling allied with the risk involved make this an unattractive target for any but a large Company.

I therefore recommend that the prospect be offered for Joint Venture to a larger Company. CRAE are known to be exploring for this style of copper mineralisation in the McArthur Basin and should be approached.
EXPLORATION LICENCE 4081

- APOLLO -

NATIONWIDE RESOURCES PTY. LIMITED

Bauhinia Downs and Mount Young
1:250,000 sheets

FIG. 2
GEOLOGY

E.L. 4081

1:250,000

NATIONWIDE RESOURCES PTY. LTD

(See Text for legend)
Summary

Exploration Licence 4081
Northern Territory

Tawallah Pocket
(Proposed first year expenditure $25,000)

This area of 295 sq. kms situated 950 kms by road from Darwin, has potential for lead-zinc-copper-silver, uranium and diamonds. The E.L. contains the Apollo lead-copper prospect, possible extensions of the Mariner lead prospect, which is situated to the south-west uranium prospects and potential diamond bearing areas.

The H.Y.C. (Here's Your Chance) deposit 35 kms to the south-east of E.L. 4081 contains the largest published and open cut reserves in the world of base metals. That is, 227 Mt (possibly proved to 300 Mt now) of 10% zinc, 4% lead, 44 g/t silver and 0.12% copper.

E.L.A. 4081 has potential for "red-bed" style copper mineralisation in the Mallapunyah Formation and stratabound base metal mineralisation in the Wollgorang Formation. Another exploration target is the possibility of an unexposed stratiform lead-zinc deposit in the same stratigraphic position as the H.Y.C. deposit.

Past drilling at the Apollo Prospect has shown several base metal-silver intersections of interest e.g., 15m at 2.15% Pb, 5.6 g/t Ag which includes 2m at 8.4% Pb, 13 g/t Ag and 1 m at 5.6% Pb, 4 g/t Ag. Further results are not available at present. Large untested areas of Mallapunyah Formation in the Tawallah Pocket area which are covered by soil, laterite or sandstone have potential for significant mineralisation.

There are also a number of uranium anomalies found by other companies in E.L. 4081 which have not been adequately explained. Due to changes in policies of Companies involved E.L.'s are relinquished without completion of very good initial ground work. This has occurred here. There are a number of lithological units of particular interest in this E.L. The Scrutton Volcanics Unit is most attractive in view of the high amplitude of recorded anomalies. The Yiyintyi Sandstone with contained radiometric anomalies is equivalent to Westmoreland Conglomerate host to large uranium/gold deposits to the east of Pandanus Creek and Westmoreland. The uranium/gold deposits in the Westmoreland Conglomerate have several features in common with those at Roxby Downs, namely their tectonic setting and association with coarse clastic sediments and basic volcanics. It is believed that favourable factors such as geological setting, stratigraphic succession and lithological characteristics of the Tawallah Group offer a possibility of locating uranium mineralisation of economic significance.

Several major Companies are increasing their exploration for diamonds in this region. The incidence of major faulting and cross faulting increases the favourability of this area for diamond potential. Basic dykes have been reported particularly near the uranium anomalous areas and these will be investigated initially.
E.L. 4081: (Originally E.L.A. 4080 and later E.L.A. 4081)

This area of approximately 295 sq. kms was granted 4/3/83, with a minimum expenditure of $25,000 during year 1. It is prospective for base metals, silver, uranium and diamonds. Although these commodities are outside the guidelines of minerals sought by Nationwide Resources Pty. Limited, the area presented targets of dimensions too encouraging to ignore.

E.L. 4081 covers an area of volcanics and sediments in the Tawallah Range north west of McArthur River Homestead. The H.Y.C. deposit 55 kms S.E. of E.L. 4081, contains the biggest published reserves in the world of base metals and is the largest open cut reserve ever in the world.

This E.L. contains the Apollo lead - copper prospect hosted by the Mallapunyah Formation and also has possible extensions of the Mariner lead-silver Prospect. The lead anomaly of the latter extends for over 7 kms to the north into E.L. 4081. All lead mineralisation intersected by drilling was oxidised and hosted by leached sediments of the Tooganinnie Formation with the highest grade interval intersected assaying 13% Pb over 7m. This prospect requires testing over its full strike length and its origin and controls understood.

Further mapping around the Apollo Prospect of geology and structure is required west of the mineralised outcrops to ascertain where the mineralised zone is in the stratigraphic sequence. Electrical geophysics is required also if the mineralisation is proven to be shallow.

It appears that previous drilling by Comapnies was incorrectly positioned. The best results obtained were:

Apollo 2 RDH 42.0 m
0 – 15.0m at 2.15% Pb, 5.6 g/t Ag, which includes 0 – 2.0m at 8.4% Pb, 13 g/t Ag, 11.0 – 12.0m at 5.6% Pb, 4 g/t Ag.
Also –
24.0 – 25.0m at 1.08% Pb.
38.0 – 39.0m at 1.25% Pb.

Apollo 6 RDH 30.0 m
0 – 4.0m at 3.35% Pb, 14 g/t Ag, which includes 1.0 – 2.0m at 0.54% Pb, 16 g/t Ag.

Apollo 28 RDH 27.0 m
14.0 – 20.0m at 0.66% Pb which includes 17.0 – 18.0m at 1.90% Pb.

With the very shallow dips the potential area of mineralisation is quite extensive. The western extension, which is bounded by a major fault (1.0 to 1.5 km west of the main surface mineralisation) was subject to a line of bedrock percussion drill holes previously by another company. To the north, east, and possibly south, the potential mineralised sequence within the Mallapunyah Formation is masked by extensive soil laterite or Cretaceous age sandstone cover.

From later work it was concluded that the galena mineralisation occurs bedded in cherty (silicified dolomite) rocks regarded as being the basal part of the Amelia Dolomite (McArthur Group).

The associated copper, zinc, barium and silver values are generally low, although grades in the outcrops are relatively richer. A degree of lithological control is apparent but the work done has not clearly established the origin of the mineralisation. Petrological study suggest that the mineralisation either predates or is contemporaneous with the silicification of the dolomite. There are a number of lithological units of particular interest in this E.L. The Scrutton Volcanics is most attractive in view of the high amplitude of recorded anomalies. The Yiyintyi Sandstone with contained radiometric anomalies is equivalent to the Westmoreland Conglomerate host to large uranium/gold deposits to the east of Pandanus Creek and Westmoreland. The uranium/
gold deposits in the Westmoreland Conglomerate have several features in common with those at Roxby Downs, namely their tectonic setting and association with coarse clastic sediments and basic volcanics. It is believed that favourable factors such as geological setting, stratigraphic succession and lithological characteristics of the Tawallah economic significance. Uranium anomalies located previously by other Companies were not adequately explained, not followed up and prematurely dismissed. Several major Companies are increasing their exploration for diamonds in this region. The incidence of major faulting and cross faulting in the Tawallah Group increases the favourability of this area for diamond potential. Basic dykes have been reported particularly near the areas anomalous for uranium and these will be investigated initially.
NATIONWIDE RESOURCES PTY LIMITED

F.L. 4081 TAWALLAH N.T.

PROGRESS REPORT

by

D. F. WARD

D F Ward
November, 1983

Don F Ward & Assoc Pty Ltd
29 Binnari Road,
HORNSBY HEIGHTS NSW 2077
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   2.2 Local Geology
3. MINERALISATION
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   3.2 Copper
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Appendix 2 Apollo Prospect E.L. 1372 E.I.P. Surveys
Appendix 3 Apollo Prospect - Assay Results Rotary Percussion Drilling

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Fig 1 Locality Plan 1:250,000

PLANS

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2. APOLLO LEAD PROSPECT E.L. 4081 TAWALLAH N.T. Geology and Drill Holes 1: 10,000
1. INTRODUCTION

E.L. 4081 covers an area of 295 sq kms and is located in the Tawallah Ranges in the north eastern region of the Northern Territory. It is located 450 km SE of Darwin and 70km west of Barroloola. See Fig 1. The area was granted to Nationwide Resources Pty Limited on 4th May, 1983 for a period of six years.

The Licence is located on the south central margin of the Mt Young 1:250,000 Geological Sheet with a short arm extending south onto the Bauhinia Downs 1:250,000 Geological Sheet.

The area is accessible by rough track eastwards from the maintained access road connecting Nathan River Station in the north with the Carpentaria Highway in the south which extends west to join up with the Darwin - Alice Springs Stuart Highway.

Topographically, the area consists of a central zone of low rolling hills and scattered mesas virtually surrounded by a high partially dissected quartzite plateau. The only feasible vehicular access is from the west.

The climate is monsoonal with the annual rainfall of 500mm to 750mm falling mainly in the period January-March.

Permanent waterholes are scarce in the immediate area and are mainly confined to the quartzite gorges.

This report presents the results of air photo scale (1:25,000) mapping conducted during August-September, 1983 together with base metal exploration conducted previously by CEC and BHP.

2. GEOLOGY

2.1 Regional Geology. The Apollo Lead Prospect is located in a downthrown block of McArthur Group rocks located within the larger horst block of older Tawallah Group and Lower Proterozoic rocks which form the Tawallah Ranges. The Tawallah Ranges are located within the Batten Trough of the McArthur Basin northwest of the McArthur River Zn, Pb, Ag deposit and south of the Urapunga Tectonic Ridge.

The softer carbonate and silty rocks of the McArthur Group have weathered out preferentially to the more resistant sandstones and quartzites of the surrounding older rock suites to form Tawallah Pocket.

Large areas within the Pocket are covered by thin Cambrian Bukalara Sandstone, Cretaceous sediments, and Cainozoic ferricrete and wind blown sand.

The Proterozoic rocks have been subjected to a very long period of oxidation, leaching and silicification which has resulted in the loss of the bulk of the sulphide mineralisation.

2.2 Local Geology. Tawallah Pocket is divisible into three structural units consisting of an east-west median horst block bordered on the north and south by downthrown blocks.
E.L. 4081 covers the northern downthrown block. Geological mapping recently completed by Nationwide has shown the Apollo lead-barite mineralisation to be hosted by the Toogaininie Formation and not by the Amelia Dolomite as originally thought. Both formations are composed of silt-carbonate cycles with the same average thickness and carbonate content in Tawallah Pocket and can be differentiated reliably only when the Mallapunyah Formation and Tatoolia Sandstone can be recognised underlying or overlying the formations.

The western half of Tawallah Pocket within E.L. 4081 is occupied by sillicified Toogaininie Formation which dips gently west towards the Apollo Fault, the large fault which borders the Pocket on the west.

The structure is complex within this fault zone with some large lenses of infolded Tatoolia Sandstone.

Between the Apollo prospect and the Apollo Fault, a large portion of the area is covered by (?) Cambrian Bukalara Sandstone and lesser Cretaceous sediments. The (?) Bukalara Sandstone is fossiliferous and locally downfolded against branches of the Apollo Fault with dips approaching 90 degrees. East of the Apollo prospect, typical Tatoolia Sandstone dips gently west under the mineralised sillicified carbonates. Dips are generally less than 10 degrees.

An extensive sheet of horizontal Cretaceous fossiliferous sediments covers the lower portion of the Tatoolia Sandstone east from the Apollo prospect and extends almost to the eastern limit of Tawallah Pocket where a narrow strip of west dipping Mallapunyah Formation crops out.

It is possible that the Cretaceous sediments mask a N-S horst block of older sediments, the southward extension of a horst block of Wollogorang Formation (Tawallah Group) which protrudes into the Pocket at the north end.

North from the Apollo Prospect, the area is covered by an unbroken sheet of sand which probably overlies a sheet of ferricrete. Air photo trends indicate underlying sediments strike northwest.

3. MINERALISATION

3.1 Lead Barite. The mineralisation consists primarily of galena and barite in a sillicified dolomite host.

Two periods of sillicification are probably present. The first is probably genetically related and more or less contemporaneous with the lead mineralisation. The second period is probably related to the long periods of weathering before deposition of the Cambrian Bukalara Sandstone and before deposition of the Cretaceous sediments.

The galena takes two distinct forms, the first as bedded very fine grained galena 2 to 10 millimicrons diameter set in a chert groundmass and as coarse euhedral crystals disseminated through the rock or as coarse fracture fill.

Barite occurs as a fracture fill associated with galena and also as a replacement of diagenetic or sabkha bladed gypsum crystals. These gypsum pseudomorphs occur as sparse laths 1mm wide by 1 to 3cms long or in masses
composed of >50% laths up to 5mm wide and 10cms long. These laths are sometimes arranged in "shell bursts" radiating in three dimensions. The maximum development of barite after gypsum appears to occur on the west to south west margin of the lead mineralisation.

Minor copper mineralisation occurs with the lead-barite mineralisation but mainly occurs in pink chert as bedded very fine grained disseminations of chalcopyrite andchalcolite flanking the lead mineralisation along the north margin of the area and extending west as far as the Apollo Fault. Grades are subecononic with maximum values in fresh rock probably of the order of 0.2% Cu over 1 metre thickness.

Zinc values are extremely low in the lead mineralisation but increase to the west where rarely exceed a few hundred ppm.

No other metals appear to be present in anomalous amounts.

The mineralisation style appears to be identical in most respects to the Eastern Creek Lead Barite mineralisation located 25km to the NNW. The latter deposit is hosted by the Baikirini Dolomite of the Nathan Group. The Nathan Group unconformably overlies the McArthur Group and is overlain unconformably by the Roper Group.

The mineralisation differs from the normal Great Scott Style which lacks silicification, fine bedded mineralisation and association with gypsum.

The timing and origin of the mineralisation in both prospects is obscure. CEC geologists relate the mineralisation to the Roper Group unconformity, however, Roper Group rocks are not present in the Tawallah Pocket.

The mineralisation at Apollo appears to be confined to laterally discontinuous lenses of silicified dolomite. RDH2 of CEC indicates that these lenses may be vertically stacked. RDH2 is the only hole in the CEC and BHP programmes which intersected galena. Most holes were sited between the rough mineralised chert outcrops and did not intersect chert lenses again indicating that the chert lenses are not randomly distributed but possibly vertically stacked and controlled by more or less vertical fractures.

The zone of anomalous resistivity indicated by the IP surveys is located along the eastern margin of the outcropping lead mineralisation suggesting that the zone of strongest mineralisation is here (now largely leached away) and not down dip to the west.

The zone of anomalous lead mineralisation is about 900 metres wide and 2.5 to 3km long and strikes NWW. Maximum thickness could exceed 40 metres. The only anomalous lead mineralisation known outside this zone occurs in RDH 31 of BHP which intersected an anomalous formation 20 metres thick with lead values from 100 to 900 ppm, zinc values 125 to 690 ppm and copper values from 60 to 200 ppm. This hole is adjacent to the Apollo Fault.

The original grade of mineralisation was probably highly variable but due to the strong leaching is now impossible to estimate. Locally, grades probably exceeded 20% Pb over thicknesses of 1 or 2 metres as indicated by chip sample 31-8-01 which was taken from the exposed 65cm of thickness of the mineralised
E.L. 4081 covers the northern downthrown block. Geological mapping recently completed by Nationwide has shown the Apollo lead-barite mineralisation to be hosted by the Tooganinlie Formation and not by the Amelia Dolomite as originally thought. Both formations are composed of silt-carbonate cycles with the same average thickness and carbonate content in Tawallah Pocket and can be differentiated reliably only when the Mallapunyah Formation and Tatoolo Sandstone can be recognised underlying or overlying the formations. The western half of Tawallah Pocket within E.L. 4081 is occupied by silicified Tooganinlie Formation which dips gently west towards the Apollo Fault, the large fault which borders the Pocket on the west. The structure is complex within this fault zone with some large lenses of infolded Tatoolo Sandstone.

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Two periods of silicification are probably present. The first is probably genetically related and more or less contemporaneous with the lead mineralisation. The second period is probably related to the long periods of weathering before deposition of the Cambrian Bukalarra Sandstone and before deposition of the Cretaceous sediments.

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Barite occurs as a fracture fill associated with galena and also as a replacement of diagenetic or sabkha bladed gypsum crystals. These gypsum pseudomorphs occur as sparse laths 1mm wide by 1 to 3cms long or in masses
lens beside RDH2. Some oxidation of the fine grained galena is evident
together with patches of strong leaching. The sample assayed 18.02% Pb, and
16.6 g/t Ag.

3.2 Copper. The rotary percussion drilling programme intersected numerous
anomalously high copper values, not all of which are in weathered rock and
which do not appear to be due to supergene enrichment. These values, which
range from 100 to 780 ppm over 1 metre are hosted by the red bed silty
sediments of the lower Toogoolwah Formation and upper Tatoola Sandstone.
These background values are higher than normal but do not indicate ore grades
may be present in Tawallah Pocket.

CEC examined copper mineralisation in the Amelia Dolomite near the south end
of Tawallah Pocket and mineralisation was associated with strong
silicification and may be genetically related. Similar or stronger copper
mineralisation may occur at depth below the Apollo zone.

4. GEOCHEMISTRY

The Apollo Prospect was discovered in 1977 during a high density stream
sediment sampling programme (about 10 samples per square kilometre). This
programme covered most of Tawallah Pocket and all expected outcrops of the
Toogoolwah Formation. No other mineralised areas were located.

The mineralisation was located during follow up of two stream sediment samples
assaying 220 to 250 ppm Pb. No lead secondary minerals were located on the
surface. The mineralised cherts exhibited a leached skin 1 centimetre or more
thick. Lead minerals were located only by cracking large boulders.

Strongly mineralised cherts tend to leach deeply but have a characteristic
pitted appearance on weathered surfaces. Rocks with this pitted appearance
occur throughout the Apollo area and continue south to the Joes Gully area.
These pitted rocks often contain small patches of yellow finely crystalline
pyromorphite or a yellowish earthy mineral which may be plumbojarosite. A chip
sample containing this latter mineral collected north of Joes Gully assayed
595 ppm Pb, 1187 ppm Cu, 211 ppm Zn and 5.64 g/t Ag, confirming the existence
of original mineralisation (Sample 28-8-01).

Three chip samples were assayed for Thallium to test a possible association
with HYC style hydrothermal fluids in view of the thin potash rich (?) tuff
beds located in the area. Thallium values range up to hundreds of ppm in the
HYC. However, the high grade sample containing fresh galena from the Apollo
outcrop (31-9-03) assayed 18.2% Pb but only 1 ppm Thallium. Sample 28-8-01
contained <1 ppm and Sample 28-8-02 contained 7 ppm. However, this latter
sample is a manganese rich cap (7.98% Mn) which has probably scavenged some
metal values (Pb 253 ppm, Zn 518 ppm, Cu 58 ppm, Ag 1.20 ppm and Ba 5590 ppm).
These low values do not support a close association.

5. GEOPHYSICS

5.1 Previous Surveys. Both CEC and BHP have conducted IP geophysical
surveys over the Apollo prospect.
CEC tested seven lines of dipole-dipole IP in August 1980 with a 125 metre spread. The lines are 4700N, 4900N, 5100N, 5300N, 5500N, 5700N and 5900N. The most southerly line, 4700N passed 500 metres south of the main Apollo lead mineralisation and, 1400 metres north of Joe's Gully mineralisation. Effective coverage extended west to 3700E but not to the Apollo Fault.

BHP tested two lines in August 1981 with a 200 metre spread, lines 5,000N and 6,000N. Line 5,000N passed through the middle of the main Apollo mineralisation and both lines extending west to the Apollo Fault. The southern extension of the mineralisation including that around Joe's Gully has not been tested by geophysics.

Both IP surveys obtained essentially similar results with the Tatooa Sandstone on the east margin of the area and at depth being reflected by an upper resistive zone corresponding probably to the Upper Dolomitic member and an underlying lower resistivity unit with a higher chargeability background corresponding to the lower silty-sandy half of the Tatooa Sandstone.

The Toogalinlie Formation above the Tatooa Sandstone has a more irregular pattern. A feature which appears on all lines in both surveys is a restricted resistivity high which trends west of north and crosses Line 5000N at about 4300E vertically below the eastern margin of the outcropping lead mineralisation and crosses Line 6000N at about 4000E. This resistive body lies within the Toogalinlie Formation and is deepest, largest and most resistive at the south end and weakens to the north as it approaches the surface.

Both the geophysics and geological mapping indicate the sediments strike NW so that the Tatooa Sandstone becomes shallower to the north.

This resistive body could be caused by a sub vertical zone of strong silification of the Toogalinlie Formation corresponding with the outcropping chert-galena-barite mineralisation. The degree of silification (and mineralisation?) drops off rapidly to the north.

The only chargeability anomaly obtained was on Line 6000N at depth below 4000E (10.3m/sec) associated with a local resistivity low and located at about the contact of the Toogalinlie Formation and the Tatooa Sandstone.

5.2 Discussion. The resistivity high below the main Apollo outcrops does not reach the surface even though strong silification is present. The low resistivity recorded near the surface is probably caused by the strong leaching of the sediments caused in turn by the oxidising of the sulphides. This leaching resulted in a series of discontinuous very high resistivity chert lenses set in a porous low resistivity matrix. IP would not be able to detect the sulphides in the chert lenses. The strongest mineralisation could be expected in the middle of the Toogalinlie Formation where the reducing bituminous dolomites are thickest and best developed and it is probably this portion of the formation which outcrops in the mineralised area. Mineralised carbonates probably would not extend deeper than about 50 metres below the surface since the carbonate proportion drops off in favour of sand and silt towards the base of the Toogalinlie Formation.
Silicification and (?) mineralisation could again increase -
(a) in the dolomite - evaporite rich top half of the Tatoola Formation
and
(b) especially in the hydrocarbon and evaporite rich Amelia Dolomite.

The resistive zone parallels the strike to the SSE so that the mineralised
horizon will not extend appreciably deeper.

6. ECONOMIC POTENTIAL

The mineralised zone which measures 2500m + by 900m with a maximum thickness
exceeding 40 metres may have contained economically significant tonnages of
lead mineralisation however the entire mineralised zone is now above the water
table and is heavily leached except for some remnants which contain fresh
galena and cerussite.

The outcropping mineralisation is therefore not of economic significance
especially in such a remote area. The trace lead mineralisation intersected
in RDh31 beside the Apollo Fault also does not appear to have economic
significance at this point.

The only potential mineralisation below the water table would be hosted by the
Amelia Dolomite (demonstrated to be evaporite rich and hydrocarbon rich
further south in the Pocket) or the dolomite rich upper half of the Tatoola
Sandstone and controlled by the same fracture zone which appears to have
controlled the Apollo mineralisation.

This potential zone therefore lies at depth the Apollo - Joe's Gully
mineralisation. The precise thicknesses of the Tooganning Formation, Tatoola
Sandstone or the Amelia Dolomite are not precisely known in Tawallah Pocket
but are probably of the same order or slightly less than the normal
thicknesses in the Tawallah area. The true thicknesses may be less than
normal since the algal phase of the sedimentary cycles indicate shallow water
and often hypersaline conditions. The maximum thickness of the Tooganning
Formation would probably be 280 metres, the Tatoola Sandstone 140 metres and
the Amelia Dolomite, 90 metres.

The top of the Amelia Dolomite, in the vicinity of the resistivity high would
be 60 metres of Tooganning Formation plus 140 metres of Tatoola Sandstone.

The Amelia Dolomite at depth could carry either lead mineralisation of the
Apollo style or copper mineralisation of the style cropping out to the south
in Tawallah Pocket which is similar to the Gordons Copper (Coppermine Creek)
and Sly Creek Copper deposits.

However a conjectural target at a depth of 200 metres requiring holes up to
300 metres or possibly more in depth involves a risk too high for a small
exploration Company but may be of sufficient potential to interest one of the
larger companies such as CRAE currently operating in the area.

7. RECOMMENDATIONS

It is recommended that the Company does not undertake any further ground
surveys but offers the area for Joint Venture to one of the larger companies
currently operating in the area such as CRAE or WMC.
Area Mapped EXPLORATION LICENCE 4081

(See Plate 1)

- APOLLO -

NATIONWIDE RESOURCES PTY. LIMITED

Bauhinia Downs and Mount Young

1:250,000 sheets
APPENDIX 2

APOLLO PROSPECT, E.L. 1372 TAWALLAH RANGE, N.T.
E.I.P. SURVEY

INTRODUCTION

An I.P. survey was carried out over the Apollo Prospect by Scintrex Pty Limited during August 1980. Seven lines were surveyed at 125m dipole spacing over a grid approximately 1500m by 1200m.

Results

Line 4700N. This section reveals an above background chargeability high located between 4600 E and 4700 E. A resistivity high is located between 4200 E and 4350 E extending to depth. This line was very noisy and therefore difficult to obtain some N=4 readings. There appear to be no significant zones of interest on this line.

Line 4900 N. This section reveals a moderate chargeability high located between 5000 E and 5200 E. No resistivity low is associated with the chargeability response. A resistivity high which occurs on line 4700 N is also apparent on this line located between 4200 E and 4400 E. There appears to be no significant zones of interest on this line.

Line 5100 N. A moderate chargeability high exists between 4750 E and 4800 E at approximately 80m in depth. The resistivity high which is present on the more southerly lines seems to have widened and extended to a depth greater than 150m. The easterly half on this line is fairly conductive. No significant zones of interest detected.

Line 5300 N. The chargeability values in this section are fairly uniform. The easterly side of this line was extremely noisy and some N=4 values could not be obtained. The resistivity high present on the more southerly lines is still evident on this line.

Line 5500 N. Two zones of high resistivity exist on this line. One centred at 4700E extending from 50m to >120m in depth, and the other located between 3800 E and 4100 E. No significant chargeability values exist.

Lines 5700 N and 5900 N. No significant I.P. response is present on these lines.

Recommendations and Conclusions

No significant I.P. response was obtained over the Apollo Prospect. No further geophysical work is recommended.
INTRODUCTION

Scintrex Pty Limited carried out an E.I.P. Survey over the Eastern Creek Prospect, E.L. 1372 during the last two weeks of July, 1980. A total of 8 lines was surveyed using a dipole spacing of 125m.

The data is presented in the form of line-by-line pseudosections, and also contours of both chargeability and resistivity for n=1 to n=4.

Results

No significant anomalies have been observed on any of the eight lines surveyed.

Recommendations and Conclusions

No further work is considered necessary. It is recommended that the prospect be relinquished.
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