EL 9371 MORDOR POUND, N.T.
FIRST ANNUAL REPORT
For Year ending 6th January, 1997.

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1. SUMMARY

Exploration Licence 9371 Mordor Pound No. 2 is situated near the southern margin of the Proterozoic Arunta Block, central Australia, approximately 65 km ENE of Alice Springs. It covers 63 blocks (199 km²) encompassing the Mordor Alkaline Igneous Complex (MAIC), surrounding Arunta Block gneisses and escarpments of overlying Neoproterozoic basal Amadeus Basin. The licence area was investigated for its Cu-Ni potential and also for uranium and diamonds.

During tenure year one CRA Exploration Pty. Limited (CRAE) completed the following exploration activities:

- Aboriginal sacred site survey
- Rock chip, stream sediment, soil and gravel sampling
- Airborne magnetic, radiometric, and EM surveying
- Aerial photography
- Geological mapping
- Drilling
- Petrophysical and petrological studies
- Down-hole IP, magnetic susceptibility and gamma logging
- Ground magnetic, dipole-dipole and gradient-array IP surveys
- Rehabilitation of disturbed areas

Detailed heli-magnetic data collected over the entire tenement did not show any isolated dipolar anomalies (diamonds targets). The highly magnetic shonkinite was accurately outlined and analytic filtering defined a series of magnetic features along the eastern and southern basement contact.

The radiometric data, in particular the potassium and thorium channels, define the various unit contacts. Two uranium anomalies were investigated and found to be due to radon from naturally occurring springs.

A GEOTEM EM survey revealed that the alkali-igneous complex is highly resistive and no significant conductors were detected. A single isolated conductor and a rim of moderately conductive material surrounding the topographical ‘Pound’ have been attributed to the shales of the Bitter Springs Formation.

A total of 22 rock samples were collected with 16 coming from and directly around a malachitic, magnetite-rich ironstone in shonkinite (Braveheart Prospect ironstone) located near the SE margin of the complex and first located by CRAE workers in 1969. The ironstone outcrop is lozenge-shaped, approximately 26 m long by 9m wide, and strikes NE-SW. A best result of 0.73 % Cu, 0.21 % Ni and 0.18 ppm Au was returned.

A comprehensive -80# stream sediment programme revealed very little Cu dispersion moving away from the ironstone and also located the presence of a coherent 2-6 times background Cu and Ni anomaly to the N and NW of Mt Doom.

Soil lines conducted over both the Braveheart ironstone Prospect and the SE margin contact zone confirmed elevated Cu and, to a lesser extent, Ni contents in the immediate vicinity of the ironstone. Best results of 90-3000 ppm Cu were received. Soil lines along the SE margin shonkinite/basement contact showed occasional irregular elevated Cu and Ni results with a best of 135 ppm Cu and 110 ppm Ni.
A total of 15 -2mm diamond gravel samples were taken from major creeks within the EL. All samples processed to date have reported negative for diamonds and kimberlitic indicator minerals.

Ground magnetic data collected over the ironstone and the eastern and southern shonkinite / basement contacts revealed a 300 m SW anomaly extension from the ironstone and other similar anomalies around the contact.

Two diamond and two RC drill holes were completed to test extensions of the Cu-Ni ironstone at Braveheart Prospect. Best values were returned from hole DD96MD1 with 30 m at 0.25 % and 401 ppm Ni, including 1 m at 1.4 % Cu, 0.3 % Ni, 0.1 ppm Au and 0.4 ppm PGE. Visible sulphides (up to 5%) were common. The intersected mineralisation was hosted by shonkinite (mainly the equigranular variety) and cross-cut by numerous barren pegmatite dykes. Two other RC drill holes were completed, testing ground magnetic anomalies. Minor Cu mineralisation was intersected in one hole. Petrophysical analysis of ten core samples showed that the sulphide enriched zones displayed a strong (3 x background) IP response and high conductivity.

Petrophysical analysis of ten core samples showed that the sulphide enriched zones displayed a strong (5 x background) IP response and high conductivity.

Down-hole magnetic susceptibility, gamma and IP measurements indicated a shonkinite bulk susceptibility of 0.08 SI, radioactivity discrimination of the pegmatite and basement from the shonkinite and a definitive IP response due to the sulphides.

Dipole IP surveying of 5 lines around the east and south contact have shown in some cases the presence of a chargeable conductive horizon at 50 to 100 m depth, approaching the surface at the contact and toward the complex centre.

Gradient-array, 100 m spaced IP surveying of the entire contact has shown a 2 km length anomaly extending SW from the ironstone. Large order anomalies occur toward the interior of the shonkinite complex.

2. CONCLUSIONS AND RECOMMENDATIONS

Conclusions drawn from the exploration activities completed during tenure year one were:

• The highest Cu, Ni and Au values returned from all rock chip sampling came from the Braveheart ironstone.

• A roughly 2500 m (E-W) x 700 m (N-S) sized anomalous Ni and Cu stream sediment anomaly was detected ~1 km north of Mt Doom.

• Stream sediment assay results showed very little Cu, Ni and Au dispersion away from the outcropping Braveheart ironstone with the anomalous halo extending no greater than 100 m downstream from source.

• Stream sediment results over the syenite portion of the MAIC are low and are swamped by the higher background values of the mafic part of the complex.
- A distinct 100-200 m wide Cu and Ni anomalous soil sample zone exists around the ironstone, however, these values rapidly diminish to the NE and SW along strike from the ironstone.

- Recognisably subtle anomalous Cu and Ni peaks (80-135 ppm) occur on some of the contact grid soil sample lines which correspond with airborne and/or ground magnetic anomalies.

- Drilling at the Braveheart ironstone prospect showed that mineralisation continues at depth in the form of blebby pyrrhotite ± chalcopyrite, pyrite, magnetite and trace millerite. The mineralised zone maintains width from diamond drill hole DD96MD1 down to diamond drill hole DD96MD2 (total vertical depth of ~85 m) suggesting that this mineralised zone continues further at depth, dipping to the NW.

- Recorded grades in both diamond holes, especially in DD96MD2, were diluted due to the presence of cross-cutting barren pegmatite dykes.

- A second, smaller mineralised zone was intersected only in hole DD96MD2 (5.1 m from 179.5 mbc averaging 0.11 % Cu) suggesting the start of another deeper-extending mineralised zone.

- RC percussion holes RC96MD2 and 4 which were designed to intersect any strike extensions of the ironstone related mineralisation failed to encounter any mineralisation apart from elevated pyrrhotite (trace to <5 %). This suggests that either these holes completely missed any strike extensions that are present or that the mineralisation has only very limited strike extent (<200 m long) and rapidly dies out giving the body a lensoidal shape but currently open-ended at depth. Strike dimensions of the mineralised body may, however, increase at depth.

- RC percussion holes RC96MD3 and 5 which targeted airborne magnetic features intersected elevated amounts of pyrrhotite suggesting that these magnetic features are due to elevated pyrrhotite content, rather than magnetite enrichment.

- Hole RC96MD5 failed to intersect Cu or Ni mineralisation within the shonkinite but did, however, intersect 4 m of Cu mineralisation restricted entirely to a cross-cutting quartz/carbonate breccia. This breccia also dips steeply towards the centre of a large airborne magnetic feature suggesting the source of the Cu may be from deeper shonkinite associated with this magnetic anomaly.

- The absence of discrete dipolar magnetic anomalies downgrades the potential for diamond targets.

- The MAIC has a highly variable magnetic texture but analytic signal filtering has revealed ‘pods’ of concentrated magnetic material around the periphery and interior of the complex.

- The mineralisation displays an increased magnetic susceptibility suggesting that the dominant magnetic mineral is pyrrhotite. This establishes a potential link between magnetic anomalies and sulphide occurrence.
• No significant uranium channel radiometric anomalies were observed. Two anomalies on the western edge of the MAIC were checked and found to be due to radon from natural springs.

• The three radiometric channels combine to provide a valuable aid to mapping by accurately defining buried contacts and distinguishing the various units. Enhancements of the data over the shonkinite allow the individual constituents of the unit to be differentiated.

• The electromagnetic survey showed that the MAIC is highly resistive and no conductive anomalies were apparent that would indicate the presence of massive sulphides. Likewise there were no anomalies external to the MAIC that would reflect diamondiferous diatremes.

• A large isolated GEOTEM electromagnetic anomaly and a periphery of conductive material is due to the conductive shales of the Bitter Springs Formation.

• A subtle GEOTEM anomaly in the NE of the pound remains unexplained but is likely to be caused by a faulted pod of Bitter Springs Formation.

• Mineralisation intersected at Braveheart has a clear IP response (both chargeable and conductive) of between 5 and 10 times background however larger and more intense anomalies occur toward the interior of the complex.

• Inversions reveal a subsurface link between the mineralisation at Braveheart and the interior IP anomalies indicating that the mineralisation may increase toward the complex centre.

• A two kilometre length SW extension to the ironstone IP anomaly is inferred by the gradient array survey. This feature is predominantly due to an elevated conductivity.

• A high degree of correlation between the IP anomalies and the magnetic analytic signal suggests that pyrrhotite is probably the dominant sulphide.

Recommendations resulting from the above conclusions were:

1. Follow up the large stream sediment geochemical anomaly N of Mt. Doom with initial geological investigation and then soil sampling if appropriate.

2. A more detailed multi-element geochemical statistical interpretation should be carried out on the multi-population stream sediment data set. Syenite and shonkinite stream sediment sample populations should be analysed separately rather than as a single complete set.

3. To continue soil sampling to test for continued correspondence with combined subtle geochemical elevation in Cu and Ni and magnetic features.

4. Future drilling should be planned to intersect the continuation of the known mineralised zones at depth and to test selected geophysical targets.
5. No further diamond exploration to be carried out pending final results of gravel samples.

6. Filtering to be applied to the airborne located line data to enhance subtle anomalies that have been obscured by the gridding process.

7. Re-processing of the GEOTEM data covering the shonkinite to enhance any subtle characteristics that may relate to the mineralisation and prospective zones.

8. Perform orientation surveys of ground TEM system (and possibly DIGHEM) over mineralisation and other selected IP and magnetic features.

9. Extend gradient array and dipole-dipole IP over areas that display unusual characteristics such as the analytic signal peaks and anomalous stream sediment zones.

3. **INTRODUCTION**

Exploration Licence 9371 Mordor Pound No. 2 is located within the Mesoproterozoic Arunta Block, approximately 65km ENE of Alice Springs, central Australia (Plan NTd 6411). It lies wholly within The Garden Station Pastoral Lease (NT Por. 662) and covers an area of 63 blocks (199 sq. km). Access is generally good along the unsealed Undoolya Station Road. Alternative routes are via the Ross Highway to the south, or north along the unsealed Arltunga Road.

The EL encompasses the Mordor Alkaline Igneous Complex (MAIC), a 26 km² inverted heart-shaped body consisting of a suite of fractionated alkali igneous rocks (syenite, shonkinite and minor ultramafics). The complex intrudes high-grade metamorphic rocks of the Mesoproterozoic Arunta Block which is unconformably overlain by the Neoproterozoic Heavitree Quartzite (basal unit of the Amadeus Basin). The quartzite forms high standing escarpments of the Georgina Range which form the three sides of the Mordor Pound. The igneous complex occupies the centre of the pound and is generally flat lying apart from a central outcrop of ultramafic rocks known as Mt Doom.

For a period of 20 years from 1975 the area was held under a ministerial reserve from occupation for the purpose of academic study and the proposed extraction of ribbon stone material.

The tenement was originally applied for to allow exploration for a range of possible mineralisation styles. The MAIC was considered prospective for Cu-Ni and PGE mineralisation associated with the mafic / ultramafic intrusives. Exploration for U mineralisation was also carried out. The area's structural setting and the petrologic similarity between alkali mafic rocks and kimberlite led to routine prospecting for diamonds.

The licence area was granted to CRAE on 07 December, 1995 for a period of six (6) years. This report details the work programmes completed within the tenement during the first tenure year (to 6th January, 1997).
4. GEOLGY

4.1 Regional Geology

The Arunta Block, located in central Australia, is a complex assemblage of early to Mesoproterozoic meta-igneous and meta-sedimentary rocks. According to Shaw (1990), the block can be divided into three partially fault-bounded provinces: a Central Province of high grade metamorphic rocks (up to granulite facies) and a few granites, flanked by the Northern and Southern Provinces, consisting of lower grade metamorphic rocks (generally up to amphibolite facies).

The Arunta Block can also be divided into three divisions or stages according to stratigraphic evolution, based upon facies assemblages and lithological correlation (Shaw and Stewart, 1975b). Division 1 is the oldest division (~2000 Ma) and consists of mafic, felsic and aluminous granulites and gneisses, concentrated in the lower parts of the division, with lesser calc-silicates and marbles concentrated in the upper parts. Division 2 in the Northern Province consists of aluminous and siliceous meta-sediments while in the Southern Province quartzofeldspathic gneisses are dominant. Division 3 is the least extensive of the three divisions and is characterised by orthoquartzites.

The block appears to be a mobile zone which initially formed by continental collision (1800-2000 Ma) and has since undergone several phases of deformation and igneous activity. Major episodes of metamorphic deformation took place around 1800 Ma and 1500 Ma while major magmatic deformation events occurred around 1700 Ma and 1000 Ma (Shaw, 1990).

Neoproterozoic (Adelaidean) sediments of the Amadeus Basin unconformably overlie and flank the Arunta Block at its southern margin. Basin development began around 900 Ma and sedimentation ceased during the Carboniferous (Freeman, et al., 1990).

Exploration Licence 9371 Mordor Pound No. 2 centres on a differentiated alkaline igneous complex known as the Mordor Alkaline Igneous Complex (MAIC). The complex is located within Division 2 metamorphics of the Southern Province of the Arunta Block. The complex has been dated at 1160 Ma (Langworthy and Black, 1979) indicating that it probably formed during the early phases of the final major magmatic event and post all of the early major episodes of metamorphic deformation which influenced the Arunta Block. Considerable deformation also occurred later, during the Alice Springs Orogeny, around 400 Ma. This deformation event involved considerable NE-SW compression, forming many large E-W faults and thrusts, and was the last major deformation event to influence the region.

The MAIC is evident, on 3.2 km spaced 1965 BMR magnetics, as a 2000 nT positive anomaly in a relatively quiet background. The peak of the anomaly is central to the complex and coincides with the ultramafic lithologies. It is located on the southern edge of a regional E-W trending gravity gradient and is adjacent to a localised gravity low.

The complex is also located along the Woolanga Lineament, a major inferred deep-seated NW-SE trending structural zone cross-cutting at least 100-150 km of the Arunta Inlier and continues under the Amadeus Basin to the SE. The Mud Tank Carbonatite has also formed along this lineament, ~50 km NW of the Mordor Complex, suggesting a strong connection between the formation of this structure and the emplacement of alkaline / ultrapotassic magmas.
4.2 Local Geology

The MAIC is a 26 km$^2$ suite of fractionated ultrapotassic igneous rocks which intrude quartzofeldspathic-biotite gneisses of the Arunta Block Jennings Gneiss. Major rock types within the complex are syenite, shonkinite (a melanocratic syenite, consisting largely of pyroxenes and potassic feldspar) and ultramafic rocks (phlogopite-rich pyroxenites and peridotites and minor dunite).

The igneous complex can be divided into two geographical and compositional zones: an eastern oval-shaped area of shonkinite with minor ultramafic rocks and a larger syenite body in the west (Plan NTd 6412). The eastern mafic body consists of a roughly central ultramafic body (Mt Doom) surrounded by shonkinite and a number of smaller ultramafic bodies which appear to be arranged concentrically around the central body.

The MAIC shonkinite can be divided into three main textural types:

- A medium-grained (2-5mm) equigranular type which appears to be the most abundant variety.
- A porphyritic variety which is composed of numerous large (up to ~20 mm long) subhedral grey-white K-feldspar phenocrysts surrounded by a medium-grained, phlogopite-rich mafic groundmass.
- A poikilitic variety consisting of large (up to 30 mm across) grey-white K-feldspar crystals or crystal-aggregates (poikioelectrics) with diffuse, embayed margins and containing abundant mafic inclusions - suspended within a medium-grained phlogopite-rich groundmass.

Relatively small ultramafic bodies are located within the shonkinite component of the complex. These are perhaps later dyke or pipe-like bodies which have intruded into the shonkinite although may represent remnants of an ultramafic layer or rafts within the shonkinite.

Younger quartz-feldspar pegmatite dykes, often zoned, and quartz breccias cross-cut all other rock types and are most concentrated in the shonkinite portion of the complex. The pegmatite dykes generally trend NE-SW to E-W while the breccias usually trend NW-SE (geological Plans NTd 6412 and NTd 6413). Gole (1996) suggests that these pegmatite dykes are the end products of the alkaline fractionation processes which occurred at the MAIC, however, very high quartz contents (up to ~95 %) within many of these granitic dykes may have been difficult to achieve through fractionation alone.

Two theories have been proposed to explain the formation of the intrusive complex:

1. A single parent alkaline / ultrapotassic magma sourced all of the above igneous rock types with the first magma pulse being ultramafic in composition but through fractionation processes subsequent intrusive pulses became less mafic. In this way older ultramafic rocks were intruded by shonkinite which was in turn intruded by syenite (Baraclough, 1981; Gole, 1996).

2. The other theory suggests essentially the reverse with an earliest syenite body being intruded by shonkinite followed finally by intrusion of ultramafic dykes meaning that the parent alkaline source(s) was becoming progressively more mafic over time (Langworthy and Black, 1978).
5. PREVIOUS WORK

CRAE discovered the MAIC from interpreting a sub-circular feature in aerial photography and confirmed its presence by visiting it in February, 1969 (Kostlin, 1971). The area was initially named the ‘Georgina Range Complex’ and subsequently investigated for its magmatic sulphide and rare earth potential. The following work was carried out by CRAE during the 1969-71 exploration programme (Kostlin, 1971):

5.1 CRA Exploration (1969-1971)

Stream Sediment Sampling

Two hundred samples were collected with 168 assayed for Ag, (Co), (Cr), Cu, Mo, Ni, Pb, U, Zn and the remaining 32 assayed for Ba, Ce, La, Nb, P2O5, Pt, Se, Sr, Ta, Te, Y, Zr.

Results:

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<th>Ni</th>
<th>Cu</th>
<th>Pb</th>
<th>Zn</th>
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<td>Max.</td>
<td>200</td>
<td>130</td>
<td>30</td>
<td>64</td>
</tr>
<tr>
<td>Ave.(approx)</td>
<td>45</td>
<td>40</td>
<td>15</td>
<td>45</td>
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- No other elements returned significant results
- Uranium contents were consistently low (max. 4 ppm U)

Soil Sampling

1413 samples were collected over mafic / ultramafic portion of the MAIC and assayed for Ni, Cu, Cr, Co, Pb, Zn, Ag and (Mo).

Results:

Generally low geochemistry with exception of Ni and Cu

- 200-800 ppm Ni over ultramafics (u/m’s)
- 50-200 ppm Ni over mafics
- Elevated Cu over u/m’s (relatively common zones of >100 ppm Cu; up to 1260 ppm Cu).

Rock Chip

Forty four rock chip samples were collected and were assayed for a large suite of elements including Ag, Ba, Be, Cr, Co, Cu, (Ga), (K), Mn, Ni, (P), Pb, (Rb), Sn, Sr, Ti, Sr, V, Y, and Zn. The elements (An), As, Au, Bi, Ce, Cd, (Cs), (Er), Eu, Ge, Ir, La, Mo, Nb, Nd, Os, Pd, (Pr), Pt, Rh, (Rn), Ru, Sb, Se, Ta, Te, Th, (Tl) and W were requested. but not detected at limits quoted .

Most significant results:

- Three samples collected over a small ‘gossanous feature’ (25 m x 8 m) within shonkinite (now known as the Braveheart ironstone) recorded up to 5000 ppm Cu, 1950 ppm Ni, 300 ppm Zn and 140 ppm Pb
• Small diorite outcrop recorded 2.88% U, 9770 ppm Th (due to brannerite in phlogopite).

**Petrology**

Fifty five rock samples (and a number of coarse fraction drainage samples) were collected for petrological work.

**Geophysical Surveys**

Ground magnetic and scintillometer surveys were carried out over the central portion of the complex (mafics and ultramafics) using detailed and semi-detailed line spacing (200 ft, 400 ft and 800 ft), with 200 ft intervals on each line. Six E-W lines and five N-S lines of gravity data were collected.

**Results:**

• Both the detailed magnetic and gravity data suggest a causative, vertical-sided pipe-like body of ultrabasics measuring approx. 3km diameter, extending from near-surface to approx. 6km depth (CRAE Report No. 4604 by Kirton and Doe, 1971).

**Geological Mapping**

The area was mapped in detail by Rudd (1:11 280 scale) and referred to in CRAE Report No. 3844 (Kostlin, 1971).

From this work CRAE concluded that metal values were below commercial / economic levels and that these metal values reflected the natural metal contents of the rocks rather than mineralisation.

**5.2 BMR (1974, 1981)**

In 1974 B.M.R geologists collected rock samples for age determination, geochemical and petrographical analysis. They used the name ‘Mordor’ and proposed the name ‘Mordor Pound’ for this area (B.M.R., 1974).

The area was next investigated by Barraclough for the BMR in 1981. He studied the lithological / petrographic nature of the complex and its relationship to carbonate intrusives (Barraclough, 1981). The following work was carried out:

**Soil Sampling**

• Correlation between soil assays and sample site lithologies (CRAE samples)
• Cumulative frequency plots completed (CRAE sample results)

**Auger Drilling**

• 69 auger holes drilled to bedrock in two areas of no outcrop - to test for possible kimberlite. Shonkinite and pyroxenite were intersected at bottom of holes.
Diamond Drilling

- Four diamond drill holes for a total of 354.6m
- MCDDH1: 96.5m; DH2: 91.0m; DH3: 69.5m; DH4: 97.5m
- Investigated possible Ni and Cr mineralisation in u/m's and REE's in 'carbonatite'.

Petrology

- Eight thin sections from drill core samples.

6. EXPLORATION ACTIVITIES

6.1 Aboriginal Sacred Site Survey

A sacred site clearance survey was completed over the exploration area by the Aboriginal Areas Protection Authority (AAPA). No sites of significance to traditional custodians were located and a work clearance certificate was issued.

6.2 Aerial Photography

A colour photography survey of the EL at 1:10000 scale was commissioned in order to provide a base for geological mapping and ground survey planning. The survey was flown by Airexplex Pty Limited on 14th of January 1996 between 8am and 9am.

6.3 Geological Mapping

Geological reconnaissance and mapping was undertaken along the SE margin of the igneous complex to investigate possible strike extensions of a 'gossan' mapped by earlier CRAE geologists. The 'gossan' is a magnetite-rich ironstone with minor malachite mineralisation and is now referred to as the Braveheart ironstone. This ironstone is a pod-like, very magnetite-rich, porphyritic shonkinite body ~25 m long by 8-9 m wide which is surrounded largely by equigranular shonkinite.

The following observations were made:

- No further ironstone outcrop was located.

- Shonkinite is the dominant lithology and has a strong E-W foliation marked by the preferred orientation of feldspar and mica phenocrysts. Outcrop of shonkinite is poor to the N of the ironstone, but extensive (and more porphyritic) to the SW.

- The shonkinite is often strongly magnetic, averaging approximately 0.03 SI units and ranging from 0.001 - 0.08 SI units. The magnetite ironstone itself recorded readings of up to 1.2 SI units (data from hand-held magnetic susceptibility meter).

- Basement biotitic gneisses near the intrusive complex contact recorded up to 0.03 SI units. By comparison, 'interbedded' leucocratic gneisses are weakly magnetic to non-magnetic.
• Feldspathic to quartzofeldspathic gneisses at and near the intrusive complex contact commonly display a porphyroblastic texture and are, in many places, intensely foliated. Generally, the gneisses appear to be more biotitic and strongly foliated with increased distance from the contact. Around the contact zone these gneisses are very commonly sheared giving the large feldspar crystals elongated lozenge or eye-shapes (augen gneiss).

• At a number of locations the basement gneisses form prominent relief around the perimeter of the intrusive complex. This is noted at both the syenite and shonkinite contacts and is probably a result of contact metasomatism / hornfelsing related to the intrusions. Large rafts of ridge-forming basement gneiss occur as scattered remnants along and within the SW margin of the syenite intrusion.

• Pegmatite dykes in the intrusive complex are more extensive than is evident from aerial photography or than has been plotted on previous maps (eg. Rudd, Barraclough).

Prior to the commencement of the drilling programme, detailed mapping was completed at the Braveheart Prospect (the mineralised ironstone area) to better define drill targets (Plan NTd 6414). This mapping showed that the equigranular variety of shonkinite is the dominant alkaline rock type directly adjacent to the basement contact with the porphyritic variety becoming the dominant lithology ~50-100 m away from the contact.

6.4 Geophysical Work

Extensive geophysical work was conducted over the tenement during the year of tenure. In total, nine surveys were completed. Four were carried out prior to drilling:

• Magnetic Susceptibility of NTGS core
• Heli-magnetic / radiometric
• GEOTEM airborne EM
• Ground magnetics

and five were conducted upon completion of the drilling program

• Petrophysical measurements
• Down-hole magnetic susceptibility and gamma
• Down-hole IP
• Dipole-dipole IP
• Gradient-array IP

The objective of this work was to investigate the geophysical characteristics of the MAIC and subsequently use this information to identify drill targets.

6.4.1 Magnetic Susceptibility of NTGS Core

The magnetic susceptibility of various lithologies, both weathered and fresh, that occur within the MAIC were measured to enable:

• differentiation of units based on magnetic response
• accurate modeling of aeromagnetic and ground magnetic data.

Measurements were made on core from four 1975 NTGS diamond drillholes (MCDDH1-MCDDH4), using a Geofinstruments JH-8 magnetic susceptibility meter.

Multiple readings were taken at random intervals along core (ranging in size from \( \frac{1}{2}\)BQ through to NQ) to determine an average and maximum value of magnetic susceptibility for each of the constituent rock types.

Calibration of the JH-8 is done for a half-space (e.g. outcrop) so for measurements made on core the following corrections were applied:

<table>
<thead>
<tr>
<th>CORE SIZE</th>
<th>FACTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>NQ</td>
<td>1.9</td>
</tr>
<tr>
<td>BQ</td>
<td>2.1</td>
</tr>
<tr>
<td>( \frac{1}{2})NQ</td>
<td>2.2</td>
</tr>
<tr>
<td>( \frac{1}{2})BQ</td>
<td>2.6</td>
</tr>
<tr>
<td>( \frac{1}{4})BQ</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Results are presented in Appendix X.

Average shonkinite values ranged between 0.09 SI units and 0.5 SI units, syenite ranged between 0.12 SI units and 0.15 SI units, while the broad group of ultra-mafic rocks (dunite, lherzolite, pyroxene, wherlite and websterite) ranged between 0.02 SI units and 0.33 SI units.

In general the ultra-mafic rocks returned the highest average susceptibility readings followed by shonkinite and then the syenite with the lowest average values.

The magnetic susceptibility survey of the core showed that:

• Magnetite concentrations (the controlling factor in susceptibility values) vary considerably, both between and within the lithologies. This variation will inherently corrupt the process of magnetic modeling and attempts to define unit contacts by this manner would, at best, be unreliable.

• As there is not a strong correlation between magnetic susceptibility and the rock type only a broad distinction can thus be made between the lithologies on the basis of magnetics.

6.4.2 Heliborne Magnetics / Radiometrics

High quality, high resolution magnetic and radiometric data was acquired over the entire tenement enabling:

• detection of discrete dipoles
• identification of uranium channel anomalies
• delineation of units based on magnetic and radiometric responses.

Rugged terrain and the need for close proximity surveying, to detect radiometric anomalies, dictated the use of a helicopter based platform.
The 1500 line km survey was flown by contractor GeoInstruments on the 24th to 28th of March 1996. Survey data are presented in Plans NTd 6415 to 6423. A logistics report detailing the system operation and survey specifications together with quick-look images are in Appendix XI.

There are three distinct magnetic textures which define various geological units within the EL. These are:

- A non-magnetic signature defines the Heavitree Quartzite and the Bitter Springs Formation
- A speckled variably-magnetic signature defines the gneiss, syenite and the metamorphic units.
- A highly-magnetic signature defines the shonkinite unit.

The analytic signal produces an image in which the highs occur over the magnetic source or contact. The following points are noted:

- The outline of the shonkinite unit is clearly visible and a series of peaks occur along the east and south basement contact.
- Within the shonkinite, larger analytic anomalies reflect the more magnetic ultramafic assemblages.
- The Mud Tank metamorphics in the NE corner of the tenement are characterised by a patchy appearance.

Individual units are clearly defined by the radiometric data, in particular the K and Th channels. The shonkinite and quartzite units are practically devoid of any radioactivity while the syenite, in contrast is highly K-rich. The basement has equal activity in the Th and K channels except around the syenite unit where it is enriched in thorium and uranium.

The following results were obtained as a result of the heliborne magnetics / radiometrics survey:

- Two uranium channel anomalies bordering the unconformity were ground checked and found to be caused by radon gas escaping from natural springs.

- The analytic signal peaks around the SE margin of the shonkinite may in part be due to the contact between the magnetic shonkinite and the non-magnetic augen gneiss. However, the coincidence of one peak with the mineralised ironstone outcrop at the Braveheart prospect may indicate that the remaining peaks reflect similar mineralisation occurrences.

- No isolated magnetic dipole responses were detected that would indicate potential diamondiferous diatremes.

- Several lower priority uranium anomalies in the SE corner of the tenement require ground follow-up and the ratio profiles need to be thoroughly checked for single point responses. (Plans NTd 6422 and 6423)
6.4.3 Airborne Electromagnetics (GEOTEM)

Conductivity information was acquired using a low cost EM system over the MAIC to enable:

- detection of discrete surficial conductors
- detection of large, highly conductive ore zones
- delineation of units based on conductivity responses.

The 760 line km survey was flown by contractor GeoTerrex between the 29th of April and the 1st of May 1996. Survey data are presented in Plans NTd 6424 to 6481. A logistics report detailing the system operation and survey specifications together with quick-look images are in Appendix XII.

The MAIC together with the Heavitree Quartzite and Granitic Gneiss are non-conductive while the Bitter Springs Formation is highly conductive. An isolated conductor on the western edge of the survey area was attributed to a wedge of Bitter Springs Formation. A subtle, early time, isolated conductor was detected on the NE flank of MAIC in an area covered by unconsolidated talus slope scree. The highly conductive Bitter Springs Formation is apparent a short distance to the north and this anomaly may be a faulted pod of the same.

No anomalous conductors were evident in or around the intrusive complex that would be indicative of massive sulphides. Similarly there are no diatreme style conductive responses.

6.4.4 Ground Magnetics

Detailed ground magnetics was acquired, initially over the ironstone outcrop, and then around the SE periphery of the shonkininite unit to:

- ascertain the spatial relationship between the ironstone and the analytic signal peaks
- model the magnetic response of the ironstone to assist with drill planning
- reveal analogous magnetic anomaly occurrences around the contact
- identify structural controls on the mineralisation.

Survey details are as follows.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>50 line km</td>
</tr>
<tr>
<td>Magnetometer</td>
<td>Scintrex EnviMag in Walkmag mode.</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.5 nT</td>
</tr>
<tr>
<td>Line direction</td>
<td>090° T, 0° T, 340° T</td>
</tr>
<tr>
<td>Line spacing</td>
<td>50 m</td>
</tr>
<tr>
<td>Sensor height</td>
<td>1.6 m</td>
</tr>
<tr>
<td>Sample interval</td>
<td>1 sec (~1.3 m)</td>
</tr>
<tr>
<td>Magnetics noise envelope</td>
<td>±25 nT (No diurnal correction)</td>
</tr>
<tr>
<td>Navigation control</td>
<td>Pre-established grid (DGPS located)</td>
</tr>
</tbody>
</table>

The survey was conducted by CRAE in two phases, in late May and in late September 1996. Survey data are presented as Plans NTd 6482 to 6484 and quick-look images and magnetic modeling results are in Appendix XIII.
Difficulty was encountered with the automatic tuning of the proton-precession type magnetometer in this area due to the very high gradients. As a result, the majority of readings had high noise levels and on occasions the tuning failed, producing a plateau of erroneous values until tuning was restored. Consequently there are numerous leveling errors apparent in the data and some anomalies will not be real, however the majority of the data is satisfactory and allows for a detailed interpretation.

The large dipolar anomaly of the shonkinite unit, as seen on the TMI airborne data, is evident on the ground data as a steady background increase from south to north.

The contact between the shonkinite and the gneiss is manifest as a change in magnetic character from a ‘noisy’ high amplitude appearance to a smoother moderate amplitude. A 200 m wide zone centred about the contact displays a subdued magnetic response. Two major faults (interpreted from the airborne magnetics) which intersect the shonkinite near the ironstone outcrop have corresponding zones of subdued magnetics.

The ironstone is manifest as a 4000 nT dipolar anomaly on traverse L1100 at 7405400 mN. A subtle continuation of the anomaly to the SW of the outcrop terminates on traverse L700 at 7405150 mN. The magnetic anomaly associated with the ironstone is distinct from a larger broad anomaly immediately to the NE and it is this feature which gives rise to the analytic signal peak.

Modeling was carried out on the anomaly described above, and the source of the feature was demonstrated to be a near vertical outcropping body of limited depth extent with a susceptibility of 0.37 SI units.

A series of anomalies near the contact between 446200 mE and 446800 mE have a similar size and amplitude to the ironstone anomaly. Three broader lower amplitude anomalies are evident on the basement side of the contact between 7407000 mN and 7407600 mN.

In general the ground magnetic survey showed that:

- The ironstone has an anomaly which is distinct from the general magnetic characteristics of the shonkinite. It is close to, but not the cause of, the analytic signal anomaly seen from the heli-magnetics. Modeling results were used to plan the drill collar position and orientation and subsequent drilling proved the model to be reasonably accurate.

- The analytic anomaly is caused by the larger magnetic feature NW of the ironstone which is sourced by a more magnetic section of shonkinite that is bounded by faults on the north and south sides.

- The zones of subdued magnetic response about the contact and the interpreted faults is due to magnetite depletion possibly caused by movement of oxidising fluids through these zones of weakness. Alternatively the poikilitic shonkinite, which occurs predominantly near the contact, is normally lower in magnetite content. In either case, a reduced magnetite content is substantiated by the down-hole magnetic susceptibility measurements of DD96MD1 and DD96MD2.

- Several anomalies, similar in character to the ironstone anomaly, occur around the contact. These anomalies may reflect buried mineralised ironstone analogues and
require further ground follow-up and testing. Of particular interest are the series of anomalies in the SW corner as these parallel a corresponding gradient array IP anomaly.

6.4.5 Dipole-Dipole IP

A total of 7.5 km of dipole-dipole IP surveys was carried out after the drilling program was completed (see Section 6.6). Disseminated sulphides were frequently encountered in many of the holes, particularly those testing the ironstone at depth.

The abundance of disseminated sulphide favoured the use of induced polarisation as a tool to directly detect mineralisation, and with the sulphide grains ranging in size from 0.05 mm to 10 mm an anomalous phase response was likely to occur over a broad frequency range.

Data was acquired along an orientation line crossing the ironstone to:

- determine the ability of IP to detect the known mineralisation
- if proven effective, gain additional cross-sectional depth information
- detect extensions to the known mineralisation and define drill targets

and then other prospective areas were surveyed in order to:

- detect anomalies that may reflect mineralisation
- provide sub-surface structural information
- generate drill targets.

The surveys were conducted by contractor Zonge Engineering and Research Organisation Pty Ltd (ZERO) during September 1996.

A 1400 m orientation line was surveyed over the ironstone along a NW-SE section defined by DD96MD1 and DD96MD2. The line was centered about DD96MD1 and stations marked out at 50 m intervals.

Transmitter electrodes were initially prepared using auger-holes and re-useable metal plates, however rocky ground conditions and difficult vehicle access to the majority of sites necessitated the use of the traditional shallow pits and foil electrodes. Tx currents of between 1 and 3 amps were achievable in the highly resistive ground conditions.

Full spectral IP surveys to n=8 at a-spacings of 100 m and 50 m were undertaken to determine the best a-spacing / frequency combination to detect the mineralisation. Data quality was excellent with low noise and good repeatability.

Data from the surveys were processed and quality checked using CRAE’s IPBASE software and submitted to ZERO’s S2DIP program for smooth-model inversion.

The inversion process converts the pseudo-section data into a depth-section (termed the “smooth-model”) which is a more geologically meaningful way of presenting the IP and resistivity information. The accuracy of the inversion is determined by the RMS error between the observed and calculated IP or resistivity responses.
A degree of geological control can be placed on the inversion routine by varying the weighting of the smoothness constraints in the horizontal and vertical directions. This will force the inversion to try to fit the data to either a flat-lying or a vertical contact style of geology.

Inversions were run with two types of constraints; equal weighting of directional smoothness (dipping contacts) and strong vertical smoothness (vertical contacts).

Dipole-dipole IP surveys were also carried out after the completion of the gradient array IP work along four lines (446300 mE, 447000 mE, 7406500 mN and 7407800 mN) to the west and north of the orientation line in order to test gradient array IP anomalies. Line 447000 mE was surveyed with 100 m station spacing, all others had 50 m stations.

Results of the IP and the inversion are presented in Appendix XIV. The first two figures for each line have three panels. The bottom panel is of the observed parameter (Resistivity or IP). The middle panel shows the calculated parameter from the inversion process and the top panel is the inversion model of the parameter. In all cases red depicts high conductivity or high chargeability (IP effect). The third figure is the inversion model of the metal factor, a value derived by multiplying the conductivity with the chargeability, and this plot provides the best discrimination of potentially mineralised areas.

Data collected on Line 1 (the orientation line) have shown that a 50 m station spacing provides optimal resolution with maximum coverage. Numerous types of inversions on these data sets have resulted in the equal weighting criteria being adopted as standard.

Results of the orientation line showed the following:

- The ironstone and the sulphides intersected during drilling are manifest as a conductive and chargeable anomaly (hence a metal factor anomaly).
- Inversions show that a large anomaly on the NW end of the line is linked, via a "sill-type" continuation at 75 m depth, to the anomaly caused by the known mineralisation.

The following lines were surveyed upon completion of the gradient array IP surveys.

Line 446300 mE was designed to test a gradient array feature (7405000 mN) analogous to the ironstone anomaly and the linear SW extension of the ironstone anomaly.

Results showed:

- Both of these features are predominately due to near surface conductivity effects.
- A sill-type anomaly begins approximately half way along the line at 75 m depth and extends to a large anomaly at the north end of the line.

Line 447000 mE was surveyed to test the anomaly seen on the NW end of Line 1 and the SW extension of the ironstone anomaly. Also tested was a large analytic signal anomaly at 7406300 mN.
Results showed:

- An IP anomaly (the same as the one on Line 1) occurs at 7406300 mN between 50 and 200 m depth. This feature is in part coincident with a conductive anomaly particularly where it reaches the surface as a combined anomaly at 7406500 mN. A sill type IP anomaly extends northward from this point at 100 m depth.
- The SW ironstone anomaly extension is primarily due to an intense near surface conductivity anomaly although the inversion does show that it may be connected to a deeper conductive sill.

Line 7406500 mN covers a linear gradient array anomaly at 448300 mE and the peak of a broad, high amplitude anomaly at 447750 mE.

Results showed:

- The linear anomaly is due to an elevated surficial conductivity response that continues and deepens to a broad anomaly on the west end of the line. Between 447600 mE and 447900 mE there is an intense IP anomaly which is coincident with the peak of the gradient array anomaly.

Line 7407800 mN tests a gradient array anomaly at 448500 mE and the southern end of an elongate analytic signal anomaly.

Results showed:

- The gradient array anomaly is due to coincident sub-surface conductive and IP anomalies. The conductivity pattern is very irregular on this line while the IP data shows a coherent broad IP anomaly at 75 m depth that extends from the western end to the middle of the line.
- The analytic signal anomaly coincides with the position of the IP feature.

In general the IP work showed that:

- The mineralisation is manifest as a conductive and chargeable anomaly that is linked by sub-surface continuations to larger and more prolific anomalous zones toward the center of the complex (demonstrated on all IP lines and also on the gradient array surveys).
- A significant correlation exists between the location of these large IP anomalies and the analytic signal highs, indicating that the source of the magnetic anomaly is also responsible for the observed IP effects.
- The values for the IP effect are too high (>70 mrad) to be solely due to magnetite so the presence of sulphides would be necessary to generate anomalies of this magnitude.
6.4.6 Gradient-Array IP

Down-hole and dipole-dipole IP surveys showed that the mineralisation was chargeable and conductive and potentially linked to other larger near surface anomalies. A gradient array survey was conducted, initially over the Braveheart Prospect, to:

- determine if this more rapid survey technique could detect the mineralisation
- improve the spatial resolution of IP information at minimal cost
- extend coverage around the SE shonkinite contact to detect further mineralisation
- ascertain the spatial connection between the analytic highs and the IP responses.

The surveys were conducted by contractor ZERO during September 1996.

A total of 41 km of gradient IP data were collected on five contiguous grids that covered the SE contact. Three grids with N-S lines covered the southern contact and two grids with E-W lines covered the eastern contact. On all grids the lines were 100 m apart with stations marked out at 50 m intervals. Grids typically covered a 1km² area with lines 1 km in length, although the first grid (Braveheart) was extended to the north and east. The grids were established using an OmniStar™ differential GPS system with an accuracy of ±5 m.

Transmitter electrodes were placed central to, but 500 m off the ends of each grid. They were constructed by digging a 2 m x 2 m x 0.3 m pit, lining with foil, adding water and back-filling with soil. The wire connecting the transmitter to the electrodes was re-located to the opposite side of the grid as the survey progressed in order to minimise EM coupling. Transmitter current of up to 5 amps were sustainable with well watered pits.

Complex resistivity data (ZERO method) from a spread of nine potential electrodes were simultaneously measured using a GDP-16 receiver. The spread was then moved a further 400 m along line and the process repeated. Grids were usually completed within three days.

The data from each grid were processed and combined to create a composite data set covering the entire SE contact margin. The results of the survey are presented as Plans NTd 6485 to 6488 and as quick-look images in Appendix XV.

A discrete metal factor anomaly is observed to be coincident with the mineralisation, this in turn connects with a string of lower order conductive anomalies along a 1.9 km SW trend.

Average conductive and chargeability values for the shonkinite were 0.4 mhmhos/m and 30 mrads respectively and for the augen gneiss were 0.15 mhmhos/m and 10 mrads.

Very large amplitude conductive and chargeable anomalies are evident on all grids toward the centre of the complex. Peak values were 1.6 mhmhos/m on line 7407900 mN and 99 mrads on line 447000 mE. The highest combined value occurs at the most northern end of line 447300 mE and this is reflected in the metal factor image which also shows very high values occurring on the western end of Line 7406200 mN.

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In general the gradient array IP work showed that:

- Gradient array IP surveying was successful at detecting the known mineralisation. The deeper IP features seen in the dipole-dipole surveys are probably being detected by this survey however the surficial anomalies are by far more prominent.

- The shonkinite has a higher background chargeability than the augen gneiss and the contact between the shonkinite and the augen gneiss is readily mapped by the abrupt change in chargeability.

- Overlying the chargeability image with the analytic signal of the magnetics has revealed a significant correlation. High concentrations of magnetite can contribute an IP effect however the values in this case are generally too high to be due to magnetite alone. This, together with the presence of large conductive features, indicates that the metal factor anomalies are good drill targets.

6.5 Geochemical Sampling

6.5.1 Rock Chip

A total of 22 rock chip / grab samples were collected, concentrating on the Braveheart magnetite / malachite ironstone and submitted to Amdel Laboratories Limited in Alice Springs. These were assayed for Au, Pt, Pd by fire assay/AAS; Ag, As, Bi, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, P, Pb, U, Th, V, Zn by ICP OES/MS method; and Ba by the XRF method. Sample ledgers and results are shown in Appendix II while sample locations are shown on Plans NTd 6489 and NTd 6414.

Best result was a rock sample (5487710) taken from the Braveheart mineralised ironstone which recorded 0.73 % Cu, 0.21 % Ni and 0.18 ppm Au. Lead and zinc were moderately elevated in some samples. The maximum Au result obtained from the Braveheart ironstone was 0.51 ppm Au (5488055). The average tenor for the 11 rock samples (5487709-5487712 and 5488051-5488057) taken from the Braveheart ironstone was:

\[ \text{0.44 % Cu; 0.13 % Ni; 0.13 ppm Au.} \]

A rock chip sample (5487749) taken from a small Cu occurrence (malachite and chlorite veining in porphyritic shonkinite) about 400 m SW of the Braveheart ironstone returned 0.41% Cu. No other anomalous elements were recorded.

A rock chip sample (5487751) from a NE trending K-feldspar / quartz pegmatite dyke near the southern margin of the complex returned 0.20% U and 0.11% Th. A rock chip sample (5487750) from another pegmatite dyke recorded 300 ppm U and 600 ppm Th. This confirms the presence of localised high uranium in pegmatites as reported by previous explorers.

No other significant results were obtained from rock chip / grab samples taken away from the immediate Braveheart ironstone area.

Two rock grab samples (5488063 and 5488064) were taken from a small, conductive GEOTEM anomaly located in the NE of Mordor Pound near the fault contact between
Arunta Block basement and the Heavitree Quartzite. The anomaly is masked by unconsolidated talus slope scree. Limonitic/goethitic siltstone float was sampled in the vicinity of the GEOTEM anomaly and returned a maximum of 1200 ppm Cu and 190 ppm Ni. Given the siltstone-sandstone nature of this sample and that it occurred as float near the base of the Heavitree Quartzite escarpment suggests that this sample was from a slightly mineralised horizon/layer within the lower Amadeus Basin sequence. A rock chip sample (5488065) collected from a silicified, limonitic/goethitic Heavitree Quartzite outcrop to the south of the anomaly, did not return any significant results.

6.5.2 Stream Sediment

A total of 301 (5 x -20+40# and 296 x -80#) stream sediment samples were taken and submitted to Amdel Laboratories Limited, Alice Springs. These were assayed for Au, Pt, Pd by fire assay/AAS; Ag, As, Bi, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, P, Pb, U, Th, V, Zn by the ICP OES/MS method; and Ba by the XRF method. Sample ledgers and results are shown in Appendix III while sample locations are shown on Plan NTd 6490. Results for Cu and Ni are displayed on Plans NTd 6491 and NTd 6492 respectively.

The sampling covered the entire MAIC, with detailed sampling over the mafic / ultramafic portion of the complex (237 samples at a density of approx. 12 samples per km²), and semi-detailed sampling over the syenite portion (58 samples at a density of approx. 3.5 samples per km²).

Highest results came from samples taken in creeks which drained directly off the mineralised Braveheart ironstone. Overall results were strongly reflective of lithology with background metal values from creeks draining shonkinite and ultramafics being significantly higher than those draining syenite and gneissic basement. Despite this strong lithological influence, percentile analysis of the assay data revealed a significant coherent 2500 m (E-W) by 700 m (N-S) anomalous zone of Cu and Ni centering ~1 km N of Mt. Doom (central Mt. Doom located ~446620 mE / 7407400 mN). Results in this anomalous zone were generally 2-6 times background levels. This anomalous zone can not be directly attributed to drainage off the Mt. Doom ultramafic body.

Results from samples draining directly off the ironstone show elevated Cu (135-220 ppm c.f. ~50-60 ppm background) with anomalous Pb (~2.5-3.5 times background) while Ni, Fe and Zn are only, at best, slightly elevated. Moving into larger creeks slightly away (as little as 50 m) from the ironstone, samples generally show the opposite effect with only background Cu but elevated Zn (~2 times background) and Fe (2-3 times background). Nickel is highly variable due to influence from ultramafic bodies. This indicates that the dispersion halo for Cu at the Braveheart prospect is small and that elevated Pb may be a useful indicator for Cu mineralisation.

6.5.3 Soil Sampling

6.5.3.1 Orientation

Two orientation / check sample lines were collected over the central pyroxenite bodies (Mt Doom area). Two lines of seven and eleven samples respectively were collected and sieved to -40# and -80# for a total 36 samples (5487713 - 730: -40#; 5487731 -
Assay results for Cu, Ni, and Co were generally similar for both fractions, although the -40# samples did peak marginally for Cu and Ni. Results appear comparable to previous CRAE results from the early 1970's. Weakly anomalous Au contents were recorded in three samples (11, 12 and 45 ppb Au). Full sample ledgers and assay results are shown in Appendix IV. Selected elements are summarised below:

<table>
<thead>
<tr>
<th></th>
<th>Cu (ppm)</th>
<th>Ni (ppm)</th>
<th>Co (ppm)</th>
<th>Cr (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Value</td>
<td>400</td>
<td>440</td>
<td>80</td>
<td>1000</td>
</tr>
<tr>
<td>Ave. Value</td>
<td>95</td>
<td>250</td>
<td>60</td>
<td>550</td>
</tr>
</tbody>
</table>

### 6.5.3.2 Braveheart Prospect

A soil grid, centered on the Braveheart Cu-Ni-Au-bearing ironstone, was established at the prospect. The grid consisted of five 100 m spaced lines (Lines G1-G5) ranging from 250 m - 300 m in length and 25 m sample intervals from which a total of 57 -40# soil samples were taken. Results are given in Appendix IV while locations are shown on Plan NTd 6489. Cross-section graphical representation of the assay results of each soil line plus corresponding geology and ground magnetics are shown on Plans NTd 6519-NTd 6522 and NTd 6533.

Assay results confirm elevated Cu and to a lesser extent Ni contents in the immediate vicinity of the ironstone. An extension of the geochemical anomaly is present 100 m to the W of the ironstone with up to 540 ppm Cu and 195 ppm Ni recorded near pegmatite veining in shonkinite. The Cu anomaly is fairly broad, with assays from 90-540 ppm Cu over 175 m, mainly over equigranular shonkinite with best results of 90-3000 ppm Cu over 100 m at the ironstone. Weakly anomalous Au was recorded in the soils on both lines: up to 26 ppb Au at the ironstone and 5 ppb Au 100 m to the W. Zinc is the only other element of significance, commonly recording >100 ppm (max. 135 ppm Zn), but rarely corresponding with the Cu anomalism.

### 6.5.3.3 Magnetic Anomalies/Contact Zone

Soil sampling and ground magnetometry were completed over selected airborne magnetic anomalies along the SE margin. Ten lines ranging from 175 m - 325 m extend from Arunta basement gneisses into MAIC shonkinite, covering the ‘analytic signal’ magnetic anomalies. A total of 98 -40# soil samples were taken. Results are given in Appendix IV while locations are shown on Plan NTd 6489. Cross-section graphical representation of the assay results of each soil line plus corresponding geology and ground magnetics are shown on Plans NTd 6493 - NTd 6501 and NTd 6518.

Background values for Cu and Ni were both about 45-50 ppm. Six samples recorded results greater than 100 ppm Cu (maximum of 135 ppm corresponding with a large aero-magnetic response at the NW end of line 8). Four samples recorded results 100 ppm Ni or greater (maximum 110 ppm). Maximum results include 3 ppb Au and 310 ppm Zn. A further four of the soil anomalies corresponded to aero-magnetic anomalies (Line 2: samples 5488119 and 5488122; Line 4: sample 5488140; and Line 9: sample 5488089). In addition to these a further 5 soil samples correspond with ground magnetic anomalies. Apparent best matches with subtle Cu and Ni geochemical anomalies and magnetic anomalies occur on soil lines 2, 4, 5, 7 and 8.
6.6 Drilling

Diamond and reverse-circulation percussion (RC) drilling, was carried out by contractors Gorey and Cole Drillers Pty Ltd, Alice Springs, and commenced early June taking approximately four weeks to complete. A total of two diamond and four RC drill holes were completed. Locations of the six drill hole collars are displayed on Plan NTd 6489. Drill hole statistics are summarised below:

Table 1: Drill Hole Statistics

<table>
<thead>
<tr>
<th>Hole No.</th>
<th>TD (m)</th>
<th>AMGE</th>
<th>AMGN</th>
<th>Azimuth (Magn.)</th>
<th>Inclination</th>
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<td>447564</td>
<td>7405432</td>
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<tr>
<td>DD96MD2</td>
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<td>7405457</td>
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<td>-75°</td>
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<tr>
<td>RC96MD2</td>
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<td>7405400</td>
<td>145°</td>
<td>-60°</td>
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<td>7405245</td>
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<td>-60°</td>
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<tr>
<td>RC96MD5</td>
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<td>448184</td>
<td>7406407</td>
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<td>-60°</td>
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6.6.1 Diamond

The first diamond hole, DD96MD1, was sited 25 m NW of the ironstone (see Table 1. and Plan NTd 6414), aimed to intersect the sub-surface extension of the mineralised ironstone at about 30 m depth. The hole intersected varied shonkinite lithologies with numerous pegmatite dykes / veins and terminated at 122.60 m in augen gneisses of the Arunta basement.

Significant sulphide mineralisation, (5-10 %), in the form of pyrrhotite, chalcopyrite and pyrite was intersected from 23 m to 54 m. Full drill hole ledgers and assay results are shown in Appendix V. A cross section with geology, assays and IP results is shown on Plan NTd 6523. Assay results are summarised below:

Table 2: DD96MD1 Assay Results:

<table>
<thead>
<tr>
<th>From (m)</th>
<th>To (m)</th>
<th>Interval (m)</th>
<th>% Cu</th>
<th>ppm Ni</th>
<th>g/t Au</th>
<th>g/t Pt+Pd</th>
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<td>4.38</td>
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<td>0.02</td>
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<td>34.00</td>
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<td>170</td>
<td>&lt;0.01</td>
<td>0.34</td>
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</table>

Including: 1 m at 1.4 % Cu, 0.28 % Ni, 0.1 g/t Au, 0.41 ppm Pt+Pd from 24-25 m
2 m at 0.67 % Cu, 520 ppm Ni, 0.05 g/t Au from 34-36 m

Page... 23
The overall mineralised zone is 30.38 m from 23.62 mbc averaging 0.25 % Cu and 401 ppm Ni (or 23.38 m at 0.31 % Cu and 497 ppm Ni ignoring the barren pegmatite-rich intervals).

The majority of this mineralisation was hosted by a fresh, medium-grained, equigranular shonkinite. This mineralisation does however extend approximately 7 m into a footwall fresh porphyritic shonkinite believed to be the equivalent unit to the magnetite-altered (?) porphyritic shonkinite found at surface (Braveheart ironstone).

Petrographic description of the mineralisation (Appendix IX) noted:

- Sulphides and oxides form aggregates with slightly modified lobate shapes where sulphide mode is low to moderate to blebby; and massive aggregates with cuspatc margins where the sulphide mode is high.

- Chalcopyrite forms anhedral, blebby to elongate grains within pyrite-rich aggregates and as inclusions within pyrite grains. Millerite generally occurs within pyrite aggregates and has well-formed cuspatc to anhedral grains with smooth curved grain boundaries with other phases.

- The shapes of the sulphide aggregates clearly indicate that the sulphides form part of the igneous mineral assemblage.

DD96MD2 was 25 m step-back drill hole (see Table 1 and Plan NTd 6414), aimed to intersect the mineralised zone in hole DD96MD1 at about 50-60 m depth below the surface. The hole intersected a similar assemblage of mixed shonkinite, barren pegmatite and was terminated in basement gneiss at 215.5 m (Plan NTd 6523). Full drillhole ledgers and assay results are shown in Appendix V.

The main sulphide mineralised zone intersected in DD96MD1 extends into DD96MD2, with 33 m from 52 mbc at 0.11 % Cu and 259 ppm Ni. The zone has a similar thickness but a lower grade than the upper intersection primarily due a larger number of barren pegmatite dykes and veins which dilute the grade accordingly. The overall 33 m zone consists of a total 17.2 m of mineralised intervals averaging 0.18 % Cu separated by numerous low grade pegmatite-rich intervals. The best 1 m sample was 0.81 % Cu, 920 ppm Ni and 0.12 ppm Au from 80-81 m. As in hole DD96MD1, the mineralisation is hosted within fresh, medium-grained shonkinite, however, a footwall porphyritic shonkinite appears to be absent.

A second smaller mineralised interval was intersected deeper in the hole at 179.5-184.6 m giving 5.1 m at 0.11 % Cu. Mixed equigranular to poikilitic shonkinite with minor (1 m) weakly porphyritic shonkinite are the hosts to this particular zone of mineralisation.

The main mineralised zone is tabular in shape and dips approximately 55° to the NW. The shonkinite / gneissic basement contact dips at approximately 85° NW near the surface and shallows to about 65-70° at depth.

**6.6.2 RC-Percussion**

Four RC percussion holes were drilled. Two holes, RC96MD2 and 4, were designed to test for any lateral extension to the Braveheart ironstone to the NE and SW, based upon
the strike of the ironstone outcrop (Plan NTd 6414). One hole, RC96MD3, targeted a ground magnetic anomaly 350 m to the SW, along strike from the ironstone (Plan NTd 6414). One hole, RC96MD5, drilled an E-W trending malachite bearing, quartz carbonate breccia vein coincident with an aeromagnetic anomaly (Plan NTd 6489).

Sample results were generally low having only elevated Cu (100-300 ppm average) and Ni (75-200 ppm average) in intervals where sulphides (mainly pyrrhotite) were noted in the percussion chips (background is ~40 ppm Cu and 30-40 ppm Ni). Best results were:

RC96MD2: 5 m at 310 ppm Cu, 105 ppm Ni (0-5 m); in equigranular shonkinite.

RC96MD3: 4 m at 145 ppm Ni (0-4 m); in equigranular shonkinite (0-2 m) and porphyritic shonkinite (2-4 m).
5 m at 100 ppm Cu, 145 ppm Ni (44-49 m); hosted in porphyritic shonkinite.

RC96MD4: 4 m at 620 ppm Cu, 180 ppm Ni (4-8 m); in equigranular shonkinite.
3 m at 240 ppm Cu, 100 ppm Ni (99-102 m); in porphyritic shonkinite.

RC96MD5: 4 m at 0.11 % Cu at 43-47 m; in quartz-carbonate breccia within porphyritic shonkinite (including 1 m at 0.29 % Cu at 43-44 m).

Results for other elements were generally low, however, high Cr and V values (290-440 ppm) were detected in association with the better Cu and Ni results.

6.6.3 Petrophysical Measurements

Ten samples of mineralised and barren core from within the shonkinite and basement gneiss were petrophysically analysed to:

- determine contrasts in various physical parameters,
- directly relate geophysical responses to particular rock types.

The work was conducted by contractor Systems Exploration Pty. Limited during early August 1996.

Measurements of the density, porosity, conductivity (galvanic and EM), IP resistivity and chargeability, magnetic susceptibility and remnant magnetisation were made on the following samples from the two diamond drill holes.

From drill hole DD96MD1

- mineralised porphyritic Shonkinite (48.91-49.05 m)
- unmineralised porphyritic Shonkinite (64.38-64.53 m)
- basement Augen Gneiss (120.30-120.45 m)
- unmineralised poikilitic Shonkinite (65.95-66.10 m)

From drill hole DD96MD2

- unmineralised mixed equigranular and poikilitic Shonkinite (152.69-152.81 m)
- mineralised poikilitic Shonkinite (180.18-180.36 m)
- unmineralised equigranular Shonkinite (100.65-100.82 m)
- moderate-high grade bleb/"clot" form mineralised equigranular shonkinite (73.75-73.93 m)
- very high grade mineralised equigranular shonkinite (80.12-80.27 m)
- moderate grade disseminated and small interstitial bleb-form mineralised equigranular shonkinite with ~15% magnetite (80.90-81.02 m)

Method descriptions and results are presented in Appendix XVI.

The high-grade and disseminated mineralisation (>10% total sulphides intersected around 80 m in DD96MD2) have prominent EM conductivity and galvanic resistivity responses and a noticeably higher apparent density.

Zones of magnetite / pyrrhotite concentration in the same section of mineralisation return susceptibility values of up to 0.38 SI units. Values of between 0 and 0.03 SI units occur in all unmineralised samples.

IP measurements have shown that the mineralised samples display an elevated chargeability of up to five times background level (78 msec = 78 mrad).

The petrophysical study has demonstrated the following points:

- Sufficient contrasts exist that will enable detection of the mineralisation using ground based geophysical methods in this and other locations.

- Magnetic susceptibility, density, conductivity and chargeability are all observed to increase to a recognisably anomalous level in the mineralised samples.

- Scope exists for the use of detailed gravity surveys to define highly mineralised zones, and one or two test lines over prospective areas (i.e. combined anomalies) would verify its usefulness.

6.6.4 Down-Hole IP

Down-hole IP surveys of holes DD96MD1 and DD96 MD2 were carried out to:

- verify and quantify the expected IP response of the mineralisation
- vindicate the use of ground based dipole-dipole IP surveys.

The surveys were conducted by contractor ZERO in late August 1996. Results of the surveys are shown in Appendix XVII.

A dipole-dipole array probe with an a-spacing of 1 m was used for the 282.5 m of down-hole surveys. Transmitter current was set to 1 mA at 0.125 Hz frequency. The holes were logged upwards at 5 m intervals from EOH to the water table at 23 m using both spectral and time-domain measurements.

Spectral IP was used to determine if the mineralisation displayed a frequency dependent chargeability. Plots of the apparent resistivity, phase and metal-factor showed a
response variation coincident with the sulphide zone. A quantitative measure of the IP effect from this data was ambiguous. Results of this survey are being analysed by ZERO as the normal assumption of a half-space model for the interpretation of the spectral response is invalid in the case of a down-hole (full-space model) survey.

Time-domain IP measurements show that the mineralisation which is located between 24 and 55 m in DD96MD1 and 52 and 85 m in DD96MD2, has a peak chargeability value of 140 msec which is a factor of 10 above the background value of 14 msec. The resistivity also drops by a factor of 10 from a background of 1000 ohm-m to a value of ~100 ohm-m in the mineralised section.

Chargeability values in DD96MD2 are less consistent throughout the mineralised zone (cf. DD96MD1) and unexplained negative values occur in some places particularly near the end of the hole. The highest conductive and chargeable anomaly occurs in DD96MD2 at 80 m, corresponding to the zone from which the sample returning the best petrophysical results was taken.

The metal-factor plots clearly distinguish between the mineralised and unmineralised sections and peaks where the assays have returned the best Cu and Ni content.

Down-hole IP surveying has:

- successfully shown that the mineralisation is characterised by elevated chargeability and conductivity effects, each a factor of at least 10 above background values.
- indicated that ground dipole-dipole IP surveying would be an effective technique for the detection of this type of mineralisation.

6.6.5 Gamma and Magnetic Susceptibility Logging

Gamma and magnetic susceptibility logs were collected from holes DD96MD1, DD96MD2 and RC96MD5 to:

- establish radiometric and magnetic characteristics of lithologies / mineralised zone
- assist with the identification of cross-hole geological links.

The work was carried out by CRAE immediately following the drilling program in mid July 1996. Results of the logs are presented as Plans NTd 6528 and NTd 6529.

A total of 448 m of combined log data were collected in the three aforementioned holes using an Auslog DLS2+ digital logging unit equipped with interchangeable gamma and magnetic susceptibility probes. Logging of the three remaining RC holes was not completed as they had collapsed directly beneath the pre-collar casing.

Large spikes in the gamma trace are due to the high potassium content of pegmatite dykes. A subtle increase of 10 cps occurs in the average gamma values beneath the mineralised zone while the basement gneiss has a twofold increase in response (up to 80 cps) compared to the shonkinite.

The magnetic susceptibility values oscillate between 0 and 0.08 SI, but on average the shonkinite has a value of 0.01 SI. When compared with the location of the mineralisation, however, a broad pattern of increased (0.025 SI) associated magnetism
is evident. Magnetic susceptibility is also significantly higher (0.04 SI units) in the augen gneiss.

In general the above geophysical logging methods showed that:

- The gamma response does not directly indicate where the mineralisation occurs however it may assist with determining how the pegmatites link between holes. Other important relationships may become evident with further investigation.

- The magnetic susceptibility results show a correlation between magnetic mineral content (magnetite and/or pyrrhotite) and sulphide enriched zones. This finding would indicate that the large analytic signal anomalies from the airborne data are valid drill targets in their own right.

6.6.6 Drilling Summary

The 1996 drilling programme confirmed the presence of sulphide mineralisation within the mafic portion (shonkinite) of the MAIC. Diamond drill hole DD96MD1 confirmed the extension of the mineralisation seen at surface as a weakly mineralised ironstone. This mineralisation, however, differed from the very magnetite-rich surface expression in that it was represented by small to medium-sized interstitial blebs (probably late magmatic) consisting primarily of pyrrhotite with lesser amounts of chalcopyrite and pyrite. Generally only minor amounts of magnetite were intersected in this mineralised zone.

Step-back hole DD96MD2 confirmed the presence of a continued down-dip extension of this mineralised zone down to a depth of at least 50 m (top) to 85 m (bottom) giving a current down-dip length of this mineralised body of at least 80 m. The average grade of the mineralised zone in hole 2 was lower than in hole 1 (0.11 % Cu versus 0.25 % Cu) but had a slightly wider intersection width (30 m versus 33 m). Recorded grades in both holes, especially in DD96MD2, were diluted due to the presence of cross-cutting barren pegmatite dykes.

Equigranular shonkinite was seen as the preferential host although in the upper levels porphyritic shonkinite was an important footwall host to the mineralisation.

The continuation and very slight thickening of this apparently lenticular-shaped, late magmatic mineralised body from surface to hole DD96MD2 suggests that this body continues further at depth.

Percussion holes RC96MD2 and 4 failed to intersect any significant mineralisation, apart from 5 m at 310 ppm Cu near top of hole 2 and 4 m at 620 ppm Cu and 145 ppm Ni near the top of hole 4, suggesting no major lateral / strike extensions of the mineralisation, at least in the areas drilled by these holes.

Percussion holes RC96MD3 and 5 targeted airborne magnetic anomalies and failed to intersect large volumes of magnetite within the shonkinite. The shonkinite within these holes did, however, contain slightly elevated pyrrhotite contents (trace to 2 % average visual estimation) and therefore may be the cause of these anomalies. Hole RC96MD5 did intersect elevated copper content of 4 m at 0.11 % Cu but this was restricted entirely to a quartz-carbonate breccia (also observed as mineralised at surface) which cross-cut
the shonkinite. This mineralised breccia dips steeply to the NNW (-75-80° - 340°T) generally towards the central zone of the adjacent airborne magnetic anomaly. This suggests that this breccia acted as a conduit which tapped copper-rich fluid originating from a source deeper within the nearby shonkinite and perhaps associated with the magnetic anomaly.

6.7 Gravel Sampling

A total of 15, -2 mm, 20 kg gravel samples were taken to test the licence area for possible diamond bearing diatremes. Processing of these samples, at the CRAE Belmont, Perth laboratory, revealed no micro or macro diamonds (for all samples) or diamond indicator minerals (for the five samples so far processed for Kimberlitic Indicator minerals). Gravel sample co-ordinates and current available results are presented in Table 3. Sample locations are presented on Plan NTd 6515.

Table 3: EL 9371 -2mm Gravel Sample Results (DPO: 81922)

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6.8 Petrography

Two petrographical reports were completed as part of the 1996 work programme. These reports were carried out essentially in order to better understand the geology, component lithologies and formation of the MAIC.

6.8.1 Gole, M. (June, 1996)

This report, by consultant geologist M. Gole, in addition to the above objectives, aimed to assess the MAIC’s potential for Ni mineralisation. The report was based upon brief field observations, inspection of diamond drill core (from the 1975 NTGS drilling programme) five rock chip samples and reviewing several publications and reports. Full petrographical descriptions from this report are shown in Appendix VII.
The main conclusions reached in this report were:

- The MAIC consists of three gradational lithologies; syenite, shonkinite and minor ultramafic rocks; all with well-preserved igneous textures and are related by fractional crystallisation of a K-rich mafic magma.

- The ultramafic bodies within the complex are perhaps rafts (or layers) within the shonkinite rather than intrusive plugs.

- Syenite has intruded the shonkinite and that shonkinite (and therefore syenite) has intruded the ultramafic rocks.

- Igneous textures observed in both hand specimen and polished thin section demonstrate that most of the sulphides contained within the complex's igneous rocks are magmatic in origin.

6.8.2 Pontifex and Associates (June, 1996)

This report was written by A.C. Purvis of Pontifex and Associates Pty. Ltd and was based upon a petrographic study of 10 rock samples (5488217-5488226). Four of these samples were taken from and around the Braveheart ironstone (see Plan NTd 6414), one sample from the syenite part of the MAIC (Sample 5488221) while the remainder were ultramafic rocks taken mainly from the NW area of the shonkinite body (Mt. Doom area), see Plan NTd 6489.

The main conclusions / comments of this report are:

- The studied samples may represent a subvolcanic plutonic system with a parent magma which was quite potassic (shoshonitic to lamprophyric).

- The pooling of magma into subvolcanic magma chambers reduces the diamond prospects.

- Trace copper sulphides occur in the most magnetite-rich rocks, with chalcopyrite and/or bornite largely enclosed in magnetite. This suggests O and S fugacity conditions outside the stability fields of pyrrhotite or pyrite.

6.9 Rehabilitation

IP transmitter electrode pits were rehabilitated on completion of the survey work. Aluminium foil was removed and disposed of at the Alice Springs tip, the pits were back-filled and raked.

All drill sites were rehabilitated at the end of the field season. On completion of drilling, all drill hole collars were capped. At the end of the field season, the caps were replaced by conical concrete plugs. Drill pads were harrowed to aid drainage and regrowth. Sample bags from RC holes were buried at the drill site.

Two drill sumps were left open as they will be required for the 1997 drilling programme. Access tracks were not harrowed as they also will be required for the 1997 field work programmes.
7. REFERENCES


8. KEYWORDS


9. LOCATION

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10. LIST OF DPO'S

81925-81933; 81936-81939, 81941. ie:

Rock Chip/Grab: 81926, 81929
Gravel (diamond) samples: 81932
Stream Sediment: 81927, 81930
Soil: 81925, 81928, 81931
Drilling (diamond): 81937, 81939, 81941
Drilling (percussion (RC)) 81936, 81938
Petrography: 81933.
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<td>EL 9371 MORDOR POUND AIRBORNE GEOPHYSICAL SURVEY URANIUM POTASSIUM RATIO PROFILES</td>
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<td>EL 9371 MORDOR POUND GEOTEM SURVEY FLIGHT PATH SHEET 1 OF 1</td>
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<td>N/Td 6425</td>
<td>EL 9371 MORDOR POUND GEOTEM TOTAL MAGNETIC INTENSITY CONTOURS</td>
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<td>EL 9371 MORDOR POUND GEOTEM X CHANNEL ADI CONTOURS</td>
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<td>N/Td 6427</td>
<td>EL 9371 MORDOR POUND GEOTEM Z CHANNEL ADI CONTOURS</td>
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<td>N/Td 6428</td>
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<td>EL 9371 MORDOR POUND SOIL TRAVERSE LINE G3 GEOLOGY, ASSAYS, MAGNETICS</td>
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<td>EL 9371 MORDOR POUND DDG6MD001 AND DDG6MD002 DRILL SECTION GEOLOGY, Cu-Ni-Au, IP METAL FACTOR</td>
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<td>EL 9371 MORDOR POUND RC96MD002 DRILL SECTION GEOLOGY, Cu Ni Au ASSAYS</td>
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<td>EL 9371 MORDOR POUND RC96MD003 DRILL SECTION GEOLOGY, Cu Ni Au ASSAYS</td>
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