GEOPGKO LIMITED
CENTRAL AUSTRALIA

Annual and Final Report on Exploration
Licence No. 228

Compiled by

B.N. Duck

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Tennant Creek, N.T. August, 1977
ANNUAL AND FINAL REPORT ON EXPLORATION LICENCE NO. 228

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<td>1786</td>
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1. INTRODUCTION

Exploration Licence No. 228 held by Geopeko Limited and
Australian Ores & Minerals Limited, was granted on the
21st May, 1972. Under Section 38B Sub-section (11) of
the Northern Territory Mining Ordinance 1939 - 1972.
The Exploration Licence has been renewed annually.

The area covers 116 square kilometers (44.7 square miles)
and its north eastern corner is situated 62 kms on a
true bearing of 237° from Tennant Creek (See fig. 1.).

Access to the Exploration Licence is via a bitumen road
from Tennant Creek to the Warrego Mine of Peko Mines
Limited, thence 11.5 kms along the Wiso Bore Road, to
a formed dirt track that runs south for approximately
63 kms to Geopeko Limited Rover Camp at the Rover 1
Prospect which lies on the southern boundary of the
Exploration Licence. Lateral access within the Exploration
Licence is via a graded track to the east and west of
the Rover Camp. The track to the east provides an
alternate access route to the Exploration Licence via
either a track from Cabbage Gum Bore or a track from
Kelly Well. Both tracks join at Kelly Well, which is
situated approximately 20kms east of the Exploration
Licence boundary.

This report outlines the exploration activities conducted
by Geopeko Limited on the Exploration Licence for the
It is the fifth statutory Annual Report and as such is
also the Final Report. For details of Exploration Licence
as granted and for previous work - refer details to the
report listed in the Bibliography.

Prior to the area being held as an Authority to Prospect
by Australian Ores & Minerals Limited, an area which
embraces the Exploration Licence was covered by an
aeromagnetic survey by the Bureau of Mineral Resources.
An additional low level aeromagnetic survey was conducted
over the area by Geophysical Resources Development for
Australian Ores and Minerals Limited in 1970-71 while
the area was held by an Authority to Prospect.
The following is a list of Mineral Leases, either granted subject to survey or recommended for granting, within Exploration Licence No. 228.

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<td>1110E</td>
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<td>Rover 16 No. 2</td>
</tr>
</tbody>
</table>

These leases are all held in the name of Geopeko Limited and Australian Ores & Minerals Limited.
3. REGIONAL GEOLOGY

The Exploration Licence is devoid of outcrop. Previous diamond drilling at Rover 1, Rover 4 and Rover 14, in conjunction with information extrapolated from adjacent regional geology has established the stratigraphic succession shown in Table 1 below:

**TABLE 1**

Regional Stratigraphy of Exploration Licence No. 228

<table>
<thead>
<tr>
<th>Era</th>
<th>Period</th>
<th>Rock Unit</th>
<th>Lithology</th>
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<tr>
<td>CAINHOZOIC</td>
<td>Quaternary</td>
<td>Surficial Deposits</td>
<td>Sand, Silt, laterite gravel.</td>
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<tr>
<td></td>
<td>Tertiary</td>
<td>Surficial Deposits</td>
<td>Pisolithic gravel.</td>
</tr>
<tr>
<td>PALAEOZOIC</td>
<td>Middle</td>
<td>Merrina Beds</td>
<td>Siltstone, Sandstone, Dolomite.</td>
</tr>
<tr>
<td>Cambrian</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROTEROZOIC</td>
<td>Lower</td>
<td>Warramunga Groups</td>
<td>Siltstone, Shale and Dolomite and porphyroid.</td>
</tr>
<tr>
<td>Proterozoic</td>
<td></td>
<td></td>
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</table>

Unconformity varies from 60 - 180 metres vertical depth.

The Cambrian is known to extend to the west and south of the Exploration Licence. The sediments are indicative of a shallow sea (dolomite, stromatolites, fossil detritus) with generally calm sedimentation conditions (some individual beds can be correlated over at least 70 km).

The varying thickness and lack of lateral extent of the basal conglomerate unit is indicative of channel filling deposits. Within the Exploration Licence the
unconformity is seen to dip gently to the west suggesting a flat peneplain pre-cambrian surface prior to the deposition of the Merrina Beds.

The extent and depth of the Warramunga Group is unknown, however, it consists of a sequence of very fine clastic sediments some possibly being tuffaceous. The major structures are elongated east-west giving regional cleavage in the same direction, with suggested major faulting.
4. REGIONAL GEOPHYSICS

Geophysical surveys that have been carried out over the area embracing the Exploration Licence consist of two aeromagnetic surveys in 1956 and 1960 by the Bureau of Mineral Resources and one low level aeromagnetic survey by Australian Ores and Minerals Limited in 1970-71.

The most prominent features of the low level aeromagnetic survey is the WNW-ENE magnetic ridge which cuts across the western half of the Exploration Licence. One of the anomalies (Rover 14 Prospect) adjacent to this ridge has been tested by diamond drilling and found to be due to a discrete ironstone body.

The magnetic character over the remainder of the Exploration Licence is featureless except for six magnetic highs in the extreme eastern area of the Exploration Licence.

Two of these (Rover 1 and Rover 4) have been tested by diamond drilling and have been found to be caused by discrete ironstone bodies.

During the field season total force ground magnetic surveys were carried out over grid extension on Rover 6 and Rover 11.

Throughout the year detailed computer analysis of all geophysical data resulted in delineation of drilling targets for Rover 4 Anomaly 2, Rover 11, Rover 12 and Rover 16. Additional targets were also selected for Rover 1 on a combined basis of geological and geophysical interpretation.
5. PROSPECT EVALUATION

5.1 Rover 1

5.1.1 Location

Rover 1 Prospect is situated 68 kms on a true bearing of 235° from Tennant Creek at the intersection of latitude 20° 00' 06" with longitude 133° 39' 08". Access (see fig. 1) is via a formed dirt road to a point 11.3 kms west of the Warrego Mine, thence on a dirt track in a southerly direction for 63 kms.

5.1.2 Summary of Previous Activities

The prospect was covered by five mineral leases (ML 543E to ML 548E inclusive and ML 679E). A grid has been established and a total force magnetic survey conducted over it.

Initial analysis of the magnetic data indicated a target which when subsequently tested by diamond drilling in 1972 gave a negative result. A re-analysis of the geophysical data delineated the presence of two discrete bodies. A succession of drill holes and associated wedge runs has been designed to test these bodies.

5.1.3 Summary of Activities for the Year Ending 21st May, 1976

Rover 1 D.D.H. 7 parent and WRO 1 were drilled early in the year. The parent hole was abandoned at 328 metres because of drilling difficulties and WRO 1 was halted at 201 metres for similar reasons.

Rover 1 D.D.H. 8 and D.D.H. 9 were pre-collared to 102 metres and 76.0 metres respectively. D.D.H. 8 was abandoned at that depth because of excessive caving and D.D.H. 9 was abandoned at 76.0m because of excessive deviation.

All geological logs and associated details are attached as appendices 2 to 7 and figures 3 to 6.

Because of drilling difficulties no major alterations to the interpretation of the causative bodies at
5.2 Rover 4

5.2.1 Location

Rover 4 Prospect is situated 2.2 km on a true bearing of 034° from Rover 1 Camp, at the intersection of latitude 19° 59' 02" longitude 133° 39' 40". Access is from the Warrigo - Rover Camp road.

5.2.2 Summary of Previous Activities

The prospect was covered by four, sixteen hectare leases (ML 6898 to ML 6888 inclusive). A grid was established and reased using an Askania magnetometer. Later, grid extensions were added and the complete grid was rereaded with the elevated sensor total force magnetometer.

5.2.3 Summary of Activities for Year Ending 21st May, 1977

(a) The following grid extensions were surveyed in on the prospect.

<table>
<thead>
<tr>
<th>From</th>
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<tr>
<td>2250mN</td>
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<tr>
<td>2350mN</td>
<td>2500mN</td>
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<tr>
<td>2450mN</td>
<td>2500mN</td>
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</table>

(b) A total force magnetic survey was carried out over these lines and some check measurements were made over existing grid lines.

Analysis of all data pinpointed a drilling target for D.D.K. 1.

(c) Three diamond holes were drilled into the prospect, encountering serious deviation problems, with "lode zone" type material although nothing of economic importance.

Summary logs follow:

Rover 4 Anomaly 1 D.D.K. 1

Collar Co-ordinates: Grid: 2003E 2889.3N
Latitude: 19° 59' 05" Longitude: 133° 39' 40"
Bearing: 015° True
Inclination: -78°
Total Length of hole: 429 metres
Target: 323 metres vertically below 2030E 2973N.
Hole Summary

0.0 - 34.0m No core.
34.0 - 92.3m Siltstones, dololutes.
92.3m Cambrian - Lower Proterozoic unconformity
92.3 - 248.0m Fine grained sediments including tuffs and carbonates
248.0 - 296.4m Hematite-chlorite-jasper-dolomite
296.4 - 330.5m Sediment breccia
330.5 - 336.5m Chloritic sediments
336.5 - 337.9m Chlorite hematite.
337.9 - 348.3m Sediment breccia.
348.3 - 406.1m Chloritic mudstones
406.1 - 418.7m Chlorite quartz porphyry
418.7 - 423.8m Mudstone
423.8 - 429.0m Mudstone and quartz porphyry

Rover 4 Anomaly 1 D.D.H. 2 and WRO 1
Collar Co-ordinates: Grid: 2062E  3104N
Latitude: 19° 56' 57" Longitude 133° 39' 42"
Bearing: 185° True
Inclination: - 39°
Total Length of Hole: D.D.H. 2 Parent 169m
D.D.H. 2 WRO 1 166m
Target: 323 metres vertically below 2030E  2973N

Hole Summary

0.0 - 54.0m No core.
64.0 - 77.0m Siltstones and carbonates (Cambrian)
77.0 - 96.0m No core (Unconformity estimated to be at 95.0m)
96.0 - 169.0m Fine sediments with tuffs and carbonates.

D.D.H. 2 WRO 1 Commenced at 152 metres but was stopped due to excessive deviation.

Rover 4 Anomaly 1 D.D.H. 3
Collar Co-ordinates: Grid 1945.5E  2867.5N
Latitude 19° 59' 04" Longitude 133° 39' 20"
Bearing: 030° True
Inclination: - 78°
Total Length of Hole: 407 metres
Target: 323 metres vertically below 2030E  2973N.
Hole Summary

0.0 - 90.0m  No core
90.0 - 96.0m  Cambrian sediments
96.0m  Cambrian - Lower Proterozoic Unconformity
96.0 - 248.4m  Fine sediments, often hematitic, some
tuffaceous, many with carbonates.
248.4 - 273.7m  Chloritic sediment with chert, jasper
and dolomite.
273.7 - 276.0m  Hematite jasper - quartz
276.0 - 284.2m  Banded mudstones with dolomite.
284.2 - 290.4m  No core
290.4 - 329.2m  Magnetite hematite jasper-dolomite
329.2 - 331.4m  Chloritic sediment breccia.
331.4 - 331.9m  Chlorite magnetite.
331.9 - 374.3m  Chloritic sediments.
374.3 - 377.0m  Veined sediments.
377.0 - 407.0m  Porphyroid, breccia and fine sediment
intermixed.

(d) Only minor chalcopyrite mineralisation occurred within
the "lode zones" encountered.

(e) Appendices 5 to 7 show the detailed logs including
geological, assay, survey and magnetic susceptibility
details.

5.3  Rover 11

5.3.1 Location

Rover 11 Prospect is situated 12 km on a true bearing of
284° from Rover 1 Camp at the intersection of latitude
19° 58' 25" with longitude 133° 32' 33". Access is via
a graded road west from Rover 1. This graded track
passes through the five northern most leases of the
prospect.

5.3.2 Summary of Previous Activities

Fifteen, fifteen hectare mineral leases (ML 1083E to
ML 1088E inclusive and ML 1091E to ML 1099E inclusive)
have been pegged across the established grid. A total
force magnetic survey was conducted over the prospect
on this surveyed grid.
5.3.3 Summary of Activities for the Year Ending 21st May, 1977

Grid extensions were added to the existing grid over which a total force magnetic survey was carried out.

The following lines were pegged:

- 2300mE from 500mN to 1500mN
- 2400mE from 000mN to 1500mN
- 2500mE from 500mN to 1500mN
- 2600mE from 000mN to 1500mN
- 2700mE from 500mN to 1500mN
- 2800mE from 000mN to 1500mN
- 2900mE from 500mN to 1500mN
- 3000mE from 000mN to 1500mN
- 3100mE from 500mN to 1500mN

Detailed analysis of all geophysical data defined a target for drilling. A collar was pegged and a site prepared for drilling to commence.

5.4 Rover 12

5.4.1 Location

Rover 12 prospect is situated 20.5 kms on a true bearing of 084° from Rover 1 prospect, at the intersection of latitude 19° 57' 11" with longitude 133° 28' 00". Access is via the graded track west from Rover 1 then due north 1 km.

5.4.2 Summary of Previous Activities

A surveyed grid was established across the prospect over which nine, sixteen hectare mineral leases (ML 11001 to ML 11080 inclusive) were pegged.

5.4.3 Summary of Activities for the Year Ending 21st May, 1977

A total force geomagnetic survey was conducted over the prospect and detailed analysis defined a target for diamond drilling (See fig. 10)

5.5 Rover 14

5.5.1 Location

Rover 14 Prospect is situated approximately 14 kms on a true bearing of 238° from Rover 1 Camp, at the intersection of latitude 19° 57' 44" and longitude 133° 31' 29".
Access is via a graded track west from Rover Camp.

5.5.2 Summary of Previous Activities

The prospect was gridded, and a total force magnetic survey was conducted over it. Four mineral leases (ML 732E to ML 735E inclusive) were pegged on this grid.

Geophysical analysis lead to diamond drilling of the prospect which revealed a discrete ironstone body in sediments however no significant economic mineralisation was encountered.

No further work has been carried out.

5.6 Rover 16

5.6.1 Location

Rover 16 Prospect is situated approximately 17.5 kms on a true bearing of 287° from Rover 1, at the intersection of latitude 19° 52' 23" with longitude 133° 29' 34". Access is via a graded track to a point approximately 19.5 kms west of Rover 1, thence on a bush track in a northerly direction for approximately 2km.

5.6.2 Summary of Previous Activities

A surveyed grid was established and two, fifteen hectare mineral leases (ML 1109E and ML 1110E) were pegged. A total force magnetic survey was carried out and analysis pinpointed a target for drilling.

No work was carried out in the year ending 21st May, 1977.

5.7 Rover 17 and Rover 18

5.7.1 Location

Two small anomalies were picked out by intense study of the airborne magnetic survey. These were designated as Rovers 17 and 18, however no further work has been undertaken.

The two anomalies lie between Rover 11 and Rover 12.
6. EXPENDITURE

6.1 Actual Expenditure

The total expenditure for the year was $153,650.14. The following is an analysis of this figure:

Diamond Drilling $113,536.49
Assaying $3,676.70
Surveying & Drafting $3,181.35
Leasing $498.60
Geological Services $11,178.98
Geophysical Services $9,606.82
Administration $7,224.00
Unallocated Field Expenses $5,047.10

Total 1976 - 1977 $153,650.14

(a) The various sub-divisions above are costed directly the exceptions being Unallocated Field Expenses and Administration Costs.

(b) Unallocated Field Expenses consist of the following overheads:

Field Messing
Field Vehicle Operations
Workshop Supplies
Field Supplies
Depreciation - Field Plant

(c) Administration Costs are proportioned on the same basis as Unallocated Field Expenses.

(d) In the five years, 1972-1977, the Actual Expenditure was $654,619.00 whereas the Total Commitment for the same period was $368,000.00.
7. THE ENVIRONMENT

Rover Camp

Geopesko Limited have established a semi-permanent camp at the Rover 1 Prospect. It consists of a mobile kitchen and mess, mobile caravan, part of which serves as an office, and a portable 8 man bunkhouse. A shed has been erected to store messing and drilling supplies. An ablution block containing a septic tank, washing machine and hot water service has been installed.

A 15 KVA generator supplies the camp with power. Water is pumped from a water bore to a 500 gallon tank situated on a stand in the central camp area.

A fuel dump for both petrol and diesel has been established approximately one km west of the camp. A large pit 500m south of the fuel dump has been excavated for the purpose of dumping rubbish. This is burnt daily.

Roads and Access Tracks

The main Wiso Bore - Rover Camp road is graded twice a year. Once prior to the wet season, and once after to repair wet season damage. Concurrent with this the Rover Airstrip is graded to clear it of low scrub and spinifex.

Access to the prospects within Exploration Licence No. 228 is via a partially formed graded track that runs from the Rover Camp to 3 kms east of the Point Walkefield Trig. Each prospect is reached by following the initial track from the above main road to the prospect. Application for permission to grade these well defined vehicle tracks and establish several new graded tracks has been submitted to the Mines Branch. Employees working on Exploration Licence No. 228 use only the existing tracks in an effort to minimise the disturbance of the vegetation and ground surface.
BIBLIOGRAPHY


COLVILLE, R.G., 1975 (b) Final Report on Area Relinquished from Exploration Licence No. 228 (August) *Geopeko Limited Company Report (Unpubl.)* Tennant Creek

COLVILLE, R.G., 1975 (c) Geology of Exploration Licence No. 228 (December) *Geopeko Limited Company Report No. 76/1 (Unpubl.)* Tennant Creek, N.T.

DUCK, B.H., 1976 Final Report on Area Relinquished from Exploration Licence No. 228 (July) *Geopeko Limited Company Report (Unpubl.)* Tennant Creek, N.T.


APPENDIX 1

DESCRIPTION OF AREA

ALL THAT piece or parcel of land in the Northern Territory of Australia containing an area of 21.11 square miles more or less, the boundaries of which are described as follows, subject to all applications for mining tenements and excluding therefrom all mining tenements granted or registered and all reserves included within the definition of 'reserve' in Section 7 of the Mining Ordinance.

AREA 'A'

Commencing at the intersection of latitude 19 degrees 57 minutes with longitude 133 degrees 28 minutes thence proceeding to the intersection of latitude 19 degrees 57 minutes with longitude 133 degrees 30 minutes thence proceeding to the intersection of latitude 19 degrees 58 minutes with longitude 133 degrees 30 minutes thence proceeding to the intersection of latitude 19 degrees 58 minutes with longitude 133 degrees 28 minutes thence proceeding to the intersection of latitude 19 degrees 57 minutes with longitude 133 degrees 28 minutes.

AREA 'B'

Commencing at the intersection of latitude 19 degrees 57 minutes with longitude 133 degrees 30 minutes thence proceeding to the intersection of latitude 19 degrees 57 minutes with longitude 133 degrees 35 minutes thence proceeding to the intersection of latitude 20 degrees 00 minutes with longitude 133 degrees 35 minutes thence proceeding to the intersection of latitude 20 degrees 00 minutes with longitude 133 degrees 33 minutes thence proceeding to the intersection of latitude 19 degrees 59 minutes with longitude 133 degrees 33 minutes thence proceeding to the intersection of latitude 19 degrees 59 minutes with longitude 133 degrees 30 minutes thence proceeding to the intersection of latitude 19 degrees 57 minutes with longitude 133 degrees 30 minutes.

AREA 'C'

Commencing at the intersection of latitude 19 degrees 58 minutes with longitude 133 degrees 39 minutes thence proceeding to the intersection of latitude 19 degrees 58 minutes with longitude 133 degrees 40 minutes thence proceeding to the intersection of latitude 20 degrees 00 minutes with longitude 133 degrees 40 minutes thence proceeding to the intersection of latitude 20 degrees 00 minutes with longitude 133 degrees 38 minutes thence proceeding to the intersection of latitude 19 degrees 59 minutes with longitude 133 degrees 38 minutes thence proceeding to the intersection of latitude 19 degrees 59 minutes with longitude 133 degrees 39 minutes thence proceeding to the intersection of latitude 19 degrees 58 minutes with longitude 133 degrees 39 minutes.
PROSPECT/MINE: SURFACE DRILLING

Log of Hole: Rover 1 D.D.H. 7
Location: Rover 1
Purpose of Hole: To test the H2O bodies 30 metres east of D.D.H. 4 Parent intersections.
Proposed By: P. LeMessurier
Proposed Target: E: N: R.L.
Hole Planned By:
Hole Approved By:

Hole Logged By: J. Duck

Collar Co-Ordinates:
  Proposed: 1207 E: 633.5 N: R.L.
  Actual: 1207 E: 633.5 N: R.L. Picked up By:

Collar Bearing:
  Proposed: 010° Grid: Magnetic:
  Surveyed: Grid: Magnetic: Surveyed in By: J. Ward
  Actual: 010° Grid: 005.5° Magnetic: Picked up By:

Collar Inclination:
  Proposed: -80°
  Surveyed:
  Actual: -80° Surveyed in By: J. Ward

Target Depth: 570m m.
Proposed Final Depth: 650m m.
Actual Final Depth: 328m m. Hole Terminated By:
Reason for Termination:

Drilling: Date Commenced: 17.11.76 Date Completed: 4.2.77
Drilled By: Geopekko Limited - Contractors
Wedges Placed At: 144m, 265m, 295m, 317m, WRO 1 commenced 158m.
Remarks:
  Target 500m Vertically Below 1230E 860N
  No Assay Taken

Economic Summary Result:
Hole terminated because after excessive westerly deviation intersection would be made too far west of target towards D.D.H. 4 Parent.
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Rover 1 D.D.H. 7 Parent was cored 40 metres east of D.D.H. 4 Parent and it was designed to have the same plan as D.D.H. 4 Parent.

A strong easterly swing in the azimuth of D.D.H. 7 Parent developed in the flat lying Cambrian sediments, and this was corrected by a Clappison wedge at 144 metres, collar bearing was 010° Grid and at 143 metres was 024.5° Grid. The wedge altered this azimuth to 018.5° Grid at 151 metres.

From the unconformity at 136.2 metres, the hole was seriously affected for the first time by high fracture frequency, and by well developed cleavage sub parallel to the core axis.

Although variable in location and often in effect, dewatering channels are prominent sub parallel to cleavage and core axis, and probably acted as another agent effecting hole deviation.

From approximately 250 metres, cleavage development and dewatering features decrease while bedding becomes more consistent at an angle of 0° to 7° to core axis. Thus it appears that the dominant reason for persistent hole bearing of 355° Grid to 359° Grid is bedding.

Because of the low angle of bedding and the marked deviations of holes 3 Parent and 2 WRO 5, it is anticipated that to drill in the area of D.D.H. 7 target on a bearing outside the envelop 353° - 360° Grid would cause marked deviation in the lower reaches of the hole.

In summation, it appears that a strong easterly swing can be expected in the Cambrian sediments, but this will be counteracted by a strong westerly movement in the upper regions of the Lower Proterozoic rocks where the cleavage is well developed. From approximately 250 metres in Rover 1 D.D.H. 7 Parent, the preferred drilling direction was 355° to 359° Grid.

Although D.D.H. 7 Parent was designed to follow D.D.H. 4 Parent it differed dominantly because of cleavage being better developed and at a flatter angle to the core in the upper zones of the Lower Proterozoic rocks in 7 Parent.
NOTE: Target 500m vertically below 1230 E 860N

GEOPEKO LIMITED
TENNANT CREEK-CENTRAL AUSTRALIA

PLAN OF
ROVER 1 D.D.H. 7

SCALE: 1:250
DATE: 17 2 77
GEOLOGIST: B.H.D.
DRAWN: &H.
T.F. 1829
ROVER 1 DDH 7

GEOLOGICAL LOG

0.0 - 54.0m
No Core

54.0 - 62.5
MASSIVE YELLOW BROWN DOLOMITIC SILTSTONE
Massive dolomitic siltstone with rare fine pale grey bedding. Friable, rare vugs, some clayey zones.

BEDDED DOLOMITIC SILTSTONE
The colour grades from pale yellow brown to grey which is the more dominant and fresher colour. Bedding laminae seen to be cross bedded, slumped, scoured and infilled but generally very thin and uniform.
63.7m Bedding 80°
66.2m Over 10cm bedding changes from 79° to 85°.
68.8m Scour marks in fine laminae infilled by grey massive dolomitic siltstone.
71.7m Bedding 80°
76.3m Bedding 77°

62.5 - 78.3

78.3 - 80.0
MASSIVE DOLOMITE
Massive hard yellow-grey dolomite with some small limonite (?) coated vugs.

80.0 - 83.4
MASSIVE DOLOMITIC MUDSTONE
Grey grading to chocolate brown massive dolomitic mudstone. Upper contact orange (over 4cm) then dark grey with no bedding or banding to 80.5m where yellow and orange bedding (?) contact then yellow brown grading to chocolate brown. dolomitic mudstone. The chocolate brown mudstone contains pale coloured angular and irregular flecs of similar material indicating probable soft sediment deformation. This material then grades back a pale grey similar rock type.

83.4 - 84.3
SPOTTED VUGGY DOLOMITE
Massive dolomite, with pale pink to yellow flecs approximately 2mm diameter. Minor small vugs minor stylolite development.

84.3 - 85.0
HARD JOINTED BROWN DOLOMITIC MUDSTONE
Hard fractured mudstone, with fractures sub parallel to core axis and paralleling bedding.
Slightly dolomitic

85.0 - 90.0
MASSIVE DOLOMITIC MUDSTONE
Minor sub angular vugs (after f & fossils (?) , some clay clots and disturbed zones - bedding generally not apparent.
86.9m Chert nodule.
87.0 - 87.6m Fine banding with fine vugs - probably leaching of the more readily dissolved carbonate.
88.1m Breccia with 3 cm of dark chocolate brown muddy matrix containing angular dolomitic fragments.

90.0 - 91.6m

**CHERT NODULES AND SILICEOUS FOSSILS IN DOLOMITIC MUDSTONE**
Matrix is grey, dolomitic and contains pale brown round to sub rounded chert nodules, and white siliceous fossils.

91.6 - 96.3

**SILICEOUS FOSSILS IN DOLOMITIC MUDSTONE**
As above but with no chert nodules.

96.3 - 97.2

**CHERT NODULE IN DOLOMITIC MUDSTONE**
As for 90.0 - 91.6m - only very rare siliceous fossils.

97.2 - 101.3

**ALGAL DOLOMITE**
Upper zones gradational from above with rare chert nodules, rare fossils grading w into a grey algal dolomite to dolomitic mudstone with development of stylolite structures.

101.3 - 103.6

**VUGGY GREY ALGAL DOLOMITE**
Algal dolomite as above with less terrigenous material. Irregular vugs well developed from solution cavities.

103.6 - 105.9

**MASSIVE GREEN - GREY DOLOMITE MUDSTONE**
Massive fine dolomitic mudstone - minor bedding (78° at 105.4m)

105.9 - 107.3

**MASSIVE CHOCOLATE BROWN DOLOMITE MUDSTONE**
Massive mudstone with banding and flow features.

107.3 - 112.6

**COARSE SANDSTONE**
Fine to coarse sandstone with some conglomeratic bands. Cement is dolomitic but only minor, matrix is fine sand and sometimes is minimal leaving coarse sand layers with no matrix or cement. Some matrix (109.0 - 109.2) is chocolate brown mudstone.

112.6 - 113.5

**PALE DOLOMITIC FINE SANDSTONE**
Pale brown grey massive fine sandstone with minor dolomitic cement, minor coarse sand.

113.5 - 114.0

**BANDED, STAINED DOLOMITE MUDSTONE**
Bands often brecciated and dislocated, staining of red brown limonite - hematite.
E.O.H. 114.0m

ROVER 1 DDH 7 PARENT RECOMMENDED AT 92.4m

2.4 - 94.0

**SILICEOUS FOSSILS IN DOLOMITIC MUDSTONE**
As for 91.6 - 96.3m above.

94.0 - 94.9

**CHERT NODULES IN DOLOMITIC MUDSTONE**
As for 96.3 - 97.2 above.

94.9 - 99.0

**ALGAL DOLOMITE**
As for 97.2 - 101.3m above. Gradational top is the same.
GEODETICAL LOG

99.0 - 101.1  VUGGY GREY ALGAL DOLOMITE
             As for 101.3 - 103.6m above.

101.1 - 103.5 MASSIVE GREEN-GREY DOLOMITIC MUDSTONE
             As for 103.6 - 105.9m Above.

103.5 - 105.0 MASSIVE CHOCOLATE BROWN DOLOMITIC MUDSTONE
             As for 105.9 - 107.3m Above

105.0 - 110.3 COARSE SANDSTONE
             As for 107.3 - 112.6m Above

110.3 - 111.2 PALE DOLOMITIC FINE SANDSTONE
             As for 112.6 - 113.5m Above

111.2 - 112.1 BANDED DOLOMITIC MUDSTONE
             As for 113.5 - 114.0 Above. Banding consists of red brown
             mudstone and pale, stained dolomite, Minor vughs

112.1 - 117.0 CHOCOLATE BROWN DOLOMITIC MUDSTONE
             Massive chocolate brown mudstone minor pale coloured flecs,
             and signs of disturbance. Upper contact grades from pale grey.

117.0 - 136.2 COARSE SANDSTONE AND CONGLOMERATE
             Conglomerate pebbles up to 6cm long and consisting of chert,
             coarse granite and sandstone; minor dolomitic cement. Some
             zones porous where no cement or fine sand matrix. Clay zones
             show signs of mobility and soft sediment disturbance.

B.D. / C.W.  25.5.77
ROVER 1 D.D.H. 7 PARENT
GEOLOGICAL LOG: By: B. Duck

METRES
136.2 Cambrian - Lower Proterozoic Unconformity

136.2 - 136.7 PURPLE GREY DISORIENTED SHALE
This zone appears to be part of the weathering effect of
the unconformity - the mudstone is the same as that below
but it has been fractured and disoriented. The fragments
are irregularly shaped, although angular, and recemented by
fine grains of the same material.

136.7 - 137.1 PURPLE GREY SHALE
Same material as above - undisturbed.
Fractured at 10° to the core axis - possibly cleavage.

137.1 - 142.1 HIGHLY FRACTURED GREY SHALE
Fracturing is generally along and across the well developed
cleavage which is sub parallel to the core. Maximum core
length is 11 cm.
Dewatering features are seen throughout - as pale yellow-grey
channelways along cleavage as at 138.4 metres and 141.0 metres
and as yellow brown bleached zones with darker brown staining
as at approximately 139.5 - 139.6 metres (depths uncertain
due to core loss).
138.4m Cleavage at 9°.
138.7m Cleavage at 10°, bedding at 53°, bedding appears to
be against cleavage with strike differences of 85°.
140.6m Joint parallel to core axis.
Recovery: 136.2 - 142.1m 71% Fractures per metre 59.5

142.1 - 144.0m RED BROWN AND GREY SHALE
Massive shales as above with increased red brown discoloration
from dewatering. At 142.6 metres pillow like structures
(5cm x 2cm) elongated to show fluid movement.
Recovery 100%
Fractures per metre 20

144.0 - 148.0 No core recovery - wedge emplaced.

148.0 - 151.0 GREY/GREEN MUDSTONE/SHALE
Banded mudstone/shale similar to that above. The banding is
similar in colour and grain size to the very fine dewatering
zones following cleavage above. A medium - coarse sand bed
occurs at 148.3 metres and at 11° to the core axis. Younging
is clearly towards the collar.
148.5m Banding of yellow brown in the normal grey green at 45°
towards the core axis.
149.5m Cleavage parallel to the core. Parting is common parallel to the core axis, throughout this zone.
150.2m Banding is above at 20° to the core axis.
Recovery 100% Fractures per metre 24.7

151.0 - 155.3
QUARTS AND CHERTY ZONE
White quartz is generally massive and contains very fine grained chloritic sediment fragments and veins with minor patchy dark red carbonate. The cherty material is possibly fine tuff but no clear indication is visible in hand specimen; the chert is pink massive, hard, often finely fractured and irregularly veined by quartz and darker red-brown dewatering channels.
151.0 - 151.35m Quartz as above. Lower contact has open vugs in the quartz - lined with fine calcite rhombs.
151.35 - 152.8m Very fine mudstone as for 148.0 - 151.0m with irregular banding of the fine yellow brown dewatering zones. This unit highly fractured.
At 152.7m is a bed of silicified mudstone intruded by a dark red material. Injection by this material has disrupted the silicious bed and clearly indicates upward flow towards the collar.
152.8 - 155.3m Very fine cherty zone as above - possibly tuffaceous. Lower contact at 28° to the core axis. From 154.8 - 155.0m Quartz as above is intermixed with the pink cherty material. Some dark green chloritic sediment also intermixed.
Recovery 151.35 - 152.8 = 69% Fractures per metre 151.35 -
Remainder 100% 152.8m = 68.0/m
Remainder 21.8/m

155.3 - 158.2
GREY GREEN FINE MUDSTONE/SHALE
As above with fane local zoning and gradation in colour from pale yellow brown to the darker green grey. These are effects of dewatering and mobility of solutions.
155.8 - 156.0m Dark red coarse silicious band - The coarsest "fragments" are pale pink and angular. Unit is probably tuffaceous.
156.2 - 156.4m Pink cherty "fragment" - similar material as for 152.8 - 155.3m. The "fragment" is contorted with exterior contacts showing chloritic development and partial resorption whereas internal fractures are sharp and angular with dark chlorite veining and dark red clastic material
similar to that in 155.8 - 156.0m. Recovery 100% Fractures per metre 24.2/m

158.2 - 190.0

DARK GREY VERY FINE PHYLLITIC SHALE

Dark grey massive very fine phyllitic shale. Some thin disturbed beds throughout. These are dark red and coarse carbonates or pale green and coarse. Both types of beds are disturbed by dewatering channels and by minor movement along cleavage planes which are sub parallel to the core. Many of the coarse chloritic beds have acted as nuclei for bleaching and chloritisation of the dark grey sediment. Throughout the unit are fine pale green flecks which are elongated sub parallel to the core axis and are zones of bleaching about a nucleus as mentioned above for the bedding.

All of the bedding mentioned below, as such, is disturbed, often showing local folding.

Throughout the unit, very fine mica (probably sericite) occurs giving the rock a variable pearly lustre as the core is rotated. Kink banding often occurs.

158.6m Bedding 12°. Also chloritised zones, elongated parallel to core axis.

159.2m Bed (coarse pink carbonate) at 15° to core axis. Very fine mica (sericite ?) gives poorly lustre to whole rock

162.8 - 163.0m Highly fractured zone.

163.7 - 164.0m Highly fractured zone.

165.6m Bedding 28°, cleavage 12°, Bedding against cleavage, strikes similar,

168.0m 2cm quartz, dark pink carbonate and chlorite vein at 10° to core axis.

170.7m Chloritic bed, highly disturbed, but at estimated 34° to the core axis.

174.7m Bifurcating quartz and pink carbonate veins (from dewatering) at 27° to the core axis.

176.5m Minor bed, or dewatering channel tightly folded by further action of rising fluids.

179.7m Bedding at 10° against cleavage at 6°. Minor kink bands.

182.2m Fine chloritic bed with bleached contacts at 25° to core axis.

182.9m Cleavage at 5° to core axis.

186.9m Chloritic bed at 23° to core axis.
ROVER 1 D.D.H. 7 PARENT

GEOLOGICAL LOG

METRES

188.0m Fine beds at 20° to core axis.
188.7m Fine beds at 33° to core axis.

Recovery 100%  Fractures per metre 9.8

190.0 - 193.0m No core is recovered - wedge run.
193.0 - 238.0m DARK GREY VERY FINE PHYLITIC SHALE

Same material as for 158.2 - 190.0m with thin pink carbonate beds, pink carbonate veining, dark and light green chlorite veining from dewatering and dark green chlorite in beds effected by the rising dewatering fluids (such beds have a bleached pale yellow brown aureole about them).

194.2m Thin carbonate vein (?) at 73° to core axis.
195.7m Highly contorted carbonate and chloritic bed.

196.3m White quartz-carbonate band - "vein" at 78° to core axis.

197.3m White quartz carbonate "vein".

199.2m Pink carbonate and chlorite in disturbed bed at 32° to the core axis. Disturbance is minor but sub parallel to the core axis.

200.7m Thick (1.5cm) carbonate and chlorite bed thoroughly disrupted by passage of fluids - direction of movement appears to be away from collar. Rounding is towards collar and tailing effects are towards bottom of hole.

201.8m Cleavage parallel to core.

202.7m Carbonate and chlorite in vein filling cleavage plane parallel to the core.

204.1m Bedding 55°
205.5m Bedding (?) 75°

210.5m Cleavage 6° to core axis (well developed)

213.0m Chlorite carbonate band at 61°

214.9m Quartz carbonate chlorite bed cut by bright green epidote (?) as from dewatering channel.

218.2m Pale brown with light chlorite - at 25° to core axis.

220.8m 2cm vein of chlorite with dark carbonate at 36° to the core axis.

222.0m Cleavage at 3°

223.8m Pink carbonate vein at 58°

226.8m Carbonate vein at 51° and with bedding at 15°. Bedding against cleavage at 10°. All strikes similar. Assuming the the flattest cleavage bedding dips 85° to bearing 170°.

228.2m Bedding 30°. Cleavage estimated sub parallel to core axis.

234.0m Cleavage parallel to core axis.
METRES

234.9m Dark green chlorite band with light pale green brown "selvedge" edges. Band at 23° to the core axis.

236.4 - 237.0m Banding of pink, green and brown colouring - variable - at 20° to core axis. One band of green and white carbonate (1.5cm thick) broken but rounded parallel to other banding. Carbonate - Chlorite surrounded by thin edge of dark green chlorite.

237.8 - 238.0m Gradational contact with that below. The sediments of above are clearly intruded by the pinker material of below.

Recovery 100%

Fractures per metre 9.0

238.0 - 242.7

ALTERED FINE SEDIMENT

This occurs as a medium brown coloured sediment with a grain size similar to those above but it appears to have been a sediment (as above) which has been completely replaced by rising fluids. Throughout are small zones composed of dark red reactive carbonate often associated with minor chlorite. These appear to have been beds (as at 239.1m) which have been generally total disturbed and mobilised from original placement.

The rock in general is massive, uniform and does not show cleavage although any "streaming" is at approximately 15° to the core axis.

Recovery 100%

Fractures per metre 12.1

242.7 - 245.9m

GREY GREEN FINE SEDIMENT

Similar to the sediment above, but with minor red carbonate zones, cleavage developed at approximately 10° to the core axis, and with irregular veining and intrusion by pale brown dewatering fluids. Well fractured.

Recovery 84.4%

Fractures per metre 34.8

245.9 - 248.9

ALTERED FINE SEDIMENT

Pale brown fine sediment as for 238.0 - 242.7m with estimated 5% pink carbonate and remnant beds (or possibly coarse veining) and disturbed zones. These carbonates usually have rounded edges marked with a thin zone of chlorite - and very similar to some of the chlorite and carbonate zones of Rover 4 (e.g. D.D.H. 3 219.6m). The lower contact is sharp and at an angle of 35° to the core axis. This contact appears to mark a coarser bed in the original fine sediment. One cm before the contact is an area of approximately one cm diameter which has not been replaced.
Below the contact (i.e. away from the collar) chlorite content can be seen to decrease over a distance of 15 cm, such that it appears that the rising fluids that have "bleached" the sediments first of all chloritize then.

Recovery 100%
Fractures per metre 11.0

248.9 - 270.4
DARK GREY VERY FINE PHYLLITIC SHALE
As for 193.0 - 238.0m. Dark grey very fine shale with thin bedding difficult to see in core but often enhanced by rising fluids from dewatering processes. Carbonates - pink and white - usually as coarsely crystalline veins cut the core at a high angle, with a thickness 0.2 - 1.0 cm thick, always regular but occasionally broken with rounded edges (as in Rover 4 D.D.H. 2, 101.0m).

252.8m Thin bedding (unaltered) at 27° to the core axis, 2mm vein of carbonate at 60° to core axis and with the bedding, strikes similar.

256.4m Bedding replaced by zone (1.5cm wide) of pale brown "bleaching" at 51° to the core.

258.2m Unaltered bedding at 40° to the core.

258.9m Chlorite "vein" surrounded (both sides) by pale brown discouloration - apparently an undulating thin bed replaced - at 40° to core.

260.5m Cleavage at 3° to the core axis.

260.8m Thin unaltered bedding at 90° to the core, bleached zone at 38° to the core axis.

264.8m Thin bifurcating carbonate veins at 65° to the core cut by a later carbonate chlorite vein (1cm thick) at 14° to the core axis.

No Core 265.0 - 268.0m Wedge run.

269.8m Carbonate vein at 40° to core axis.

Recovery: Except for wedge run 100%
Fractures per metre 6.1

270.4 - 274.6m ALTERED FINE AND MEDIUM SEDIMENT
A zone similar to those above where the "normal" sediments have been bleached, there are pink carbonate "beds" or probably veins. From 271.8 to 272.6m is a massive medium grained fine sediment which has been completely altered to a pale brown colour. Contact at 272.6 is sharp and partially parallel to the core axis. Younging in this material appears to be towards the collar.
Recovery 100%

From 272.6m the sediment is very fine, chloritic and show streaming sub parallel to the core axis.

**274.6 - 328.0**

DARK GREY VERY FINE PHYLLITIC SHALE

As for 193.0 - 238.0m

Cleavage poorly developed but still sub parallel to the core axis. Minor low grade development of very fine mica.

277.0m Chloritised thin beds at 50° to core.

279.6m "Bleached" bedding at 80° to core axis.

280.4m Bedding (Bleached) at 85° to core axis.

283.3m Thick chlorite "veining", some "bleaching" on outer boundaries - probably a replaced bed - now m undulating but generally at 15°.

287.2m 2cm thick quartz, chlorite, carbonate.

287.3m Undulose banding of very fine mica (sericite) giving variable pearly lustre of rock.

289.0m Thin Bed (?) of carbonate at 5° to the core axis. Side closest to collar consists of 1.5cm of very fine grey green "bleached" zone.

291.8m Bedding 5°

**No Core** 295.0 - 298.0m (Wedge)

299.0m 2cm chlorite band at 8° to core axis.

303.4m Bedding at 7°.

310.9 - 311.5m Bedding at 1° to core axis.

314.3m Bedding 5°.

315.2m Cleavage faint but sub parallel to core axis.

315.3 - 316.2m Bedding undulating parallel to core.

**No Core** 317.0 - 319.0m (Wedge)

319.0 - 319.3m Quartz with pink carbonate, dark green and pale green chlorite?.

320.0 - 322.8m Sediment as above but with increased fracturing sub parallel to the core and with minor "bleached" zones due to dewatering.

325.0 - 328.0m Considerable chlorite bands at 12° to the core axis, cutting the dark grey brown very fine sediment.

Recovery: 100% apart from wedges

Fractures per metre: 7.7

WRO 1 commenced 158.0m

E.O.H. 328.0m

B.D./C.W. 4.3.77
GEOPEKO LIMITED
TENNANT CREEK
Northern Territory

PROSPECT/MINE: ROVER 1 SURFACE DRILLING
Log of Hole: ROVER 1 D.D.H. 7 WRO 1
Location: ROVER 1
Purpose of Hole: TO TEST THE H2O BODIES AFTER THE FAILURE OF DDH 7 PARENT
Proposed By: B. DUCK Date:
Proposed Target:
Hole Planned By: Date:
Hole Approved By:
Hole Logged By: NOT LOGGED

Collar Co-Ordinates:
Proposed 1207 E:633.5 N: R.L.
Surveyed: E: N: R.L. Surveyed in By: J. WARD Date: 13.4.76
Actual: 1207 E:633.5 N: R.L. Picked up By:

Collar Bearing:
Proposed: 010° Grid: Magnetic:
Surveyed: Grid: Magnetic:
Actual: 010° Grid: Magnetic:

Collar Inclination:
Proposed: - 80° Surveyed in By: J. WARD
Surveyed:
Picked up By:
Actual: - 80°

Target Depth: 570 m.
Proposed Final Depth: 650 m.
Actual Final Depth: 201 m. Hole Terminated By: B. DUCK
Reason for Termination:
Drilling: Date Commenced:
Drilled By: GEOPEKO LIMITED CONTRACTORS
Wedges Placed At: DDH 7 WRO 1 COMMENCED 153M WEDGES AT 184m, 190m
Remarks:
HOLE ABANDONED BECAUSE OF EXCESSIVE INVERSION DEVIATION.

Economic Summary Result:

*NOT LOGGED - SAME DETAILS AS DDH 7 PARENT*
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<tr>
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<th>Dip</th>
<th>Bearing</th>
<th>Remarks</th>
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<tbody>
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<td>172m</td>
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<td>79.0</td>
<td>010.5</td>
<td>WRO commenced @ 158m down parent hole.</td>
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<tr>
<td>8.2.77</td>
<td>184m</td>
<td>Photo</td>
<td>80.0</td>
<td>005.0</td>
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<tr>
<td>14.2.77</td>
<td>200m</td>
<td>Photo</td>
<td>82.0</td>
<td>357.0</td>
<td>Hole abandoned @ 200 metres.</td>
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PROSPECT/MINE: ROVER 1 D.D.H. 8 SURFACE DRILLING

Log of Hole: ROVER 1 D.D.H. 8

Location: ROVER FIELD

Purpose of Hole:

Proposed By: L. FARRAR Date:
Proposed Target: 1235 E: 860 N: 500 R.L.
Hole Planned By: Date: Checked:
Hole Approved By:
Hole Logged By: G.J. BUJTOR

Collar Co-Ordinates:

Proposed: 1223 E: 631.5 N: R.L.
Surveyed: 1223 E: 631.5 N: R.L. Surveyed in By: G.J. BUJTOR Date: 14.4.77
Actual: 1223 E: 631.5 N: R.L. Picked up By:

Collar Bearing:

Proposed: 010° Grid: Magnetic:
Surveyed: Grid: Magnetic: Surveyed in By: G.J. BUJTOR
Actual: 010° Grid: Magnetic: Picked up By:

Collar Inclination:

Proposed: - 80°
Surveyed: Surveyed in By: G.J. BUJTOR
Actual: - 80° Picked up By:

Target Depth: 580° m.
Proposed Final Depth: 625° m.
Actual Final Depth: 102 m.

Hole Terminated By:

Reason for Termination:

Drilling: Date Commenced: 22.4.77 Date Completed: 25.4.77
Drilled By: ROCKDRILL CONTRACTORS
Wedges Placed At:
Remarks:

Hole abandoned at 102m due to excessive cave in. Target 500m vertically below 1235E 860N.
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<tr>
<td>24.4.77</td>
<td>100m</td>
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<td>-84°</td>
<td>-84°</td>
<td>31.5°</td>
<td>36.0°</td>
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</table>

Hole caved; depth most probably around 80 metres.
Hole abandoned at 102 metres.
ROVER 1 DDH 8

GEOLOGICAL LOG:

METRES

0.0 - 2.0

Unconsolidated sand, bulldust with minor grey dolomite

2.0 - 4.0

Very minor dolomite. Predominantly, partly consolidated coarse sandstone - some heavily hematite stained. Possible small siliceous quartz fragments - veins?

4.0 - 6.0

Coarse grained sandstone (pebble sandstone) with some fragments (pebbles) up to 4mm across. Calcite/dolomite veins are common.

6.0 - 8.0

Unconsolidated sand/sandstone with minor dolomite fragments and calcite/dolomite veins.

8.0 - 10.0

Unconsolidated sand.

10.0 - 12.0

Unconsolidated sand, minor sandstone, minor dolomite fragments.

12.0 - 14.0

Cream to light coloured dolomite.

14.0 - 16.0

Cream to light yellow coloured siltstone - clay with minor sandstone and dolomite.

16.0 - 18.0m

Sandstone/siltstone - somewhat similar to that from 14.0 - 16.0m.

18.0 - 20.0

Clay/siltstone.

20.0 - 22.0m

Claystone - siltstone with minor dolomite. Laminations present.

22.0 - 24.0

Siltstone minor dolomitic siltstone.

24.0 - 26.0

Coarse siltstone/sandstone.

26.0 - 28.0

Coarse siltstone/sandstone. Greyish - creamish in colour.

28.0 - 30.0m

Siltstone/sandstone.

30.0 - 32.0

Reddish coloured coarse grained sandstone.

32.0 - 34.0m

Greyish - cream siltstone with minor reddish coarser grained sandstone?

34.0 - 36.0

Cream and reddish brown (oxidised and iron stained) siltstones/fine sandstone.

36.0 - 38.0

Same as above.

38.0 - 40.0

Coarse cream to white coloured sandstone with numerous quartz - chalcedony/chert fragments. Appears to be somewhat coarser grained than that from 32.0 - 38.0m.

40.0 - 42.0

Cream to white coloured sandstone with parts highly oxidised (orange - reddish brown in colour). Numerous quartz/chert - chalcedony bands are present. Some of the sandstone is somewhat porous with open cavities and high water flow.
Dark reddish brown, highly oxidised and iron stained sandstone/coarse siltstone with abundant quartz/chalcedony/cherth bands and pockets.

Similar to that above, i.e. 42.0 - 44.0m. Oxidised reddish - brown and yellow.


Cream to white and yellowish shales.

Yellow - brown coloured shales/fine siltstones with some fragments of cream coloured sandstone.

Light yellowish brown coarse siltstone and sandstone. Some reddish oxidised zones.

Fine shales/siltstones with some coarser siltstone/sandstone fragments.

Light yellow - brown siltstones.

Yellow - brown siltstone.

Ironstained and oxidised yellow - brown and grey coarse siltstone grading into fine sandstone.

Siltstones similar to that from 60.0 to 62.0m. Some minor shale fragments.

Orange - brown siltstone and abundant fragments of steel greysiltstone.

Steel grey coloured siltstones.

Steel grey well bedded/laminated siltstones.

Steel grey siltstones.

As above.

As above. Water changed colour at 76.75m - different rock type?

As above. Some possible quartz/cherth fragments.

Steel grey siltstones and brown-bone coloured dolomite with some cavities and possibly silicified in parts.

Chocolate brown - deep red coloured siltstones/shales which appears to be partly dolomitic.

Grey brown to bone coloured dolomite with minor quartz fragments. Some of the dolomite appears to be partly porous.

Dolomite - dolomitic siltstone, and quartz-chalcedony (probably silicified dolomites). Caved material mixed with sample.

Dolomitic siltstones grading into dolomites. Light grey -brown in colour, Siltstone.
ROVER 1 DDH 8
GEOLOGICAL LOG
METRES

88.0 - 90.0  Caved material mixed with sample.
            Light grey-brown dolomite/dolomitic siltstone with some bedding present.

90.0 - 92.0  Brown - bone coloured dolomite with numerous calcite veins.

92.0 - 94.0  Dolomite as above.

94.0 - 96.0  Dominantly dolomite with some dolomitic siltstones.

96.0 - 98.0  Dolomitic siltstones and dolomites, the former dominant.

98.0 - 100.0 Grey dolomitic siltstones.

100.0 - 102.0 Grey dolomitic siltstones.

Hole abandoned at 102m due to cave in.

E.O.H.  102 metres

SUMMARY LOG

0.0 - 12.0m  Unconsolidated sand.

12.0 - 65.0m Cream to white and yellow brown siltstones and claystones in places grading into sandstones or coarse siltstones. Minor quartz-chert-chalcedony bands.

65.0 - 79.0m Steel grey, well laminated siltstones.

79.0 - 90.0m Grey-brown dolomite and dolomitic siltstone.

90.0 - 96.0m Brown to bone coloured dolomite.

96.0 - 102.0m Grey dolomitic siltstones.

G.J.B./C.W.  9.5.77
PROSPECT/MINE: SURFACE DRILLING

Log of Hole: ROVER 1 DDH 9

Location: ROVER FIELD: ROVER 1 LEASES

Purpose of Hole: TO TEST PARADIGM MODEL

Proposed By: L. FARRAR
Proposed Target: 
Hole Planned By: 
Hole Approved By: 
Hole Logged By: G. J. BUJTOR

Collar Co-Ordinates:

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Surveyed in By: G. BUJTOR Date: 22.4.77
Picked up By: 

Collar Bearing:

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Surveyed in By: G. J. BUJTOR
Picked up By:

Collar Inclination:

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Surveyed in By: G. J. BUJTOR
Picked up By:

Target Depth: 680 m
Proposed Final Depth: 700 m
Actual Final Depth: 76.0 m

Hole Terminated By:

Reason for Termination:

Drilling:- Date Commenced: 27.4.77 Date Completed: 28.4.77
Drilled By: ROCKDRILL CONTRACTORS
Wedges Placed At:
Remarks: Hole abandoned at 76.0 m due to excessive deviation in bearing and dip. Target 550 m vertically below 1000E/875N.

Economic Summary Result:

S.M.C. 11927/1073
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<td>-85.75°</td>
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</table>
GEOLOGICAL LOG: BY: G.J. BUJTOR

METRES

0.0 - 64.0
No recovery or sample taken. Roller-bit drilling.

64.0 - 66.0
Light brown to yellow siltstones.

66.0 - 68.0
Light brown to yellow siltstones and some steel grey
dolomitic? siltstones.

68.0 - 70.0
Steel grey, well bedded siltstones or shales. Not
noticeably dolomitic.

70.0 - 72.0
As above

72.0 - 74.0
As above

74.0 - 76.0
As above.

E.O.H. 76.0 metres.
Hole abandoned at 76.0m due excessive deviation in
bearing and dip.

G.J.B./C.W. 10.5.77
PROSPECT/MINE: ROVER 4 DDH 1
Log of Hole: DDH 1
Location: 2 MILES NORTH OF ROVER 1 BASE CAMP - ON ROAD TO WARREGO
Purpose of Hole: TO TEST MAGNETIC ANOMALY

Proposed By: L. F. Farrar Date: 7.7.76
Proposed Target: E: N: R.L.
Hole Planned By: Date: Checked:
Hole Approved By:
Hole Logged By: B. Duck

Collar Co-Ordinates:
Proposed: 2003 E 2869.5 N: R.L.
Surveyed: E: N: R.L. Surveyed in By: G. Bujtor Date: 8.7.76
Actual: 2003 E 2869.5 N: R.L.
            Checked By: J. Ackland
              Picked up By:
Collar Bearing:
Proposed: 015° Grid: Magnetic:
Surveyed: Grid: Magnetic:
Actual: 015° Grid: 010.5° Magnetic:
          Picked up By:
Collar Inclination:
Proposed: -78° Surveyed in By: G. Bujtor
Surveyed: Surveyed in By: G. Bujtor
Actual: Actual: -78° Picked up By:

Target Depth: m.
Proposed Final Depth: 400 m.
Actual Final Depth: 429 m.
Hole Terminated By:

Reason for Termination:

Drilling: Date Commenced: 9.7.76 Date Completed: 18.8.76
Drilled By: Contract Drilling - Geopeko Limited
Wedges Placed At: 202m, 212m, 243m

Remarks: Target Co-ord 323m vertically below 297N 2030E

Summary Result
Jasper-dolomite lode type rocks 248.2 - 295.5m
Chlorite hematite minor sulphides 295.7-296.4m and
336.6 - 337.9m
Sediment breccia (as in Gecko 296.4-330.5m and 337.9 - 348.3m
Significant Assays 1.36% Cu 248 - 249m 1.24%Cu 273 - 274m
2.20% Cu 253 - 254m 1.10% Cu 275 - 276m
1.53% Cu 266 - 269m 4.3 g/t Au322 - 325
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ROVER 4 DDH 1

Geological Log

By: B. Duck

No Core

0 - 34.0m

OLIVE BROWN CLAY

Part of the weathering profile, minor silt, some sand size fragments. Some manganese staining in the fractures of the fatty clay.

Recovery 75%

34.0 - 38.8m

FINE CLAY CONGLOMERATE

Particles are up to 1cm diameter, and appear to be of similar composition as the matrix which is a hard fatty clay with minor orange-brown iron staining. Large nodules (up to 5cm diameter) of red brown earthy hematite throughout. Lower contact undulating at 40° to the core axis.

Recovery 100%

38.8 - 39.6m

RED BROWN MOTTLED WHITE SILTY CLAY

Mottling is red brown hematite, the finer mottles appear angular and brecciated whereas the larger ones, in excess of 10cm are rounded.

This zone appears to be the lower mottled/pallid zone of a lateritic profile.

42.0 - 42.5m Massive red brown hematite with fine clay in the many hairline fractures throughout.

Recovery 100%

39.6 - 47.4m

BEDDED PALE YELLOW SILTSTONE

Yellow and white bands mark the bedding generally, dominantly silty with some clay, no apparent carbonate, some fine white micas. Fine vugs with brown staining indicating possible pyrite?. Considerable minor flame structures, possible dewatering effects, but in both directions (up & down) from bedding plane.

51.5m So 74°

Between 49.5m & 56.0m 1.7m of core lost.

Bedding decreases towards base of unit, which becomes a white and pale brown clayey siltstone.

Recovery 82%

47.4 - 68.2m

CHERT

This band is only seen as rounded fragments of grey and brown chert. Rounding caused by drill rig.

68.2 - 68.3m

MASSIVE YELLOW AND GREY CALCILUTITE

Fine clayey siltstone with minor carbonate.

Recovery 95%

68.3 - 71.5m
ROVER 4 DDH 1
GEOLOGICAL LOG

71.5 - 78.3m

BEDDED HARD LIMESTONE

Vugs generally aligned along bedding in this harder more calcareous material. This unit does not absorb moisture as quickly as the more silty variety above.
Recovery 98%

78.3 - 84.4m

GREY, BEDDED SILTSTONE AND CALCILUTITE

Beds rich in grey silt with minor carbonate and flecks of white mica aligned along bedding, interbedded with thicker beds rich in carbonate. The siltier beds absorb moisture very well in comparison to the others.
Bedding decreases towards base of unit, and contact with that below is gradational over 40 cm.
Recovery 100%

84.4 - 89.4m

MASSIVE CHOCOLATE BROWN CALCILUTITE

Deep brown in colour, siltstone, absorbant, minor grey siltstone flecks and zones, minor carbonate throughout.
Recovery 100%

89.4 - 92.2m

CALCARENITE

Quartz and lithic grains are subrounded, with the larger ones generally being more angular. Matrix is rich in carbonate. The grains tend to be almost spherical towards the base of the unit. Average grain size 1 to 1.5 mm. The unit is well sorted with decrease in matrix towards base.
Recovery 100%

92.2 - 92.3m

BASAL CONglomerate

Sand size fragments as above, no fine matrix, but with coarse angular fragments, of underlying chloritic and hematitic stained fine grained mudstones.

UNCONFORMITY AT 92.30 METRES

92.30 - 101.50m

GREY FRACTURED MUDSTONE

Highly fractured mudstone with red hematite staining. Fragments are angular and broken to average 14 cm diameter. Maximum core length 16 cm.
Recovery 63.0%

101.50-104.80m

GREY MUDSTONE

Fine grained bedded mudstone.
102.2 E 68º against So 30º, strike difference 30º
Recovery 90.9%
Fracture frequency: 27 m.

104.80 - 112.90m

RED BROWN BEDDED HEMATITIC MUDSTONE

Generally the mudstone is red brown but with some pale grey brown silty flecks and dykes (?). 2 cm of fine porphyroidal
texture at 109.2m. Minor faulting (2cm maximum movement) throughout. Quartz filled fault from 110.0m to 110.30m. This quartz includes angular fragments of the hematitic mudstone. 106.3m So 30°

Cleavage not clear.
Recovery 100%
Fracture frequency: 57/m

112.90 - 113.40m FRACTURED GREY MUDSTONE
Highly fractured fine grained bleached (?) equivalent of that above.
Recovery 100% (estimated)
Fracture frequency: 150/metre (estimated)

113.40 - 117.20m GREY BROWN TUFF
This unit is generally fine to medium grained and contains clay flecks, rounded chert (?) fragments with white/grey sericite/chlorite aureoles clear quartz grains and a fine sediment (?) matrix. Both contacts appear to cause bleaching of the surrounding hematitic mudstones. The lower contact has a strike difference of 75° with the bedding below it. The contact dips at 35° so dips with the contact also at 35°.
Similar to 131.7 - 144.5, 192.2 - 193.4m.
115.6m banding at 35° to core axis.
Recovery 100%
Fracture frequency: 8/m

117.20m - 119.40m RED BROWNHEMATITIC MUDSTONE WITH LIMESTONE BEDS
Hematitic mudstone with pale grey brown silty Carbonate bands showing pull apart features and soft sediment rounding.
As mentioned above, upper contact is bleached.
118.40 So 44°
Parting is along bedding/flowage feature with cleavage not developed.
Recovery 100%
Fracture frequency: 21/m

119.40 - 121.85m BLEACHED AND HEMATITIC MUDSTONE
Hematitic mudstone as above shows minor grey "spotting" (porphyroidal texture) well fractured, some dark grey km brown fine sediment (?) zones. Upper and Lower contacts consist of quartz, banded with chlorite, talc (?) and earthy hematite. The unit appears to be a zone of alteration within the red brown hematitic mudstone; with the quartz zones marking the contact effect.
Recovery 100%
Fractures frequency: 35/m

**HEMATITIC MUDSTONE**
As for 117.20m - 119.40m, parting along bedding planes.
123.80m So (?) 35°
125.80m 10cm of unidentified dark grey brown mineral, pearly lustre, hardness 4.5, minor talc and chlorite.
128.30m So (?) 31°
Lower contact gradational with that below.
Recovery: estimated 100%
Fracture frequency: 122.0 - 123.5m 100/metre
123.5 - 131.7m 11/metre

**BANDED TUFF**
Sericite chlorite rock with irregular blebs of limeonite/hematite throughout. Minor chloritised lithic fragments (possibly andesitic?). Overall the rock is soft (hardness approximately 3) red brown, purple brown and grey green, often banded. Grain contacts are not clear and some bleaching has occurred. Coarser towards base. Parting is irregular and generally across banding.
134.0m banding 34° to core axis.
138.6m banding 36° to core axis.
142.8m banding 28° to core axis.
Well fractured 136.2 - 136.9m.
Recovery: estimated 100%
Fracture frequency: 136.2 - 136.9m 78/m
Remainder: 11/m

**RED BROWN HEMATITIC MUDSTONE WITH LIMESTONE BANDING**
Fine bedding throughout, quartz, chlorite, limestone banding paralleling bedding 145.9-146.1m, 146.7m, 147.4m.
The banding at 146.1m is cut by dewatering channels. Angular brecciation at 150.7m and 150.9m.
146.5m So 30°
148.2m So 33°
Recovery 100%
Fracture frequency: 7/m

**RED BROWN AND GREY MUDSTONE**
This unit is similar to that above with a large number of thicker beds of grey mudstone.
Cleavage is poorly developed.
159.60m So 25° to core axis
162.0m So 15° to core axis.
164.20m Thin bedded hematite dolomite
165.0 - 165.70m Banded hematite dolomite vein cutting bedding and varying from 30°, to parallel, to the core axis.
165.90m  So 39°
169.40m  So 11°
170.20m Quartz, hematite dolomite, and chlorite irregular veining, some brecciation of the sediments.
Recovery 100%
Fracture frequency:
Highly fractured 151.8 - 152.4
Remainder of interval 15/metre

171.6-192.2m GREEN GREY CHLORITIC MUDSTONES
Minor bedding with cleavage poorly developed. Some quartz and hematite dolomite veining.
174.0  So 26° against S₁ at 25° strike difference 10°
179.1m  So 24°
182.0 - 182.4m quartz, hematite dolomite vein sub parallel to the core axis
183.3 - 183.6 as above.
183.7 fault with quartz, chlorite and hematite dolomite veining
183.3 - 186.9 Irregular quartz veining .
186.6 - 187.0m Quartz and hematite dolomite vein, sub parallel to core axis.
188.7  S₁ 45° against So 27° Strike difference 10°.
With core aligned in attitude drilled: if S₁ strikes 095° and dip 65° S then So dips 60° to 310° or, if S₁ strikes 095° and dip 30°N, So dips 75° to 125°. Cleavage well developed.
191.6m Quartz and hematite dolomite vein at 70° to core axis.
Recovery 100%
Fracture frequency: 11/metre

192.2-193.4m GREY PINE TUFF
Very fine pale coloured sediment (?) with green flecs generally aligned along what appears to be cleavage. Very similar to 131.7 - 144.5m.
Recovery 100%
Fracture frequency: 10/metre

1.4-199.0m CHLORITIC FINE MUDSTONE
Grey green massive mudstone with minor zones of purple-brown mudstone. Quartz and hematite dolomite vein mx at 197.0m.
Recovery 100%
Fracture frequency: 10/metre
GREY TUFF
Grey and grey green fine tuff, some bedding, well bedded
205.6 - 206.8 m. No core from 202 - 205.4 m - wedge 206.3 m
So 40° to long core axis.
Recovery: 100% except for wedge zone
Fracture frequency: 7/metre

206.8-235.3 m
GREY GREEN CHLORITIC MUDSTONE
Chloritic mudstone with some finer grained zones and some
coarse lithic greywacke beds. Cleavage poorly developed -
parting generally along bedding and joint planes.
206.9 - 207.0 m 10 cm of chloritic mudstone with numerous thin
(1-2 mm) veins of quartz and hematite dolomite sub-parallel to
the core axis.
208.2 - 208.7 m joint parallel to core axis.
209.4 m
210.2 - 210.4 m Bed of coars lithic greywacke. The coarse
fragments are pale green chlorite (?) with the groundmass of
dark green chlorite and clays (?). Lower contact is at 20° to
the core axis.
212.0 - 217.3 m Wedge placed - No. core
217.6 m 2 cm quartz and hematite dolomite vein with slickensides
through the centre of the vein.
220.1 - 220.5 m lithic greywacke as for 210.2 - 210.4 m. Some
larger fragments up to 8 mm long by 2 mm wide.
220.7 - 231.0 m Highly fractured zone. Generally irregular
fractures, wavy sub parallel to the core axis. Average size
of fragment 3 cm diameter, maximum 10 cm.
231.0 - 231.1 m lithic greywacke
233.6 m
233.8 - 234.1 m lithic greywacke
234.9 - 235.1 m lithic greywacke, bottom contact so at 78° to
core axis. Thin quartz veining (max. 1 mm) at 17° to core axis
throughout. Parting often along these planes. The lithic grey-
wacke bands may in fact be pyroclastic layers. Apart from wedge
and highly fractured zone: recovery 100%.
Fracture frequency: 20/metre

235.3 - 239.4 m
CHLORITIC MUDSTONES WITH QUARTZ VEINS
Similar rock to above with considerable quartz and minor
chlorite veining. Veins are banded and undulating but approx.
40° to core axis.
Recovery: 95% (estimated)
Fracture frequency: 33/metre
GREY FINE SILICIFIED MU DSTONE
Grey and grey brown fine sediment tending to be chloritic towards base.
Recovery 100%
Fracture frequency: 3/m

WEDGE EMPLACED - No Core

247.4 - 248.2m

CHLORITE
Dark green chlorite or sediment with chlorite with minor veining, of quartz, red hematite and carbonate.
Recovery 100%
Fracture frequency: 8/metre

248.2 - 253.4m

HEMATITE-CHLORITE-DOLomite-Jasper
Dark red jasper with carbonate veining causing fracturing, and minor chlorite and specularite veining.
252.3 - 252.6m Black "greasy" chlorite vein.
Recovery 100%
Fracture frequency: 9/metre

253.4 - 254.1m

JASPER-HEMATITE-CHALCOPYRITE-DOLomite
Recovery 100%
Fracture frequency 8/metre

254.1 - 259.5m

HEMATITE-CHLORITE-DOLomite-Jasper
As for 248.2 - 253.4 with minor chalcopyrite.
Recovery 100%
Fracture frequency: 14/metre

259.5 - 261.8m

QUARTZ-CHLORITE-JASPER-HEMATITE-DOLomite
Minor quartz and chalcopyrite and possibly pyrite throughout.
Dull black hematite increases with depth Core broken at right angles to axis only.
Recovery 100%
Fracture frequency: 18/metre

261.8 - 265.4m

CHLORITE DOLomite
Fine crystalline carbonate with chlorite throughout. Numerous carbonate veins and black to dark green wavy chlorite veins.
Minor metallic hematite and rare chalcopyrite veins. The carbonate is rarely coarsely crystalline and always reacts vigorously with hydrochloric acid.
Recovery 100%
Fracture frequency 13/metre

SULPHIDE-HEMATITE-CHLORITE-JASPER-DOLomite
The sulphide is dominantly chalcopyrite throughout with some massive pyrite. Some zones with no jasper
Recovery 100%
Fracture frequency: 13/metre
2 - 269.5m

CHLORITE-JASPER-DOLOMITE-HEMATITE
Hematite content slightly exceeds carbonate content. Minor chalcopyrite throughout.
Recovery 100%
Fracture frequency 13/metre

269.5-283.6m

HEMATITE-CHLORITE-DOLOMITE-JASPER
Minor chalcopyrite and rare pyrite. Irregular carbonate veining. Highly fractured zone 273.7 - 274.0m. Outside highly fractured zone:
Recovery 100%
Fracture frequency: 9/metre

283.6-287.0m

HEMATITE-CHLORITE-DOLOMITE
Hematite is fine red earthy variety in the chlorite and carbonate. Some zones of what appears to be a dololutite (?)-considerable carbonate veining often causing brecciation.
Recovery 100%
Fracture frequency: 6/metre

287.0-295.5m

CHLORITIC CALCILUTITE
Fine grained hematitic and chloritic calcilutite with thin irregular carbonate veining. Carbonate content estimated 60-80%
Recovery 100%
Fracture frequency: 7/metre

295.5-295.7m

FRACTURED CHLORITE
Contact zone from above to that below, rare chalcopyrite.
Recovery: estimated 50% and highly fractured.
Note: In the above zones the carbonates react with cold dilute hydrochloric acid so are more likely to be dominantly calcite than dolomite;

295.7-296.4m

CHLORITE HEMATITE WITH MINOR SULPHIDES
Massive black metallic hematite with minor pyrite and chalcopyrite.
Recovery 80%
Fracture frequency 15/metre

296.4-330.5m

SEDIMENT FRECCIA
The fragments range in size from approximately 3mm diameter to a maximum of 3.0cm. Although they vary in shape they are a rounded and only rarely do angular fragments occur. They are of a chloritic mudstone in a chloritic sediment matrix. Fracturing of the core is generally at right angles to the core axis. Minor chalcopyrite throughout.
Overall it is very similar to the sediment breccia at Gecko. 317.1 - 317.6m Many of the fragments are hematitic and may have been part of a hematite shale. 318.7-318.8m The fragments are angular and the matrix contains jasper. 329.3 - 329.8m Some hematitic fragments. Recovery 100%
Fracture frequency: 8/metre

330.5-336.0m CHLORITIC MUDSTONE
Massive chloritic mudstone. Minor brecciation as above, but fragments are larger, and often banded. Some fine irregular quartz veining. Recovery 100%
Fracture frequency: 7/metre

336.0-336.5m BLACK CHLORITIC CLAYSTONE
Minor chalcopyrite flecs. The very fine sediment is bleached at 336.3m. Recovery 100%
Fracture frequency: 10/metre

336.5-337.9m CHLORITE HEMATITE
Black chlorite vein 337.0 - 337.3. Fine black chlorite flecs in the hematite 337.3 - 337.9m. Recovery 100%
Fracture frequency: 9/metre

337.9 - 348.3m SEDIMENT BRECCIA
The fragments in this breccia zone are much coarser than those for 296.4 to 330.5 and the fragment/metrix boundary is often very indistinct.

342.8 - 343.1m Hematitic fragments as for 317.1-317.6m.
343.7 - 344.5m Black waxy chlorite with some chalcopyrite and veins of hematite.
345.6m S₁ poorly developed at 63° to core axis. Recovery 100%
Fracture frequency: 7/metre

348.3-406.1m CHLORITIC MUDSTONE WITH QUARTZ VEINS
The quartz veins are irregular in direction and thickness, and often cause angular brecciation in the mudstone. Minor veins of chlorite with chalcopyrite, and rare veins of chalcopyrite. 399.0 - 406.1m The general grey green colour is often replaced in this zone by a light grey brown such that the rock has a mottled bleached appearance.
399.8m S₁ 44° Some fine straight quartz veins parallel S₁.
405.2 - 406.1m Over this zone the intensity of brecciation by the quartz veining is increased. Contact with the underlying porphyry is sharp.
Recovery 100%
Fracture frequency: 10/metre

**CHLORITE QUARTZ PORPHYRY**
The megacrysts are of quartz often containing chlorite. They are generally sub angular with average dimensions of approximately 2mm diameter. Rare circular ones do occur. Edges of the megacrysts are blurry and illdefined. Some bands of chloritic sediment intermixed throughout. Rare fine chalcopyrite throughout. Minor quartz veining.
410.0 - 410.85m Fine chloritic mudstone band with 3cm porphyritic vein at 410.6m. Other sediment veining or inclusions are at 411.1m, 411.3m, 412.3m.
Recovery 100%
Fracture frequency: 10/metre

**FINE GREY MUDSTONE**
Fine grey to grey brown mudstone, no clear bedding feathers, minor irregular quartz veining throughout.
419.5m, 419.8m. Irregular chlorite veining with contact effects showing red to red brown staining and slight bleaching of the sediment.
421.6m 5mm chalcopyrite vein.
Recovery 100%
Fracture frequency: 13/metre

**CHLORITIC FINE MUDSTONE WITH MINOR QUARTZ PORPHYRY**
The sediment is similar to that above but with more chlorite and minor quartz porphyry bands at: 426.0 - 426.1m, 426.2m, 427.6 - 427.7m, 428.4 - 428.5m, 428.9 - 429.0m.
Recovery 100%
Fracture per metre 13

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PROSPECT/MINE: ROVER 4
Log of Hole: DDH 2 & WRO 1
Location: 200M NORTH OF RN DDH 1
Purpose of Hole: TO TEST SOME MAGNETIC ANOMALY & TARGET AS DDH 1

Proposed By: B. DUCK Date: 16.8.76
Proposed Target: E: N: R.L.
Hole Planned By: Date: Checked:
Hole Approved By:

Hole Logged By: B. DUCK

Collar Co-Ordinates:
Proposed: 2062 E: 3104 N: R.L.
Surveyed: E: N: R.L. Surveyed in By: J. ACKLAND Date: 17.8.76
Actual: 2062 E: 3104 N: R.L. Picked up By:

Collar Bearing:
Proposed: 185° Grid: Magnetic:
Surveyed: Grid: Magnetic:
Actual: 185° Grid: 180.5° Magnetic:

Collar Inclination:
Proposed: - 80°
Surveyed: Surveyed in By: J. ACKLAND
Actual: - 80° Picked up By:

Target Depth: 365 m.
Proposed Final Depth: 425 m.
Actual Final Depth: 169 m. Hole Terminated By:

Reason for Termination:

Drilling:- Date Commenced: 24.8.76 Date Completed: 2.9.76
Drilled By: GEOPEKO LIMITED - CONTRACTORS
Wedges Placed At: 151 (Casing Wedge), 152m.
Remarks: Parent stopped due to inability to recovery bull nosed bit
WRO 1 stopped due to excessive deviation Target as for DDH 1

Only Warramunga sediments intersected, after Cambrian

S McD. 11997/1073
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BX casing wedge at 151m
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GEOLOGICAL LOG : By: B. Duck

0 - 64.0m
No Core

64.0 - 68.0m
GREY NODULAR CHERT
Probably had a yellow clay matrix between the chert nodules. Recovery 5%

68.0 - 69.5m
PALE YELLOW-BROWN CALCILUTITE
This unit is massive with only one example of bedding at 82° to core axis. Minor white coarse clastic carbonate fragments throughout. Matrix yellow brown, very fine and carbonate rich. Minor manganese staining towards base. Recovery 100%
Fractures per metre 5.6

69.6 - 73.0m
GREY VUGGY LIMESTONE
Very fine grained, lining of vugs more reactive to acid than matrix, rare stylolites. Some thin silt and clay bands. Recovery 74%
Fractures per metre 20

73.0 - 75.0m
BROWN BEDDED AND POROUS CALCILUTITE
Upper section of unit is dominantly massive, with minor bedding and vugs. Bedding is well developed from 74.4m. Bedding as fine, brown and white layering, undulating, often distorted and occasionally truncated as at 75.1m. Parting is along bedding when bedding is flat. Bedding at 80° at 75.8m. Recovery 100%
Fractures per metre 22

76.0 - 77.0m
GREY AND YELLOW FINE CALCARENITE
Some coarse clear quartz fragments, subrounded, matrix very fine and cemented with carbonate. Minor vugs and yellow clay zones throughout. Recovery 100%
Fractures per metre 20

77.0 - 96.0m
No Core - Cambrian - Lower Proterozoic unconformity estimated to be at approximately 95.0m.

96.0 - 97.0m
DARK RED BROWN CALCAREOUS SEDIMENT BRECCIA
Matrix dark red-brown, silty, massive with no features or apparent carbonate. "Breccia fragments" are elongated and sub-rounded in red brown calcareous silty material. Average dimensions estimated to be 1.5cm x 3.5cm. They appear to be disrupted calcilutite beds in the massive siltstone. Later fracturing is filled with calcite -this fracturing only rarely passes through a fragment.
Recovery 100%
Fractures per metre 5

97.0 - 104.3m
LIMESTONE IN BEDDED HEMATITE MUDSTONE/SHALE

The mudstone is bedded, non fissile, parts along bedding is a red brown colour and has no measurable cleavage. The limestone occurs as beds approximately 1cm thick but of ten thinner. They are contorted showing sudden thickening and thinning, and pull apart structures. The limestone (it reacts vigorously with dilute hydrochlorine acid) is estimated to be 15% of the unit. Thin fractures filled with carbonate throughout.

97.3 - 97.5m Coarse lithic greywacke bed - possibly tuffaceous consists of lithic fragments in a matrix of hematite and sericite with minor calcite.

98.3m Bedding 57° to core axis.

99.4m Younging towards the collar.

99.7 - 99.8m Limestone bed.

102.7 - 102.75m Grey chloritic (?) fine sediment band.

103.1 - 103.2m Quartz, chlorite, carbonate band parallel to bedding.

103.7 - Bedding 54°.

Recovery 100%
Fractures per metre 8.5

104.3 - 105.1m
GREY AND PURPLE FINE TUFF

There is a marked colour and grain size change to that above and below. The top 30cms are bedded and pale grey whereas the remainder is grey to purple with less bedding. Bedding is often marked by pale brown flecs with indistinct boundaries.

104.7m Bedding 58°

Recovery 100%
Fractures per metre 7.5

105.1 - 116.2m
BEDDED HEMATITE MUDSTONE/SHALE WITH LIMESTONE

As for 97.0 - 104.3m with less carbonate which decreases down the hole. No carbonate beds after 113.3m. The top 8cm is soft brecciated with fragments of limestone beds in a muddy matrix with chlorite and some quartz.

Beds generally finer towards the base of the unit with grey fine beds up to 2cm thick (same sediment as that below).

105.6 Carbonate veining parallel to the core axis.

107.4 Bedding 58° to core axis.

107.6 Carbonate veins at 15°

111.1m Bedding 57°

Recovery 100%
Fractures per metre 9.1
GEological LOG

116.2 - 122.3m GREY FINE TUFF
This is generally grey green, very fine grained, with only minor coarser bands. Some "fuzzy" pale brown and purple mottling.
Sandy lens at 116.3m shows platy minerals aligned parallel to bedding at 46° to core axis.
At 116.4m in the purple "fuzzy" fine tuff, is a rounded embayed clast (greater than 5cm diameter) of chloritic mudstone.

118.3m Bedding contact undulating and shows grading to the collar. Fine banding increases towards the base.
Recovery 100%
Fractures per metre 5.9

122.3 - 128.0m RED BROWN HEMATITE MUDSTONE/SHALE with grey green banding.
Banding similar to 97.0 - 104.3m, but no calcareous. These beds are generally grey to grey - often the grey appears as a "contact effect" between the central green and the surrounding brown. Some grey "notches" appear to develop along porous bedding planes - and these may in fact be a later stage effect.

124.3m Bedding 65°
126.8m Bedding 48°
Recovery 100%
Fractures per metre 5.7

128.0 - 135.15m MOTTLED FINE TO MEDIUM TUFF
The colours are varied and range from green, to grey, purple, pale brown, pink and black. These generally vary with the bedding. The unit has a fine grain to 133.2m with minor square and round chlorite (?) aggregates in some beds between 128.5m and 129.4m. Some of these have a pale pink nucleus.
Bedding varies between 55° - 65° between 129.7m and 132.0m.
The unit becomes gradually coarser, with coarser bands often 133.2m. These consist of lithic fragments, chlorite aggregates and chert (?) fragments.
Bottom 5cm contains coarse angular lithics and chert (?) in a matrix of chlorite and sericite and altogether interspersed between individual disrupted beds from the chloritic sediment below.
Recovery 100%
Fractures per metre 11

135.15 - 144.1m RED BROWN HEMATITE MUDSTONE/SHALE
As for 122.3 - 128.0m Parting only on bedding planes, with minor bedded carbonates. Lower contact gradational.
ROVER 4 DDH 2 & WRO 1
GEOLOGICAL LOG

140.5m Bedding 58°
142.0m Younging to collar
143.7m Bedding 72°
Recovery 100%
Fractures per metre 7.9

144.1 - 149.9m
FINE TO MEDIUM TUFF
As for 128.0 - 135.15m, The dominant colours in this unit are the greens and pale browns with a general pink colour towards the base. No purple mottling as above. Bedding is common, the pale brown units generally containing the dark green to black chlorite aggregates (or chloritised lithic fragments).
148.5m Bedding 43° to core axis. The unit is coarse grained from 148.7m to the base.
Marked wavy disturbance from 149.2 - 149.3m.
Recovery 100%
Fractures per metre 5.7

149.9 - 151.8m
GREY AND RED BROWN BEDDED MUDSTONE/SHALE
The bedding is very fine, and at 61° to the core axis. The red brown colour appears different to that above in that it is not primary but appears as a replacement feature. In places small (1cm diameter) circles of unaltered chloritic mudstone can be seen.
Recovery 100%
Fractures per metre 5.3

151.8 - 165.0m
GREY GREEN BEDDED MUDSTONE/SHALE
Thin beds, generally very fine, some fine greywacke units, i.e. 158.9 - 159.5m, 161.1 - 161.6, and 161.9 - 162.2m. Minor thin slip sheared beds at 153.1m, 158.0m, and a unit which may be a soft sediment, breccia from 164.4 to 164.8m. Minor siderite vein throughout.
152.7m Bedding 65° to core axis.
153.7m Younging to the collar. Cleavage not developed.
Recovery 100%
Fractures per metre 11.1

165.0 - 166.0m
GREY BEDDED TUFF
One siderite vein, minor dark green chlorite aggregates to 1cm diameter some containing pale pink nuclei.
Recovery 100%
Fractures per metre 4

166.0 - 169.0m PALE BROWN AND PURPLE TUFFS INTERBEDDED WITH GREY
ROVER 4 DDH 2 & WRO 1

GEOLOGICAL LOG

PALE BROWN AND PURPLE TUFFS INTERBEDDED WITH GREY GREEN MUDSTONE/SHALE

Well fractured zone, comprising thin units similar to those above.

Recovery 100%
Fractures per metre 22

E.O.H. 169 metres

WRO 1 started at 152 metres and was stopped at 166 metres.
The core recovered was the same as logged above.
Details not recorded.

B.D./C.W. 15.11.76
PROSPECT/MINE: ROVER 4 ANOMALY 1

Log of Hole: ROVER 4 ANOMALY 1 D.D.H. 3p & WRO 1

Location: 50M W OF R4 DDH 1 APPROXIMATELY 2KM N.E. OF ROVER CAMP

Purpose of Hole: TO HIT TARGET NOT INTERSECTED BY DDH 1 & DDH 2

Proposed By: P. LE MESSURIER Date: 9.9.76
Proposed Target: 2030 E: 2973 N: R.L. 323 METRES BELOW SURFACE
Hole Planned By: R. MAHER Date: 9.9.76

Check: B. DUCK
Hole Approved By:
Hole Logged By: B. DUCK

Collar Co-Ordinates:
Proposed: 1945.5 E: 2867.5 N: R.L.
Surveyed:
Actual: 1945.5 E: 2867.5 N: R.L.

Surveyed in By: J. ACKLAND Date: 10.9.76
R.L. Picked up By:

Collar Bearing:
Proposed: 030° Grid: 025.5° Magnetic:
Surveyed:
Actual: 030° Grid: 025.5° Magnetic:
Surveyed in By: J. ACKLAND
Picked up By:

Collar Inclination:
Proposed: -78°
Surveyed:
Actual: -78°

Surveyed in By: J. ACKLAND
Picked up By:

Target Depth: 360 m.
Proposed Final Depth: 425 m.
Actual Final Depth: 407 m. Hole Terminated By: B. DUCK

Reason for Termination: NO MORE LODE ZONE ANTICIPATED

Drilling: Date Commenced: 11.9.76 Date Completed: 5.11.76

Drilled By: GEOPEKO LIMITED

Wedges Placed At: 154m, 173m, 189m, 194m, 284m

Remarks:

Economic Summary Result:

S.McD. 118233/1072
ROVER 4 ANOMALY 1 DDH 3

HOLE SUMMARY

This prospect contains a sequence of sediments of which some are tuffaceous and many are dolomitic. Similar units have been found at Rover 1.

A unique lode zone of dolomites, jasper, hematite, magnetite and minor sulphides was encountered. A Summary log follows:

0.0 - 90.0m
No Core

90.0 - 96.0m
Cambrian sediments

96.0 - 248.4m
Fine grained sediments, often very hematitic, some tuffaceous, many with carbonates and showing brecciation and bedding throughout.

248.4 - 273.7m
Very fine chloritic sediments with chert, chlorite, jasper, quartz and dolomite.

273.7 - 276.0m
Hematite jasper-quartz.

276.0 - 284.2m
Chloritic and hematitic mudstones with banded dolomite.

284.2 - 290.4m
No Core - Wedge

290.4 - 329.2m
Magnetite hematite jasper/dolomite

329.2 - 331.4m
Chloritic sediment breccia.

331.4 - 331.9m
Chlorite magnetite.

331.9 - 374.3m
Chloritic sediments.

374.3 - 377.0m
Sediment heavily veined by quartz, chlorite and magnetite.

Minor Sulphide.

377.0 - 407.0m
Intermixed zone of porphyroid/breccia and fine sediment. E.O.H. 407.0m

The only significant assays are tabulated below.

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Remarks:
- Wedge at 154 metres
- Wedge at 173 metres
- Wedge at 189m Hole stopped at 192 metres
- Branch commenced at 180m
- Possibly affected by magnetite. Wedge @ 284m
- Possibly affected by magnetics
- Possibly affected by magnetics
- Possibly affected by magnetics
- E.O.H. 407m
### ROVER 4 ANOMALY 1 DDH 3
### ASSAYS

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0.0 - 90.0
No Core

90.0 - 91.0
CHOCOLATE BROWN MEDIUM SILTSTONE
Minor grey coarse silt beds, rare thin carbonate beds. Bedding at 90.2m at 83° to core axis.

91.0 - 95.5
GREY BROWN POORLY SORTED SANDSTONE
Generally medium to coarse grained with 25% greater than 2mm diameter. The grains are sub angular to sub-rounded. Bed of fine gravel at 91.5m is uncemented and the grains revealed are quartz, quartzite, chloritic mudstone and some fine grains with a granitic texture. Rare carbonate cement throughout the unit. Thin, grey, fine silt lenses throughout the unit. Thin, grey, fine silt lenses throughout. Younging distinctly towards the collar.

UNCONFORMITY AT 95.5m

95.5 - 97.0
GREY FRACTURED FINE MUDSTONE
Fracturing is tight, cemented and at approximately 20° - 50° to the core axis. Recementing in places is by carbonate, although generally no reaction with acid. From 96.0 - 97.0m, only core recovered is highly fractured (greater than 100/m) This unit appears to be a recemented weathered zone of the Warramunga Group rocks but not entirely a Cambrian feature.

97.0 - 101.5
No Core Recovered. Cuttings washed up were of dark red brown platy fragments with minor grey-green mottling. Possibly a sheared zone.

101.5 - 105.6
RED BROWN HEMATITIC MUDSTONE
Banding is grey and very fine with no apparent carbonate. The unit is highly fractured to 104.0m. 104.8m Bedding at 32° to core axis.
The bedding often shows solution features developing from the bedding planes out into the hematitic fine sediment resulting in bleaching, or further down the hole -chloritisation. The lower contact is gradational.
Fractures/metre 101.5 - 104.0: 60/m Recovery 100%
104.0 - 105.6: 25.4/m

105.6 - 110.8
GREY-GREEN FINE MUDSTONE
Very similar to that above, but of a different colour, with more chlorite in the thin beds. Clay size content high. Cleavage only very faint, and not measurable, jointing common. Joints are open and limonite coated. 105.9m Bedding at 42° to the core axis.
106.2m Joint, undulating at 16° and against the bedding. Strike directions differ by an estimated 20°.
Chlorite content appears to be highest in the centres of thin beds, with decrease in chlorite content outwards. Some bleaching effect as in unit above by "chloritising solutions" 109.3m Bedding at 47° to the core axis.

110.8 - 115.3

RED-BROWN HEMATITIC FINE MUDSTONE

Hematitic unit as above for 101.5 - 105.6m. Parting is along bedding planes, or on open limonite coated joints. Bedding as above with some bleaching effects.

111.2m Joint at 6° against bedding
113.9m Bedding at 40°
115.0m Bedding at 37°

115.3 - 129.9

GREY GREEN CHLORITISED FINE MUDSTONE

More chloritic and massive than above, bedding not as distinct, chloritisation effects include resorption and rounding of separated blocks, streaming and fracturing. Both contacts are gradational.

From 115.5 to 115.8m, joint parallel to core axis, open, with limonite staining, and another joint at 9° to the core axis. The strikes of these are parallel and at right angles to the strike of the bedding.

116.7m Bedding at 29°
117.6m Wedge shaped very chloritic lense
119.3m Bedding at 20°. Chloritisation effect shows resorption and rounding of 4cm x 1.5cm "fragment" of similar material to that outside the chloritic zone.

121.9 - 122.0m Chloritic zone with rounded sediment "fragment included.

124.1m Bedding at 5°
124.5 - 124.7m As for 121.9 - 122.0m
125.8m Joint at 5° to core axis, against bedding at 3°.
127.7m Bedding at 28° to the core axis.

Fracture Frequency: 105.6 - 129.9: 10.2/m Recovery 105.6 - 129.9m: 100%

129.9 - 134.7

GREY AND PURPLE GREY SILICIFIED VERY FINE MUDSTONE (CHERT?)

Both contacts gradational. The sediment (?) is very fine, no bedding, probably a chert. From 132.2m to 133.2m is a brown and grey zone with numerous angular quartz filled fracture zones. Vugs from 132.2m to 132.3m are lined with fine quartz crystals. The upper two metres of the unit are highly fractured.
134.3 - 134.4m Quartz filled breccia zone.  
Recovery 93.8%  Fracture Frequency 49.1/metres

**GREY AND PALE BROWN BEDDED TUFT**

Upper contact is sharp, and grain size increases down the hole.

134.7 - 136.0m Fine chlorite flecks at irregular intervals.  
Some of these are very fine and occur in the bedding planes, 
while most are aligned almost at right angles to the bedding 
either along cleavage or the main joint direction. All this 
later chlorite type occurs with a narrow bleached zone around it.

136.1m A 3cm bed of medium to coarse tuff with very little 
cement or very fine matrix. More friable than above.

137.6m Bedding undulating, colour “fuzzy” with some bleached 
spots, some coarse fragments of chert, quartz, lithics (?) 
and feldspar (?). Bedding at 43° to the core axis. The coarse 
fragments are rounded to sub rounded and usually with a 
chlorite halo surrounded by a bleached zone.

137.8m Clean open joint at 24° to the core axis. Strike of 
joint at right angles to strike of bedding.
Recovery 100%  Fractures Frequency 20/metres

**HEMATITIC ZONE**

Dominantly red brown hematitic fine sediment zone with high 
carbonate content.

Compare thin section description for samples TS2013, 
(180.2 - 180.3 metres) TS 2014 (188.3 - 188.4 metres) and 
TS 2009 (212.55 metres).

138.8 - 141.7m Red Brown Hematitic Mudstone  
As for 110.8 - 115.3m No carbonate, minor bleaching and 
spotting.

141.3m Bedding at 46° to core axis.
141.7 - 154.7m Red Brown Hematitic Mudstone, minor Dolomite 
Beds.

A massive hematitic mudstone with only minor bedding which is 
predominantly of thin carbonate beds and lenses. Not cleaved, 
but well fractured with limonite staining on the open joint 
faces. The carbonate beds are of the order of 2 to 5mm thick 
and the lenses are often flattened, rounded or faulted off on 
the ends; but of the order of 1cm x 3cm.

The carbonate content is an estimated 5% - 10%. Younging is 
indicated by these lenses at 145.6m, 146.0m and by water
extrusion channel at 154.4m as up the hole towards the collar whereas at 154.5m apparent younging ia away from the collar. All of these features are of doubtful reliability, and bedding is continuous and uniform between 154.4m and 154.5m.

145.6m Bedding at 8° to the core axis.
146.1m Bedding at 6° to the core axis.
153.6m Bedding at 11° to the core axis.
154.5m Bedding at 27° to the core axis.
Recovery 138.8 - 154.7m : 100%
Fracture Frequency: 138.8 - 154.7m: 50/metre for 149.1 - 151.1 and 19.9m for the remainder

154.7 - 159.0  No Core - Wedge emplaced.
159.0 - 162.2  GREY AND PINK TUFF

This unit commences as a fine, massive, tuff with no bedding or coarse fragments, whereas the lower section of the unit is coarse grained with 40 - 50% of the rock composed of fragment of quartz, pink feldspar (?) and some calcite greater than 0.5mm diameter.

161.5m Bedding at 30° to the core axis.
161.0m A 10cm band of very fine grey material intruded, brecciated and resorbed by chlorite and matrix fluids of the coarser material beneath. The 3cm above the lower contact at 162.2m is also of very fine (cryptocrystalline?) material, and contains individual dark red carbonate beds dislocated from the unit beneath. One small angular fragment (0.5cm x 1.0cm and showing alteration) from this fine material is incorporated in the overlying coarse grained tuff, with a zoned aureole about it.

162.2 - 169.4m  FINE GREY TUFF WITH MINOR CARBONATE

Very fine yellow grey tuff with only minor banding, chloritic and colour variations. The carbonate inclusions are rounded blocks or possibly lenses of a red brown colour always with a 3 - 4 mm selavage edge of chlorite.

From 167.5m to 169.4m are siderite and calcite veins paralleling the core.

169.1m Bedding (?) at 53° to the core axis, with possible grading towards the collar.

In Rover 4 D.D.H. 2 similar pink carbonate inclusions with chlorite edges occur at 162.3m.
Recovery: 159.0 - 169.4m : 100%
Fracture Frequency 159.0 - 169.4m: 12.5/metre
CHLORITE, DOLOMITE, HEMATITE MUDSTONE - SEDIMENT BRECCIA

Most of the "breccia" fragments are coarse sub rounded pink dolomite which appear to be displaced beds. The matrix is of hematite mudstone (as for 141.7 - 154.7m). Some of the dolomite fragments are a deep green colour due to the inclusion of dark green fibrous chlorite.

169.4 - 170.5m Disruption is severe where all components are thoroughly intermixed, minor bleaching of the hematite mudstone occurs at 170.1m.

170.5 - 172.3m This section is dominantly composed of the pink dolomite with no chlorite and only minor mudstone. Possible bedding (or flow foliation) at 171.6m is at 10° to the core axis.

172.3 - 174.0m 60% of this section is the hematite mudstone matrix and the remaining 40% is composed of pink dolomite and the chloritic dolomite. These fragments show soft sediment deformation characteristics, such as pull apart features, bending, impact deformation and a tendency to roll up and form "snowballs".

Matrix estimated to be 80% at 173.5 - 174.0m. The chloritic fragments contain a much lower percentage of carbonate that reacts with cold acid.

(ANDEL Report MP 2223/77 describes TS 2013 from 180.2 - 180.3m as having shard textures in a rock of 75% cryptocrystalline silica, 20% sericite 3% dolomite and 2% paques. The unit 172.3 - 174.0 is the same material as for 179.8 - 187.4m).

Recovery 100% Fracture Frequency: 13.0/metre

174.0 - 178.0
No Core - Wedge emplaced

178.0 - 179.1
YELLOW GREY FINE TUFF

Massive, no clear banding, fracturing irregular, very fine grained.

179.8 metres Two 1.5cm diameter pink and green carbonate fragments. Both with 1mm chlorite around outside edge. One was rectangular, but has been torn apart, zone between has only minor chlorite development in the tuffaceous matrix. Other fragment is well rounded.

TUFF, CARBONATE AND CHLORITE BRECCIA

Matrix near top of unit is the fine yellow tuff as above with pink dolomite? (No reaction with acid) and chlorite (estimated 25%) flecs.
Chlorite increases down the hole, and with fine carbonate cement (?) hosts, angular to sub angular pink dolomite fragments which are often outlined by dark green chlorite. Carbonate in matrix increases towards base.

HEMATITE MUDSTONE WITH PINK DOLOMITE BLOCKS AND FRAGMENTS - SEDIMENT BRECCIA

As for 172.3 - 174.0m

181.2m Chloritic dolomite snowball with a second "fragment" bent around it. Snowball approximately 1-5cm diameter. Some of the pale green coloured fragments are very fine grained, do not react with cold acid and appear cherty.

PINK DOLOMITE

Pink dolomite with paler coloured bands of similar material, and dark red brown hematite mudstone beds. These beds (?) are irregular and often, the material tends to flow into fractures and joints.

187.5m Banding 28° to core axis.

188.3 - 188.4m TS 2014 reveals that this rock consists of up to 98% dolomite (identified as such by XRD) with minor clay and opaques. It is recrystallised and contain small stylolitite structures.

Recovery 178.0 - 189.6m: 100%

Fracture Frequency: 12/metre

E.O.H. 189.6m

D.D.H. 3 WRO 1 Commenced 179.8 metres

CLORITE AND PINK DOLOMITE BRECCIA

As for 179.1 - 179.8m D.D.H. 3 Parent

HEMATITE MUDSTONE WITH DOLOMITE FRAGMENTS - SEDIMENT BRECCIA

Very similar to 172.3 - 174.0m and 179.8 - 187.4m in 3P.

The brecciation appears to be a flow brecciation with silicified (?) chlorite (?) flow bands that can be seen to be zoned from the inside grey green to the rim of the red-grey to the dark red brown of the enclosing hematitic mudstone. This can be seen at 183.1m and 183.4m with angle to core axis of 17° and 20° respectively. The large tabular fragments of dolomite also often show a similar direction i.e. at 184.0m 5°, and at 184.6m 12° to the core axis.

Throughout the unit, many fragments are completely disoriented; pale brown bleaching occurs from a central nucleus and only minor chloritic dolomite occurs TS 2013 has been described (by AMDEL) on containing 75% cryptocrystalline
silica, 20% sericite, 3% dolomite and 2% opaques. The sample sectioned did not contain any of the larger dolomite "fragments". Well developed shard textures were seen indicating tuffaceous origins.

**PINK DOLOMITE**

Pale pink bedded (?) recrystallised dolomite. Bedding is seen as: (1) minor beds of dark red brown mudstone, usually considerably offset by small fractures and faults. Bedding(?) at 188.4m at 38° to the core axis (111) At 186.6m is a very thin irregular bed with open fracturing developed along it, with only thin mud coating and parallel to the core.

At 191.3m a similar type of bed is seen undulating from 10° to the core in one direction, through 0°, to 10° in the opposite direction. This is dominantly only local structure, so does not represent any major structural closures (111). This third type of bedding (?) is seen parallel to that at 188.4m and is only minor colour variations due to differing hematite (?) content in the dolomite.

From 191.4 to 193.1m - minor chlorite, quartz and the muddy matrix occur in a highly irregular disturbed zone.

Refer TS 2014 (188.3 - 188.4m) for a petrographic description by AMDEL.

**194.0 - 194.8**

No Core - Wedge emplaced.

**RED BROWN HEMATITIC MUDSTONE**

Only minor carbonate veins and fragments occur. At 195.6m is a zone with an undulating contact between two areas of differing hematitic composition giving the impression of soft sediment mobility.

**196.2 - 198.7**

**PINK DOLOMITE**

An upper zone (196.2 - 196.7m) is dark pink coarsely crystalline (possibly siderite) with only minor dolomite, calcite and hematitic mud. Minor banding in this unit does occur, but only faintly. From 196.7 to 198.7m is a pink fine crystalline dolomite - as for 186.5 - 194.0m (refer TS 2014). Minor chlorite/talc veining and coating on fractures.

**198.7 - 200.3**

**PINK DOLOMITE AND HEMATITIC MUDSTONE**

Gradational zone from that above to that below. Estimated 65% dolomite, 35% hematitic mudstone. The two different material show mutual interpenetration by flowage and disruption with only minor brecciation and angular displacement.
PINK DOLOMITE "BEDS" IN HEMATITE MUDSTONE

The hematite mudstone is the same very fine grained dark red brown material as above with pink or white "beds" of dolomite through it. The mudstone and the dolomite are in approximately equal proportions. The "beds" are not uniform, but undulating and show rounding as seen on pull-apart structures. These "beds" are usually a pink colour but there is a second dolomite type being only an estimated 5% of the unit which is a white vein type. In direction these appear to transgress the pink "vein" but are not actually seen cutting them. At 202.0m one of these "beds" is actually seen to cut across the "vein". It is possible that "beds" are in fact flowage features.

Parting is on irregular fractures, most of which are coated with talc, chlorite and sometimes purple micaceous hematite.

200.6m The "beds" are at 86° to the core axis.
202.4m The "beds" are at 81° to the core axis.
204.9m - 208.0m Zone of the same material as above but have a prominent "flow direction" is at 35° (at 205.4m) to the core axis. At 205.1m are small pillow type structures of the pink dolomite in a matrix of the hematite mudstone. The flow direction here is at 36° to the core axis.

PINK DOLOMITE

Pink dolomite with white bedding, undulating but at 5° to the core axis. As for 196.2 - 198.7m.

COARSE DOLOMITISED TUFF (?)

In hand specimen this consists of coarse dolomite in a red brown and green matrix. There is minor feldspar fragments. The fragments are sub-angular, 0.2 - 1.0mm diameter and equant.

The thin section description by AMDEL describe it as dolomite (45%) intergrown with microcrystalline silica (15%) and fine flakes of muscovite - sericite (15%). Embayed, anhedral quartz (10%) and round orthoclase (5%) occur throughout, and the orthoclase contains abundant inclusions of dolomite. (See the "Service Report by AMDEL dated January, 1977 - on file).

The upper contact is a bedding contact at 19° to the core axis with younging (fromdewatering movement) towards the m collar. The lower contact is at 11° with similar strike to that above but dipping in the opposite direction.
ROVER 4 ANOMALY 1 DDH 3 WRO 1

GEOLOGICAL LOG

METRES

At 209.6m is a mudstone "fragment" which appears to be the base of a thin (1.5cm) band of mudstone which lies between the dolomite and this coarse material.

210.0 - 210.35 BEDDED PINK DOLOMITE

As for 196.2 - 198.7m (Refer diagram)

210.35 - 211.3m PINK DOLOMITE IN HEMATITE MUDSTONE

As for 200.3 - 209.4m

211.3 - 211.75 PINK DOLOMITE

Same bed as 210.0 - 210.35m (Refer diagram)

211.8 - 214.65 COARSE DOLOMITISED TUFF (?)

Same bed as for 209.4 - 210.0m. Upper contact 25°, lower contact 47°. Upper contact strike at 45° to lower contact strike.

214.65 - 214.85 BRECCIATED PINK DOLOMITE

Gradational zone from the coarse dolomitised material that below, with chlorite, hematite mudstone. The coarse material is stratigraphically above this unit (See diagram) Contact closest to collar is sharp while deeper one is gradational.

214.85 - 215.2 DISTURBED PINK DOLOMITE

Pink dolomite is disturbed, only minor (estimated 10%) hematite mudstone.

215.2 - 215.5 MASSIVE DOLOLUTITE

Pink-brown fine grained dolomitic mudstone. Two irregular very thin carbonate beds. Contact closest to the collar at 20° to the core axis.

215.5 - 216.7 CONTACT ZONE between two beds sub parallel to the core.

Gentle anticlinal zone with beds open fractured. The stratigraphic lower-most bed is a brecciated pink dolomite and the upper bed is a hematite mudstone. Lower contact is at 18° to the core axis.

216.7 - 217.4 DISTURBED PINK DOLOMITE

Minor hematite mudstone, minor irregular secondary white dolomite banding sub parallel to bedding in the dolomite below.

217.4 - 218.6 PINK BEDDED DOLOMITE

Pale to white bedding consistently between 54° - 58° to core axis throughout unit.

218.6 - 223.0 PINK DOLOMITE "BEDS" IN HEMATITE MUDSTONE

Similar to 200.3 - 208.9m but the hematite mudstone content estimated 70%, finer and a darker colour.
The "beds" show minor disturbances such as pull apart features, squeezing, crumpling "soft fracturing" (with dewatering effects) and rounding of all edges.

219.4m Bedding at 54°
222.3m Folded bedding at 58°.

223.0 - 225.2

**DARK PINK DOLOMITE**

Darker than those pink dolomites above. Rare paler beds usually disrupted, minor hematite mudstone beds. Towards base, intermixing of the mudstone and the dolomite to form dolomite "tear drop pillows" in the hematite mudstone. Overall, darker colour appears due to higher mud content throughout. Irregular veining of pink and white carbonate throughout.

224.9m-Stylolite at 64°.

225.2 - 228.4

**FINE HEMATITE MUDSTONE WITH MINOR DOLOMITE BEDS**

As for 218.8 - 223.0m, but with dolomite/mudstone ratio estimated 20/80. The dolomite beds are less deformed, but still show pull apart features with rounding of the corners and ends of the broken zones.

Minor white flecs throughout. These are rounded, ovoid (maximum dimension 1.5mm) with a centre that reacts with cold dilute hydrochloric acid. The rim is non reactive and appears to be a bleached zone.

228.3m Parting is along bedding planes at 70° to the core axis.

228.4 - 229.3

**BEDDED PINK DOLOMITE**

This thin unit contains white "bedding" and hematite mudstone beds at 73° to the core axis. Only minor disturbance has occurred.

229.3 - 230.55

**DOLOMITE-MUDSTONE BRECCIA**

Estimated 70% carbonate and 30% mudstone matrix. Minor chlorite "Fragments" of dolomite are rounded, sub angular and angular. They are often stained orange-pink, as are the boundaries of the minor white carbonate veins. No apparent carbonate in the mudstone matrix.

Upper contact at 40° with the bedding up hole, but with strike difference of 45°.

230.55 - 230.7

**DOLOLUTITE**

Fine grained dark red dololutite band.

230.7 - 231.8

**DOLOMITE BRECCIA**

Dominantly red carbonate, minor mudstone some rounded and sub angular fragments as
for 229.3 - 230.55m  20 - 30% of the rock is composed of white irregular carbonate veining. Minor chlorite throughout.

231.8 - 232.5

**BEDDED RED DOLOMITE**

Bedding is faint with only minor disturbance. Mud content appears low. (estimated to be 20 - 30%).

232.3m  Bedding at 47°
232.45m  Bedding at 48°

232.5 - 232.9m

**RED DOLOMITE BRECCIA**

This unit is quite different from the other breccias. The fragments are angular, dark red brown and clearly are fractured portions of a similar but darker bed. Both the red matrix and the fragments contain carbonate that reacts with cold acid but the matrix is more reactive than the fragments. Fragments vary in size from 3 x 1mm to 5 x 1cm. Lower contact is sharp and at 10° to the core axis.

232.9 - 233.3

**RED DOLOLUTITE**

Although finer, this unit is texturally very similar to the dololutite of 209.4 - 210.0m and 211.75 - 212.65m.

233.3 - 234.6

**DISRUPTED DOLOMITE**

Red and white brecciated and disturbed limestone with minor chlorite banding. Irregular white carbonate veining throughout - some at 30° to the core axis against bedding with strike differences of 30°. Minor zones - probably disrupted beds - of hematite mudstone.

234.6 - 235.0

**BEDDED DOLOLUTITE**

Matrix of red hematite mudstone with fragmental white and pink carbonate rimmed by hematite.

"Bedding" consists of thin (average 2mm) beds of white carbonate or red hematite mudstone. This is not clearly bedding here, but when core is fitted together then these beds parallel good bedding further down the hole. Bedding at 234.7m is at 51° to the core axis.

235.0 - 235.5

**DISRUPTED BEDDED DOLOLUTITE**

This is generally pink with fine "fragmental" carbonate in a hematite mudstone matrix. Faint bedding is sub parallel to that below. White carbonate veining against the bedding at 25° to 40° to the core, with strike difference (with bedding) of an estimated 15°.

235.5 - 236.0

**LAMINATED DOLOLUTITE**

Dark red finely laminated mudstone with an estimated 30 - 40% carbonate. Two, one on beds of chloritic coarse grained dolomitic material. Truncated beds at 235.9m indicate
younging away from the collar, thus the beds appear to be overturned at this point.
The lower contact is gradational (over 10cm) with the chloritic zones beneath.

236.0 - 252.6 CHLORITIC ZONES
Whereas the above materials have been a dark red and presumably hematitic, the following zones are more chloritic.

236.0 - 238.0 CHLORITIC MUDSTONE WITH DISRUPTED PINK LIMESTONE BEDS
The mudstone is a massive very fine grained chloritic material comprising an estimated 60% of the total.
The limestone beds are pink to red brown, some have been brittle fractured and displaced only very slightly; some have been rounded, bent or balled up. Minor irregular white carbonate veining.
Numerous pale apple green chlorite (?)

238.0 - 238.9 CHLORITIC MUDSTONE WITH FINE PINK DOLOMITE
The mudstone is as above with fine imm square of rhomb shaped flecs of pink to red carbonate. Only minor disturbed beds as above, but one band consists entirely of clusters of this fine carbonate.

238.9 - 239.5 CHLORITIC MUDSTONES, MINOR PALE CARBONATE
Similar to 238.0 - 238.9m but the dolomite is very pale coloured, with more "clusters" than above and these have diffuse borders.

239.5 - 242.6 LAMINATED CHLORITIC MUDSTONE WITH MINOR DOLOMITE
Very finely bedded material, with bedding undulating only slightly, with dip parallel to the core axis. Minor carbonate flecs along the bedding, some are rhomb shaped, some are rounded with chloritic centres. Minor lenses and nodules of pink and white carbonate throughout, these are rounded and distorted illustrating soft sediment deformation.
Faint cleavage developed throughout, at 240.7m cleavage at 58° to the core axis.
242.4m Bedding 16° with cleavage 63°, strike difference 5° - 10°. If cleavage strikes east-west (say 085° azimuth) and dips south then bedding strikes 050° and dips to 330° at 100° (i.e. the beds appear overturned. Indistinct dewatering channels indicate that the stratigraphic top is away from the collar.
ROVER 4 ANOMALY 1 DDH 3 WRO 1

GEOLOGICAL LOG

METRES

242.6 - 243.9

CHLORITIC MUDSTONE WITH RED DOLOMITE BEDS

The chloritic mudstone is very fine and massive, constituting 60% of the rock.
The dolomite beds are mildly distorted and fractured, and with a general alignment of 23° - 27° to the core axis.
Fracturing is often along this bedding plane.

243.9 - 244.4

PURPLE - GREY VERY FINE MUDSTONE

Upper (bedding) contact at 13° to the core axis. Lower (bedding) contact at 10° to the core axis. The unit is dark purple grey colour with pale green-grey staining (chlorite? epidote?) along fractures and cleavage traces. Cleavage at 50° to the core axis and against bedding.

244.4 - 245.0

CHLORITE (?) DOLOMITE AND MUDSTONE

Well laminated (bedded?) unit with "streaming" of chlorite(?) or epidote (?) which is very fine, pale blue green and surrounds rounded aggregates of pink dolomite. Dolomite nodules and aggregates make up an estimated 20 - 30% of the unit.  "Bedding" at 244.9m is at 12° to the core axis.

245.0 - 248.4

LAMINATED PURPLE-BROWN MUDSTONE

Very finely bedded (average 0.5mm), no apparent carbonate. Bedding distinguished by variations in concentrations of hematite and chlorite. Rare beds contain fine white clayey flecs elongated parallel to the bedding.

245.5m Bedding at 4°
246.2m Bedding parallel to the core.
246.5 - 246.6m Coarse pale green greywacke. Only part of the bed cut by the core. Contains rounded and sub rounded pink quartz and lithic fragments; in a pale blue green chloritic(? matrix. No apparent carbonate.
247.1 - 247.9m Highly fractured
248.0m Bedding 30°.

248.4 - 254.6

MASSIVE CHLORITIC MUDSTONE

Very fine grained dark green mudstone. Thick (to 10cm) quartz and chlorite veining at 45° - 55° to the core axis throughout. Bedding traces have apparently been destroyed by the chloritisation that has taken place.

252.1 - 252.2m As for 252.7 - 252.8m
252.7 - 252.8m Pink, red and grey silicified laminated mudstone. Introduction of silica and jasper have enhanced earlier bedding, making some bands stand out with varying degrees of richness of the jasper or white silica.
Bedding at 22°.
Discolouring by the siliceous solutions leave some
irregular grey patches with only traces of bedding acrps
these linking up with the pale grey and red zones either
side. Upper and lower contacts gradational with the chloriti
zones through pale grey to grey green to green colouring and
a similar variation in hardness.
This effect has taken place prior to the introduction of the
chlorite.

253.4 - 253.8 As for 252.7 - 252.8m above. Bedding 56°.

254.6 - 255.5
CHLORITIC SEDIMENT WITH QUARTZ BRECCIA
Fine, massive green chloritic mudstone with angular fragment
of white quartz. Minor zones with pink brown angular
carbonate fragments.

255.5 - 256.1
CHLORITE, JASPER, CHERT
The top 20cm is dark grey chlorite, (massive) or dark green
very chloritic sediment followed by a mixed zone of chlorite,
chert and jasper over 10cm, then 30cm with minor chlorite but
dominantly grey chert. Contacts are irregular and gradational

256.1 - 257.9
CHLORITE, JASPER, HEMATITE DOLOMITE
Chlorite estimated 10%, jasper 20% earthy red hematite
and metallic hematite estimated 20%, white dolomite 50%
All irregularly concommitantly interveined.

257.9 - 258.4
CHERT AND HEMATITE
Irregular grey chert, cut by & intermixed with red earthy
hematite. Rare carbonate veining.

258.4 - 259.4
GREY CHLORITIC MUDSTONE
Massive very fine dark green chloritic mudstone with minor
quartz, chalcopyrite and dolomite. The dolomite occurs as
aggregates of fine nodules or as very thin (less than 0.5mm)
veins. The quartz is veined and brecciated, while the
chalcopyrite occurs associated with the quartz veins. Both
contacts are distinct.

259.4 - 260.1
JASPER DOLOMITE
Jasper 30%, very fine irregular veining. Dolomite 50%. Quartz
and chlorite each 10%.

260.1 - 260.8
CHLORITIC MUDSTONE
Chloritic very fine sediment, minor pyrite (as fine disseminated
aggregates) red earthy hematite and chlorite veins.
DOLOMITE AND CHERT BANDED CHLORITIC MUDSTONE
Chert bands have been flow stretched and are now elongate, rounded and sometimes abruptly folded. Minor red hematite. Both contacts gradational, chert band at 50° at 260.9m and dolomite band at 55° at 261.3m.

SILICIFIED RED HEMATITE WITH QUARTZ AND DOLOMITE
The dark red earthy hematite (70%) has irregular angular vein generally sub parallel, at 27° - 60°, filled with quartz (or chert ?). The hematite has been silicified and looks similar to jasper but is a deeper brown colour, with the same characteristics as jasper. Some tension gashes filled with the quartz (or chert ?). Minor specularite and chalcopyrite.

GREY BANDED DOOLULUTITE
Grey green and purple very fine sediment (estimated 30%) with grey, white and green carbonate which reacts with dilute hydrochloric acid. (estimated 60%). White carbonate veining estimated 10%. Veining paralleling banding (at 53° at 264.0m) and at right angles to it. Minor irregular veining showing rounding of fragments where the chlorite intrudes.

DARK GREEN VERY FINE MUDSTONE
Very fine grained mudstone - no apparent cleavage or bedding.

BANDED DOOLULUTITE AND HEMATITIC MUDSTONE
The dololulite is the same as for 263.4 - 267.1m with irregular anddistorted banding of very fine red brown hematitic mudstone. Some chloritic mudstone bands with fine carbonate flecs of approximately 0.3mm diameter. Carbonate veining as above, but with some irregular pytgenitic quartz and carbonate veining. Lower contact is 5cm quartz and pink hematite (?) which is fractured and irregular.

VERY FINE MUDSTONE
Dark green and purple brown very fine mudstone with no cleavage or bedding seen. Fractures contain pink fine hematite or apple green chlorite (or epidote?). The lower contact is gradational over 10cm.

BANDED DOOLULUTITE
As for 263.4 - 267.1

VERY FINE MUDSTONE
As for 269.9 - 272.4m but with 5cm of banded dololulutite from 273.4m which is cut by a fault at 26° to the core axis.
DOLOMITE HEMATITE & JASPER QUARTZ

The hematite is black metallic with some specularite (total estimated at 20%); the jasper is generally dark red, but 40% is paler and banded as for the zone 252.7 - 252.8m. Total jasper content is 30% of the unit. The quartz is white, translucent and usually as a veining but often massive and estimated at 40%. In the quartz is white to yellow white irregular, dolomite which is only slightly reactive with acid. Rare pyrite throughout.

276.0 - 284.2

VERY FINE CHLORITIC AND HEMATITIC MUDSTONE WITH BANDED DOLOMITE

276.0 - 277.2m Chloritic mudstone with irregular hematitic mudstone and dolomite veining. The dolomite is much more irregular than above (estimated 25%).

277.2 - 277.8m Pink (hematitic?), white and green (chloritic) dolomite interbedded with very fine chloritic mudstone.

277.8 - 281.2m Chloritic mudstone with very fine (less than 1mm) rounded quartz eyes with minor very fine short irregular veining of yellow-white dolomite.

278.2 - 279.0m As for 277.2 - 277.8m Dolomite veining through-out, irregular but generally at right angles to the core. Bedding at 278.9m 11° and at 279.0m 44° in interbedded dololultite and hematite mudstone/shale.

279.0 - 279.3m As for 277.8 - 281.2m but the quartz becomes coarser and more common with depth.

279.3 - 279.8m Hematitic and chloritic mudstone interbedded, in ratio 55% - 30% respectively with 15% of quartz-dolomite veining.

279.8 - 280.3m Hematitic mudstone interbedded in dololultite. Bedding 39° to core axis.

280.3 - 281.0 Purple-brown very fine mudstone with minor x chlorite bands some of which are not continuous but "stretched" pull-apart structures with rounded ends.

281.0 - 282.2m Chloritic mudstone interbedded with dololultite Minor "soft" disturbance noted throughout. Minor fold feature at 282.0m. Bedding at 281.7m at 18° to core axis and at 282.1m bedding is at 16° in the opposite direction. Stripes differ by an estimated 25°.

282.2 - 283.1m Very fine chloritic mudstone with translucent to transparent white to blue white very fine quartz eyes. Fine porphyrooidal - as for 279.0 - 279.3.
283.6 - 284.2m Interbedded chloritic mudstone with dololutite. Bedding 34° to core axis. Minor "pinch and swell" structures - similar to 280.3 - 281.0m.

284.2 - 290.4m No core - wedge run.

QUARTZ HEMATITE JASPER DOLOLUTITE INTERMIXED WITH VERY FINE CHLORITIC SEDIMENT

Chloritic dololutite veined and breciated by quartz, jasper and dolomite. Minor hematite. The chloritic mudstone is a fragmental with black sub-round to sub angular fragments and similar quartz "fragments" in a very fine chloritic matrix. Rare chalcopyrite in the fine sediment.

291.8 - 295.3m

QUARTZ HEMATITE DOLOMITE JASPER

Irregular mass of interveining by dolomite, metallic hematite and quartz brecciating and cutting the quartz, dolomite and jasper. Minor chlorite.

295.3 - 296.5m

DARK GREEN CHLORITIC SEDIMENT

This unit consists of a very fine chloritic sediment (?) matrix containing sub angular to sub rounded fragments of black, dark green and red brown very fine sediment. The fragment average 1mm diameter but vary up to 5mm. The unit is faintly magnetic and contains no apparent carbonate. In hand specimen, the material consists of 30% fragments and 70% matrix.

296.5 - 308.1m

QUARTZ HEMATITE DOLOMITE/JASPER

The jasper and dolomite dominant throughout but vary through an estimated 20% - 70% at differing intervals. The unit is a zone (as for 291.8 - 295.3) which is concommitant-ly interveined and brecciated throughout and carries minor pyrite and chalcopyrite with pyrite being the dominant sulphide. Overall estimates are dolomite and jasper 35-50% each with 10% quartz and hematite (often specularite).

308.1 - 310.9m

(CHLORITE) MAGNETITE HEMATITE DOLOMITE

The hematite is black, metallic and occurs as very fine irregular veins, the magnetite occurs as "dendritic" features apparently based on the hematite veins and as stoll structures. The dolomite is of two varieties - a massive pale yellow-white, and a more translucent green (chloritic?) to white variety, which generally is the one veining, all else. Dolomite 60 - 70%.

At 308.8m some open vugs have calcite, chalcopyrite and a
poorly crystalline orange mineral (unidentified) apparently non reactive with hydrochloric acid.

Minor chalcopyrite and pyrite throughout.

309.9 - 310.0 10m cm of massive black earthy magnetite.

SULPHIDE DOLOMITE CHLORITE HEMATITE/MAGNETITE

The hematite magnetite is much more massive in this zone and is interspersed with the dolomite, pyrite and chalcopyrite. This hematite and magnetite is intermixed with very fine dark green earthy chlorite.

From 313.5 - 313.9m is a chloritic dololulite with bedding(?) at 57° to the core.

MAGNETITE CHLORITE DOLOMITE

Possibly a chloritic dololulite which illustrates some banding, but is disrupted by dolomite, magnetite, hematite and jasper veining. The chlorite is very fine throughout, the magnetite usually occurs as fine gm growth features which look dendritic or show atoll structures quite often along a bands of hematite (?) (or possibly earlier magnetite). These bands are regular and smooth but have no consistent measurable direction. The hematite is generally more massive and at 319.8 m shows some vugs closely associated with some jasper. The jasper is often brecciated and is only minor throughout whereas the dolomite veining appears to crosscut all other mineralisation and is clearly a later event. Rare pyrite and chalcopyrite.

DOLOMITE HEMATITE MAGNETITE

Although the dolomite is overall less than 20% it does increase, with depth, from 5% to a maximum of 30%. The magnetite and hematite vary from massive to vuggy (hematite) and very irregular veining (generally hematite). Minor jasper occurs throughout, as does rare pyrite and chalcopyrite.

329.2 - 331.0

CHLORITIC SEDIMENT BRECCIA

Minor magnetite and hematite throughout this unit but the breccia fragments are sub angular to rounded and consist of chloritic fine sediment, some of which show what may be remnant bedding. The fragments occupy 30-40% of the rock with 50% as a chloritic matrix. The remainder is made up of quartz, hematite, magnetite, pyrite and chalcopyrite. The sulphides generally occur as very thin disoriented veins.
From 330.4m elongated but sub angular quartz "fragments" increase and from 330.7m jasper (in a similar form) is the dominant mineral.

FRACUTED VERY CHLORITIC FINE SEDIMENT
This is a highly fractured black to very dark green chloritic sediment with slickensides probably indicating an area of shear.

331.9 - 368.5m

CHLORITIC VERY FINE SEDIMENTS
Massive very fine chloritic sediment with minor bedding laminations and rare poorly developed cleavage. All jointing shows slickenside development often coated with fine chalcopyrite. Joint direction is not uniform - there appears to be three or four major directions - not measured.

337.0m Fine bedding at 70°
337.4 - 338.6m Irregular quartz veining sub parallel to core axis.

Thin irregular quartz veining with rare chalcopyrite throughout remainder of unit.

352.0m Fine laminations at 34° to the core axis.
352.6 - 352.7m Brecciated zone of angular quartz and chlorite
354.5 - 354.9m Thick irregular quartz veining.
355.2m Bedding at 40° against cleavage at 43°. Strike differences 15°.

368.5 - 374.3

VEINED CHLORITIC VERY FINE SEDIMENTS
As above but with more chlorite, quartz and chalcopyrite veining.

370.3m 7m thick chlorite vein with a centre of chalcopyrite.
372.2m Fine laminations at 53° to the core.
372.7 - 372.9m Quartz chlorite porphyroid/breccia
(Refer below) Upper contact at 39° to the core axis.

374.3 - 377.0

INFI LLED BRECCIATED MASSIVE FINE SEDIMENT
The sediment is fine grained with much less chlorite than those above.

Angular brecciation appears to be caused by the multiphase veining of quartz, magnetite/hematite, chalcopyrite and chlorite. The quartz is dominant (estimated 90% of the veining) with the hematite/magnetite occurring as black fine lines estimated at 0.1 - 0.2mm thickness, and at
spacings of 1 - 2mm. These represent episodic deposition on the walls of the fractures, by an iron oxide rich material.

**INTERMIXED ZONE OF PORPHYROID/BRECCIA AND FINE SEDIMENT**

The porphyroid/breccia is a quartz chlorite rock with quartz (30%) averaging 3mm diameter up to 1cm diameter maximum. The shape of the quartz varies from circular with a skeletal internal structure, to angular fragments. The matrix appears to be predominantly chloritic (but no thin sections taken).

The sediment is a pale green-grey, the same as for

368.5 - 374.3m, but often cut by irregular angular quartz, chlorite and chalcopyrite veins.

377.0 - 382.3m, Porphyroid/breccia.

382.3 - 385.5m Fine to very fine sediment minor porphyroid, chalcopyrite and quartz veining.

385.5 - 388.0m Porphyroid/breccia

388.0 - 389.4m Fine sediment with veining as above.

388.6m Fine banding at 38° to the core axis.

389.4 - 407.0m Mixed zone of sediments and porphyroid breccia. Maximum sediment "bed thickness" is 40cm.

E.O.H.

B.D./C.W. 21.6.77
Sample: TS2009; TS37155

Rock Name:
Altered (dolomitized) tuff.

Hand Specimen:
A pink to reddish-brown coloured rock with a well developed fragmental texture.

An X-ray diffraction trace shows that the rock consists mainly of dolomite with smaller amounts of quartz, muscovite, chlorite, orthoclase and hematite chert.

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

<table>
<thead>
<tr>
<th>Constituent</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dolomite</td>
<td>45</td>
</tr>
<tr>
<td>Muscovite-sericite</td>
<td>15</td>
</tr>
<tr>
<td>Microcrystalline silica</td>
<td>15</td>
</tr>
<tr>
<td>Quartz</td>
<td>10</td>
</tr>
<tr>
<td>Chlorite</td>
<td>5</td>
</tr>
<tr>
<td>Orthoclase</td>
<td>5</td>
</tr>
<tr>
<td>Rutile</td>
<td></td>
</tr>
<tr>
<td>Opaques and semi-opaques</td>
<td>5</td>
</tr>
</tbody>
</table>

This sample consists mainly of dolomite intergrown with microcrystalline silica and fine flakes of muscovite-sericite. The dolomite forms irregularly shaped crystals up to 0.5 mm in size and polycrystalline aggregates which are separated by intergranular structures of intergrown microcrystalline silica and phyllosilicates. The interstitial microcrystalline silica and clay intergrowths are somewhat similar to the matrix of the previously described altered tuffs (TS2006-8; TS37152-4) although their extensive intergrowth with carbonate has largely destroyed any fragmental textures.

Anhedral quartz grains up to 0.5 mm in size are disseminated through the rock and locally exhibit highly embayed shapes typical of phenocrystic quartz in volcanic rocks. Anhedral, round orthoclase crystals up to 0.8 mm in size are also disseminated through the rock and generally contain abundant inclusions of dolomite.

The chlorite occurs mainly intergrown with the muscovite and microcrystalline silica as flakes and flaky aggregates with a pale green, weakly pleochroic colour. Traces of translucent yellowish rutile disseminated through the rock as small grains below 0.05 mm in size.

Opaques occur mainly marginal to the round dolomite crystals and polycrystalline aggregates as anhedral grains up to 0.3 mm in size and narrow vein-like structures below 0.05 mm wide. Locally the opaques are concentrated into large patches up to 3 mm in size. Translucent, reddish-brown iron oxides are intergrown with much of the dolomite imparting a turbid colour to the dolomite.

This sample appears to represent a tuffaceous rock somewhat similar to the previously described altered tuffs which has been extensively replaced by dolomite. This sample contains potash feldspar crystals which are lacking in the previously described altered tuffs and these potash feldspar crystals have also been largely replaced by dolomite.
Sample: TS2013; TS37157

Rock Name: Silicified tuff or tuffaceous sediment.

Hand Specimen: A massive reddish-brown coloured rock with patches and arcuate structures of paler green coloured material.

An X-ray diffraction trace of this sample shows that it consists mainly of quartz with a smaller proportion of muscovite and minor amounts of dolomite, chlorite and hematite.

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

<table>
<thead>
<tr>
<th>Constituent</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cryptocrystalline and microcrystalline silica</td>
<td>75</td>
</tr>
<tr>
<td>Sericite</td>
<td>20</td>
</tr>
<tr>
<td>Dolomite</td>
<td>3</td>
</tr>
<tr>
<td>Opaques and semi-opaques</td>
<td>2</td>
</tr>
</tbody>
</table>

This sample consists essentially of a very fine-grained matrix of microcrystalline to cryptocrystalline silica intergrown with finely divided phyllosilicate flakes. The phyllosilicates have been termed sericite but probably consist mainly of finely divided muscovite and a smaller proportion of chlorite as suggested by the X-ray diffraction results. Most of the matrix has a somewhat turbid character produced by finely divided, micron-sized inclusions which most likely represent hematite and imparts the reddish colour to the matrix in hand specimen. The matrix exhibits well developed shard textures indicating a tuffaceous origin for the rock.

The sample is cut by several veins up to 0.8 mm wide filled with granular dolomite. The dolomite is also present locally as irregular patches up to 0.5 mm in size. In a few of the patches fibrous chlorite is intergrown with the dolomite. Minor fibrous chlorite is also present as small patches below 0.3 mm in size.

The thin section does not include any of the large green structures noted in hand specimen and these are believed to consist of dolomite and fibrous chlorite.

A single anhedral quartz grain approximately 0.8 mm in size was noted.

This sample is a very fine-grained tuff or tuffaceous sediment which retains well developed shard structures despite silicification to produce abundant cryptocrystalline to microcrystalline silica.
Sample: TS2014; TS37158

Rock Name: Dolomite.

Hand Specimen:
A pale pink coloured rock with an irregular mottled to banded character. The carbonate was identified as dolomite by X-ray diffraction.

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

<table>
<thead>
<tr>
<th></th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dolomite</td>
<td>98</td>
</tr>
<tr>
<td>Opaques and semi-opaques</td>
<td>1</td>
</tr>
<tr>
<td>Clay</td>
<td>1</td>
</tr>
</tbody>
</table>

This sample is comprised almost completely of dolomite with a fine grain size of approximately 0.1 to 0.15 mm and a recrystallized, interlocking granular texture.

The only other minerals present in the sample are translucent, reddish-brown iron oxides and clay-sericite which are concentrated in narrow bands below 0.1 mm wide which have a subparallel orientation and a highly undulose character. These bands are considered to represent stylolites or incipient stylolites.

This sample is a recrystallized dolomite with some small stylolitic structures. The stylolites in this sample are much smaller and less well developed than the remnant stylolites noted in sample TS2010 (Obs. 41) (TS37156).
Fig. 1  LOCALITY PLAN SHOWING E.L. 228

Fig. 2

APPROXIMATE POSITIONS OF ROVER PROSPECTS
WITHIN EXPLORATION LICENCE No. 228
RESIDUAL MAGNETIC INTENSITY

GREEN SWAMP WELL
WITH ADDITIONS FROM OTHER SURVEYS
BILLIATT II
GEOPEKO LIMITED

APPROX SCALE 1:50,000

CONTOUR INTERVAL 10.0 GAMMAS
SHADINGS ON LOW SIDE 5.0 GAMMAS

DATUM 1965 IGFR UPDATED TO 1974
FLIGHT LINE SPACING 400 METRES
FLIGHT ALTITUDE 100 METRES AMSL
FLown AND COMPILED 1973-19/4
INSTRUMENT GEOMETRICS G-803 PHOTON MAGNETOMETER

LOCATION INDEX

LEGEND

- Mineral Lease
- Grid Lines
- Graded track
- Well defined vehicle track

SURVEY AND COMPILED BY:

geoMetrics
EL 228

TF1786