HUCKITTA PROJECT
EXPLORATION LICENCE 987

FINAL REPORT TO DEPARTMENT OF MINES,
NORTHERN TERRITORY
JANUARY 1975.

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AUTHOR/S: E. Reid

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AUSTRALIAN ANGLO AMERICAN LIMITED
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1. SUMMARY

Exploration Licence EL. 987 is located 250 km north-east of Alice Springs, Northern Territory and covers an area of 540.3 km² in the Georgina Sedimentary Basin.

Rock types exposed are dolomites, limestones, shales and sandstones of the Cambro-Ordovician Arrinhrunga and Tomahawk Formations.

A 1/4 km x 1/4 km grid, subsequently levelled, gravity surveyed and geologically mapped, was placed over an area of 33.25 km² of a section of the Arrinhrunga Formation containing known lead-zinc-barite mineralisation.

The Huckitta project was aimed at testing the effectiveness of a detailed gravity survey. Bouguer patterns which could be correlated with lithology, structure and known lead-zinc-barite mineralisation were sought.

Bouguer patterns were found to correlate with major lithologies and structures. The known mineralised horizon coincides with a weak gravity anomaly which is too weak to represent a shallow massive sulphide lens of mineable size.

2. INTRODUCTION

2.1. Location

The Huckitta Exploration lease is located on "Arapunya" Station, 250 km east north east from Alice Springs. The lease covers an area of 540.3 km² and spans from 22°15' S to 22°30' S latitude and 135°43' to 135°55'E longitude.

2.2. Access

The licence area may be reached by air using light aircraft, to the unlicenced Arapunya airstrip (600m long). The best road access from Alice Springs is via the Plenty Highway to Mud Tank then via "Mt. Swan" and "MacDonald Downs" stations to "Arapunya", a total distance of 400 km. Four wheel drive is not obligatory in dry weather when the trip may be accomplished in seven hours.
2.3. Environment

The region may be described as semi-desert. The usual vegetal cover consists of sparse low (< 3m) mulga and acacia or spinifex and other grasses. Eucalypts trace the drainage courses. In protected niches such as the gorges incising the Dulcie Range, native Collitris pines predominate.

2.4. Geological Setting

The licence area is situated over the Upper Cambrian Arrinthuranga and Cambro-Ordovician Tomahawk Formations near the southern margin of the Georgina Basin. The shape of the lease was designed to incorporate the longest strike length of an horizon in the Arrinthuranga Formation known to contain lead-zinc-barite mineralisation. This horizon is 100m stratigraphically above a distinctive marker horizon, the Eurowie Sandstone Member, occurring near the middle of the carbonate rich Arrinthuranga Formation. The Proterozoic basement is thought to be about 2km below the surface at Huckitta.

3. HISTORY

3.1. Discovery

W.H. King identified galena within silicified dolomites at latitude 22°20'S and longitude 135°50'E in 1959. The mineralisation was found to strike for about 3km on the eastern limb flank of a very gentle southerly plunging syncline, known now as the Turkey Creek Syncline. He hand sorted and sold 15 tons of 65 - 70% lead ore. One analysis of this galena yielded 53ppm silver and a trace of bismuth.

3.2. Enterprise Exploration N/L

In early 1960 King negotiated a joint venture deal with Enterprise Exploration N/L. An Authority to Prospect an area of 7777km² was granted to the company and a diamond drilling programme formulated. Eight holes were drilled - a total of 439m. Operations ceased in late 1960 having assessed the mineralisation to be a series of thin, stratabound, lenticular ore zones trending north westerly cut off in the south east by a north trending fault with the eastern block down dropped. Mineralisation was considered to be largely stratigraphically controlled, with minor structural control expressed in ore accumulations being noted along minor anticlinal axes.

Enterprise considered the down dropped eastern block as the best target for any future work.
3.3. Bureau of Mineral Resources - Geological Surveys

In 1960 Government geologist K. G. Smith mapped the Huckitta 1:250,000 sheet defining the lithologies and most of the stratigraphy accepted today. Government geologists Woolley and Rowchoy mapped the lead workings and their immediate environment using Smith's new nomenclature. Mineralisation was considered to be syenetic with subsequent supergene enrichment and redistribution of galena and silica. Viability of the deposit was assessed to be economic only if the metre thick 3000 metre long 4% lead bearing body was known to continue down dip. Contemporaneous drilling by Enterprise Exploration N. L. showed this not to be the case.

3.4. B. M. R. Geophysical Surveys

3.4.1. Gravity Surveys

In 1960/61 reconnaissance gravity surveys were undertaken in the Georgina Basin, provided by oil and gas interests. The major survey result was a clear delineation of the borders of the Georgina Basin. Some twenty major gravity features were described and tentatively interpreted as relating to features such as basement topography, plutonic intrusions etc. From the surveys, the 1:250,000 Huckitta bouguer map was compiled. The pertinent features in the vicinity of EL. 987 are:

(i) The "Ooratippra High", 50km to the north east of our grid and thought to represent a basement topographic high.
(ii) The "Amaroo Sub-basin" 50 km to the south east, thought to be an expression of the topographic low under the Dulcie Syncline.
(iii) The "Huckitta Sink" a well situated 45km south of the Huckitta lead-zinc occurrence probably related to the Jinka granite pluton and adjacent granitized Archaean rocks.

3.4.2. Magnetic Surveys

In 1964 an aeromagnetic survey of the southern Georgina Basin was flown and a depth of $2 \frac{1}{2} \text{km}$ to basement was calculated in the vicinity of EL. No. 987.

3.5. Central Pacific Minerals

This company undertook a percussion drilling programme in October 1971. Nine angled holes were drilled on a 30.5m (100 feet) x 30.5m grid close to the outcropping zone of mineralisation. The deepest holes were 46m (150 feet) the total footage being 337m (1105 feet). Seven holes were drilled within 300m (650 feet) of Kings workings whilst another two holes were drilled 900m (3000 feet) further south along strike from Kings Workings.
Assay results were poor with only one five foot interval achieving 1% lead and three intervals 1% zinc. These intervals were all no deeper than 9m (30 feet) deep and less than 15m (50 feet) down dip from the surface mineralised zone.

The drilling programme ceased early in November 1971.

3.6. Conzinc Riotinto Australia Limited

Mr. V. Bege, a research geologist with C.R.A. Ltd. the predecessor of Enterprise Exploration Limited, visited the Huckitta lead-zinc-barite deposit and the AAA camp for two days August 30th to September 1st. The trip was designed to reconsider the style of the Huckitta mineralisation in the light of a wider understanding of lead-zinc deposits than existed 14 years previously. Mr. Bege considers the Huckitta lead-zinc-barite deposit to be a late diagenetic accumulation derived from a syngenetic sulphide dispersion occurring through the adjacent dolomites.

4. WORK COMPLETED - AAA

4.1. Aims

The Huckitta project was designed to test the effectiveness of a detailed gravity survey over an area of known mineralisation. Derived Bouger gravity features were to be correlated with lithologies, geological structures and possible zones of lead-zinc mineralisation.

A 20 million tonne lead-zinc-pyrite spherical ore body model was used to derive the grid station interval of 250 metres. A tabular, shallowly dipping ore body was realised to be much harder to detect.

4.2. Gridding and Surveying

A rectangular (3.5km x 9.5km) area of the lease encompassing the outcropping lead-zinc-barite mineralisation of Kings Workings was accurately gridded and surveyed using a theodolite - chain - compass technique. The station interval is 250m x 250m. Two adjacent lines were extended westwards by ten stations each making a total of 602 stations on the grid. Stations were levelled to an accuracy of ±3cm and gravimetric readings taken to an accuracy of ±0.01 m gal. The final Bouger values are estimated to be accurate to ±0.05 m gal. These final Bouger values were related to the regional BMR gravity station network by a tie-in of the main grid base station with a Government station on the Bundy River 90km distant.
4.3. **Geological Mapping**

i) The gridded area was geologically mapped at a scale of 1:25,000 and 21 rock samples were taken for geochemical assay.

ii) A photogeological map of the EL area was compiled by J. Cameron at a scale of 1:80,000.

4.4. **Geophysical Interpretation**

Assessment of field gravity values was undertaken in Adelaide Office by consulting geophysicist R. Smith.

Further geophysical interpretations were made by D. Trussell.

5. **RESULTS**

5.1. **Geology**

The grid exposes some four hundred metres true thickness of sediments. All units are thought to be of Upper Cambrian age.

The highest unit is a cubic (after halite) casted sandstone of the Tomahawk Beds which conformably overlies dolarenites, dolomites, oolitic and algal dolomites, subordinate calcareous equivalents, shales and siltstones of the Upper Arrinthurunga Formation. The latter conformably overlie the forty metre thick halite-casted crossbedded Eurowie Sandstone Member. Carbonate rocks, shales and siltstones of the Lower Arrinthurunga Formation conformably underlie the Eurowie Sandstone. Both vertical and lateral facies changes are noted on the surface and are suggested from the drill log data at hand.

One intrusive igneous rock has been located. It appears to be a pyroxene and K-feldspar, porphyritic dolerite, cropping out as a near vertical dyke two metres in width and cross cutting units in the southwestern portion of the grid. Such post Cambrian intrusive rocks are very rare.

Some 25 individual lithologies were mapped and classed as follows:


ii) Cambrian evaporite zone - possibly sub-aerial - producing a cubic casted silicification of dolomites and algal dolomites, containing galena, sphalerite and barytes. Symbolized (Cvd)

iii) Stromatolitic dolomite/dolarenite containing galena and barytes distributed along sutures; spatially and temporally related to class ii) sediments. (Cvd)

iv) Dolomites, algal dolomites, dolargillites, shales and subordinate limestones and other calcareous equivalents of (Colds) low energy, high salinity environment.
5.1. Geology - Cont.

v) Moderate energy moderate salinity environment for distinctly textured dolomite/dolarenite intergrowth often with a stromatolitic habit. (Cgldo) It is the host rock of lithology class iii).

vi) Dolarenites with subordinate calcarenites of high energy low salinity environment. (Cldo)

vii) Oolitic dolomites and subordinate oolitic limestones of high energy high salinity environment. (Cold)

viii) Cubic casted (probably after halite) cross bedded sandstone possibly partly subaerially lain and of high energy low salinity environment. (usg).

It was noted that some outcrops exhibit, for the same textural composition, a change in chemical composition from calcareous to dolomitic in a lateral distance of one metre. This distance is too small to be satisfactorily attributable to facies variations. A metasomatic dolomitization process is implied suggesting many dolomitic rocks were originally calcareous rocks.

The inability to distinguish primary from secondary dolomites renders invalid any paleo-environmental distinction between dolomitic rocks and their calcareous textural equivalents.

Three biogenic textured rocks were observed:

i) A wormy intergrowth of dolomite and dolarenite showing no apparent symmetry other than frequent delineation into stromatolitic ovoids ranging to 1 metre across.

ii) "Collenia" algal dolomites and limestones consisting of cupolas up to 3cm across, the thin sutures often containing sandy carbonate wedges. This unit is often in a stromatolitic habit.

iii) "Girvanella" dolomites, most usually located in the algal unit directly below the Eurowie Sandstone member. Cupolas are up to 40cm across.

The region is structurally simple with gentle undulations about a NW/SE axial trend being the prime structural component. Some of the folds, the Turkey Creek syncline for example, may be accentuated by the effects of faulting of a limb. The regional warping is interpreted here as a reflection of basement topography which is buried by the order of 2000-2500m of sediments. Monoclinal flexuring is present at various places and may reflect slight movement along fault planes.
5.1. Geology - Cont...

Two styles of minor folding also exist.

i) Shallow symmetrical folds generally trending east-west
with a shallow variable plunge and of wavelength ranging
up to 100m.

ii) Chevron shaped anticlinal flexures consistently perpendicular
to the primary warping axes, with shallow plunge to the west
and limbs dipping at up to 60°. There are no corresponding
synclinal features. The amplitude ranges up to 3 metres. This
structural feature is noted only in the carbonate rocks - never
in the Eurowie Sandstone.

A fault has been identified trending west of northerly from
26300N, 7650E to 28400N, 7000E (Plan NTR-6-252). The
eastern side is down-dropped by a maximum vertical displacement
of ± 20m and minor flexuring has occurred. No evidence has
been found for fault continuation south, to cut off the zone of
mineralisation, as has been contended by previous investigators.
A gradual change of host rock composition from a highly silicified
to a non-silicified carbonate host rock possibly foreshadows the
spatial limit of mineralisation in this southerly direction.

A tectonic history of the region may have been as follows:

i) Gravity consolidation of sediments of the Georgina Basin
with molding to the topography of the basement producing warping
and, in one location, a slump fault.

ii) Slight folding by N/S compression producing minor folding
with E/W axial directions ± 70° to the direction of the major
warp axes.

iii) Intrusion of dolerite dykes.

iv) Flexuring due to erosional hydrostatic pressure stress release.

v) No metamorphism.

Weathering is slight within the area of the grid, though it is
severe elsewhere in the EL. Some regions are surfaced by
mesas and buttes of remnant Tertiary laterite. Surficial
weathering within the grid is expressed in places as leaching and
oxidation of sulphides in silicified dolomites, leaching of the
sandstone matrix, silification of carbonate units directly below
the Eurowie Sandstone Member, rare ferruginization and silification
of black shale? outcrops and has produced pockets of iron and
manganese oxides. Rock geochemistry indicates that the latter
products are unlikely to have borne sulphides other than pyrite.
5.1. Geology - Cont...
Cavitation due to leaching has occurred. In carbonate rocks cave systems and sinkholes are not uncommon. Within the down dip extension of the ore zone, small scale pervasive cavitation due to leaching of sulphides, barytes and possibly jarosite $K\cdot Fe_3(\text{SO}_4)_2(\text{OH})_6$ is evident from existing drillhole data.

5.2. Geophysics

5.2.1. Equipment
An Anglo American Corporation Worden 320 gravity meter was used at Huckitta. It was checked and calibrated by R. Smith at the Adelaide calibration range after its flight from Africa and checked again at the Alice Springs' calibration range before arriving at the field site. Two persons, J. Wilkie and E. Reid, were instructed in its use and maintenance.

5.2.2. Procedure
Instrument functioning and long term drift were checked by a morning camp reading taken after one hour's temperature equilibration. During the day, new stations were linked in loops of five or six to one of three base stations spread across the grid. Short term drift caused by diurnal temperature changes restricted loop times to about one hour. A final camp reading was taken in the evening.

5.2.3. Error Factors
The final error for the station Bouger values is $+ 0.05$ m gal, i.e. 1/10th the contour interval of the Bouger map. The values were calculated using an assumed rock density of $2.7 \text{ g/cm}^3$ throughout. However the rock density varies from $2.8 \text{ g/cm}^3$ for carbonate rocks and dolerite, to approximately $2.4$ for the casted Euowie Sandstone member, to approximately $2$ for the zones of alluvium covering portions of the grid. The low topography over the grid renders these density differences not critical to the Bouger value calculation. Bouger value changes of up to one milligal may occur over the sandstone plateau comprising the eastern half of the grid. However, the surficial trends observed on the contour map are unlikely to be obliterated.

5.2.4. Geological/Geophysical comparisons
The following table lists correlatable features:

[Table]

9/....
### TABLE I

<table>
<thead>
<tr>
<th>Gravity Feature</th>
<th>Geological Feature</th>
</tr>
</thead>
</table>
| 1) Gradient increase West to East. Magnitude 11.5mgal | Compounded regional gravity, gradient of magnitude 4mgal (from 1:250,000 regional gravity anomaly) and lithological expression of the thinning of the Eurowie Sandstone Member ($\rho = 2.4 \text{gcm}^{-3}$) to the east exposing the denser carbonate succession $\rho = 2.8 \text{gcm}^{-3}$.
| 2) Sharp depression extending north from station 165 to station 396. | Expression of vertical to steeply dipping portion of lighter Eurowie Sandstone at the faulted anticline, flanked by denser carbonates. |
| 3) A trough extending S.E. to N.W. across the eastern third of the grid. | A synclinal warp, where the thickness of alluvium and or lighter sandstone is likely to be greater. |
| 4) A slight 0.5 mgal ridge of variable shape extending N.W. from station 9 to station 547. | The only gravity expression that may be related to known lead-zinc-barite mineralisation: i.e. the thin shallowly dipping silicified dolomite unit encompassing Kings workings. The shape of the anomaly closely follows the extent of the mineralisation down dip, as shown by mapping and drilling viz: broader to the north and narrow to the south where erosion has left a narrow isthmus along the crest of the ridge. |
5.3. Geochemistry

5.3.1. Whole Rock Geochemistry

A sample of barytes from near Station 471 was cleaned of all visible galena and analysed by X-ray fluorescence spectroscopy for total barium, strontium and lead. The results are as follows:

%    % Component as RS04
Ba  54.7  93.3  Barytes  BaSO$_4$
Sr  1.8   3.8   Celestine  SrSO$_4$
Pb  0.012 0.008 Anglesite  PbSO$_4$

i.e. 97.1% (Ba Sr)SO$_4$

The lead content was likely due to occluded galena, indicating, with such a low sulphate lead content, little change of lead from sulphide to sulphate form.

5.3.2. Trace Element Rock Geochemistry

Twenty rock samples were analysed for Cu, Pb, Zn, Cd, Ag, Bi, Ni and Mn, using atomic absorption spectroscopy. The results are tabulated in Table II.
<table>
<thead>
<tr>
<th>No. Sample</th>
<th>ROCK DESCRIPTION (Plan NTR-6-252)</th>
<th>RESULTS</th>
<th>EVALUATION</th>
<th>New Lead Zinc Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cu</td>
<td>Pb</td>
<td>Zn</td>
</tr>
<tr>
<td>D1708</td>
<td>Creek cobble of silicified dolomite containing ferruginous laminae</td>
<td>12</td>
<td>210</td>
<td>85</td>
</tr>
<tr>
<td>D1710</td>
<td>Small cluster of cubic pseudomorphs of maroon iron oxides</td>
<td>48</td>
<td>3200</td>
<td>1200</td>
</tr>
<tr>
<td>D1711</td>
<td>Partly weathered sulphides in silicified dolomite</td>
<td>140</td>
<td>10.2%</td>
<td>7.5%</td>
</tr>
<tr>
<td>D1712</td>
<td>Weathered sulphides in silicified dolomite</td>
<td>110</td>
<td>0.9%</td>
<td>2.6%</td>
</tr>
<tr>
<td>D1713</td>
<td>Highly weathered sulphides in silicified dolomite</td>
<td>95</td>
<td>1090</td>
<td>3.2%</td>
</tr>
<tr>
<td>D1714</td>
<td>Galena from Kings Workings</td>
<td>310</td>
<td>&lt;26.5%</td>
<td>0.95%</td>
</tr>
<tr>
<td>D1715</td>
<td>Veneer of small cubic pseudomorphs of iron oxides on silicified algal dolomite</td>
<td>80</td>
<td>1090</td>
<td>200</td>
</tr>
<tr>
<td>D1716</td>
<td>Black float (close to source) with subhedral cubic pseudomorphs</td>
<td>90</td>
<td>590</td>
<td>560</td>
</tr>
<tr>
<td>D1717</td>
<td>Cubic casted silicified algal dolomite</td>
<td>18</td>
<td>30</td>
<td>130</td>
</tr>
</tbody>
</table>
### TABLE II - Cont. . .

<table>
<thead>
<tr>
<th>No. sample</th>
<th>ROCK DESCRIPTION (Plan NTR-6-252)</th>
<th>RESULTS</th>
<th>EVALUATION</th>
<th>Anomalous Pb</th>
<th>Pb/Zn Barren</th>
<th>New Lead/Zinc Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1718</td>
<td>Ferruginized silicified algal dolomite</td>
<td>65 &lt;5 160 190 &lt;10 3 5.5% &lt;1</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>D1719</td>
<td>Black ferruginized sandstone</td>
<td>12 75 60 5 &lt;10 2 300 &lt;1</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>D1720</td>
<td>Cubic casted silicified dolomite containing sphalerite (&amp; some galena)</td>
<td>210 270 9200 5 &lt;10 55 100 3</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1721</td>
<td>Dolomite with tiny greenish stained cavities</td>
<td>8 &lt;5 42 12 &lt;10 6 400 Λ1</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>D1722</td>
<td>Ferruginous silicified algal dolomite</td>
<td>55 15 170 55 &lt;10 4 500 Λ1</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>D1723</td>
<td>Ferruginous algal dolomite</td>
<td>35 930 970 130 &lt;10 6 4.8% Λ1</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1724</td>
<td>Gossanous rock with box works</td>
<td>80 25 150 90 &lt;10 8 4100 Λ1</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>D1725</td>
<td>Gossanous rock with box works</td>
<td>25 180 95 60 &lt;10 7 2300 Λ1</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>D1727</td>
<td>Dolarenite</td>
<td>8 30 85 10 &lt;10 10 400 Λ1</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>D1728</td>
<td>Mosaic brecciated limestone</td>
<td>32 340 280 18 &lt;10 10 100 Λ1</td>
<td>*</td>
<td>*</td>
<td></td>
<td>* ?</td>
</tr>
</tbody>
</table>
5.3.2. Trace Element Rock Geochemistry - Cont. . .

It is noted from the rock chip geochemical results that, upon weathering, cadmium disperses from its close sulphide association much more quickly than does zinc. In a similar environment therefore, high cadmium values may indicate proximity to a zinc sulphide source. A slight affinity of cadmium for carbonate rocks is suggested by the results.

It was attempted to use nickel to distinguish possible weathered basic intrusive rocks from highly weathered sedimentary rocks. However, the values obtained are non-definitive.

There is a strong direct relationship between manganese used as an indicator of intensity of lateritization and nickel. The higher nickel values are considered to be an expression of the scavenging properties of the oxides of manganese, for transition metal ions.

Silver results, like cadmium results, show a strong direct relationship with sulphide concentration. The sample of galena submitted (D1714) yielded 78ppm (2.3/4 oz per tonne) silver.

The most striking results obtained were possibly those for Bismuth. By Atomic Absorption spectroscopy, all samples yielded less than 10 ppm. Three samples were submitted for checking, using Emission Spectroscopic methods, and the results were all less than one ppm. Such low values within sulphides may be paralleled with the low arsenic and antimony values which are associated with stratiform syngenetic/diagenetic sulphide deposits of the Pine Point, Mississippi type. High arsenic and antimony values are associated with the stratiform epigenetic sulphide deposits of the Kuroko type.

The mineralisation is considered to be unrelated to any igneous source. Sources of Pb, Cu, Zn, Cd, Ag, could be from meteoric waters from palaeo-topographic highs located over basement highs. The "Ooratippra Gravity High" to the North East could be such a source area for the base metals of the Huckitta lead-zinc-barite occurrence.
5.4 Mineralisation

The four minerals galena, sphalerite, barytes and chalcopyrite, have been observed in outcrops of silicified dolomites and silicified algal dolomites. Galena and barytes also occur in outcroppingstromatolitic dolomites. Zones of mineralisation are observed to vary in thickness from a few millimetres to over a metre. From geochemical results, new horizons of mineralisation have been identified widely over the grid. However, they are small to the degree of becoming insignificant. The main zone, which incorporates King’s workings, consists of three individual horizons. However, of these, one is clearly predominant. The habit and style of the surface mineralisation is as follows:

Galena

Galena has four modes of occurrence -

(a) as laminae up to 1 cm thick parallel to bedding in silicified dolomites;

(b) as large cubic crystals (up to 3 cm edge) often in minor aggregates up to 10 cm long, in homogenous poorly bedded silicified dolomites;

(c) as medium to large crystals (up to edge 2 cm) and aggregates distributed along the sutures dividing stromatolitic ovoid bodies of fresh algal dolomites;

(d) as small (≤ 0.5 mm) grains disseminated through silicified collenia algal dolomites.

Galena is often noted to oxidize first to a vitreous dark dark greenish brown material (plumbojarosite?) and then to white to off white microcrystalline platy aggregates of cerussite (PbCO₃).

Sphalerite

Sphalerite has one known mode of occurrence as honey coloured cubo-octahedral crystals (≤ 1 cm edge) in homogenous silicified dolomite. Upon oxidation, sphalerite is noted to corrode its silicified dolomite wall rock to leave a roughly spherical cavity.

Barytes

This mineral has two modes of occurrence -

(a) as laminations of platy crystals parallel to bedding in silicified dolomites;

(b) as sheaves of plates penetrating silicified dolomites.

Upon weathering, barytes dissolves, leaving slotted casts.
5.4 Mineralisation - Cont. . .

Chalcopyrite

This mineral occurs very rarely as anhedral blebs \( \leq 1 \text{cm}^3 \) in volume. In carbonates weathering has produced a green stained aureole of about 1 cm width around the sulphide.

Enterprise Exploration Pty. Ltd. and Central Pacific Minerals NL both realised very low lead-zinc values in most assays. Much cavitation - usually in siliceous rock - was encountered. Diamond core log data shows a close association of lead-zinc-barite mineralisation, cavitation, and zones of silicification of dolomitic rocks. Both diamond and percussion drilling noted a weakening of silicification and concomitant assay values down dip. This spatial restriction of sulphides and cavities to the west, implies a northwesterly trending ribbon-like shape to the lead-zinc-barite zone.

Ore mineral textures suggest that crystalisation occurred when the matrix was still relatively soft, permitting large crystal growth and host rock penetration. That no mineralisation has ever been found along faults or jointing or fracture surfaces suggests mineral emplacement before the process of host rock lithification, i.e. at a diagenetic to late diagenetic stage.

The existence of fine galena disseminated through silicified algal dolomites, where larger sulphide/sulphate grains occur as planar masses or aggregates or laminae may suggest a degree of remobilisation and accumulation of sulphide to such surfaces, from a more fine grained dispersed source.

The highest grades of lead-zinc-barite mineralisation are associated with silicified dolomitic rocks suggesting that the processes of silicification and mineralisation are related.

Little genetic significance is placed upon the dolerite dyke as a source of lead and zinc since its intrusion through lithified dolarenites, considered to be younger than the mineralised horizon, infers that it post dates the mineralisation.
6. DISCUSSION

The close correlation in space and time between the silicified dolomite host and the lead-zinc-barite mineralisation may reflect an evaporative origin for both. The presence of halite casts in the Eurowie and Tomahawk sandstones and the occurrence of barite and jarosite give substance to the contention. The occurrence of three narrow, geographically restricted incidences of this kind of mineralisation within a narrow stratigraphic thickness also tends to substantiate this viewpoint, adding an element of cyclicality.

A comparison with a Sabkha evaporative pan environment is drawn up in Table III below:

<table>
<thead>
<tr>
<th>TABLE III</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SABKHA</strong></td>
<td><strong>HUCKITTA</strong></td>
</tr>
<tr>
<td>1. Stratabound mineralisation within strata accumulated along the shoreward fringe of a sea.</td>
<td>Stratabound, near shore, associated halite casted sandstones,</td>
</tr>
<tr>
<td>2. Hosted by grey/black shales or dolomites. Stromatolitic/algal mat association.</td>
<td>Hosted by fresh (rare) and silicified dolomitic rocks, often algal and often stromatolitic.</td>
</tr>
<tr>
<td>3. Underlain by red beds.</td>
<td>Underlain by ≤ 100 m of carbonates before 30 m of red bed - porous Eurowie Sandstone member.</td>
</tr>
<tr>
<td>4. Overlain by evaporites and dolomites.</td>
<td>Overlain by barite-rich zone then dolomites.</td>
</tr>
<tr>
<td>5. Laterally and vertically zoned with respect to metals.</td>
<td>Barytes above; zinc and lead (unknown relationship) below; silification grades upwards in intensity.</td>
</tr>
</tbody>
</table>
6. **DISCUSSION - Cont.**

A weakness in the comparison lies with the fact that the Eurowie Sandstone is stratigraphically nowhere closer than 60 m to the mineralised zones. Possibly, the lack of this rock as an aquifer has limited the development of better grade mineralisation.

The Huckitta lead-zinc-barite sheet mineralisation appears to have produced a low gravimetric anomaly, indicating the sensitivity of the technique. The method has adequately tested within its depth limits within the gridded area the possibility of reef associated lodes of massive lead-zinc sulphide mineralisation. This exploration tool could now be used in the broader area of the Licence area for follow-up testing of restricted areas of geologically selected targets. The main difficulty to be expected during such a programme is the time lost establishing and levelling a grid of sufficient accuracy. Once this has been established the gravity survey provides a very comprehensive sub-surface test.

7. **LAND TENURE**

Exploration Licence EL. 987 was granted for a period of 1 year and expires on 23rd April 1975.

8. **RECOMMENDATIONS**

8.1. No further detailed work should be carried out in this Licence area at this time and EL. 987 can now be relinquished.

8.2. The potential for reef associated or evaporative lead-zinc sulphide mineralisation in the Georgina Basin remains good and further programmes should be implemented to test areas of good geological or geochemical merit.

Compiled by:
E. Reid.

Approved by:
R. J. Kornick,
Exploration Manager.

30th January 1975
EXPENDITURE

An approximate expenditure of $56,988 was incurred on the project to 31st December 1974 as follows:

<table>
<thead>
<tr>
<th>Cost Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Staff Costs</td>
<td>$31,018</td>
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<tr>
<td>Other Associated Costs</td>
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<tr>
<td>Operating Costs</td>
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<tr>
<td>Capital Costs</td>
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</tr>
<tr>
<td>Indirect Costs</td>
<td>$9,127</td>
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<tr>
<td>Total</td>
<td>$56,988</td>
</tr>
</tbody>
</table>