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SML 339

REAPHOOK HILL

PROGRESS AND TECHNICAL REPORTS TO LICENCE EXPIRY/SURRENDER FOR THE PERIOD 16/10/1969 TO 15/4/1971

Submitted by
Dobbyn Mines Pty Ltd and Delhi International Oil Corp.
1971

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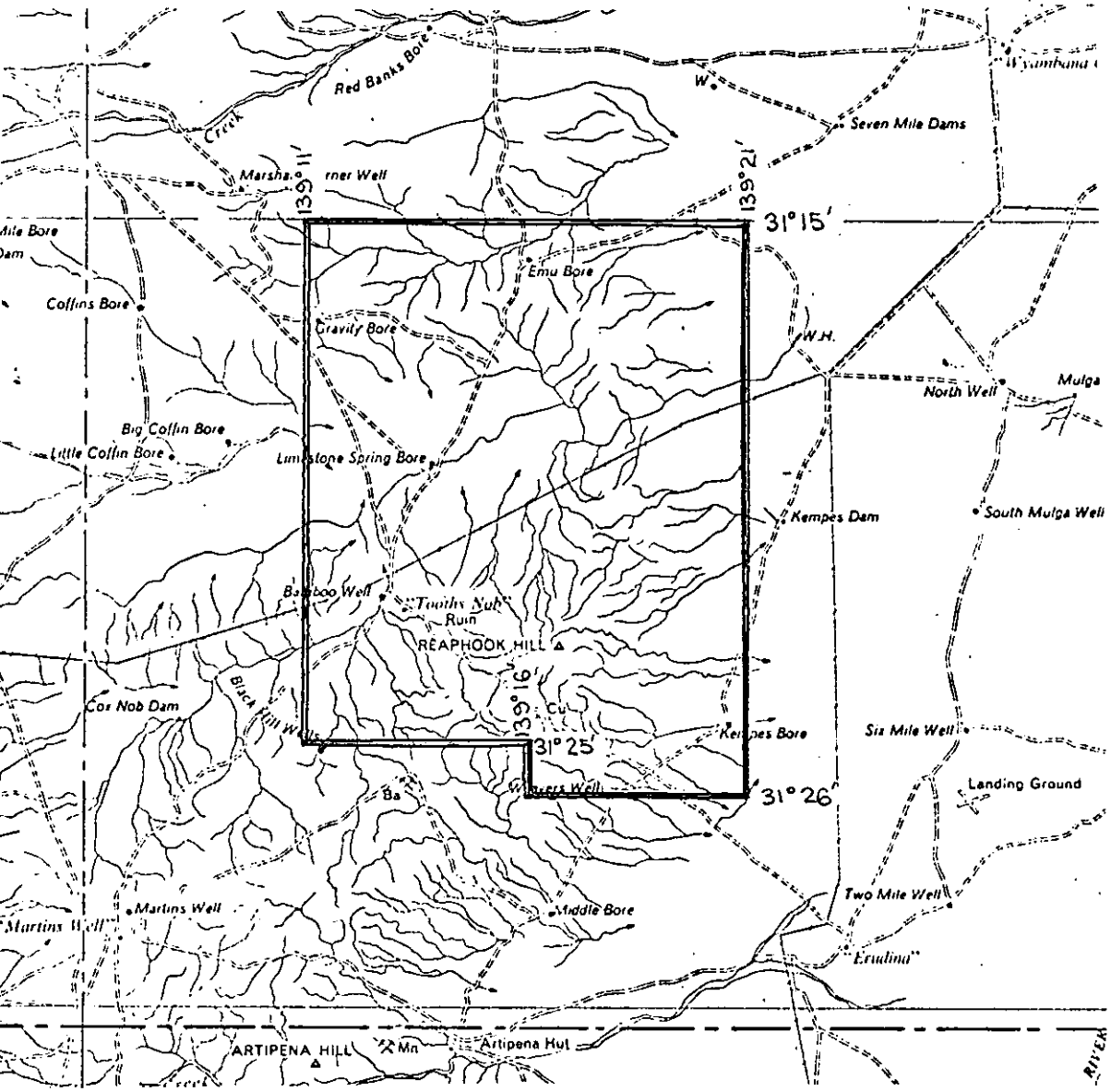
Government of South Australia
Primary Industries and Resources SA



SCALE = 1:250,000

DOBBYN MINES PTY. LTD.

DOCKET D.M. 1086/69 AREA 120 SQ MILES

1:250000 PLANS . PARACHILNA

LOCALITY

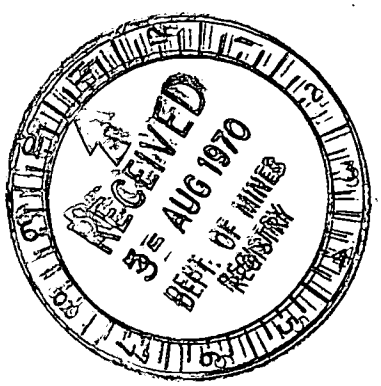
S.M.L. No. 339 EXPIRY DATE 15.10.71

CONTENTS ENVELOPE 1363

TENEMENT: S.M.L. 339

TENEMENT HOLDER: Dobbyn Mines Pty. Ltd.

ENV. 1363



DOBBYN MINES PROPRIETARY LIMITED

Special Mining Lease No. 339

Report on activities for the period ended 14th April, 1970

During the period geological reconnaissance using existing geological maps and topographical information was carried out. Existing aerial photography was examined and it was decided to commission Qasco Aerial Surveys to fly the area in colour from a height of 6,000 feet.

Colour aerial photography has proved very successful in the exploration of Proterozoic rocks in the Company's leases near Mount Isa in Queensland.

The area was flown in late January but because of technical difficulties Qasco were unable to deliver the colour prints until early April. Because of poor overlap and photo control this photography was not useable for geological interpretation. Qasco were instructed to re-fly the area.

During the period a study of all available literature especially Kennecott's report was made. Ground control points were marked out by surveyors from Delhi International Oil Corporation to enable topographical plans of a contour interval of 10 feet to be prepared.

A summary of expenditure is attached.

DOBBYN MINES PROPRIETARY LIMITED

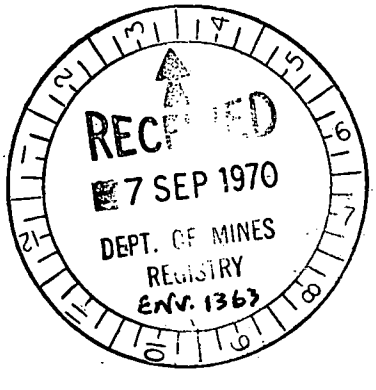
Report on Activities for the period ended 14th July, 1970.

Colour aerial photographs taken from a height of 12,000 feet were received during the period, and a geological base map was prepared.

Detailed geochemical work over selected areas will be undertaken during the next period.

A preliminary copy of the geological map with a scale of 2" = 1 mile is attached.

A summary of expenditure is attached.



1086/69

DELHI INTERNATIONAL OIL CORPORATION

VAM LIMITED

AND

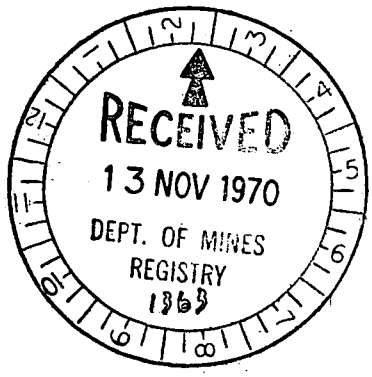
HASTINGS COPPER PTY. LTD.

SPECIAL MINING LEASE NO. 339

QUARTERLY REPORT

FOR THE PERIOD

JULY 16, 1970, TO OCTOBER 15, 1970



EXPLORATION

No field exploration work was undertaken during this report period.

During the latter part of the period, Dobbyn Mines Pty. Ltd. advised that they were no longer in a position to act as the operators for the Joint Venture formed to explore the Special Mining Lease.

A review of all existing data was undertaken by Delhi International Oil Corporation in the latter part of the period.

EXPENDITURE

Nil.

FUTURE PROGRAMME

As a result of the above review, a programme of geological field mapping, sampling and drilling will be planned to commence late in 1970, and continue through the early part of 1971. Detailed mapping, sampling (both chip and stream) and assaying are to be carried out over the copper occurrence located

south of Reaphook Hill. The drilling programme is envisioned to further test the zinc and manganese potential of that area immediately to the east of Reaphook Hill previously outlined by Kennecott Exploration (Australia) Pty. Ltd., and to test for these same minerals in other selected parts of the Special Mining Lease.

It is anticipated that conduct of these programmes will provide considerable information necessary for proper direction of further exploration or evaluation programmes, and will remedy the current deficiency in expenditure on the Special Mining Lease.

REPORT ON PRELIMINARY GEOCHEMICAL INVESTIGATIONS IN THE REAPHOOK HILL AREA S.M.L. NO. 339, SOUTH AUSTRALIA

for

DELHI INTERNATIONAL OIL CORPORATION

B.V.L. Rees

of

Cundill Meyers and Associates Pty. Ltd.

January, 1971

CONTENTS

FIGURES

SUMMARY

Eleven traverses of rock chip samples were collected during a preliminary prospecting programme in S.M.L. 339 in the Reaphook Hill region of South Australia. While no obvious zinc or manganese deposits were located during investigations a few manganese rich zones, which might be more extensive below the surface, were encountered. The Parachilna Formation contains the zinc deposit occurring north of Reaphook Hill and was a prime target during investigations. However, it was found that most localities in which this formation was to be expected, i.e. between the Pound Quartzite and Wilkawillina Limestone, were occupied by an alluvial filled depression.

Further exploration is dependant on favourable assay results of the chip samples.

INTRODUCTION

In December 1970 a brief prospecting survey was completed for Delhi International Oil Corporation in the Reaphook Hill region of the Flinders Ranges, South Australia.

Special Mining Lease No. 339, an area of about 110 square miles, is situated about 260 miles north of Adelaide. It was formerly held as S.M.L. 137 by Kennecott Australia Pty. Ltd., which company did extensive exploration in the search for zinc and manganese in 1966-67. This work is described in "Final Report on S.M.L. 137, Reaphook Hill, 25th March 1967". Several exploratory drill holes were completed, and costeans dug, to explore anomalous zones in a region one mile north of Reaphook Hill. This zone was originally detected by stream sediment sampling techniques.

The current programme was designed, in part, to further explore similar anomalous regions (but of lower grade) a few miles north of Reaphook Hill. The B.M.R. have reported a copper show south of Reaphook Hill and within S.M.L. 339. The remaining part of this programme was to locate this show and to measure and sample the outcrop.

Reaphook Hill is one of many hogbacks in the eastern Flinders Ranges southwest of Lake Frome. The block included by S.M.L. 339 is largely of high relief and well dissected by seasonal streams. To the north, east and west of the mountainous zone are Quaternary alluvial plains with clay pans and frequent dissecting water-courses. Paleozoic limestones within the mountainous region generally form "plateaux" of approximate uniform altitude and have been described by Kennecott geologists as representative of Tertiary erosional surfaces. Arenaceous formations are generally of greater altitude and are more irregularly dissected.

This region of the Flinders Ranges is semi-arid to arid with an annual winter rainfall of five to six inches. Consequently streams flow for very limited periods and waterholes are not common. However, the alluvial plains, particularly those to the west of the lease area receive much water as seepage and run off from the Flinders Ranges. Wells in these plains generally contain abundant water supplied, even if many regions to be saline and their water fit for stock use only.

The vegetation supported by the scant rainfall consists of typical desert shrub species of Acacia (Karara, mulga) Casuarina and Erimophylla with a few herbaceous species. Gums and similar tall trees are rare except near water courses where they become dominant.

GENERAL GEOLOGY AND SAMPLING METHODS

GEOLOGY

The eastern region of the Flinders Ranges, which ~~is~~ included[5] ~~by~~ the prospect area, consists of folded Upper Proterozoic and Lower Cambrian sediments surrounded by Quaternary sediments. The stratigraphic column for S.M.L. 339 is:

Quaternary:

Lower Cambrian	Hawker Group	Billy Creek Formation	red or white sandstones.
		Wilkawillina Limestone	grey to pink dolostone and limestone.
		Parachilna Formation	sandstone and siltstone.

_____ disconformity _____

		Pound Quartzite	white & red orthoquartsite and sandstone.
Protero-zoic	Wilpena Group	Wonoka Formation	Grey limestone.
		Bunyeroo Formation	Purple and green shales etc.
		Brachina Formation	Brown siltstone and sandstone.

The lithologies have been described previously by[4] Kennecott (op.cit.). During the present phase of exploration the main zone of interest was the Lower Cambrian limestones (?dolostones) and shales, which, as reported by Kennecott, were found to

contain anomalous zinc concentrations. Also included in the investigations were the small outcrops of copper carbonates in the Wonoka Formation. These formations only will be described in this report.

The Cambrian sediments occur as two elevated basins disconformably overlying Proterozoic sandstones to the west and appearing to be truncated by faults, in contact with Quaternary sediments to the east.

The lowermost sandstones of the Billy Creek Formation form the stratigraphically upper limit of sampling. The sediments are comprised of cream coloured quartzites (lines 6, 10) or red, in part, micaceous sandstones (lines 4, 5).

The Wilkawillina Limestone was the zone of prime interest in this phase of exploration. Lithologies consist of a generally monotonous sequence of grey or pink, slatey dolostones and limestone. Sandy horizons, towards the top of the formation exhibit cross bedding. There are few occurrences of manganese rich material (line 9); elsewhere manganese dendrites are not uncommon.

Whereas the limestone formations tend to form resistant hills or plateaux, the Parachilna Formation is generally represented by depressions or scree covered slopes between the Pound Quartzite and Wilkawillina Limestone outcrops. Except in the immediate region of Reaphook Hill, where Kennecott has dug many costeans, this formation is poorly exposed and its position is inferred. However, since this formation is known elsewhere in the Flinders Ranges to occur as lenses rather than a continuous horizon, inferrences such as these must be made with reservations.

Proterozoic sediments form the stratigraphic base for sampling along traverses north of Reaphook Hill. The uppermost section of Pound Quartzite consists of whitish,

massive sandstone and orthoquartzite. Occasional interbedded lenses of reddish ferruginous sandstone and micaceous siltstone also occur.

Grey, partly siliceous, limestones of the Wonoka Formation conformably underlie the Pound Quartzite. South of Reaphook Hill (lines 1, 2, 3) and near line 8, the Wonoka Formation is found to contain copper mineralisation in the form of carbonates along joints.

Sampling and descriptions of traverses

Eleven traverses of rock chip samples were taken from across the Wilkawillina Limestone and are described in Appendix No. 1.

Two areas of sampling occur (ref. Delhi International Oil Corporation inter-office correspondence, 10.12.70; J.H. Allen to D.L. Burton).

Area One

Three lines of samples were collected over the mineralised zone in the Wonoka Formation south of Reaphook Hill. The location of lines is indicated on aerial photograph No. 4, QAS 315C, Run 2, Reaphook Hill, 25.6.70. The lines are 100 feet long and samples were taken at approximate 10 foot intervals so as to include the mineralised zone and surrounding rocks (ref. figure 1).

The mineralised zone occures in a narrow (1/4 - 2 feet wide) horizon of silty limestone with a strike length of over 3/4 mile. A fault terminates the western end of the zone while the eastern end grades into barren rock. This horizon occurs at, or near, the crest of a low hill which appears prominently on the aerial photograph. Numerous faults off-set the mineralised horizon and intensive folding (so much as to duplicate the horizon in at least one locality) has also occurred. Malachite is the principal copper mineral and azurite becomes common towards the eastern end only.

Area Two

Eight sample lines of varying length and sample interval were completed across the Wilkawillina Limestone. These have been located on aerial photographs:

No. 4	-	line 4	QAS 315C
5	-	line 5	Run 2,
6	-	line 6	Reaphook
7	-	lines 7, 8, 9, 10	Hill
9	-	line 11	25.6.70

A summary of the lines is thus:

No. 4 - length 3600 feet, bearing 038°M
sample interval 50 feet.

west of 00	-	Pound Quartzite
00 - 3450	-	Wilkawillina Limestone
east of 3500	-	Billy Creek Formation

No. 5 - length 5300 feet, bearing 065°M
sample interval 50 feet.

west of 50	-	Pound Quartzite
100 - 200	-	Scree ? Parachilna Formation
250 - 450	-	Scree) Wilkawillina Limestone
500 - 5200	-	)
east of 5250	-	Billy Creek Formation

No. 6 - length 3000 feet, bearing 079°M
sample interval 50 feet.

west of 50	-	Pound Quartzite
50 - 2850	-	Wilkawillina Limestone
east of 2900	-	Billy Creek Formation

No. 7 - length 800 feet, bearing 277°M
sample interval 20 feet.

00 - 680	-	Wilkawillina Limestone
700 - 720	-	Scree (?)
west of 740	-	Pound Quartzite

No. 8 - length 1800 feet, bearing 280°M, sample interval 20 feet.

00 - 1240	-	Wilkawillina Limestone
1260 - 1280	-	Pound Quartzite
1300 - 1500	-	Wonoka Formation

No. 9 - length 1800 feet, bearing 272°M, sample interval 20 feet.

00 - 1800	-	Wilkawillina Limestone
(800 - 860		Mn & Fe lenses)

No. 10 - length 4400 feet, bearing 172°M, sample interval 50 feet.

00 - 4250	-	Wilkawillina Limestone
south of 4300	-	Billy Creek Formation

No. 11 - length 2700 feet, bearing 082°M, sample interval 50 feet.

west of 350	-	Wonoka Formation
400 - 600	-	Pound Quartzite
650 - 2000	-	Wilkawillina Limestone
east of 2050	-	Alluvium ?Wilkawillina Limestone

CONCLUSIONS

Area One

Preliminary investigations have shown that the secondary copper mineralisation in the Wonoka Formation is, at the surface, of very small stratigraphic width. Assays of the dolostone/limestone above and below the mineralised horizon should indicate if the primary copper mineralisation is dispersed further through the formation or if it is restricted to the silty band.

It seems that the latter is the case. If so, this copper show is not of economic proportions.

Area Two

This phase of sampling has covered all the Wilkawillina Limestone within the lease area - in a primary sense. Kennecott geologists are of the belief that zinc and manganese mineralisation occurred in the Wilkawillina Limestone and Pa achilna Formation in minor amounts and were concentrated by oxidating processes near the present surface. While only a few manganese rich zones were encountered, this sampling should reveal any anomalous zones. Interesting zones (i.e. where manganese oxides were located or where the base of the Wilkawillina Limestone was traversed) occur in the region of lines 8 and 9.

RECOMMENDATIONS

Area One

Providing assay results of the samples across the copper bearing silty limestone prove to be encouraging, i.e. the copper mineralisation is not confined to a very narrow horizon, a second phase of exploration might be undertaken.

Investigation by soil sampling techniques to the west and northwest of the known copper outcrop. The Wonoka Formation trends westward south of Reaphook Hill but then turns about to strike northwards to the west of Reaphook Hill. The copper mineralisation found on line 8 is not stratigraphically equivalent to the deposit in this area but its occurrence might indicate that more than one copper bearing stratum exists in the Wonoka Formation. Consequently the work proposed is:

a) to make soil sample traverses perpendicular to the strike of the rocks in several localities to fully explore this formation. The traverses should, where possible, extend across the entire formation. Sample intervals should not exceed 100 feet and preferably be 50 feet. Chip samples can be taken in addition to soil samples (the latter is preferred in a reconnaissance survey in this region as suitable outcrops for chip sampling are not always present).

b) the known occurrence of copper should be investigated at depth by drilling means. The location of a rig in this region for a programme as small as this particular one, is not economically

feasible. However, if a rig is contracted for other work it might be diverted to perform this operation. It is envisaged a small track mounted percussion rig would be most suitable at this stage.

Area Two

The Parachilna Formation is the most favourable formation for the occurrence of zinc. However, this Formation is not very well exposed in the lease area and its presence is inferred only north of Reaphook Hill. Chip sampling would not reveal its presence as this formation is typically covered by scre s, etc., or forms alluvium covered depressions between the Pound Quartzite and Wilkawillina Limestone. The best way to investigate its presence might be by drilling through the alluvium in favourable looking areas, i.e., where the boundary between the Pound Quartzite and Wilkawillina Limestone is not faulted, or, where an alluvial filled depression occurs.

Further, depending on the results of this initial phase of sampling, chip or soil samples, might be taken in the vicinity of lines 7, 8 and 9. The sampling programme would best be designed after the assay results were carefully examined.

APPENDIX 1

Descriptions of Sampling Traverses

Line 1. 100 feet long, bearing 028°M. Proposed sample interval 10 feet.

0	no outcrop
27	pinkish dolomitic limestone
44	" " "
46	" " "
50	white to grey, shaley limestone with malachite
52	pinkish dolomitic limestone
59	" " "
100	no outcrop

In addition, a channel sample was taken across the two foot wide cupriferous zone.

Line 2. 100 feet long, bearing 042°M. Proposed sample interval 10 feet.

0	no outcrop
22	pinkish dolomitic limestone
45	" " "
50	white to grey shaley limestone with malachite and minor azurite.
60	pinkish dolomitic limestone
70	" " "
90	" " "
100	no outcrop

In addition, a channel sample was collected from across the three foot wide cupriferous zone.

Line 3. 100 feet long bearing 032°M. Proposed sample interval 10 feet.

0	pinkish grey dolomitic limestone
14	"
38	"
48	" dips 18° @ 032°
50	whitish silty limestone
52	pinkish grey dolomitic limestone
56	"

Line 4. length 3600 feet bearing 038°M. Sample interval 50 feet westwards is creek, then scree of quartzite (Pound Qtzite)

00	poor outcrop of limestone
50	" " iron and manganese stained float
100	no outcrop - no sample
150	poor outcrop of limestone, Fe & Mn stained float.
200	limestone - Mn staining
250	" "
300	poor outcrop of limestone - Mn staining much scree
350	" " "
400	" " (ridge)
450	" "
500	no outcrop - scree - no sample
550	" " "
600	poor outcrop of limestone
650	no outcrop - no sample
700	poor outcrop of limestone - manganese oxide float
750	limestone
800	"
850	poor outcrop of limestone - manganese oxide float
900	" "
950	" "
1000	"
1050	limestone (creek)
1100	"
1150	"
1200	poor outcrop of limestone

1250	alluvium - no sample	
1300	creek bed - no sample	
1350	limestone	(creek)
1400	"	(ridge)
1450	poor outcrop of limestone	
1500	"	
1550	"	
1600	creek bed - no sample	
1650	poor outcrop of limestone	
1700	"	
1750	"	
1800	"	
1850	limestone	
1900	"	
1950	poor outcrop of limestone	
2000	"	
2050	limestone	
2100	"	(ridge)
2150	poor outcrop of limestone	(creek)
2200	"	
2250	"	
2300	"	
2350	"	
2400	"	
2450	"	
2500	no outcrop - no sample	
2550	poor outcrop of limestone	
2600	alluvium - no sample	
2650	" "	
2700	" "	
2750	poor outcrop of limestone	
2800	"	
2850	"	(crest)
2900	limestone	
2950	"	
3000	"	
3050	"	(creek)
3100	"	(crest)
3150	"	
3200	"	

3250	poor outcrop of limestone
3300	limestone (creek)
3350	" "
3400	limestone
3450	poor outcrop of limestone - much float
3500	reddish sandstone - Mn staining (Billy Creek Fm.)
3550	poor outcrop of sandstone
3600	"

Line 5. length 5300 feet, bearing 065°M, sample interval 50 ft.

00	poor outcrop of quartzite (Pound Quartzite)
50	no outcrop - quartzite scree, no sample.
100	" " "
150	" - scree and alluvium no sample
200	alluvium - no sample - (creek)
250	" " "
300	" " "
350	" (? Parachilna Fm.)
400	" " "
450	" " (creek)
500	" - limestone float - no sample
550	poor outcrop of limestone
600	"
650	"
700	"
750	"
800	"
850	limestone (ridge)
900	poor outcrop of limestone
950	alluvium - no sample
1000	" "
1050	poor outcrop of limestone
1100	alluvium - no sample
1150	poor outcrop of limestone
1200	"

1250 alluvium with rounded pebbles of siliceous limonite - no sample
1300 "
1350 "
1400 "
1450 "
1500 "
1550 poor outcrop of limestone
1600 "
1650 "
1700 "
1750 "
1800 "
1850 "
1900 "
1950 "
2000 "
2050 "
2100 "
2150 "
2200 "
2250 "
2300 "
2350 "
2400 "
2450 " quartzite scree
2500 no outcrop no sample quartzite scree
2550 poor outcrop of limestone
2600 no outcrop no sample quartzite scree
2650 "
2700 "
2750 "
2800 "
2850 "
2900 poor outcrop of limestone
2950 no outcrop no sample quartzite scree
3000 "
3050 "
3100 "
3150 "

3200	no outcrop no sample quartzite scree
3250	" " "
3300	poor outcrop of limestone
3350	"
3400	no outcrop no sample
3450	" "
3500	" "
3550	" "
3600	" "
3650	" "
3700	" "
3750	poor outcrop of limestone
3800	"
3850	"
3900	"
3950	"
4000	"
4050	"
4100	"
4150	limestone
4200	"
4250	"
4300	"
4350	"
4400	poor outcrop of limestone
4450	"
4500	"
4550	"
4600	limestone - well bedded - dips 25° @ 050°
4650	quartzite
4700	limestone
4750	"
4800	"
4850	"
4900	"
4950	"
5000	"
5050	"
5100	"

5150	poor outcrop of limestone
5200	"
5250	no outcrop - no sample
5300	sandstone (Billy Creek Formation)

Line 6. length 3000' - bearing 079°M. Sample interval 50 feet

00	quartzite dip 25° @ 080°M (Pound Quartzite)
50	limestone, pinkish, cross bedded (Wilkawillina Limestone)
100	limestone, pinkish, sandy
150	" " "
200	grey limestone - well bedded
250	" "
300	" poor outcrop
350	" "
400	"
450	" manganese dendrites
500	"
550	poor outcrop of limestone
600	grey limestone
650	poor outcrop of limestone - much scree
700	" "
750	pink limestone
800	poor outcrop of limestone
850	"
900	"
950	"
1000	"
1050	"
1100	limestone
1150	"
1200	poor outcrop of limestone
1250	limestone
1300	"
1350	poor outcrop of limestone
1400	"
1450	"

1500 poor outcrop of limestone
1550 " (creek)
1600 "
1650 " (ridge)
1700 poor outcrop of limestone
1750 "
1800 "
1850 "
1900 "
1950 "
2000 "
2050 "
2100 "
2150 "
2200 "
2250 "
2300 "
2350 "
2400 well bedded limestone - good outcrop
2450 " " (creek)
2500 " " (ridge)
2550 "
2600 "
2650 "
2700 limestone - cross bedding
2750 " "
2800 poor outcrop of limestone
2850 "
2900 quartzite whitish (Billy Creek Formation)
2950 " " (creek)
3000 " cross bedded

(quartzite bedding steepens from about 40° to 60° at the creek)

Line 7. length 800 feet, bearing 277°M. Sample interval 20 feet.

(alluvium east of traverse)

00 limestone
20 "
40 "
60 poor outcrop of limestone
80 limestone
100 "
120 no outcrop, scree - no sample
140 pink limestone
160 "
180 no outcrop - no sample
200 limestone - much scree
220 " "
240 poor outcrop of limestone - scree
260 "
280 limestone (ridge)
300 poor outcrop of limestone
320 "
340 "
360 "
380 sandy limestone (quartzite lenses)
400 "
420 quartzite
440 limestone - dips 15° @ 052° cross bedded
460 "
480 "
500 "
520 "
540 "
560 "
580 "
600 "
620 "
640 "
660 limestone
680 poor outcrop of limestone - scree

700 no outcrop - no sample

720 " "

740 green siltstone and minor quartzite (Parachilna Formation ?)

760 green micaceous siltstone

780 quartzite (Pound Quartzite)

800 quartzite dips 40° @ 090° (creek)

Line 8. length 1800 feet bearing 280°M. Sample interval 20 feet.

(Alluvium east of traverse.)

00 limestone

20 "

40 "

60 "

80 poor outcrop of limestone

100 limestone - ? minor rhodochrosite with dendrites.

120 poor outcrop of limestone - Mn dendrites

140 limestone

160 very poor outcrop of limestone - scree

180 ruggy limestone (? re-crystallised)

200 limestone

220 "

240 poor outcrop of limestone

260 no outcrop - scree - no sample

280 " "

300 very weathered limestone

320 poor outcrop of limestone

340 "

360 "

380 limestone

400 no outcrop - no sample

420 limestone

440 limestone
460 no outcrop - scree - no sample
480 poor outcrop of limestone
500 pink limestone - Mn dendrites
520 "
540 poor outcrop of limestone
560 "
580 "
600 limestone
620 "
640 "
660 grey limestone
680 "
700 "
720 "
740 "
760 pink ruggy limestone
780 grey limestone
800 " - Mn dendrites
820 pink ruggy limestone - Mn dendrites
840 " "
860 grey limestone
880 "
900 "
920 pink limestone
940 "
960 poor outcrop of limestone
980 "
1000 grey limestone
1020 "
1040 "
1060 "
1080 "
1100 " (ridge)
1120 "
1140 "
1160 " dips 58° @ 110°M
1180 "
1200 "
1220 "

1240	limestone and purple shale (? Pound Quartzite)
1260	no outcrop - no sample
1280	" " (? fault)
1300	limestone scree (? Wonoka Formation)
1320	siliceous, sandy limestone - Mn staining
1340	scree - no sample
1360	limestone
1380	"
1400	"
1420	well bedded limestone - dips 40° @ 125°M
1440	limestone - (minor quartzite)
1460	grey limestone
1480	"
1500	" (diggings)

Additional samples RH - 1, 2 - was collected north of 1480'. RH - 3 was collected from near 1240'.

Line 9. length 1800 feet, bearing 172°M, sample interval 22 feet.

00	grey, fine grained limestone
20	"
40	"
60	"
80	"
100	"
120	"
140	"
160	"
180	"
200	"
220	"
240	"
260	"
280	"
300	"
320	"
340	"

360	grey fine grained limestone
380	"
400	"
420	"
440	"
460	"
480	"
500	"
520	"
540	"
560	"
580	alluvium - no sample (creek)
600	limestone - Mn staining
620	"
640	"
660	grey limestone
680	"
700	poor outcrop of limestone
720	grey limestone
740	" Mn dendrites
760	"
780	manganese rich rock, with limestone
800	limestone, Fe and Mn oxide cobbles
820	" "
840	" "
860	" "
880	grey limestone
900	" (creek)
920	"
940	"
960	"
980	"
1000	"
1020	" Mn dendrites
1040	" "
1060	" "
1080	" "
1100	"
1120	" Mn dendrites
1140	" "
1160	" "

1180 grey limestone - Mn dendrites
1200 " "
1220 " "
1240 grey limestone
1260 " Mn dendrites
1280 ruggy recrystallised limestone
1300 grey limestone
1320 "
1340 "
1360 grey limestone
1380 "
1400 no outcrop - no sample - (creek)
1420 " "
1440 limestone Mn dendrites
1460 "
1480 pink limestone
1500 "
1520 brown (? ferruginous) limestone
1540 limestone
1560 " Mn dendrites
1580 " "
1600 grey limestone
1620 "
1640 "
1660 "
1680 "
1700 "
1720 "
1740 poor outcrop of limestone
1760 limestone
1780 "
1800 "

Line 10. length 4400 feet, bearing 172° M, sample interval 50 feet

00	grey massive limestone
50	"
100	"
150	"
200	"
250	"
300	"
350	"
400	"
450	"
500	"
550	"
600	"
650	"
700	"
750	"
800	"
850	"
900	alluvium - no sample (creek)
950	grey limestone
1000	"
1050	"
1100	"
1150	"
1200	"
1250	"
1300	"
1350	"
1400	"
1450	"
1500	"
1550	"
1600	"
1650	"
1700	"
1750	"
1800	alluvium - no sample - (creek)

1850 grey limestone
1900 "
1950 "
2000 "
2050 "
2100 "
2150 "
2200 "
2250 "
2300 "
2350 "
2400 "
2450 "
2500 "
2550 weathered limestone
2600 "
2650 "
2700 no outcrop - no sample
2750 limestone
2800 alluvium - no outcrop - no sample
2850 " " "
2900 " " "
2950 grey limestone
3000 "
3050 no outcrop - no sample
3100 grey massive limestone
3150 "
3200 "
3250 "
3300 "
3350 alluvium - no outcrop - no sample
3400 " " "
3450 grey limestone
3500 alluvium - no outcrop - no sample
3550 sandstone
3600 no outcrop - no sample
3650 limestone

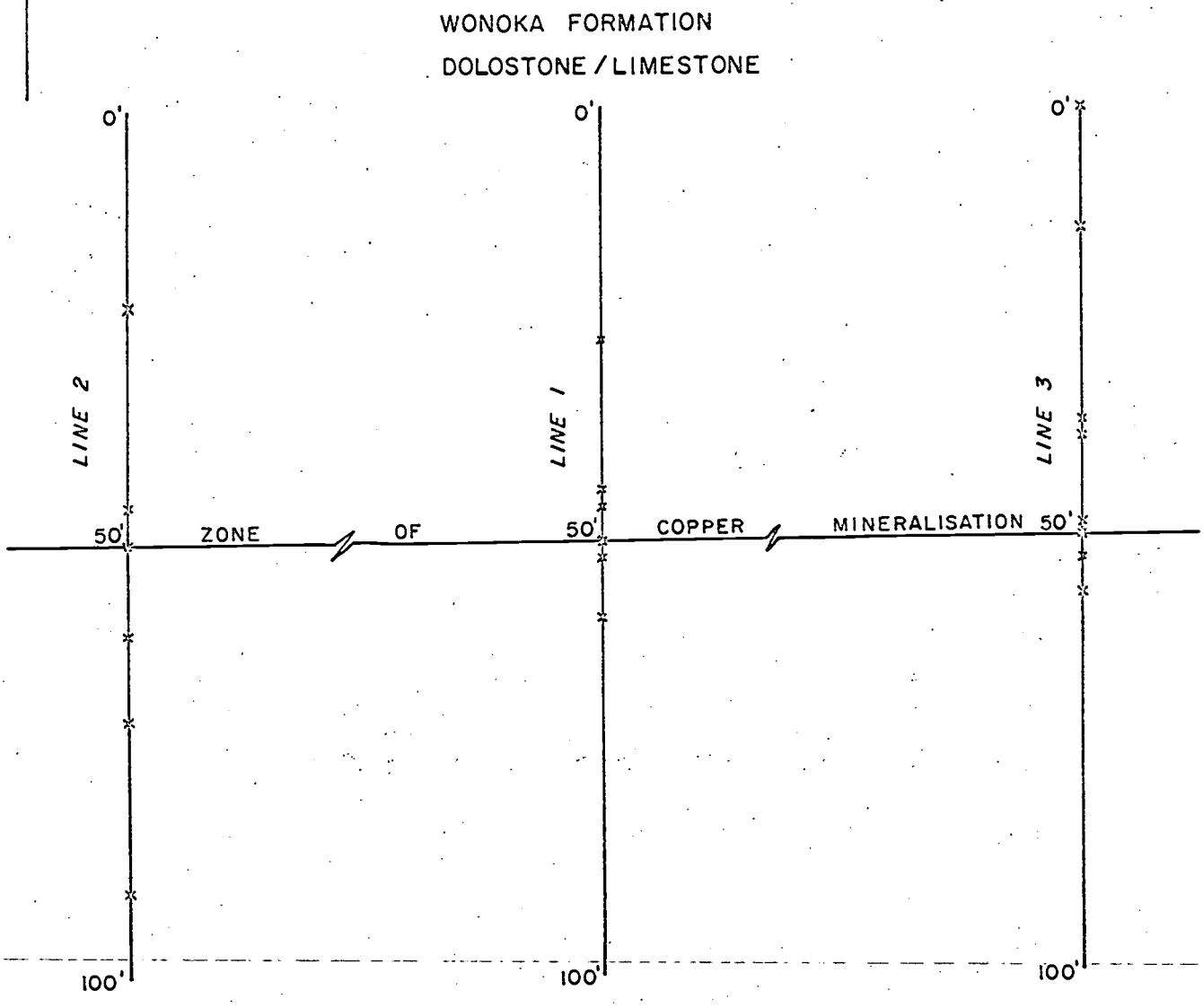
3700	alluvium - no outcrop - no sample
3750	fawn limestone
3800	ruggy, recryst. limestone - with calcite veins
3850	" "
3900	" "
3950	ruggy recryst. limestone
4000	fawn limestone
4050	" dips 20° @ 150° M
4100	"
4150	"
4200	grey limestone
4250	"
4300	alluvium - no sample (creek)
4350	scree, quartzite - no sample
4400	quartzite dips 30° @ 080°M (Billy Creek Fm.)

Line 11. length 2700 feet, bearing 082°M, sample interval 50 feet.

00	alluvium - no sample
50	fine grey limestone (? Wonoka Fm.)
100	alluvium - no sample
150	" "
200	fine grey limestone
250	brown banded limestone with manganese staining
300	brown sandy limestone - dips 40° @ 088°M
350	brown ruggy limestone with limonite and Mn staining
400	red fine grained sandstone - (Pound Quartzite)
450	brown ferruginous and micaceous sandstone Mn staining
500	white med. grained sandstone, micaceous in part
550	scree - no sample
600	pink, fine grained sandstone - much scree
650	well bedded, cherty, grey limestone (Wilkawillina Limestone)
700	grey limestone
750	" with Mn staining
800	fine brown limestone

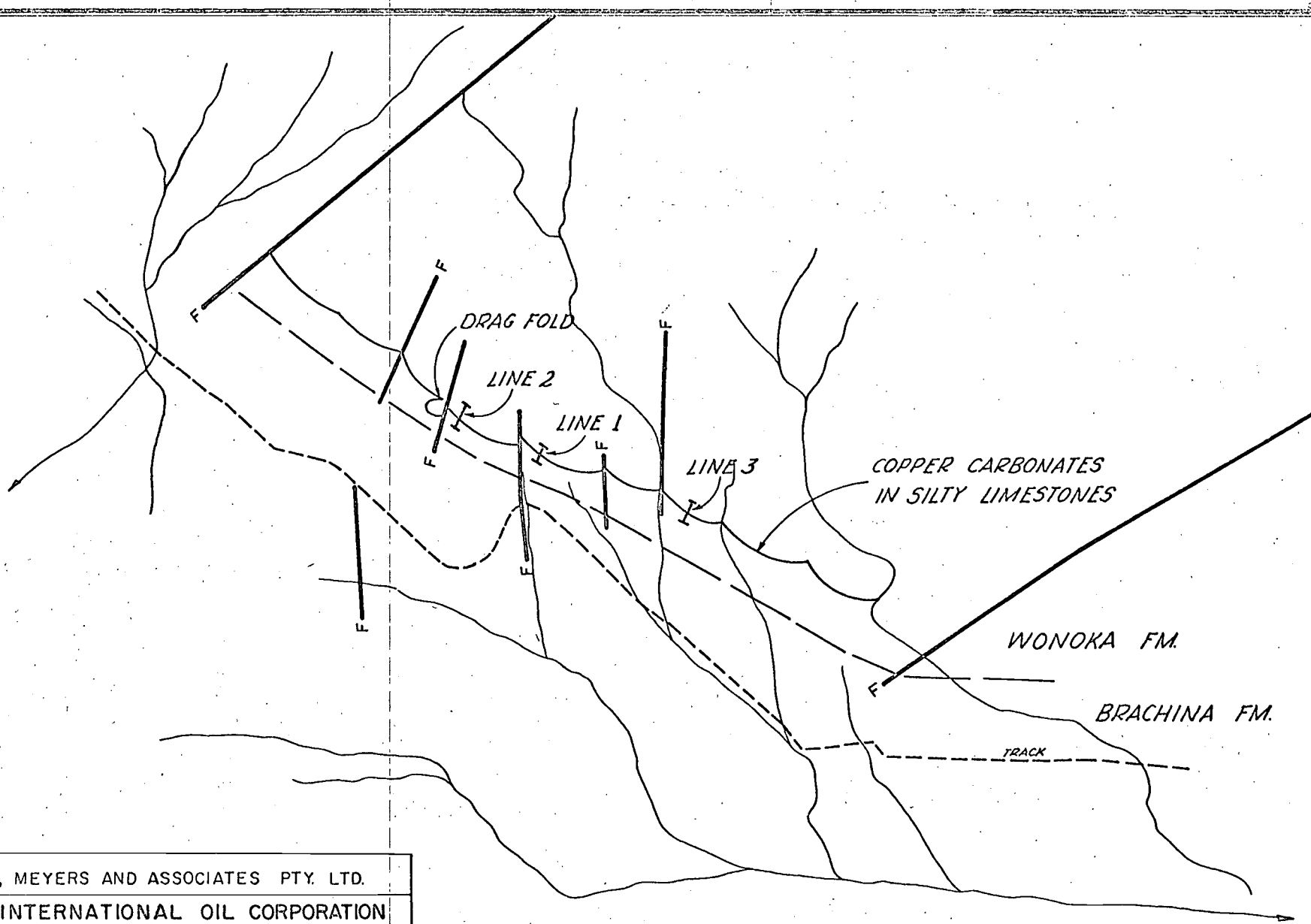
850	medium grained, brown limestone
900	pink and grey cherty limestone
950	ruggy limestone, with calcite veinlets and Mn staining
1000	grey limestone
1050	" with calcite
1100	"
1150	"
1200	dark grey limestone with calcite veinlets
1250	limestone with Mn staining
1300	"
1350	brown medium grained limestone
1400	poor outcrop of limestone
1450	"
1500	poor outcrop of limestone - much alluvium
1550	sandy limestone
1600	limestone
1650	well bedded limestone
1700	poor outcrop of limestone
1750	limestone (creek)
1800	"
1850	brown, ? re-crystallised limestone, with calcite veinlets
1900	pink limestone
1950	" (ridge)
2000	pink and brown limestone - minor Mn dendrites
2050	alluvium - limestone float - no sample
2100	" " "
2150	" " "
2200	" " "
2250	" " "
2300	" " "
2350	poor outcrop of shale
2400	alluvium - no outcrop
2450	" "
2500	" "

2550	alluvium	- no outcrop
2600	"	"
2650	"	"
2700	"	"



× SAMPLE LOCALITY

CUNDILL, MEYERS AND ASSOCIATES PTY. LTD.
DELHI INTERNATIONAL OIL CORPORATION
AREA I – SAMPLING SCHEME S.M.L. 339, REAPHOOK HILL, S.A. Fig. I
B. REES, JAN. 1971 | SCALE: 1" = 20'



CUNDILL, MEYERS AND ASSOCIATES PTY. LTD.

DELHI INTERNATIONAL OIL CORPORATION

AREA I - COPPER PROSPECT, S.M.L. 339, REAPHOOK HILL, S.A.

Fig.2

B. REES, JAN. 1971 | SCALE 1" = 1,000' (approx.)

078

1963

DELHI INTERNATIONAL OIL CORPORATION

VAM LIMITED

AND

HASTINGS COPPER PTY. LTD.

SPECIAL MINING LEASE NO. 339

QUARTERLY REPORT

FOR THE PERIOD

OCTOBER 16, 1970, TO JANUARY 15, 1971

EXPLORATION

During the period under review, one geological field party was engaged in a field mapping and chip sampling programme designed to test further the Manganese and Zinc potential of the Lower Cambrian rocks in that area adjacent to and to the north of Reaphook Hill, and to delineate and test a copper occurrence located to the south of Reaphook Hill and within the Wonoka Formation of the Adelaide System.

A total of eight chip lines were run across the Parachilna and Wilkawillina Sandstone Formations for an aggregate length of 23,400 feet. Lines 7, 8 and 9 were sampled at 20 foot intervals and lines 4, 5, 6, 10 and 11 at 50 foot intervals. All samples from these lines have been submitted to the Australian Mineral Development Laboratories for Manganese, Zinc and Phosphate determinations.

The copper occurrence to the south of Reaphook Hill was briefly investigated by chip and channel sampling. Three lines of 100 feet each were run across this body with a sample interval of 10 feet. Although this copper occurrence was traceable over a strike length in excess of three-quarters of a mile, the copper carbonates appear to be confined to a narrow zone varying from three inches to 24 inches in width.

The samples obtained from this area have also been submitted to the Australian Mineral Development Laboratories and we are presently awaiting results.

A draft copy of the detailed report covering this exploration programme is attached.

FUTURE PROGRAMME

A detailed field mapping programme is due to commence on or about March 1, 1971. Emphasis will be placed on 1) detailing the Lower Cambrian section, and 2) a thorough investigation and mapping of the Wonoka Formation with special attention being paid to mineralization and structure.

Additional work may be programmed depending on the results of work presently being undertaken by AMDEL.

DELHI INTERNATIONAL OIL CORPORATION

VAM LIMITED

and

HASTINGS COPPER PTY. LTD.

SPECIAL MINING LEASE NO. 339

QUARTERLY REPORT

For the Period

January 16, 1971 to April 15, 1971

EXPLORATION

During the period under review the consulting geologist's report was received from Cundill Meyers and Associates Pty. Ltd., all geochemical and spectrographic analyses were completed by the Australian Mineral Development Laboratories and a new field mapping party, under the direction of Dr. Brian Daley, University of Adelaide, was supported. The final written report to be prepared by the latter group has not yet been received.

Eleven traverses of rock chip samples were previously taken across the Wilkawwillina Limestone which was considered the zone of primary interest. Some 23,400 feet of chip sample traverses, with sample intervals of 20 or 50 feet were collected in the last quarter and subsequently analysed. An additional 8,900 feet of traverse on identical sample intervals were collected early in 1971. Random grab samples were collected from the copper show reported earlier and were analysed by A.M.D.E.L. although the area of mineralisation appears to be very limited. A copy of all geochemical analyses is attached to this report.

The consulting geologist's report, geochemical assays, and oral report by Dr. Daley, all suggest that a suitable target for a percussion or diamond drill programme has not evolved from the work accomplished.

amdel
The Australian Mineral Development Laboratories
Flemington Street, Frewville, South Australia 5063
Phone 79 1662, telex AA82520

1971 FEB 26 AM 8:57

Please address all correspondence to the Director
In reply quote: AN3/51/0 - 3481/71

25 February 1971

The Resident Manager
Delhi International Oil Corporation
Box 1837P GPO
ADELAIDE SA 5001

REPORT AN3481/71

YOUR REFERENCE: Purchase Order A 10721

IDENTIFICATION: As listed

DATE RECEIVED: 9/2/71

Enquiries quoting AN3481/71 to Officer in Charge please.

Analysis by: A.E. Francis

Spectrographic Analysis by: R.R. Robinson

Officer in Charge, Analytical Section: A.B. Timms

for F.R. Hartley
Director

jw

AMDEL ANALYTICAL SERVICE

JOB: 34811/71

Semi-Quantitative Spectrographic Analysis Schemes A1,A2,A3,A4,A5 & A6 BATCH .....

Results in ppm unless otherwise stated. Detection limits in brackets

Sample No.	RH1	RH2	RH3	RH4	C.L.1	C.L.2
A1						
Co (5)	40	10	5	5	10	10
Ni (5)	40	20	30	5	20	30
Cr (20)	20	x	100	20	20	20
V (10)	90	30	100	30	30	80
W (50)	x	x	x	x	x	x
Mo (3)	30	3	x	x	3	3
Mn (10)	3,000	1,000	800	300	400	300
Ta (100)	x	x	x	x	x	x
Nb (20)	x	x	x	x	x	x
Be (1)	x	x	3	x	1	1
Th (100)	x	x	x	x	x	x
Pt (10)	x	x	x	x	x	x
Pd (10)	x	x	x	x	x	x
Os (10)	x	x	x	x	x	x
Ir (2)	x	x	x	x	x	x
Rh (2)	x	x	x	x	x	x
Ru (2)	x	x	x	x	x	x
A2						
Cu (0.5)	350	10,000	350	3000	2500	2000
Pb (1)	500	350	30	30	25	60
Zn (20)	1,500	800	150	120	300	100
Sn (1)	1	x	1	1	1	1
Cd (3)	30	3	x	3	x	x
Bi (1)	x	x	x	1	1	1
Ag (0.1)	3·0	10	0·2	20	110	5·0
Au (3)	x	x	x	x	x	x
Ga (1)	1	x	10	2	2	2

Sample No.	RH1	RH2	RH3	RH4	C.L.1	C.L.2
A2 Contd.						
Ge (1)	x	x	x	x	x	x
As (50)	x	x	x	x	x	x
Sb (30)	x	x	x	x	x	x
A3						
Te (20)						
Tl (1)						
P (100)						
A4						
Na (50)						
Li (1)						
A5						
K (5)						
Rb (10)						
Cs (30)						
A6						
Ba (50)						
Sr (10)						
Y (10)						
La (100)						
Ce (300)						
Nd (300)						
Pr (100)						
Ti (100)						
Er (100)						
Sc (50)						
Eu (50)						

Results are semi-quantitative. Elements apparently present in concentrations of economic interest should be redetermined by an appropriate accurate analytical technique. X = Not detected at limit quoted.

$\frac{(A_1 + A_2)}{2} \times 29 = 17.4$

JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 1

FORM 12

TT	Sample No.		Cu		Pb		Zn		
1	1/27		15		5		45		
2	1/44		5		5		40		
3	1/46		5		5		25		
4	1/50		3000		25		40		
5	1/52		3800		10		55		
6	1/59		20		5		30		
7	2/22		5		5		50		
8	2/45		20		5		30		
9	-50		7500		50		-100		
10	-60		25		5		25		
11	-70		5		5		15		
12	-90		5		5		20		
13	3-00		130		10		50		
14	3-14 x		5		50		65		
15	-38		5		5		35		
16	-48		5		5		40		
17	-50		8900		5		40		
18	-52		10		5		25		
19	3-56		40		5		190		
20	3-14 x								

JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 2

FORM 12

TT	Sample No.			Zn	Mn	% P_2O_5			
1	4-00			600	590	0·05			
2	4-50			1400	410	0·1			
3	STD 2A								
4	-150			1200	1800	0·1			
5	-200			1400	7300	0·05			
6	-250			1400	1450	0·1			
7	-300			1200	2000	0·1			
8	-350			1900	1·1%	0·05			
9	-400	not rec'd		—	—	—			
10	-450 X			2100	1·4%	0·15			
11	-600			370	690	0·05			
12	-700			5700	9100	0·15			
13	-750			5900	6100	0·35			
14	-800			1700	3100	0·1			
15	STD LM2								
16	-850			1000	2450	0·05			
17	-900			970	690	0·15			
18	-950			3000	1200	0·25			
19	4-1000			5300	1900	0·1			
20	-450X								

FORM 12

JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 3

TT	Sample No.			Zn	Mn	P_2O_5			
1	4-1050			2700	930	0.15			
2	-1100			300	220	0.05			
3	-1150			460	1000	0.2			
4	-1200			340	810	0.15			
5	BLK			—	—	—			
6	STD 5111								
7	-1350	not mold.		—	—	—			
8	-1400			290	590	0.05			
9	-1450			430	1200	0.2			
10	-1500			160	430	0.05			
11	-1550			140	380	0.1			
12	-1650			800	660	0.35			
13	-1700			55	260	0.15			
14	-1750 X			230	390	0.1			
15	-1800			300	370	<0.05			
16	-1850			120	470	<0.05			
17	-1900			820	2700	0.05			
18	-1950			85	490	<0.05			
19	4-2000			55	190	<0.05			
20	1750 X								

JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 4

FORM 12

TT	Sample No.			Zn	Mn	P_2O_5			
1	4-2050			65	330	<0.05			
2	-2100			220	420	<0.05			
3	STD LM2								
4	-2150			180	810	<0.05			
5	-2200			240	720	<0.05			
6	-2250			320	1000	<0.05			
7	-2300			110	520	<0.05			
8	-2350 X			85	430	0.05			
9	-2400			180	1600	<0.05			
10	-2450			260	1350	0.05			
11	-2550			120	1400	0.05			
12	-2750			180	480	0.1			
13	-2800			60	190	<0.05			
14	-2850			55	190	<0.05			
15	STD 2A								
16	-2900			80	240	0.05			
17	-2950			25	230	<0.05			
18	-3000			410	1800	0.2			
19	4-3050			110	670	0.15			
20	2350X								

FORM 12 JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 5

TT	Sample No.			Zn	Mn	% P_2O_5			
1	4-3100			170	710	0.05			
2	-3150			190	930	0.1			
3	-3200			80	810	0.05			
4	STD 51/1								
5	-3250			65	360	0.05			
6	-3300			25	190	0.05			
7	-3350			65	330	<0.05			
8	-3400			55	230	0.05			
9	-3450			20	210	0.05			
10	-3500			60	220	0.05			
11	-3550			55	630	0.05			
12	4-3600			40	80	0.05			
13	5-00 x			10	130	0.05			
14	5-550			360	360	0.1			
15	-600			420	560	0.05			
16	-650			760	2900	<0.05			
17	-700			390	1200	0.05			
18	-750			950	1170	0.1			
19	5-800			1100	1400	0.1			
20	5-00 x								

FORM 12 JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 6

TT	Sample No.			Zn	Mn	% P_2O_5			
1	5-850			1030	2100	0.05			
2	-900			620	2000	0.1			
3	-1050			1450	1600	0.1			
4	-1150			410	1030	0.05			
5	-1200			310	1150	0.1			
6	STD 2A								
7	1550			330	620	0.4			
8	-1600			190	1210	0.1			
9	-1650			170	400	0.05			
10	-1700			340	520	0.15			
11	-1750			150	900	<0.05			
12	-1800 X			220	360	0.05			
13	-1850			180	530	<0.05			
14	-1900			65	460	<0.05			
15	-1950			120	730	0.1			
16	-2000			170	470	0.25			
17	STD Lm 2								
18	-2050			110	500	0.1			
19	5-2100			190	430	0.1			
20	-1800 X								

FORM 12 JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 7

TT	Sample No.			Zn	Mn	% P_2O_5			
1	5-2150			400	660	0.1			
2	-2200			150	670	0.1			
3	-2250			530	890	0.2			
4	-2300			1250	1600	0.15			
5	-2350 x			500	610	0.1			
6	-2400			90	910	0.05			
7	-2450			310	1400	0.1			
8	-2550			230	1900	0.05			
9	-2900	not rec'd		—	—	—			
10	-3300			190	1800	<0.05			
11	-3350			100	1300	0.05			
12	-3750	not rec'd		—	—	—			
13	-3800			90	970	0.15			
14	-3850			65	860	0.2			
15	-3900			30	590	<0.05			
16	STD 51/1								
17	-3950			90	660	0.1			
18	-4000			110	790	0.15			
19	5-4050			90	1600	0.05			
20	2350 x								

FORM 12 JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 8

TT	Sample No.			Zn	Mn	% P_2O_5			
1	5-4100			40	220	0.1			
2	4150			50	790	0.2			
3	4200			40	710	0.05			
4	STD Lm 2								
5	4250			50	600	<0.05			
6	4300			45	570	0.1			
7	4350			40	510	0.1			
8	4400			90	410	0.1			
9	4450X			65	330	0.15			
10	4500			25	300	0.05			
11	4550			35	400	0.05			
12	4600			15	280	0.05			
13	4650			10	220	<0.05			
14	4700			70	670	0.05			
15	4750			35	470	<0.05			
16	STD 2A								
17	4800			25	510	0.05			
18	4850			45	530	<0.05			
19	5-4900			25	240	<0.05			
20	4450X								

FORM 12 JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 9

TT	Sample No.			Zn	Mn	%P_2O_5			
1	5-4950			40	560	<0.05			
2	-5000			15	280	<0.05			
3	-5050			25	730	0.05			
4	-5100			10	240	<0.05			
5	-5150			25	300	0.05			
6	-5200			15	230	<0.05			
7	STD 51/1								
8	5-5300			120	580	0.05			
9	6-00			30	190	<0.05			
10	-50			45	760	<0.05			
11	-100			80	850	<0.05			
12	-150			70	1060	0.05			
13	-200			95	810	<0.05			
14	-250			40	1800	<0.05			
15	-300 x			45	550	<0.05			
16	-350			190	3300	<0.05			
17	-400			280	2200	<0.05			
18	-450			70	1300	<0.05			
19	6-500			70	1170	<0.05			
20	-300 x								

FORM 12 JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 10

TT	Sample No.			Zn	Mn	% P_2O_5			
1	6-550			180	770	<0.05			
2	-600			95	2000	<0.05			
3	-650			140	1800	<0.05			
4	-700			180	3100	0.05			
5	STD 2A								
6	-750			240	2300	0.05			
7	-800			380	2300	0.15			
8	-850			230	1900	0.1			
9	-900			190	1400	0.1			
10	-950			130	1800	0.1			
11	-1000 X			160	1600	0.25			
12	-1050			250	2300	<0.05			
13	-1100			100	1180	0.05			
14	-1150			120	970	0.2			
15	-1200			230	1220	0.1			
16	-1250			90	880	0.1			
17	STD LM2								
18	-1300			240	1180	0.05			
19	6-1250			200	1900	0.05			
20	-1000 X								

AMDEL GEOCHEMICAL SERVICE

JOB 3481/71

BATCH NO. 11

FORM 12

TT	Sample No.			Zn	Mn	%P_2O_5			
1	6-1400			160	1600	0.45			
2	1450			200	1270	0.1			
3	1500			140	930	0.25			
4	1550			120	1060	0.1			
5	1600 X			200	1600	<0.05			
6	1650			420	1600	0.45			
7	1700			200	1060	0.05			
8	1750			280	1800	0.1			
9	1800			350	1300	<0.05			
10	1850			190	680	<0.05			
11	1900			170	830	<0.05			
12	1950			260	1700	<0.05			
13	2000			85	1800	0.15			
14	2050			220	1060	<0.05			
15	STD 51/1								
16	2100			180	2500	<0.05			
17	2150			180	930	<0.05			
18	2200			270	1060	<0.05			
19	6-2250			180	1700	<0.05			
20	1600 X								

JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 12

FORM 12

TT	Sample No.			Zn	Mn	% P_2O_5			
1	6-2300			130	1060	<0.05			
2	2350			120	1600	<0.05			
3	2400			30	710	0.05			
4	2450			150	670	0.3			
5	STD LM 2								
6	2500			40	410	<0.05			
7	2550			15	230	<0.05			
8	2600			20	190	<0.05			
9	2650			10	150	0.1			
10	2700			25	320	<0.05			
11	2750			25	210	<0.05			
12	2800 X			95	250	<0.05			
13	2850			20	160	<0.05			
14	2900			25	310	<0.05			
15	2950			30	410	<0.05			
16	STD 2A								
17	6-3000			85	230	<0.05			
18	7-00			270	2500	0.1			
19	7-20			120	1210	<0.05			
20	6-2800X								

FORM 12 JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 13

TT	Sample No.			Zn	Mn	% P_2O_5			
1	7-40			50	1200	<0.05			
2	-60			130	1500	<0.05			
3	80			110	2100	<0.05			
4	100			130	1100	<0.05			
5	140			110	1200	<0.05			
6	STD 51/1								
7	160			140	1700	<0.05			
8	200			140	1100	<0.05			
9	220			150	1600	<0.05			
10	240			110	1200	<0.05			
11	260			40	1000	<0.05			
12	280			130	2100	<0.05			
13	300			85	840	<0.05			
14	320			120	1000	<0.05			
15	340 x			140	1200	<0.05			
16	360			95	1100	<0.05			
17	380			20	530	<0.05			
18	400			60	1000	<0.05			
19	7-420			20	550	<0.05			
20	340 x								

060

JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 14

FORM 12

TT	Sample No.			Zn	Mn	% P_2O_5			
1	7-440			15	530	<0.05			
2	- 460			25	1500	<0.05			
3	STD 2A								
4	- 480			75	1000	0.05			
5	- 500			35	980	0.1			
6	- 520			25	930	0.05			
7	- 540			85	1000	0.05			
8	- 560			45	1000	0.05			
9	- 580			110	1200	0.1			
10	- 600			250	1500	0.05			
11	- 620 X			250	2000	0.05			
12	- 640			240	1800	0.05			
13	- 660			160	1000	0.05			
14	- 680			360	1500	0.1			
15	- 740			550		0.05			
16	STD LM 2								
17	- 760			65	65	0.1			
18	- 780			190	2000	0.05			
19	7-800			35	75	0.05			
20	620 X								

JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 15

FORM 12

TT	Sample No.			Zn	Mn	% P_2O_5			
1	8-00			190	1600	0.05			
2	-20			280	1500	<0.05			
3	-40			230	1000	<0.05			
4	-60 x			140	1200	<0.05			
5	-80			330	2200	0.05			
6	-100			140	1800	0.05			
7	-120			330	2100	<0.05			
8	-140			95	1700	0.15			
9	-160			90	2300	0.05			
10	-180			320	2300	<0.05			
11	200			140	1700	<0.05			
12	-220			310	1700	0.05			
13	-240			360	2500	0.05			
14	STD 51/1								
15	-200			20	300	0.05			
16	-320			290	2700	0.05			
17	-340			370	2500	0.05			
18	-360			300	2500	0.1			
19	8-380			300	1600	0.1			
20	-60 x								

FORM 12 JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 16

TT	Sample No.			Zn	Mn	% P_2O_5			
1	S-420			320	2200	<0·05			
2	-440			90	1600	<0·05			
3	-480			180	2000	0·15			
4	-500			140	1700	0·1			
5	STD Lm 2								
6	-520			90	1700	0·05			
7	-540			85	1700	0·3			
8	-560			100	2000	0·1			
9	-580			55	1200	0·35			
10	-600 X			140	2800	0·2			
11	-620			230	3300	0·5			
12	-640			90	2300	0·1			
13	-660			120	2000	0·1			
14	-680			85	1500	0·1			
15	-700			75	1600	0·35			
16	STD 2A								
17	-720			110	2000	0·05			
18	-740			85	1600	0·15			
19	S-760			25	1200	0·1			
20	-600 X								

FORM 12 JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 17

TT	Sample No.			Zn	Mn	% P_2O_5			
1	8-780			120	2100	0.05			
2	-800			320	5000	0.15			
3	-820			280	4100	0.2			
4	840			110	1700	0.2			
5	860			170	2600	0.1			
6	880			85	1700	0.05			
7	STD 51/1								
8	900			150	2600	0.15			
9	920			40	1000	0.1			
10	940			90	1500	0.1			
11	960			170	3500	0.1			
12	980			120	2000	0.05			
13	1000			75	1300	0.15			
14	1020			50	1600	0.05			
15	1040			350	4000	0.55			
16	1060 X			230	2700	0.1			
17	1080			260	3500	0.15			
18	1100			45	1600	0.05			
19	8-1120			60	1700	0.1			
20	-1060 X								

FORM 12 JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 18

TT	Sample No.			Zn	Mn	% P_2O_5			
1	8-1140			75	2000	0.1			
2	-1160			120	3200	<0.05			
3	STD 2A								
4	-1180			65	1100	0.05			
5	-1200			40	1200	<0.05			
6	-1220			25	1100	<0.05			
7	-1240			40	1200	<0.05			
8	-1300			110	7700	0.05			
9	-1320X			450	4700	0.05			
10	-1340			85	5800	0.05			
11	-1380			260	6000	0.05			
12	-1400			250	6600	0.05			
13	-1420			150	2000	0.05			
14	-1440			180	2000	0.1			
15	STD LM2								
16	-1460			310	350	0.2			
17	-1480			430	2700	0.05			
18	8-1500			120	2800	0.05			
19	9-00			100	1800	0.1			
20	-1320X								

FORM 12 JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 19

TT	Sample No.			Zn	Mn	% P_2O_5			
1	9- 20			85	1700	0·1			
2	-40			60	1600	0·15			
3	-60			90	1800	0·3			
4	-80 X			30	1170	0·25			
5	-100			20	1060	0·4			
6	-120			40	1100	0·25			
7	-140			65	2600	0·3			
8	-160			55	1900	0·2			
9	-180			55	2000	0·1			
10	-200			60	930	0·25			
11	-220			50	1060	0·05			
12	-240			30	1240	0·05			
13	-260			100	2100	<0·05			
14	-280			60	1900	0·05			
15	-300			50	1500	<0·05			
16	-320			20	1100	0·05			
17	STD 51/1								
18	-340			65	1300	0·1			
19	9-360			90	1900	0·1			
20	-80 X								

FORM 12 JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 20

TT	Sample No.			Zn	Mn	% P_2O_5			
1	9-380			95	1600	0.05			
2	- 400			90	1800	<0.05			
3	- 420			15	10	0.05			
4	- 440			90	1400	0.05			
5	STD LM2								
6	- 460			40	1130	<0.05			
7	- 480			70	1800	<0.05			
8	- 500			85	2300	0.05			
9	- 520			65	4200	0.1			
10	- 540 x			140	4000	0.2			
11	- 560			50	1600	<0.05			
12	- 600			65	2900	<0.05			
13	- 620			60	2200	0.2			
14	- 640			60	2300	<0.05			
15	660			60	1900	0.05			
16	STD 2A								
17	- 680			30	1100	0.35			
18	- 700			60	1180	0.1			
19	9-720			50	1260	0.05			
20	540 x								

FORM 12

JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 21

TT	Sample No.			Zn	Mn	%P_2O_5			
1	9-740			85	3600	0.05			
2	-760			100	3100	0.15			
3	-780			470	1.3%	0.25			
4	-800			100	3100	0.1			
5	-820			170	6600	0.3			
6	STD 511								
7	-840			200	9800	0.1			
8	-860			130	5700	0.05			
9	-880			300	6400	0.05			
10	-900			90	2800	0.05			
11	-920			230	3600	0.1			
12	-940			75	1500	0.15			
13	-960			85	1700	0.2			
14	-980			75	2300	0.05			
15	-1000			90	1600	0.1			
16	-1020			110	3000	0.1			
17	-1040 x			100	2900	0.1			
18	-1060			120	1900	0.15			
19	9-1080			240	5400	0.05			
20	-1040 x								

FORM 12 JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 22

TT	Sample No.			Zn	Mn	%P_2O_5			
1	9-1100			360	9700	0.2			
2	-1120			250	4300	0.05			
3	-1140			210	5800	0.15			
4	-1160			160	5000	0.1			
5	STD 2A								
6	-1180			280	7600	0.05			
7	-1200			240	7500	0.1			
8	-1220			160	4100	0.15			
9	1240			180	2700	0.1			
10	-1260 X			240	3200	0.1			
11	-1280	not rec'd		—	—	—			
12	-1300			240	5100	0.1			
13	-1320			140	1900	0.05			
14	-1340			100	1900	0.05			
15	-1360			270	1400	0.15			
16	-1380			210	2600	0.05			
17	STD LM2								
18	-1440			120	2600	<0.05			
19	9-1460			190	3200	0.05			
20	-1260x								

FORM 12 JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 23

TT	Sample No.			Zn	Mn	% P_2O_5			
1	9-1480			60	1000	<0.05			
2	-1500			65	1000	<0.05			
3	-1520			560	4700	0.05			
4	-1540 X			95	4000	<0.05			
5	-1560			130	4900	<0.05			
6	-1580			110	5800	<0.05			
7	-1600			200	5300	<0.05			
8	20			90	5000	<0.05			
9	40			250	9600	0.05			
10	60			55	2800	<0.05			
11	80			60	2500	<0.05			
12	-1700			710	5500	0.15			
13	20			110	5300	<0.05			
14	STD 51/1								
15	40			120	2000	0.05			
16	60			230	3800	0.05			
17	80			95	1800	<0.05			
18	9-1800			30	1100	<0.05			
19	10-00			120	1600	0.25			
20	1540 X								

FORM 12

JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 24

TT	Sample No.			Zn	Mn	% P_2O_5			
1	10-50			65	2200	0.1			
2	-100			100	3300	0.4			
3	STD LM 2								
4	-150			100	2700	0.2			
5	-200			95	2400	0.05			
6	-250			380	3300	0.1			
7	-300 X			60	1000	<0.05			
8	-350			65	2300	0.2			
9	-400			100	1900	0.1			
10	-450			75	2900	0.2			
11	-500			45	2900	0.2			
12	-550			95	2300	0.15			
13	-600			50	2200	0.05			
14	-650			65	2600	0.2			
15	STD 2A								
16	-700			150	3600	0.05			
17	-750			35	1600	0.05			
18	-800			40	1700	0.05			
19	10-850			130	2600	0.1			
20	-300 X								

FORM 12 JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 25

TT	Sample No.			Zn	Mn	%P_2O_5			
1	10-950			45	1800	0.05			
2	-1000			90	2000	0.3			
3	-1050			120	2500	0.4			
4	-1100			40	960	0.15			
5	STD 51/1								
6	-1150			55	1400	0.15			
7	-1200			20	120	0.05			
8	-1250			120	1600	0.1			
9	-1300			75	1700	<0.05			
10	-1350			45	1100	0.05			
11	-1400			35	1100	0.15			
12	-1450			35	1500	0.1			
13	-1500 X			75	1200	0.2			
14	-1550			45	1400	0.05			
15	-1600			40	1900	0.05			
16	-1650			40	1300	0.25			
17	-1700			90	1600	0.15			
18	-1750			40	1200	<0.05			
19	10-1850			35	1200	0.1			
20	1500								

AMDEL GEOCHEMICAL SERVICE

FORM 12 JOB 3481/71 BATCH NO. 26

TT	Sample No.			Zn	Mn	% P_2O_5			
1	10- 1900			60	1300	0·3			
2	- 1950			45	1300	0·1			
3	- 2000			40	1300	0·1			
4	- 2050			55	1600	0·4			
5	STD 2 A								
6	- 2100			95	1800	0·2			
7	- 2150			110	1400	0·15			
8	- 2200			160	2800	0·25			
9	50			50	1500	0·1			
10	2300 x			75	1300	0·2			
11	50			80	1800	0·3			
12	2400			130	2100	0·35			
13	50			110	1400	0·05			
14	2500			110	1200	0·05			
15	50			20	120	0·05			
16	2600			25	310	0·05			
17	STD LM2								
18	2650			180	1800	0·15			
19	10- 2750			160	1600	0·05			
20	2300X								

FORM 12 JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 27

TT	Sample No.			Zn	Mn	% P_2O_5			
1	10 - 2950			85	1600	0.15			
2	- 3000			65	1300	0.05			
3	- 3100			210	5300	0.15			
4	- 3150 X			60	1000	<0.05			
5	- 3200			40	2700	0.05			
6	- 3250			65	2100	0.05			
7	- 3300			40	1900	<0.05			
8	- 3450			40	1300	0.05			
9	- 3550			60	620	0.05			
10	- 3650			60	950	0.05			
11	- 3750			45	1100	0.05			
12	- 3800			65	1100	0.05			
13	50			80	1100	0.1			
14	- 3900			30	1300	0.05			
15	STD 5/1								
16	3950			45	1100	0.05			
17	4000	not rec'd		—	—	—			
18	4050			40	1500	0.05			
19	10 - 4100			65	1500	0.05			
20	- 3150 X								

FORM 12 JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 29

TT	Sample No.			Zn	Mn	%P_2O_5			
1	11-850			40	3600	0.1			
2	900			10	3200	<0.05			
3	950			60	8300	0.1			
4	1000			25	3800	0.15			
5	STD 5111								
6	1050			25	6900	0.25			
7	1100			35	6800	0.1			
8	1150			20	1700	0.1			
9	1200			60	9900	0.15			
10	1250			55	10000	0.25			
11	1300			30	2100	0.35			
12	1350			90	4800	0.15			
13	1400			40	4300	0.25			
14	1450			80	2300	0.15			
15	1500 X			20	820	0.15			
16	1550			25.	1200	0.1			
17	1600			15	730	0.05			
18	1650			20	690	<0.05			
19	11-1700			15	500	0.05			
20	1500 X								

AMDEL GEOCHEMICAL SERVICE

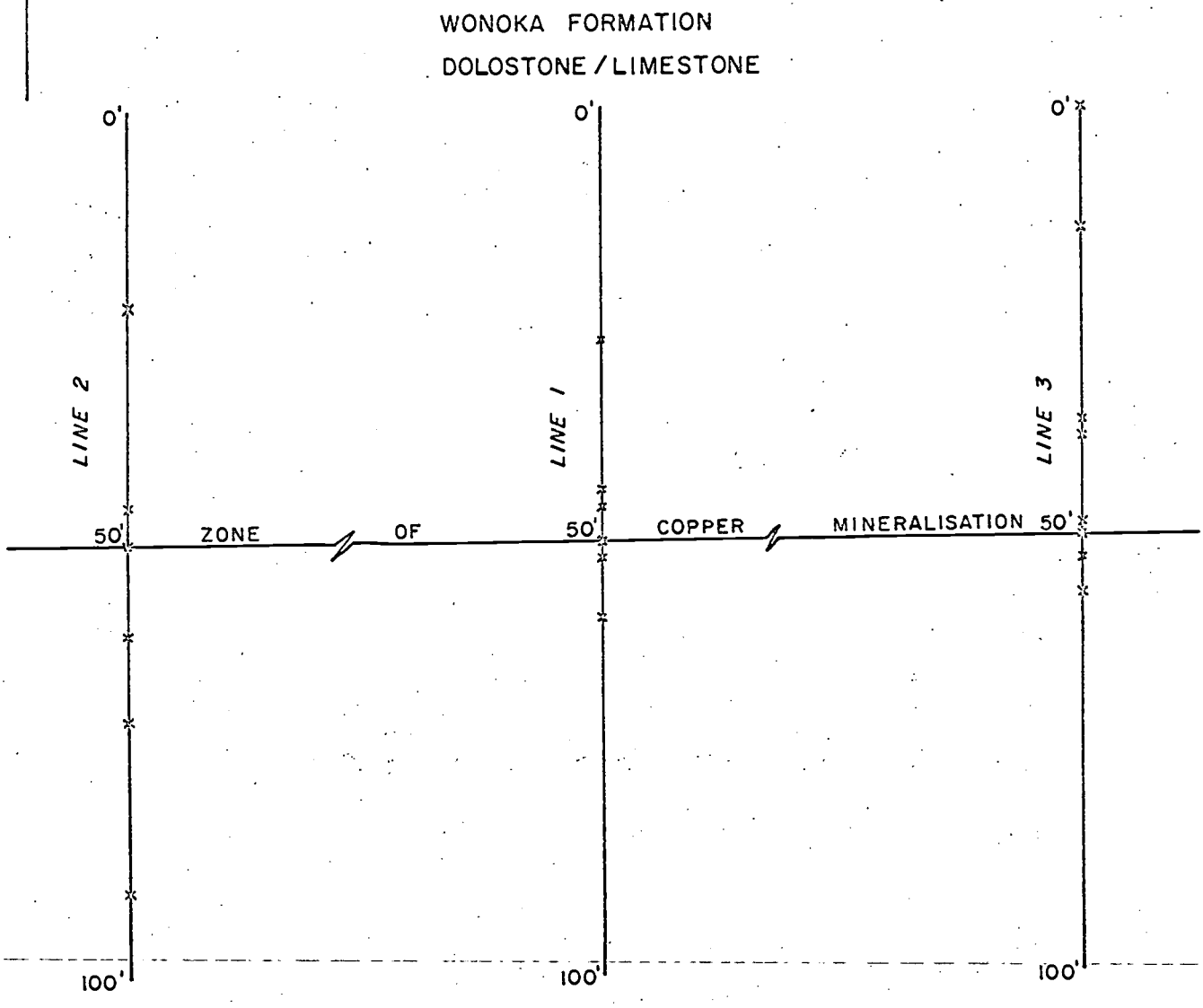
FORM 12 JOB 3481/71 BATCH NO. 28

TT	Sample No.			Zn	Mn	% P_2O_5			
1	10-4150			60	1300	0.05			
2	4200			30	1300	0.05			
3	50			15	280	<0.05			
4	STD LM2								
5	10-4400			20	70	<0.05			
6	11-50			25	730	0.15			
7	200			15	750	0.2			
8	250			15	600	0.1			
9	300			40	3000	0.1			
10	50			20	6800	0.05			
11	400 X			10	60	0.1			
12	50			25	5700	0.1			
13	500			20	1900	0.05			
14	600			20	120	0.05			
15	50			20	1200	<0.05			
16	STD 2A								
17	700			20	590	<0.05			
18	50			25	1900	0.05			
19	11-800			50	1900	0.1			
20	400 X								

JOB 3481/71 AMDEL GEOCHEMICAL SERVICE BATCH NO. 30

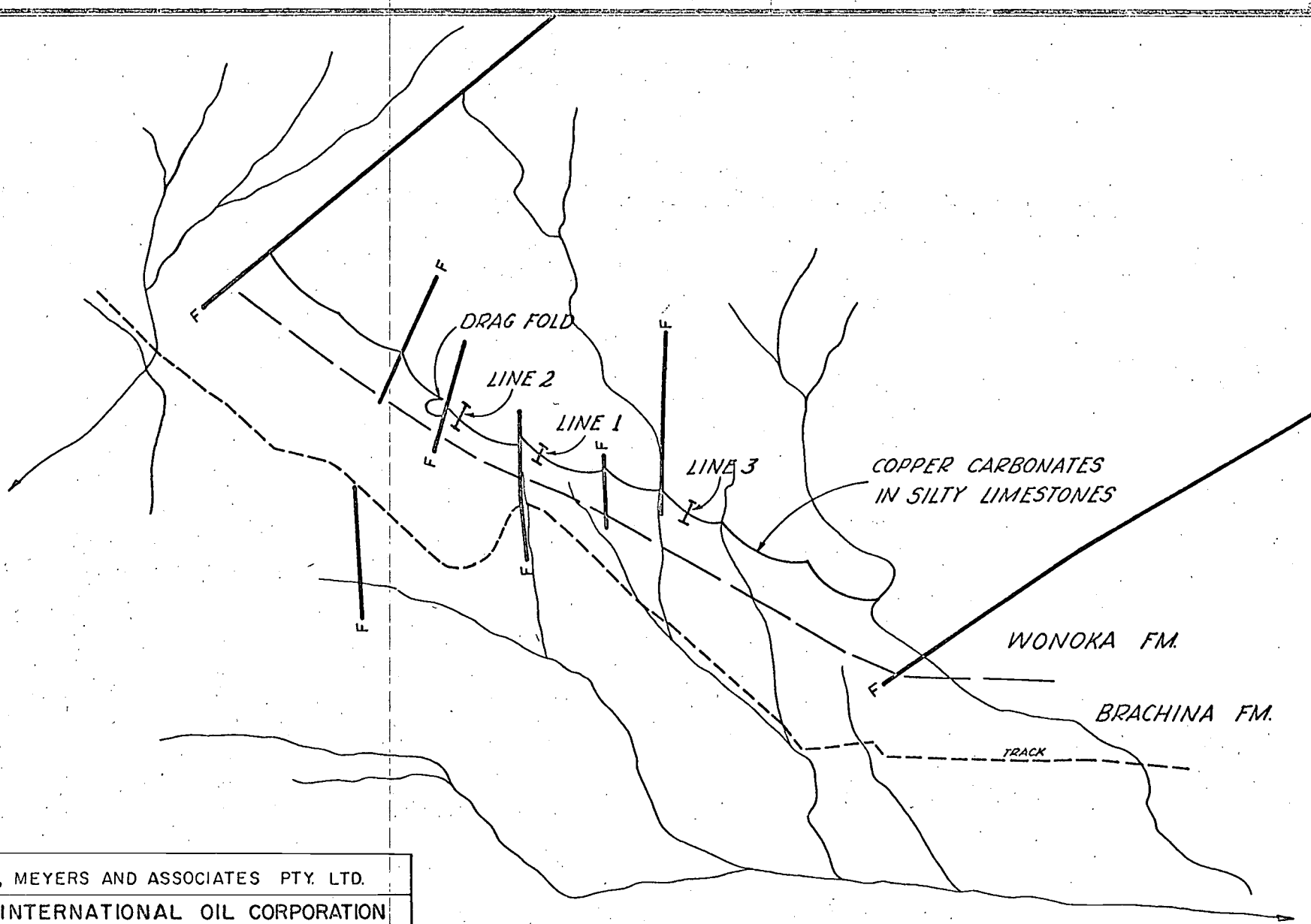
FORM 12

TT	Sample No.			Zn	Mn	%P_2O_5			
1	11 - 1750			25	2500	0·05			
2	1800			30	5600	<0·05			
3	1850			15	2800	0·05			
4	STD 2A								
5	1900			10	1600	<0·05			
6	1950 ×			10	1700	0·05			
7	2000			20	2300	0·15			
8	11 - 2350	Not Received		-	-	-			
9	4 - 1250	Not	Listed	2000	1800	0·1			
10	STD LM2								
11	5 - 2950	Not	Listed	90	1500	0·1			
12	9 - 1289	"	"	60	1800	0·05		9/1250 ?	
13	11 - 00	"	"	110	760	0·1			
14	11 - 1950 ×								
15	BLK								
16									
17				Cu Pb Zn Mn - Code 1					
18		Mn - Code 1		Results in ppm					
19		Results in %		P_2O_5 - Code 1					
20				Results in %					



× SAMPLE LOCALITY

CUNDILL, MEYERS AND ASSOCIATES PTY. LTD.
DELHI INTERNATIONAL OIL CORPORATION
AREA I – SAMPLING SCHEME S.M.L. 339, REAPHOOK HILL, S.A. Fig. I
B. REES, JAN. 1971 | SCALE: 1" = 20'



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DELHI INTERNATIONAL OIL CORPORATION

AREA I - COPPER PROSPECT, S.M.L. 339, REAPHOOK HILL, S.A.

Fig.2

B. REES, JAN. 1971 | SCALE 1" = 1,000' (approx.)

078

1963

The Geology of the Upper Proterozoic and Lower Cambrian of the Reaphook Hill Area, Eastern Flinders Ranges, South Australia.

J.G. GEHLING.

Introduction

The area under study lies some 60 miles N.E. of Hawker in the Flinders Ranges, S.A. The published Department of Mines 1:250,000 Parachilna geological sheet includes the Reaphook Hill area. Over the last two years, areas of Cambrian outcrop on this sheet have been studied in some detail by Honours students of the School of Geology. As a contribution to this regional study, the Reaphook Hill area has been divided into three sections, and is being investigated with particular attention given to the Cambrian stratigraphy.

This report covers mapping, to date, in the 13 square miles north and west of Reaphook Hill (see map). Reaphook Hill is 1274 ft. above sea level and has the co-ordinates: 139°25' E, 31°26' S.

Mapping was done on 540 ft. to the inch enlargements taken from coloured aerial photos used in photointerpretation. Preliminary sections were described, representative samples collected, and then boundaries and faults were walked. Two sections were described and measured by staffing. Continuing work will involve description of stratigraphic units from fossils collected and rock sample thin sections. A more accurate description of the stratigraphy will be written up in a final report to be presented late in October.

Geomorphology

The area of outcrop is basically a plateau cut across massive limestones, with dissection to the east and west

over less competent beds stratigraphically above and below the limestones. The climate is semi-arid. Overall the area is geomorphologically mature, such that fresh outcrop is found only where strata has been cut by creeks draining the plateau. The watershed is largely controlled by the fault pattern and the differential erosion of alternating hard and soft lithologies.

Geology

Stratigraphy

The lowermost unit mapped was the Late Proterozoic Bunyeroo Formation consisting of poorly outcropping red beds. These pass gradationally into the Wonoka Formation of green and grey bedded limestones with shaley interbeds, becoming sandier at the top. The Pound Quartzite lower boundary can be distinguished by a change from grey-green to red silts and sandstones. At the top, the formation is a massive white sandstone which passes sharply (where exposed) into the soft white clayey sands of the Cambrian Parachilna Formation. The upper boundary of this unit is not clearly seen due to the relief of the overlying Wikawillina Limestone, which is a massive unit consisting of a dolomitized basal part passing irregularly into limestones which are sandy at the top. The youngest unit of the sequence is the Billy Creek Formation, of late Lower Cambrian age; in its lower part, sandstones, limestones and shales are interbedded, but these pass rapidly into red sandy silts and shales.

The lower half of the Wilkawillina Limestone appears to be comparable lithologically and faunally with that described in the type section, some 25 miles to the west. The upper two thirds of the Billy Creek Formation exposed in the Reaphook area are lithologically similar to the named beds in the type section, but the Parara Limestone, Bunkers Sandstone and Onaparinna Shale of the type section cannot be

recognised here. As no faunas characteristic of these formations have as yet been found in the upper half of the Wilkawillina Limestone and the lower part of the Billy Creek Formation in the mapped area, correlations with the units described from the type section cannot presently be made.

Field observations have yielded the following descriptions of units mapped in the area:

The Bunyeroo Formation is only represented on the map by the upper 1000 feet of the formation. These are thinly bedded chocolate to purple shales with micaceous silt interbeds and thin dolomites, hand specimens of which have an original green core preserved. Carbonates gradually increase in frequency and bed thickness, becoming dominant at the top. At intervals, secondary copper minerals are observed as coatings on bedding partings of thin grey carbonate beds. Most carbonates are purple with manganiferous surface weathering. The upper boundary is taken as the last occurrence of red coloured beds.

The Wonoka Formation consists of thickly bedded, characteristically outcropping limestones, interbedded with green-grey silts and shales. The limestones consist of alternating "granular" fine grained limestones, silty limestones with characteristic pillow roll structures and intraclastal limestones. Thin bands of stromatolitic limestones interbedded with oolitic limestones at the top occur within green irregularly bedded silts and sands.

The Pound Quartzite is recognised as a lower red member grading into an upper white member. The red member has its lower boundary marked by a rapid change to red coloured sandy silts. About 50 feet above the base a yellow weathering 15 foot dolomite occurs, which is traceable over much of the area. The red member is characteristically friable, with more resistant lighter brown sandstones inter-

bedded. The upper white member is well exposed only in the southern part of the area. Red soft sands occur only as a minor constituent near the base; otherwise the sandstone is fairly resistant and thickly bedded. Interstitial clay in the quartz sandstones appears to be relict of a small feldspar content. Grainsize increases toward the top. Thin clay partings between coarse sandy flaggy beds have enabled the preservation of soft bodied marine coelentenates, annelids and other biogenic traces of unknown affinities, as impressions on the bottom surfaces of the sand beds. The association of fairly clean coarse sand, mud flake impressions and cross stratification type, has been suggested as evidence for shallow marine, upper neritic environment. These fossil impressions are equated with the Late Precambrian Ediacara Fauna from the Pound Quartzite of the western side of the Flinders Ranges. An effective thinning of the Pound upper member is apparent from south to north. In part this is due to faulting of the contact with the overlying Cambrian rocks, but at least in one section, red sands of the Pound pass without faulting into the Wilkawillina Limestone. Erosion and thinning of this upper member would be in keeping with the position of Ediacara Fauna horizons, which in the western Flinders Ranges are overlain by more than 1000 feet of sandstones in some sections. At Reaphook Hill, a maximum of 55 feet of sediment was measured above these fossils.

The Parachilna Formation is rarely preserved on the escarpment formed at the base of the overlying limestones. In one section it was observed to be a white to grey clayey sand, with ghosts of possible burrows. It is friable and leached in all outcrops. The Parachilna marks the basal unit of the Cambrian succession; beds are sufficiently different in character from the Pound Quartzite to enable their correlation with the Parachilna Formation.

The Wilkawillina Limestone is unfossiliferous at the base, but interbedded oolite and stromatolite beds can be recognised in the first 80 feet. Dolomitization is patchy, but all basal carbonates are dolomitic with obliteration of textures in all but a few areas. Dolomitization is associated with a variety of colours and frequent vuggs infilled by an unidentified white amorphous mineral. Minute copper carbonate specks were observed in one hand sample. Further up this unit, Archaeocyatha and Micromitra are common except in northern dolomitized outcrops where Micromitra alone are preserved. The interval characterised by Micromitra also contains bands with trilobite fragments. Hyolithes occur from this position to the top of the formation. Above the Micromitra interval, limestones are mottled, with interbeds of oolites and intraclasts. Nearer the top, birdseye limestones become prominant. The allochthonous and terrigenous content of the limestones increases near the top. Just below the top, 20 to 30 feet of planar cross-stratified calcarenites occur which are represented across a fault in the N.E. by a conglomeratic facies of carbonate boulders derived from reworking of the earlier deposited Wilkawillina Limestone. The fault has raised up a more easterly block. The upper boundary is marked in places by a red stained pisolitic limestone bed. The formation has been measured at 1440 feet thick.

The Billy Creek Formation beds are separated from the Wilkawillina Limestone by a marked change in bedding, lithology and consequently a change in relief. The lowermost member consists of an unsorted red clayey sand with fragmental shale and carbonate layers. The sediment has a muddy matrix and is very friable in outcrop with common mud cracks. A sub-aerial, low energy environment is apparent. To the north this member thins, and is represented by lighter coloured poorly bedded sands. The overlying member is a black limestone characterized by included disrupted silt laminations, and

interbedded with dark shales. This member pinches out to the north. Above the limestone there is a calcareous sandstone with poor sorting and a differential weathering, related to rhythmic change in quartz content. These pass up into a mauve and grey shale sequence with odd dolomitic and silt interbeds. Mud cracks and halite pseudomorphs indicate subaerial restricted mud flats. Above this member is another black aphanitic limestone. It becomes clayey to the north, but retains its essential appearance. Stromatolitic beds pass into concretionary beds then into more lamellar beds. Trilobite fragments are found sparsely within the member; well preserved specimens are common in certain shale beds above the black limestones. These trilobites enable correlation with this part of the Cambrian sequence, documented in two other regions. Above this horizon the formation consists of a sequence of red to chocolate shales and silts with abundant mud cracks and small scale ripples. Two or three horizons feature slump rolling with associated flat beds bearing current lineations. Below the slump-roll horizons numerous trace fossils of possible arthropod origin are preserved. These red beds account for over 1000 feet of a total 1500 feet for the Billy Creek Formation in this area.

Within the lower members of the Billy Creek Formation, peculiar green siliceous beds occur at various intervals. They vary from one half inch clayey beds within the red beds, to 15 inch resistant beds within the carbonates. Alteration of surrounding beds is apparent in the form of discolouration and the formation of siliceous geodes with calcite centres in calcarenite beds. The green beds are thought, at this stage, to be tuffaceous in origin. One bed has been traced over a 3 mile strike length, through a number of lithologies. As a volcanic marker, it would indicate thinning of the Billy Creek Formation to the north.

Structure

The area is tectonically affected by large scale faults associated with what appears to be a regional N.E. fracture pattern. Folding is only noticeable as a gentle anticline on the western margin changing to a synclinal basin on the east side of the map. Most high angle dips are due to fault block rotation, and it is likely that the folding is largely due to buckling between faults.

Apart from the complex system of NE-SW faults, there are two large NS faults which are strike faults for a considerable part of their length. Reaphook Hill is produced by this mechanism which has doubled the thickness of the white member of the Pound Quartzite. In the Billy Creek Formation, the strike fault repeats one member as documented by replication of the distinctive trilobite horizon. The eastern margin of Cambrian rocks in this area is marked by parallel faulting which raises thin blocks of Pound Quartzite and possible Wonoka limestone to the surface, indicating some 3000 feet of vertical movement.

In summary, a system of NE-SW faults with lateral movement intersect N-S faults with vertical movement.

Mineralization

Secondary copper minerals occur in a fault zone, as found in an old abandoned digging on the north end of the map, near the vermin fence. As mentioned before copper carbonates are common as thin layers in partings of carbonate layers at certain horizons in the Wonoka Formation, but all are regarded as uneconomic. It is possible that the copper carbonates found in the fault zone are derived from the Wonoka Formation.

Manganese oxides enrich the dolomite in the lower part of the Wilkawillina Limestone in patches which outcrop in areas up to 500 feet in diameter. The deposits appear

to be low grade.

Recognition of small amounts of lead and zinc carbonates in the Wilkawillina Limestone was not possible in the field due to lack of knowledge of their characteristics in such environments. Some of the vug-fill in the dolomites may have been related to zinc mineralization which occurs in the basal Cambrian of the ajoining mapped area.

A PRELIMINARY REPORT ON THE GEOLOGY OF THE KEMPES BORE AREA - EASTERN FLINDERS RANGES

F. M. GRUNT
JULY 1971.

INTRODUCTION

The Kempes Bore area is located approximately 80 miles north-east of Hawker in the eastern margins of the Flinders Ranges. The most convenient route into the area is the north-easterly track from Martins Well, passing through a small Barytes mine, past Middle Bore, Weavers Well and Kempes Bore. A further track from Kempes Bore to the old Kennecott Base Camp enables access into the central part of the area. It is advisable to use a 4-wheel drive vehicle when negotiating the track from Martins Well.

Reaphook Hill is the highest point in the area with an elevation of 1271 feet and has the co-ordinates 139°25' East and 31°26' South. Kempes Bore is approximately 4 miles east of Reaphook Hill. The climate is semi arid, while the vegetation is relatively sparse. The area is dissected by ephemeral streams flowing to the east.

Geological mapping has been carried out, using aerial photographs on a scale of 1 inch equals 540 feet. Samples have been collected from the various Formations and thin sections are being prepared for petrological work. A complete assessment of the area will be available at the end of October.

The area being studied consists of Upper Proterozoic and Lower Cambrian sediments contained within a shallow northerly plunging syncline bounded to the east by a major fault system.

The Upper Proterozoic outcrops in low hills, adjacent to steeper ridges formed by the Pound Quartzite, which marks the top of the Proterozoic.

The Lower Cambrian sequence is represented by a poorly outcropping Parachilna Formation, whilst the overlying Wilkawillina Limestone forms a

plateau approximately 250 to 350 feet above the plains that flank the area in the east. The Billy Creek Formation is contained within a north - south trending synclinal structure, closing to the south.

UPPER PROTEROZOIC

The accompanying column shows the rock types associated with each particular Formation. For the present the Wonoka Formation has been subdivided into an Upper and Lower Member. However, the Lower Member may represent a broad transitional boundary with the Bunyeroo Formation. A final decision on this boundary will be made only after a comparison with the type locality for the Bunyeroo and Wonoka Formations.

The boundary between the Wonoka Formation and the Red Pound Member is taken from the last appearance of a 'Wonoka type limestone'. The boundary is transitional and is marked by an alternation of red, silty, medium-grained sandstones and grey-green fine-grained limestones and green friable shales.

The Upper White Pound Member is characterized by approximately 100 to 120 feet of white resistant quartzites. Thinly bedded and flaggy red argillaceous to silty sands mark a fairly distinct boundary with the underlying Red Pound Member.

LOWER CAMBRIAN

PARACHILNA FORMATION

The Lower Cambrian sequence is about 2200 feet in thickness. The base of this sequence is represented by the Parachilna Formation which forms a topographic low between the White Pound Member and overlying Wilkawillina Limestone. Its outcrop is limited and where present is very weathered and

leached. In some instances the presence of the Parachilna Formation may be associated with gypsiferous clayey pockets and a very weathered clayey quartz pebble conglomerate. However, some of this material is not residual, and such criteria has to be used with caution.

The quartz pebble conglomerate is possibly represented by a number of lenses rather than a single horizon, and is frequently ferruginized and silicified, outcropping as resistant mound-like masses. In some localities there is an association of a blackish-brown rock containing iron and manganese oxides. A small occurrence of the mineral scholzite (a rare $CaZnPO_4$) is present near the base of the Parachilna Formation and appears to be localized along a small fault. The sequence thins appreciably to the north-east, from about 80 feet to 5 feet.

WILKAWILLINA LIMESTONE

In general the Wilkawillina Limestone is a massive grey-pink to mottled limestone, markedly dolomitized, particularly near the base, and is fossiliferous higher in the sequence.

The basal 300 feet is characterized by a mottled coloured dolomitized limestone and 'false gossans' of iron and manganese oxides. Associated with this iron manganese rock is a ferruginized scree or rubble which may contain small amounts of manganese.

In addition there is a variable amount of sand in these basal dolomitized limestones while small vughs present in the rock contain a whitish mineral which is possibly a Zinc carbonate. The incidence of vughs decreases higher in the sequence but they are seen again approximately 900 feet above the base in the western portion of the area.

The Wilkawillina Limestone is sandy in the upper most parts of the sequence. Rock types include 'birdseye' limestones passing into bioclastic and intraclastic beds. These are overlain by sandy limestones and cross-bedded massive calcareous sandstones. This sequence can be seen in the accompanying column.

The top of the Wilkawillina Limestone is marked by an erosional surface indicated by the presence of calcrete pisolites and a calcreted surface. The Billy Creek Formation therefore, probably lies with unconformity upon this surface.

On the basis of fossil control (Micromitra - brachiopod) and lithological differences it is clear that the Parara Limestone, Oraparinna Shale and Bunkers Sandstone of the type section are not represented in the sequence.

In addition there is a small block of Wilkawillina Limestone that occurs as an outlier in the central faulted part of the area. This can be seen on the map as south of the main mass of Wilkawillina Limestone and just north of the Scholzite occurrence. The presence of a zinc carbonate occurring in vughs, is particularly evident in the outcropping central and eastern parts of this faulted block.

BILLY CREEK FORMATION

As seen on the accompanying column the Billy Creek Formation has been broken up into several members, based on lithology, while fossil control is only present in the upper two members. The base of the Billy Creek Formation is very variable and marked facies changes occur along a considerable strike length.

Lithologically members 5, 6 and 7 are quite distinct. Member 6 however

changes along the strike to the South East and the black fine-grained, sometimes silty, limestones with thin nodular bands in the north, change laterally into greyish flaggy silty dolomites to the south-east.

Member 4 represents a sequence of relatively clean medium to coarse grained slightly calcareous sandstones and pistachio green shale marker beds, which are markedly silicified (volcanics?). Members 1, 2 and 3 are characteristic in the north but pass laterally into Member 4 as we proceed south-east. However, this problem is yet to be fully clarified and the accompanying column may have to be amended.

STRUCTURE

This can be summarized as follows:

(1) A major fault system occurs in the Eastern margins of the area. The displacement on Fault G may exceed 1500 feet.

(2) A major near vertical fault transects the south of the area with a general north-east, south-west trend. This fault continues to the south-west towards Martins Well. Its north-easterly trend diminishes (?) into the basal part of the Wilkawillina Limestone. This fault is shown as Fault A on the map.

(3) A system of strike faults add to the complexity in the central portion of the area. In general these trend east-west. However, the strike faults D and C cut across the strike and continue in a north-easterly direction.

In general the main features associated with this faulting are as follows:

(a) Folding between Faults C and D and between Faults C and E has a

general south-westerly plunge.

(b) An outlier of Wilkawillina Limestone is present as a faulted block between Faults C and E.

(c) The Parachilna Formation immediately east of Fault A has been repeated north of Fault C and again north of Fault D.

(d) The White Pound Member and the upper and middle portions of the Red Pound Member are repeated due to displacement along Fault B.

NOTE

Fault B is a steep angle reverse fault with its fault plane dipping to the North. It occurs west of Fault A.

Fault C occurs east of Fault A and south of Fault D. It is a moderate angle reverse fault that ends in a series of splinter faults.

Fault D occurs east of Fault A and north of Fault C. It is a moderate angle normal fault. It is less well established near Fault A due to lack of outcrop but is a prominent feature to the north-east.

(4) The shallow synclinal structure of the Billy Creek Formation has been controlled by periodic movements along the major faults on its eastern margins. In addition movement along Fault J has resulted in the development of a secondary hinge line that trends a little east of north.

MINERALIZATION

(1) No sulphide mineralization has been seen. IN A NUTSHELL...!

(2) Patches of ferruginized manganiferous rock occur as surficial deposits

on the Wilkawillina Limestone and Parachilna formation. These iron and manganese oxides are secondary in origin and may be classified as 'Fake Gossans'. In addition quite larger patches of ferruginized scree may contain small amounts of manganese.

(3) Some secondary enrichment of manganese oxides may be associated with faulting, as for example just west of the Kennecott costeins and east of Fault A, in the centre of the map.

(4) The presence of a white amorphous zinc carbonate (?) occurs in vughs within the basal 300 feet of the Wilkawillina Limestone. The incidence of these vughs decreases higher in the sequence but they are apparent again at approximately 900 feet above the base, in the western part of the area.

(5) The scholzite ($CaZnPO_4$) appears to be localized along a minor fault, in a single occurrence at the base of the Parachilna Formation, south of Fault C.

(6) Very small occurrences of iron and manganese oxides are present at the base of the Billy Creek Formation. Some of this secondary enrichment occurs along minor faults, for example near the small clean sand outlier on the north-east of the map.

(7) In all probability the source of the Manganese and Zinc (?) is a low grade mineralization within the Parachilna Formation and to a lesser extent in the Wilkawillina Limestone.

(8) Copper in the form of Malachite staining along joint partings in a dolomite was seen in the lower member of the Wonoka Formation, east of Fault A. Its surface indication is not extensive and is confined to a thin horizon approximately 5 feet thick. (It may be the Wearing

Dolomite which is a low grade copper bearing horizon in the Bunyeroo Formation - hence this Lower Member of the Wonoka Formation may, in fact, be the upper part of the Bunyeroo Formation.)

CONCLUSIONS AND RECOMMENDATIONS

(1) Surface sampling of the presence of copper, in what may be the equivalent of the Wearing Dolomite, could be carried out. This horizon has a good strike length and has been recorded in Jim Gehling's area (displaced across Fault A). Of particular interest is the displacement of this horizon across Fault A. Surface indicators for the presence of copper will be examined within this Fault zone during a return to the area in August.

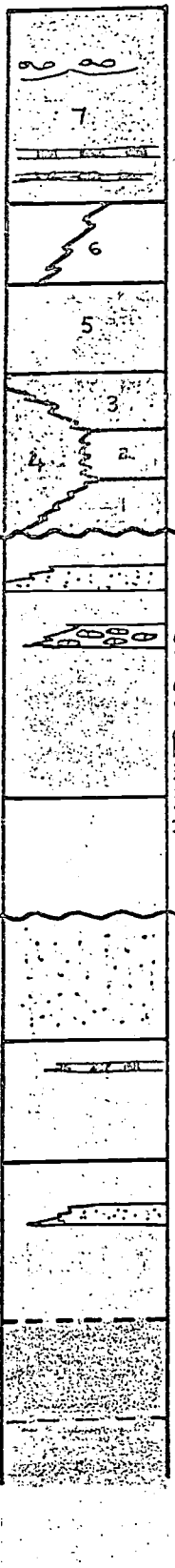
(2) The presence of Zinc in the upper part of the Wilkawillina Limestone approximately 900 feet above its base, in the west of the area (eastern extent as yet unknown) may be worthy of some attention.

(3) If Fault A can be shown to extend further to the North-east, it could provide a favourable trap for the accumulation of zinc and manganese.

(4) Petrocarb Exploration N.L. hold a total of 5 (or more) claims within the central mineralized portion of the area, where the occurrence of Scholzite, manganese oxides and zinc carbonate has been seen. The exact position of these claims are in the records of the South Australian Mines Department.

PRELIMINARY GEOLOGICAL SEQUENCE - KEMPES BORE AREA

RECENT: scree of Pound Quartzite and Wilkawillina Limestone — Piedmont gravels (PLEISTOCENE?) creek deposits of [illegible] and alluvium from outwash fans



BILLYCREEK FORMATION: thickness 900 feet.

red brown micaceous shales, sometimes grey green, very fine silty sands, thinly bedded to friable, sandy beds more massive. slump beds halite pseudomorphs, trace fossils, weathered volcanics(?) massive silty dolomite marker beds and futobite fragments towards the base.

grey black limestones, nodular in places, grading into grey silty dolomites to the east. thinly bedded and flaggy. Massive silty dolomite and volcanic(?) marker mark basal transitional contact. TRILOBITE fauna

constant member along strike of grey red mottled friable shales silty in places, rare thin 2" lenticular beds of clean limestone pale leaf green volcanic(?) marker beds

red indurated "book" sands and red silty shales and fine silty sandy [illegible] with Geodes. Pale leaf green prominent markers - Volcanics(?)

grey black limestones; grey silty dolomites with variable grey fissile, thinly bedded shale interbeds. Pale green volcanic(?) marker in southeast

red illsorted, poorly consolidated, silty feldspathic sands with cleaner lenticular more massive interbeds towards the base

} member 4: these members 1, 2 & 3 pass laterally into clean medium to coarse sands

WILKAWILLINA LIMESTONE: THICKNESS 1300 feet.

sandy limestones; massive cross bedded calcareous sands grading into ferruginized limestones and top marked by erosional surface: calcreted with pisolites.

"birdseye" limestones (grey) passing into intraclastic brecciated, stromatolitic and dolomitized limestones with archaeocyathids and hyolithids.

massive mottled dolomitized limestones with clean white Archaeocyathid limestones containing also Micromitra and Hyolithids

massive basal grey pink to mottled, sandy limestone. Scree of iron and iron, manganese rock.

PARACHILNA FORMATION: THICKNESS VARIABLE 5' to 80 feet.

argillaceous sands; calcareous sands and silts near top; outcrop limited; lenses of quartz pebble conglomerate, often silicified and ferruginized outcropping as mounds.

POUND QUARTZITE

WHITE MEMBER: THICKNESS 100-120 feet.

white massive indurated Quartzite with flaggy silty fine grained sand interbeds. Fossil impressions.

RED MEMBER: approx. thickness 800-1000 feet.

red silty sands, indurated massive to flaggy beds; thin dolomite (sandy) interbeds; grey green shales near gradational base; mudcracks.

WONOKA FORMATION approx thickness [illegible] feet.

UPPER MEMBER:

grey-green dolomites / limestones and calcareous shales, occasionly silty; flaggy red sands near top; intraformational breccias, stromatolites, slump structures and mudcracks

LOWER MEMBER(?)

or

BUNYEROO FORMATION(?)

red micaceous shales, with mudcracks grading up into grey-green dolomites / limestones and calcareous shales with mudcracks and slump structures

CAINOZOIC

PALAEOZOIC — LOWER CAMBRIAN — HAWKER GROUP

PROTEROZOIC — MARINOAN — WILPENA GROUP

SUMMARY OF THE GEOLOGY OF THE EMU BORE AREA

BY

Charles Gabrieel
1971

Summary of Geology of Emu Bore Area

Location of Area:

The map coordinates of Emu Bore as obtained from the Parachilna map sheet are 219131.

The actual area mapped lies between Emu Bore and the vermin proof fence, the latter being the boundary between Wirrealpa Station and Martin's Well Station.

Stratigraphy:

The stratigraphic formations mapped were the Bunyeroo Formation, Wonoka Formation, Pound Quartzite, Parachilna Formation, Wilkawillina Limestone and Billy Creek Formation. The first four units named are Upper Proterozoic in age and the last two are Lower Cambrian.

These names for the formations are the names as given in the type section and they are used for convenience in this brief report but their use may be revised in the final report.

Descriptions of the individual units follow:

(i) Bunyeroo Formation:

This is made up mainly of red, green and grey slightly calcareous shales and siltstones. Thin, fine grained, grey limestones are interbedded with the shales and silts near the contact of the Bunyeroo Formation with the Wonoka Formation.

These limestones occur more frequently as the contact is approached until just below the contact, limestone predominates over shales and siltstones.

The actual contact was taken as the last appearance of red shales and siltstones.

Thus the transition from Bunyeroo to Wonoka Formations is fairly gradual.

Ripple marks and structures resulting from compaction of the sediments were the main sedimentary structures present.

On the east side of the area, the sediments in the Bunyeroo Formation are complexly folded into numerous tight anticlines and synclines.

(ii) Wonoka Formation:

This is generally composed of interbeds of grey to green

calcareous shales and siltstones and fine to medium grained, grey, glauconitic, silty limestones. The limestones often contain silty laminae and there are some thin bands of intraclastic limestone in the sequence containing rounded elliptical shaped carbonate pebbles.

Slump structures, ripple marks and cross bedding are the principal sedimentary structures present.

Near the top of the formation the limestones are dolomitized and several bands of fine to medium grained dolomitic limestone occur.

These bands are very continuous and have been mapped as distinct members of the Wonoka Formation.

The bands of dolomitic limestone are interbedded with sandstones and siltstones.

The dolomitic limestone is manganiferous in places and forms black, very fine grained, massive outcrops. Minor amounts of hematite are associated with these outcrops.

The presence of glauconite and the intraclastic bands suggests a fairly shallow marine environment susceptible to some turbulence.

The contact of the Wonoka Formation and Pound Quartzite is sharp with Pound red beds lying on the last band of dolomitic limestone in the Wonoka Formation.

(iii) Pound Quartzite :

In the type section the Pound is made up of two members - the lower member is the Red pound and the upper the White Pound. In the Emu Bore area there are only two to three feet of poorly outcropping, white medium grained quartzite just below the Parachilna Formation. This probably represents the equivalent of the White Pound facies of the type section and indicates a marked period of erosion prior to the deposition of the overlying Cambrian sequence.

The bulk of the Pound Formation is made up of chocolate, red, and green micaceous shales and siltstones with some bands of red-brown fine to medium grained sandstones and quartzites.

Several thin, brown bands of fine grained limonitic, dolomitic limestone (1 - 2 feet thick) occur near the base of the Pound Quartzite.

The main sedimentary structures are clay galls and ripple marks. These structures (particularly the former) indicate deposition in a shallow water environment.

(iv) Parachilna Formation:

This is a thin, very poorly outcropping, white, fine to coarse sandstone. In some areas this formation is represented only by residual clays formed by weathering of the original rock. No really definite fossils in the form of tracks or burrows were found.

(v) Wilkawillina Limestone:

This is generally a fine to medium grained limestone. ~~The unit is medium grained limestone~~. The unit is manganiferous at the base and the first 150 ft. or so is dolomitic limestone.

There are some thin intraclastic bands, the intraclasts being rounded and of pebble size.

The principal fossils are Archaeocyathids, Hyolithids and Micromitra and these tend to occur in fairly thin richly fossiliferous bands separated by thicker, more poorly fossiliferous bands. The upper and lower limits of the Micromitra fossils were traced out and mapped to give two time lines.

The top of the Micromitra band is believed to be the approximate time equivalent of the contact between the Wilkawillina limestone and the Parara limestone in the type section in Wilkawillina Gorge. The facies represented by the Parara Limestone, Bunkers Sandstone and Oraparinna Shales in the type section are replaced by Wilkawillina Limestone type facies in the Emu Bore area.

The fossils and lithology indicate a shallow marine environment of deposition.

(vi) Billy Creek Formation:

The contact between the Wilkawillina limestone and the Billy Creek Formation is fairly sharp. In this area this unit is very

poorly outcropping. The rocks seen were composed of red and green shales and silts.

(vii) Diapiric Bodies:

A small diapiric structure was discovered on the east side of the area and is along the continuation of a fault.

Large blocks of limestones have been carried up as the diabasic material associated with the diapir moved upwards through the sediments. The result, as seen in the field now is a line of low mounds each mound having these large, fractured blocks of limestone sitting directly upon diabasic rocks.

The sediments immediately adjacent to the diapir have a bleached appearance, the alteration being caused by the diapir. Limestone breccias and sheared limestones are also associated with the diapir.

Minor amounts of hematite and traces of malachite occur in the rocks associated with the diapir.

Structure:

In the northern half of the area the Lower Cambrian and Upper Proterozoic sediments have been folded into a synclinal structure which plunges gently to the north. The limbs have a moderate dip of 30° - 40° and the east limb is truncated by a north-south fault. A series of minor faults cut the limbs of this syncline in a direction approximately perpendicular to the strike of the beds.

South of the syncline the sediments have a north-south strike and have been disturbed by several quite large faults.

Mineralization:

Minor amounts of malachite were found in places in the Wonoka and Bunyeroo Formations, the malachite appearing as thin surface films on bedding planes and in joints and cracks. Some malachite was also seen in the diapir.

Manganiferous rich rocks occur near the ttop of the Wonoka Formation. At one place a band 3 to 6 feet thick and about 150 yards long forms a black, massive, very fine grained outcrop. This band runs parallel to the strike of the rocks. There is some

hematite associated with this band.

The base of the Wilkawillina Limestone is also manganiferous.

Some hematite is associated with the diapir and occurs mainly as veinlets in the diabasic rocks and the blocks of limestone associated with the diapir.

It is suggested that a geochemical survey of the diapir and surrounding areas be done to see if there is anything of economic interest associated with the diapir.

EMU BORE

GRAVITY BORE

LIMESTONE SPRING BORE

BAMBOO WELL

TOOTH'S NOB RUIN

EARTH TANK

KEMPES DAM

KEMPES BORE

REAPHOOK HILL

WORKINGS

COSTEANS

NUMEROUS SMALL CHANNELS

ALLUVIAL FAN

LINE 11

LINE 9

LINE 8

LINE 10

LINE 7

LINE 6

LINE 5

LINE 4

SEE Fig 2 ENLARGEMENT

APPROXIMATE S.M.L. BOUNDARY

Qra

Qrt

Pw

Pp

€h

€b

PQ

Pb

M N

LEGEND

- Qra / Qrt — ALLUVIUM
- €b — BILLY CREEK FORMATION (LOWER CAMBRIAN)
- €h — WILKAWILLINA LIMESTONE (LOWER CAMBRIAN)
- Pp — POUND QUARTZITE (UPPER PROTEROZOIC)
- Pw — WONOKA FORMATION (UPPER PROTEROZOIC)
- Pb — BRACHINA FORMATION (UPPER PROTEROZOIC)
- STRATIGRAPHIC BOUNDARY
- FAULT
- APPARENT DIP
- CHIP SAMPLE LINES
- ROAD
- FENCE
- S.M.L. 339 BOUNDARY
- STREAM

CUNDILL, MEYERS AND ASSOCIATES PTY. LTD.

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GEOLOGY OF REAPHOOK HILL

S.M.L. 339, SOUTH AUSTRALIA

Fig 3

SCALE : APPROX 2 INCHES TO 1 MILE | AUTHOR : B REES

DRAWN : J.R.H. , 21 . 1 . 71

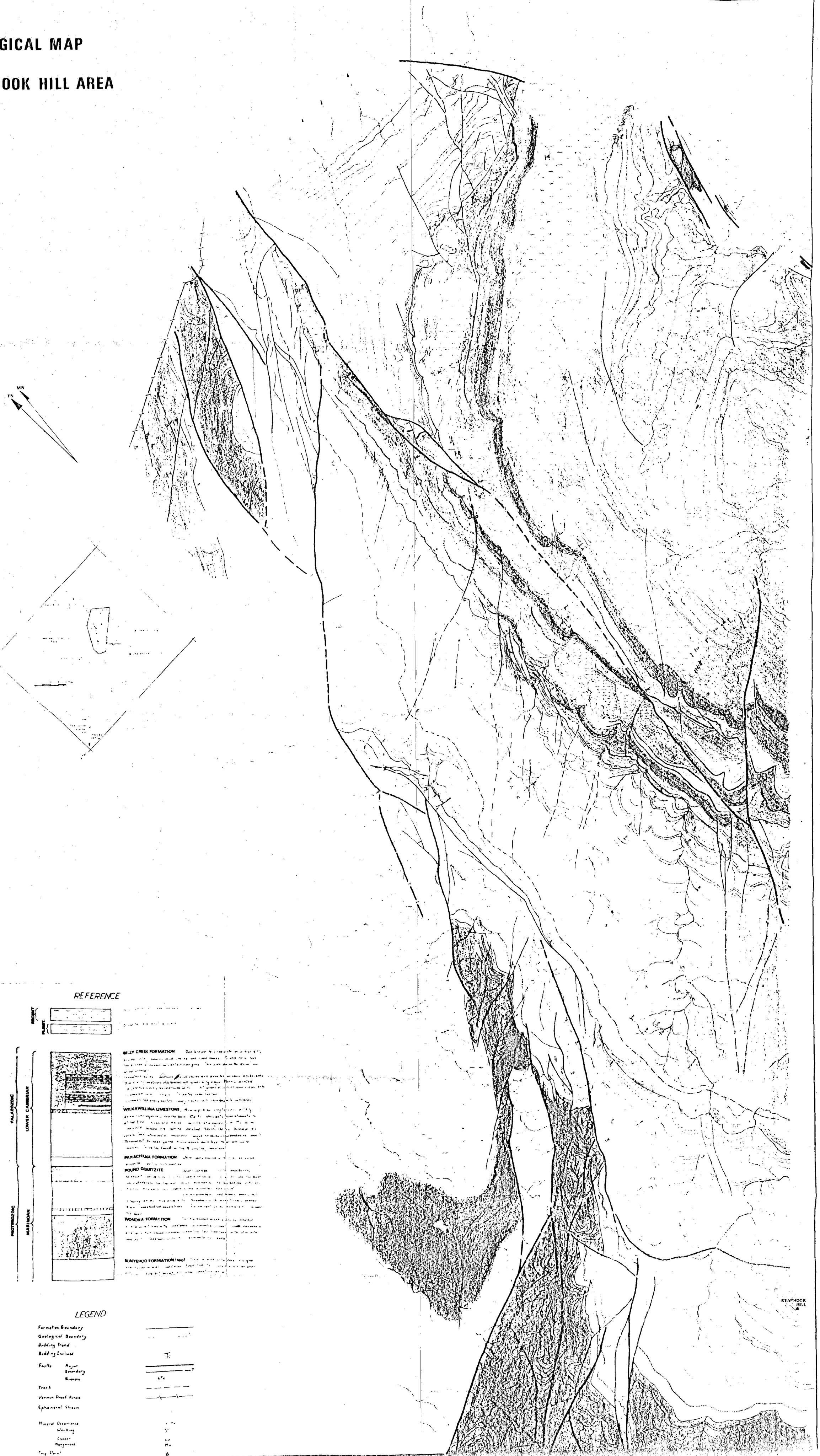
1363-4 1363


THE GEOLOGY OF THE
EMU BORE AREA,
EASTERN FLINDERS RANGES
SEDIMENTARY ROCKS
RECENT ALLUVIUM
BILLY CREEK FORMATION
WILKAWILLINA LIMESTONE
PARACHILNA FORMATION
Medium to coarse white friable sandstones and siltstones. Generally highly weathered
POUND FORMATION
WONOKA LIMESTONE FORMATION
BUNYEROO FORMATION
Ripple marks and rain prints.
IGNEOUS ROCKS.
DIAPIRIC MATERIAL
Medium grained diabase with
LEGEND.
Geological Boundary Mapped
Geological Boundary Inferred
Trend Line
Fault Mapped
Fault Inferred
Intermittent Creek
Dip and Strike.
FEET
METRES

GEOLOGICAL MAP
KEMPES BORE AREA
Preliminary Map! for present
N
MN
LOCALITY MAP of
KEMPES BORE AREA
Kempes Bore
KEMPES BORE 1 Mile
FAULT B
FAULT A
BEAPHOOK
HILL 1271 feet.
REFERENCE
PRELIMINARY GEOLOGICAL SEQUENCE - KEMPES BORE AREA
CAINOZOIC
PALAEOZOIC
LOWER CAMBRIAN
PROTEROZOIC
MARINOAN
RECENT: scree of Pound Quartzite and Wilkawillina Limestone - Piedmont gravels (Pleistocene?) creek deposits of and alluvium from outwash fans
BILLYCREEK FORMATION: thickness 900 feet
red brown micaceous shales, sometimes grey green, very fine silty sands, thinly bedded to friable, sandy beds more massive slump beds halite pseudomorphs, trace fossils, weathered volcanics(?) massive silty dolomite marker beds and Trilobite fragments towards the base
grey black limestones, nodular in places, grading into grey silty dolomite to the east thinly bedded and flaggy. Massive silty dolomite and volcanic(?) marker mark basal transitional contact
constant member along strike of grey red mottled friable shales silty in places, rare thin 2" lenticular beds of clean limestone pale leaf green volcanic(?) marker beds
red indurated 'book' sands and red silty shales and fine silty sandy with Geodes. Pale leaf green prominent markers - volcanics(?)
grey black limestones, grey silty dolomites with variable grey fissile, thinly bedded shale interbeds. Pale green volcanic(?) marker in south east
red illsorted, poorly consolidated, silty feldspathic sands with cleaner lenticular more massive interbeds towards the base
WILKAWILLINA LIMESTONE: THICKNESS 1300 feet.
sandy limestones, massive crossbedded calcareous sands grading into ferruginized limestones and top marked by erosional surface calcreted with pisolites
"birdseye" limestones (grey) passing into intraclastic bioclastic, stromatolitic and dolomitized Archaeocyathid and Hyolithid limestones
massive mottled dolomitized limestone with clean white Archaeocyathid limestones containing also Micromitra and Hyolithids
massive basal grey pink to mottled, sandy limestone. Scree of iron and iron manganese rock.
PARACHILNA FORMATION: THICKNESS VARIABLE 5' to 80 feet.
argillaceous sands, calcareous sands and silts near top, outcrop limited, lenses of quartz pebble conglomerate, often silicified and ferruginized outcropping as mounds.
POUND QUARTZITE
WHITE MEMBER: THICKNESS 100-120 feet
white massive indurated Quartzite with flaggy silty fine grained sand interbeds. Fossil impressions.
RED MEMBER: approx thickness 800-1000 feet.
red silty sands, indurated massive to flaggy beds, thin dolomite (sandy) interbeds, grey green shales near gradational base, mudcracks.
WONOKA FORMATION approx thickness feet.
UPPER MEMBER:
grey green dolomites/limestones and calcareous shales, occasionally silty; flaggy red sands near top; intraformational breccias, stromatolites, slump structures and mudcracks
LOWER MEMBER(?)
or
BUNYEROO FORMATION (?)
red micaceous shales, with mudcracks grading up into grey-green dolomites/limestones and calcareous shales with mudcracks and slump structures
geological boundary
approximate geological boundary
inferred geological boundary
fault
approximate fault position
inferred fault section
SCALE
250 0 500 1000 1500 2000 2500 3000 feet
Photo base uncontrolled
1363-2

GEOLOGICAL MAP

REAPHOOK HILL AREA



REFERENCE

RECENT

PLIOCENE

PALAEOZOIC

LOWER CAMBRIAN

PROTEROZOIC

MARINOAN

BILLY CREEK FORMATION

WILKAWILLINA LIMESTONE

PARACHILNA FORMATION

POUND QUARTZITE

WONOKA FORMATION

BUNYEROO FORMATION (top)

LEGEND

Formation Boundary

Geological Boundary

Bedding Trend

Bedding Inclined

Faults — Major; Secondary; Breccia

Track

Vermin Proof Fence

Ephemeral Stream

Mineral Occurrence

Working

Copper — Cu

Manganese — Mn

Trig Point

1363-1-FR

1363-1 -F1


REFERENCE
PROTEROZOIC
PALAEOZOIC
MARINOAN
LOWER CAMBRIAN
RECENT
PLEIST
BILLY CREEK FORMATION
WILKAWILLINA LIMESTONE
PARACHILNA FORMATION
POUND QUARTZITE
MOOROWIA FORMATION
BUNYERIOO FORMATION (top)
LEGEND
SCALE
1000
2000 Feet

SCALE IN CHAINS
0 40 80 120 160 200
SCALE IN METRES
1000 0 1000 2000 3000 4000

EMU BORE
GRAVITY BORE
LIMESTONE SPRING BORE
EARTH TANK
KEMPES DAM
BAMBOO WELL
TOOMS NOB RUIN
REAPHOOK HILL
WORKINGS
KEMPES BORE
APPROXIMATE S.A.L. BOUNDARY
NUMEROUS SMALL CHANNELS
ALLUVIAL FAN

Qra
Qrt
Eb
Eh
PQ
Pw
Pu

SCALE:
APPROX. 2" TO 1 MILE

M.N.

LEGEND

- ROAD
- FENCE
- S.A.L. BOUNDARY
- FAULT
- 30 APPROX. APPARENT DIP
- STREAM
- BORE
- EARTH DAM
- STRATIGRAPHIC BOUNDARY
- Qra ALLUVIUM
- Qrt LOW-ANGLE SLOPE DEPOSITS
- Eb BILLY CREEK FORMATION
- Eh HAWKER GROUP
- PQ POUND QUARTZITE
- Pw WILPENA GROUP
- Pu UNBERATANA GROUP

VAM LIMITED

GEOLOGY OF REAPHOOK HILL

PARACHILNA SOUTH AUSTRALIA

SCALE	Approx. 2 INCHES TO A MILE	AUTHOR	A HOLMES
DRAWN	A.P.H.	DATE	18-8-70
			PRELIMINARY MAP
		REF. NO.	

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