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SML 294

WOOLTANA

PROGRESS REPORTS AND FINAL REPORT TO LICENCE SURRENDER, FOR THE PERIOD 19/5/1969 TO FEBRUARY 1971

Submitted by
North Flinders Mines Ltd
1971

Enquiries: Customer Services Branch
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7th Floor
101 Grenfell Street, Adelaide 5000

Telephone: (08) 8463 3000
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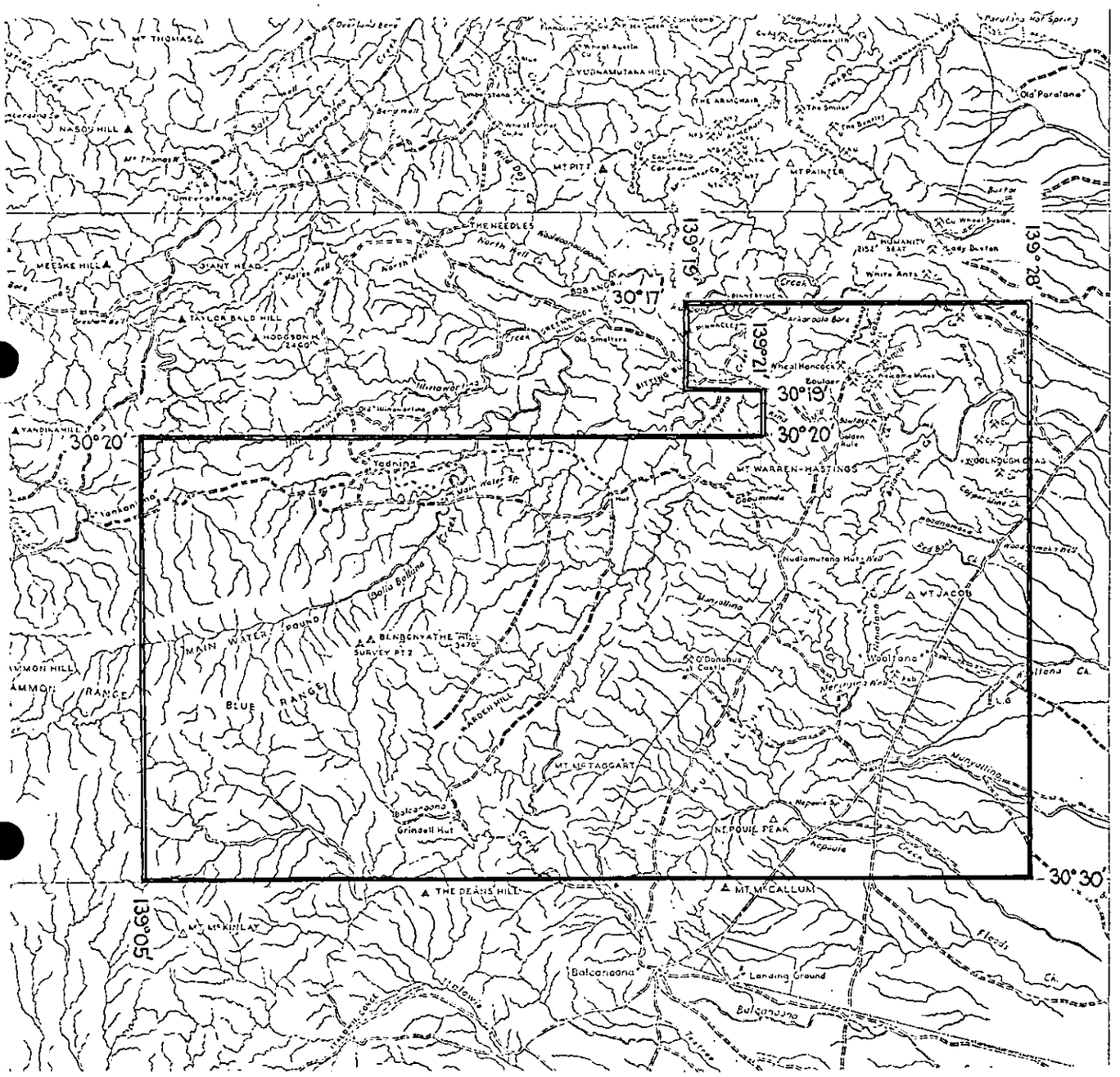
Government of South Australia
Department for Manufacturing, Innovation, Trade, Resources and Energy



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NORTH FLINDERS MINES N.L.

OCKET D.M.636/69 AREA 301 SQ MILES

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S.M.L. No. 294 EXPIRY DATE 18·5·71

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TENEMENT HOLDER: North Flinders Mines N.L.

REPORTS: (Contents Page A-G)

North Flinders Mines N.L.
Exploration report S.M.L. 294 For six months period ending 19th, November, 1969 (pgs 1-29)

Plans
Location map of SML 294
The Following reports are contained in the above.

a) JONES, W.R.R. 1970
SML 294- Progress report of 6 months ending 19th November 1969 (No Plans) (pg. 4)

b) DONOVAN, P.R. 1969
Suggested initial exploration programme on SML 294 (pgs. 5-7)
Plan:
Map showing location of prospects no title. (1226(f)-1

c) DONONAN, P.R. 1969
Notes on Lady Buxton Copper Mine, O'Donoghue's Castle Copper Mine and Blue Mine conglomerate (NO Plans) (pgs. 8-13)

d) DONOVAN, P.R. 1969
Notes on Lady Buxton and blue Mine conglomarte. (No Plans) (pgs. 14-15)

e) PONTIFEX, I.R. 1969
Mineralogical report no. 76 (No Plans) (pgd. 16-19)

f) PONTIFEX, I.R. 1969
Mineralogical report No. 37 (No Plams) (pgs 20-23)

g) WEBB, J.E. 1969
Report on Induced Polarization surveys in Northern Flinders area. (O'Donoghue Castle Mine and McLeashes Prospect). (pgs. 24-29)

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Plans:

Geological map of O'Donoghue's Castle copper prospect showing I.P. results.	(1226(1)-2)
O'Donoghue Castle I.P. profile Line AA.	(1226(1)-8a)
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O'Donoghue Castle I.P. profile Line AE.	(1226(1)-7b)
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Report:

North Flinders Mines N.L. 1970
SML 294
Progress report for six months ending 18.5.70.
(Contains several reports - see below) (pgs. 30-43)

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Location Map of SML 294.	(pg. 34)
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McLeashes copper prospect - cross section 16200N- geology ; Copper, lead and zinc results.(DWG 294-24)	(1226(3)-8)
McLeashes copper prospect- cross section 16548N- Copper results. (DWG 294-17)	(1226(3)-2)
McLeashes Copper prospect - cross section 16600N - Copper results (DWG 294-18)	(1226(3)-3)
McLeashes copper prospect - cross section 16600N- geology; copper results (DWG 294-25)	(1226(3)-9)

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Plans:

CONTENTS ENVELOPE 1226 Cont.

THIS REPORT CONTAINS THE FOLLOWING REPORTS:

a) DONOVAN, P.R. 1970
STream sediment reconnaissance survey, Wooltana area, SML 294, S.A. (pgs. 35-40)

Plans:

Wooltana Area SML 294- Stream sediment reconnaissance and follow up survey- sample location map (1226(1)-3)

Wooltana Area SML 294 Stream sediment reconnaissance and follow up survey- copper results (1226(1)-4)

Wooltana Area SML 294 Stream sediment reconnaissance and follow up survey lead results. (1226(1)-5)

Wooltana Area SML 294 stream sediment reconnaissance and follow up survey - Zinc results. (1226(1)-6)

Report:

b) GARMAN, M.R.W., 1969
Report on investigation of zinc anomaly O'Donoghue Castle mine area (pgs. 41-43)

Plan:

O'Donoghue Castle mine area- Zinc anomaly investigation (DWG 1610-20). (1226(2)-9)

Report: North Flinders Mines N.L. 1970
Exploration report SML 294 for period ending 19-11-74
(Plans?) McLeashes Copper prospect SML 294 (missing)
(pgs. 44-49)

THIS REPORT CONTAINS THE FOLLOWING REPORTS:

a) PONTIFEX, I.R., 1970
Report on the geological map of the Coup prospect
(For plan see 1226(2)-10) (Missing)

WILSON, R.B. 1970

b) Report on a rotary -percussion drilling programme O'Donoghue Castle area. (Missing)

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Cross section on lines 1600N, 1200N, 600N and 200N -geology and I.P. (DWG 294-29) (1226(4)-8)

Reports;

c) GARMAN, WATTS, GRIFFIS, McQUAT PTY. LTD.
Report on investigation of SNL 294 (Missing)

Plans:

Wooltana area SML 294 Anomaly.
Investigation sampling - sample locations
(DWG 1610-28) (1226(5)-1)

Wooltana Area SML 294 Anomaly investigation sampling- copper results.
(DWG N O. 1610/29) (1226(5)-2)

Wooltana Area SML 294 Anomaly investigation- sampling Lead results (DWG No. 1610(30) (1226(5)-3)

Wooltan Area SML 294 Anomaly investigation sampling- Zinc results. (DWG 1610-31) (1226(5)-4)

Reports:

WILSON, R.B., 1971
Final summary exploration report SML 294. North Flinders Ranges, S.A. (pgs. 50-109)

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This report the following reports

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Plan

Reports:

Plans:

Report

Plan:

CONTENTS ENVELOPE 1226 Cont.

ADDITIONAL PLAN

Wooltana Area SML 294 Stream sediment reconnaissance and follow up survey- Copper results (same as 1226(1)-4)

(1226(5)-7)

ENV 1226.

NORTH FLINDERS MINES N.L.

EXPLORATION REPORT

S.M.L. 294

For the six month period ending 19th November, 1969

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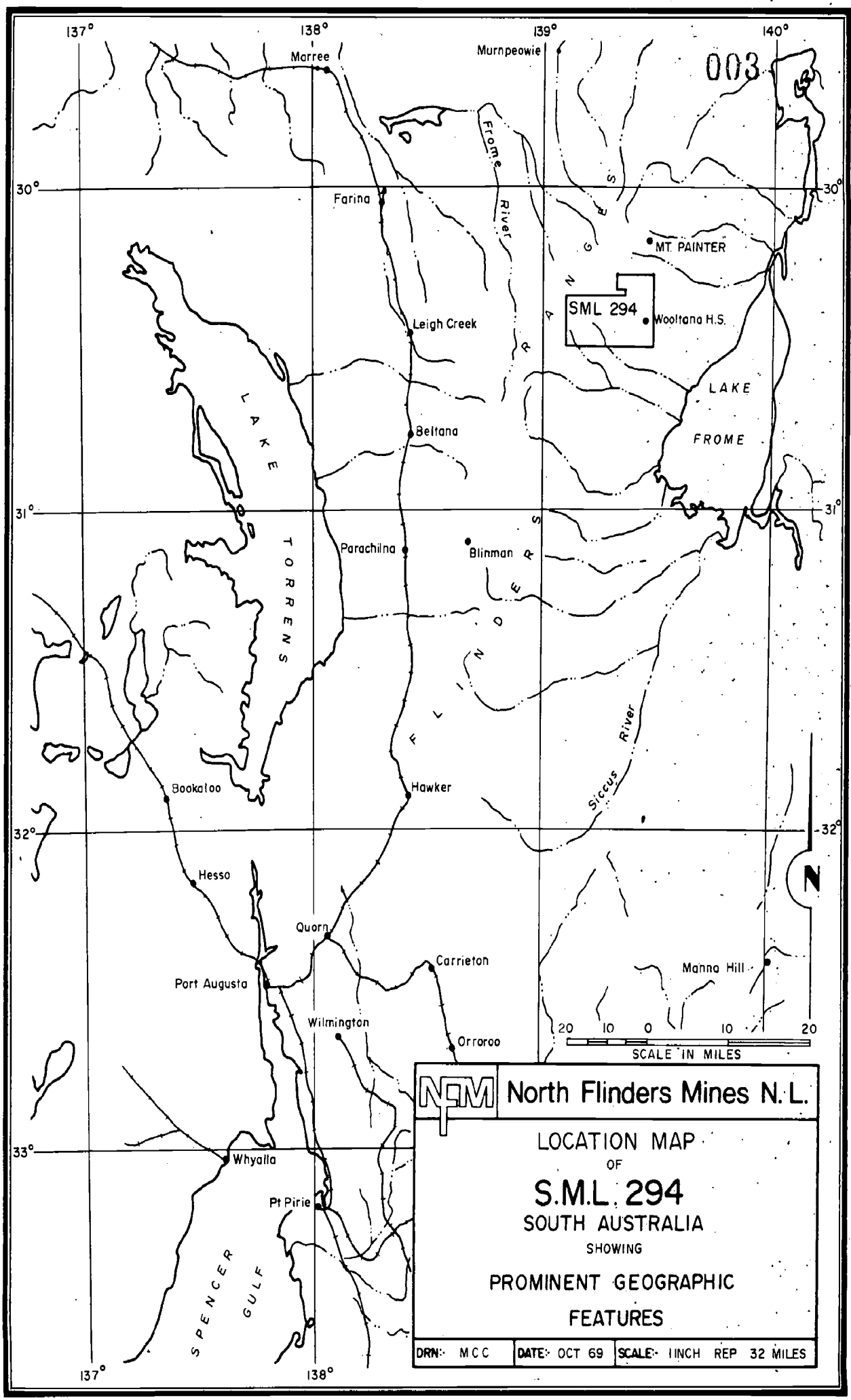
* Note: This report refers also to areas outside of S.M.L. 294. It has, therefore, been suitably edited.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SML 294
Wooltana H.S.
Leigh Creek
LAKE FROME
LAKE TORRENS
Beltana
Parachilna
Blinman
Siccus River
Bookatoo
Hawker
Hesso
Quorn
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Port Augusta
Wilmington
Orroroo
Manna Hill
Whyalla
Pt Pirie
SPENCER GULF
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SCALE IN MILES
NFM
North Flinders Mines N.L.
LOCATION MAP
OF
S.M.L. 294
SOUTH AUSTRALIA
SHOWING
PROMINENT GEOGRAPHIC
FEATURES
DRN: M C C
DATE: OCT 69
SCALE: 1INCH REP 32 MILES

BURRILL AND ASSOCIATES PTY. LTD.

Directors:
G.H.R. Burrill
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TELEGRAMS: "BURMINEX"

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10th February, 1970 - WRKJ:JEU

Director of Mines.,
169 Rundle Street,
ADELAIDE
SOUTH AUSTRALIA

Dear Sir,

SML. 294 - Progress Report for 6 months ending 19th November, 1969

On behalf of North Flinders Mines N.L., we present the following synopsis:-

Compilation of data of previous workers was completed mainly by staff of Geosurveys of Australia until the establishment of drafting and office facilities at 25 Greenhill Road, Wayville.

Dr. Donovan of McPhar's critically studied the sediment sampling of Australian Selection who unfortunately, only assayed their samples for Copper. Several anomalous areas warrant further detailed work. These are shown on the accompanying plan.

Several Induced Polarisation survey lines were run near the O'Donoghues Castle and McLeashes prospects by Austral Exploration Services Pty. Ltd. The report on this work is attached. It shows that the method is applicable in the North Flinders and its use will be extended.

EXPENDITURE:

Access, surveying, compliation of data, assaying,
Consultants, Trial I.P. survey, overheads $8, 500

Yours faithfully,
BURRILL & ASSOCIATES PTY. LTD.

W.R. Jones
.....
W.R.K. JONES
Director

CABLE ADDRESS
"PHARGEO"
ADELAIDE

McPHAR GEOPHYSICS

PTY. LTD.
INCORPORATED IN VICTORIA

005

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72 2133

50 MARY STREET, UNLEY, SOUTH AUSTRALIA
Postal Address: P.O. Box 42, UNLEY, SOUTH AUSTRALIA 5061

YSC

MEMORANDUM TO: NORTH FLINDERS MINES, N.L.

MEMORANDUM FROM: DR. P.K. DONOVAN,
McPHAR GEOPHYSICS PTY. LTD.

SUBJECT: SUGGESTED INITIAL EXPLORATION
ON SML. 294.

DATE: 14TH JULY, 1969.

INTRODUCTION

Following discussions with Mr. G. Stewart
North Flinders Mines, N.L., and Mr. T. von Sanden of
the writer has laid out short exploration programmes
Loch Ness Cu prospect and O'Donoghue's Castle Cu-Co-
prospect, with a view to finding drilling targets in the
immediate future.

The 1-inch geological sheet (Wooltana) is cu
unavailable for the area, but North Flinders are at
constructing a 1-inch geological map from unpublished
Department data.

O'DONOGHUE'S CASTLE PROSPECT

This Cu-Co-Ag prospect consists of lodes in dolomite. Blissett's map (65-226) indicates a known strike length of approximately 900 feet. Oxidation extends to at least 130 feet in No. 2 adit. According to Mr. Stewart there is also chalcopyrite mineralization in the quartzite to the east.

According to Mr. von Sanden, there is another type of Cu mineralization in the area. This consists of secondary Cu minerals within a unit named the Blue Mine Conglomerate which runs three miles from O'Donoghue's Castle to McLeashes Mine to the north, parallel to the Paralana fault. The Blue Mine Conglomerate has not been shown on Map 65-226.

Two percussion holes have been drilled in the dolomite to approx. 200' by Geosurveys, but the logs and analyses for these holes are not available at this time.

For the main Cu-Co-Ag prospect as mapped, a grid should be laid out as shown superimposed on Map 65-226. The baseline should pass through survey points C and K, and C should be designated 24N, 0W. The baseline should be pegged every hundred feet from 24N and 10N. Side lines should be pegged on 10N, 14N, 18N, 20N and 24N from 21W to 21E at 100 foot intervals.

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The grid should be covered by a magnetometer survey, and IP test lines should be carried out at 100, 200 and 300 ft. spreads on line 18N.

Depending on these results, lines 10N, 14N, 20N and 24N should be surveyed at the appropriate spread by IP. The IP work should require 3-4 days and the magnetometer work one day.

If none of these lines cross the Blue Mine Conglomerate, one or two should be extended, so that an initial test may be made.

A somewhat longer range programme would consist of pegging the baseline northwards to McLeashes Mine and rock-chip sampling the Blue Mine Conglomerate along this distance at 100 foot intervals in order to select more favourable zones for geophysical work. The baseline may "dog-leg" to take advantage of the topography.

AVAILABILITY OF CREW

An IP crew will be completing a contract near Copley on or about 4th August, 1969, and would be available to proceed directly to the Loch Ness/O'Donoghue area.

McPHAR GEOPHYSICS PTY. LTD.

P.R. DONOVAN

Mr. Stewart (2)
Files

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MEMORANDUM TO: NORTH FLINDERS MINES N.L.

MEMORANDUM FROM: DR P.R. DONOVAN, McPHAR GEOPHYSICS PTY LTD.

SUBJECT: RESUME OF AUSTRALIAN SELECTION TRUST'S REGIONAL GEOCHEMICAL SURVEY IN THE N.E. PART OF S.M.L. 294

DATE: SEPTEMBER 22ND, 1969.

GENERAL

Australian Selection Trust's S.M.L. 66 overlapped the current North Flinders Mines S.M.L. 294. The area of overlap is shown on the accompanying 60 chain Wooltana base map. AST covered S.M.L. 66 in 1964-1966 with a reconnaissance stream sediment survey at a density of approximately 10 sample locations per square mile, although 2 samples were collected at each location.

It is not known what orientation studies were carried out, if any, and which mesh fraction was analysed. A perchloric acid leach was used and only Cu results plotted.

AST used a threshold of 40 ppm Cu and on the basis of this selected and named a number of anomalies. Some of these were followed up by bank soil sampling, and based on these results, some were gridded and 3" soil samples collected.

This work is summarized in Table 1. It will be seen that several of the named anomalies were apparently not followed up. These include the following:

Munyallina: In the O'Donaghue - McLeashe's belt.

Bleachmore: This included the old Woodlamulka copper mine.

Nick:

Arkaroola: The Arkaroola anomaly should not be confused with the Arkaroola prospect, (shown on the new Mount Painter geological map (1:125,000) as lying north of theWoodlamulka mines).

DISCUSSION OF AST SOIL GRIDS

Introduction

The anomalies, and also the old copper workings and showings shown on the Wooltana sheet, may be divided into three broad groups based on the underlying host rock.

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TABLE 1 RESUME OF AST FOLLOW-UP

NAME OF ANOMALY	BANK SAMPLING, MAP NO.	SOIL GRID, MAP NO.
KINGSMILL AREA	AS 214A	
Subdivided into		
Adler/Segler		-(AS 429
Trudi		
Stevens		AS 452
Bararanna		
Nelly		AS 437
Rob		AS 439
ARKAROOLA	-	-
BLEACHMORE	-	-
CLARET	AS 204	AS 387
COUP	-	AS 455
GROAN	AS 210	-
MUNYALLINA	-	-
NICK	-	-
WYWHYANA	AS 213	AS 389

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These are:

(1) Blue Mine Conglomerate group

(2) Wooltana Volcanics group

(3) Bolla Bollana tillite group

Blue Mine Conglomerate group

The Kingsmill area and the Claret, Wywhyana and Groan anomalies are all located over the Blue Mine conglomerate.

As was found at the O'Donoghue Castle Well, this formation may be strongly leached of visible Cu at surface yet show Cu carbonates etc. a foot or so below surface.

Kingsmill

This area consists of seven coalescing soil grids and is in an area of considerable structural interest, where the NS Paralana fault splits off two NE trending faults.

It is not certain at this stage how the Nelly and Rob grids fit onto Dwg No. AS 432.

The geochemical results to date suggest that detailed geological mapping should be carried out, at least on a 1"=400ft. scale, and that an I.P. Survey is warranted. The old grids should be disregarded, and a new NS grid approximately 6000 feet long and 4000 feet EW should be pegged.

Although AST geochemical grid maps do not show any Cu occurrences, several are shown on the Wooltana sheet currently being prepared by the Mines Dept. The old Wheal Hancock Mine would appear to lie on line ST 132 of the Stevens grid.

Claret

AST's grid is 4400' long. It extends southwards from just north of the Oraldana Cu mine (whose description makes very interesting reading in Mines of South Australia p. 107) and the Golden Rule (Lively's Find) gold mine. Both of these occurrences are probably outside the AST grid. There are three known occurrences of Cu in the southern part of the grid, and another just south of the grid.

If possible this grid should be repegged, and extended to take in the mines and additional occurrences noted above.

The AST results indicate that there are two separate copper zones but this may be due to the surface soil type.

Again, after the grid has been repegged, the geochemical anomaly should be geologically mapped at 1"=400' and IP run over

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the entire anomalous area, on lines no more than 800 feet apart.

Wywhyana

AST's grid is 2400 feet long and runs across the strike of the Blue Mine conglomerate which underlies the entire area. There is no known mineralization. The main anomaly is 1600 feet long and open on the western side.

The grid should be relocated and lines 76N-92N repegged. An additional two lines should be pegged and sampled at 72N and 68N.

The geology should be mapped at 1"=400 ft., and two or three IP lines run across the most obvious areas from the geological/geochemical information.

Groan

This anomalous area, which is apparently associated with the Blue Mine conglomerate, is over 1 mile long. Although AST performed bank soil follow-up, it would probably be impossible to relocate this. A follow-up consisting of dense sediment sampling is recommended.

Other Possibilities within the Blue Mine Conglomerate

(1) The area between the Craldana copper mine and Quartpot Bore is anomalous in copper judging by the reconnaissance stream sediment survey. This area also contains AST's Arkaroola anomaly, which was apparently never followed up.

It is recommended that this area be resurveyed with maximum sediment sample cover, say 30 per square mile. The area consists of only 1-2 square miles.

(2) The belt from the southern limit of the Claret grid to the limit of the extent of the Blue Mine Conglomerate, 2 miles SW of O'Donoghue's Castle, contains the Wall, Coxcomb and McLeashe's prospects of Geosurveys, and the Munyallina anomaly of AST. The latter apparently is just west of the Blue Mine Conglomerate, as is another sediment anomaly near Nudlamutana Hut, just west of McLeashe's.

The McPhar geochemical crew have been requested to cover this belt with dense stream sediment sampling.

(3) The area of Blue Mine conglomerate north of the Kingsmill area contained another two copper showings. The new grid may be extended into this area at a later date.

Wooltana Volcanics Group

A second broad group of anomalies is related to the Wooltana volcanics. These include the Nick and Bleachmore

anomalies of AST, which were apparently not followed up, and probably the Coup which was covered by a soil grid. There are several other untested Cu occurrences in the volcanics, three of which line up along NNE - SSW fault north of Woolnough Crag. This latter group includes the Arkaroola prospect.

Coup

AST's grid is 3260 feet long, and the main copper anomaly extends 2000 feet and is open to the west, where it is over 1800 feet wide. Two diggings are shown on the grid. The grid should be relocated and lines CP92 to CP116 repegged. Additional lines should be pegged and sampled at 120 (?) and 124(?). The geology should be mapped at 1"=400 feet and two or three IP test lines run across the best geological/geochemical prospects.

Bleachmore

This prospect includes the old Woodlamulka copper mines (Mines of South Australia p.154). It is possible that the Blue Mine [illegible] may also be anomalous in this area, judging by the stream sediment results. There is another old copper working a mile north of the Woodlamulka mines. The area should be followed up by detailed stream sediment sampling in the area shown on the map.

Nick

There is no information on this anomaly. It should be followed up by detailed stream sediment sampling (approx. 20 samples).

Arkaroola Prospect

There are [illegible] workings shown along the fault within the volcanics in this area and one within the Bolla Bollana tillite. These should be inspected by a geologist as a first step.

Bolla Bollana Tillite group

Warren-Hastings (more named)

This anomalous area in the Bolla Bollana tillite should be covered by dense sediment sampling as follow-up.

There is another small anomalous stream NW of the Warren-Hastings which should also be resampled. This is again the tillites.

GENERAL OBSERVATIONS

1. As far as is known Australian Selection Trust did not geologically map any of their soil grids, although the geochemical results were quite encouraging. No geophysical work was carried out and no drilling attempted.

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2. Australian Selection Trust did not file a final report with the Mines Department, and they may have carried out more work subsequent to their progress report dated 28th February, 1966.

3. A decision should be taken whether to carry out a reconnaissance geochemical sediment survey over the remaining part of the S.M.L. (approx. 190 sq. miles) or selected parts of it.

4. There are a number of other old copper workings and shows apart from those mentioned above that require geological consideration. Those marked with an asterisk occur at or near the contact of the Tapley Hill formation (Tindelpina Shale ?) and the Bolla Bollana formation.

Welcome Mine

Great Boulder *

Mt. Jacob Prospect *

Pebble Prospect

Barraranna Prospect

Picnic Point Prospect

It should be noted that there is some confusion about the naming of the Welcome, Great Boulder and Kingsmill mines.

.....
(Signed)

PRD/BA

c.c. G. Stewart
R. Jones
File

BLE ADDRESS
"PHARGEO"
ADELAIDE

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YSC

8th August, 1969

Mr. G. Stewart,
North Flinders Mines, N.L.,
c/- Peat, Marwick, Mitchell & Co.,
134 Waymouth Street,
ADELAIDE.....5000

Dear Geoff,

Here are some notes on Parabarana, The Blue Mine Conglomerate, etc., as requested.

Lady Buxton Copper Mine

There are apparently no recent reports on this mine, and no exploration work has been carried out in the area.

There are two, possibly three, parallel lodes, one approximately 10 feet thick. Up dip the mineralization may repeat under a thick pediment.

A specimen examined by Ian Pontifex (McPhar Mineralogical Report 37) shows a gangue essentially composed of titaniferous magnetite with chalcopyrite as the sulphide.

The veins should be easy to prospect by means of a magnetometer. The ore should be extremely easy to treat and there is a possibility of selling the magnetite gangue as a by-product.

A baseline should be laid out by the next geologist in the area.

The area shows promise of supporting a small tonnage operation if the Cu grade of the veins is high enough.

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O'Donoghue's Castle Copper Mine

After visiting the mine area the writer sees no reason to change his recommendations in the memorandum dated 14th July, 1969.

Surface leaching of lode material is very severe in this area and the lode material is not very resistant. A geochemical soil survey at a depth of 6" - 1 foot should prove useful in tracing the lodes on the high ground.

Recent bulldozing has exposed a number of new lodes at the end of the hill.

It is interesting to speculate on the primary nature of the lode material following the mineragraphic description of a specimen by I. Pontifex (McPhar Min. Rept. 37). Presumably it consists either of Cu sulphides in siderite or massive sulphides of Fe and Cu.

Blue Mine Conglomerate

It is now recommended that this belt be covered by a stream sediment survey at a density of 15 samples per square mile along a strip at least one mile wide.

Topographic base maps at a scale of 1" = 60 chains should be obtained from the Mines Dept. for this purpose.

McPHAR GEOPHYSICS PTY. LTD.

P.R. Donovan

c.c. G. Stewart (2)
Files

LE ADDRESS
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ADELAIDE

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016 TELEPHONE 72 2133

50 MARY STREET, UNLEY, SOUTH AUSTRALIA
Postal Address: P.O. Box 42, UNLEY, SOUTH AUSTRALIA 5061

MINERALOGICAL REPORT NO. 76

BY I.R. PONTIFEX 15th October, 1969.

TO: The Exploration Manager,
North Flinders Mines N.L.,
25 Greenhill Road,
WAYVILLE S.A. 5034

Copy to: Mr W.R. Jones,
Burrill & Associates,
3rd Floor, Capitol House
10 William Street,
PERTH W.A. 6000

Your Reference: Samples delivered to McPhar by Mr G. Stewart 2.10.69

Material: Rock Samples.

Identification: OD 4 (O'Donohughes Castle Area)
WH 4 (Wheal Hancock Mine)

Work Requested: Petrographic description and comment on genesis.

Samples and Sections: Retained at McPhar for your future reference.

I.R. Pontifex
.....
(signed)

W.H. 4 (Wheal Hancock Mine)

Rock Name:		
	Quartz	35%
	biotite	40%
	sericite-muscovite	?10%
	chlorite	10-12%
	rutile, ?sphene, zircon	2-3%
	opaques	1-2%

This rock consists of intercalated, parallel, streak-like, and elongated lens-like bands measuring up to 8mm wide. The bands are differentiated due to the variable amounts of the main component minerals, quartz, biotite and chlorite.

The darker coloured bands consist of an allotriomorphic granular aggregate of quartz grains, average size 0.15mm. This contains abundant, disseminated flakes of biotite; and minor chlorite.

These have a similar size to the quartz and a sub-parallel orientation. Accessory, fine subhedral grains of rutile, apatite, zircon and ?sphene are scattered through these bands.

The lighter coloured bands consist largely of finer, independent quartz grains, average size 0.05 mm., scattered through a matrix of fine chlorite, muscovite and lesser biotite. The chlorite and muscovite and some biotite have a common orientation, parallel to the contact of the bands. Many flakes of biotite are oriented oblique to this direction. Accessory rutile, apatite and zircon are also scattered through these bands.

The light and dark coloured bands almost certainly represent the original bedding. The orientation of most of the micas, conformable to this banding, indicates at least one generation plane of schistocity parallel to the bedding. The orientation of some biotite in the finer bands, oblique to this direction, indicates the insipient development of a second generation slip plane in the rock.

Angular opaque grains, (0.08mm) and associated heavy minerals zircon, ?rutile, apatite are commonly disseminated along the contact between the light and dark coloured bands. Lesser amounts are randomly scattered being most abundant in the coarser quartz-biotite bands. These are original sedimentary, heavy mineral grains.

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OD 5 (O'Donoghues Castle)

Rock Name: Biotite-quartz schist.

Components:		
	quartz	50-60%
	biotite (some chloritised)	20-25%
	?clay mineral (interstitial)	?15-20%
	plagioclase	3-5%
	microcline	2-3%
	pyrite	1%
	chalcopyrite	trace
	pyrrhotite	trace
	limonite	1%

This rock has a very fine grained matrix, average grain size 0.02mm., it consists mainly of quartz grains, lesser biotite, minor chlorite. An interstitial material of indeterminate composition, occurs throughout the matrix, this is a probable clay mineral.

This matrix contains abundant elongated, lens-like patches of relatively coarse biotite and quartz, with rare plagioclase. These patches generally measure about 1.3mm x 0.5mm, but they may be much larger than this. They have a common orientation, in places they connect along the length of the long axis, giving the rock a fairly well developed schistocity.

The matrix also contains scattered, poorly defined 'clots' of sericite-clay, containing silt-size quartz grains. These measure 0.15mm across.

Both these 'clots' and lens-like bodies in the matrix can only be recognised in thin section.

The most obvious inclusions scattered through the matrix of this rock, are seen as knot-like porphyroblasts in hand specimen. These are sub-spherical, they measure up to 1cm. across, and they consist mainly of a cryptocrystalline to microcrystalline, to fine grained allotriomorphic granular quartz. Each of the three crystalline varieties generally are randomly scattered within each porphyroblast, rarely the coarser quartz occurs in the centre.

The quartz forming these porphyroblasts is commonly surrounded by flakes of biotite, it contains rare, scattered, plagioclase and microcline felspar, and also subhedral pyrite which is extensively altered to limonite. In polished section, rare, subrounded inclusions of pyrrhotite, associated by traces of chalcopyrite, are seen to occur in some pyrite grains. These have a maximum size of 0.05mm across.

The general matrix of this rock including the biotite lenses may be classified as a biotite, quartz schist, which conceivably formed from a sedimentary rock. The clay clumps may be of sedimentary, or possibly of volcanic origin./ cont'd

/cont'd

The aphanitic aggregates of quartz forming the knot-like porphyroblasts, (and containing pyrite) have a mineralogical composition very similar to that of the groundmass of acid igneous rocks.

These knots may however have derived by local quartz-felspar-pyrite segregations which more-or-less sweated out of the rock during its metamorphism.

Further petrological examination of samples from the same formation as this specimen could help confirm one or other of these interpretations.

IRP/BA

CABLE ADDRESS
"PHARGEO"
ADELAIDE

McPHAR GEOPHYSICS

PTY. LTD.

INCORPORATED IN VICTORIA

TELEPHONE
72 2133

50 MARY STREET, UNLEY, SOUTH AUSTRALIA

Postal Address: P.O. Box 42, UNLEY, SOUTH AUSTRALIA 5061

020

MINERALOGICAL REPORT NO. 37

by I.R. PONTIFEX 30th July, 1969.

TO. Exploration Manager,
North Flinders Mining
C/- Peat Marwick Mitchell & Co.,
134 Waymouth Street,
ADELAIDE S.A. 5000

Your Reference: Material collected by Dr P. Donovan during his inspection of the mines, Lady Buxton, Parabanana, and O'Donoghues Castle, July 1969.

Work Requested: (by Dr Donovan)

Mineral identification and comments on genesis where appropriate.

Sections: Retained at McPhar.

LB.1 (Lady Buxton)

Minerals in polished section, showing approximate abundance:

Titaniferous magnetite	55-65%
Hematite (variety martite)	30-40%
Chalcopyrite	far less than 1%
Limonite	2-3%
Malachite	3-5%

The polished section examined consists almost entirely of a coarse granular aggregate of titaniferous magnetite. This is fairly extensively replaced along its crystallographic planes and along intergranular boundaries to hematite - variety martite. Some grains are almost completely replaced, and these have a relict core of titaniferous magnetite.

Fine bleb-like inclusions of chalcopyrite, measuring up to 0.03 mm. across are rare within the magnetite - hematite grains. The malachite along fractures in this specimen may be partly derived from these inclusions.

Limonite forms the margins of many martitised magnetite grains, adjacent to veins of malachite. Limonite also forms an irregular network through some of the malachite but there is no positive indication that it is derived from pre-existing sulphide minerals, in-situ.

O.D.1 (O'Donoghues Castle)

This specimen consists mainly of a rather massive aggregate of siderite and limonite. The heterogenity of the aggregate makes an estimate of the mineral abundances difficult.

The siderite, and limonite (which largely consists of goethite) occurs in highly irregular, intimately intergrown patches. The goethite is altered around its margins to the secondary iron oxide, lepidocrocite.

Copper minerals are scattered through the rock. In hand specimen the most abundant of these is malachite and chalcopyrite. Fine grains of chalcopyrite occur in patches within the siderite. They are altered along their margins and grain boundaries to limonite.

../3

O.D.1 (O'Donoghues Castle) Cont'd

Fine grains of cuprite are scattered through the hand specimen, they occur in small patches and veins of a similar size to the chalcopyrite. Commonly the cuprite grains are surrounded by colloform limonite, and it has apparently derived by the oxidation of chalcopyrite in-situ.

In polished section, covellite, associated with minor chalcocite is found to be the most abundant copper mineral. This occurs as small grains (0.1mm) in voids within the iron oxides, and in the siderite matrix. In places the covellite is surrounded by earthy limonite and "walls" of limonite which form part of an irregular network. Some of this network almost certainly reflects the texture of pre-existing sulphides. A greater number of limonite boxworks appears to have formed along crystallographic axes and grain boundaries of siderite. Most parts of the network however show no regular form and give no positive indication of any particular structural or textural inheritance.

Also in the section, malachite is ubiquitous through the siderite. Small inclusions of pyrite and chalcopyrite occur in some areas of goethite.

J R Ranfurly

REPORT ON

INDUCED POLARIZATION SURVEYS

in

NORTHERN FLINDERS AREA

for

NORTH FLINDERS MINES N.L.

by

John E. Webb
Consulting Geophysicist

August, 1969.

AUSTRAL EXPLORATION SERVICES PTY. LTD.

INTRODUCTION

Induced Polarization Surveys using the variable frequency method were conducted over three areas in the Northern Flinders Ranges. The equipment used comprised a Geoscience R401 receiver and an Austral transmitter using the frequencies 3 and 0.3 cycles per second. The results are presented as Geo-electrical cross-sections of resistivity, metal factor and frequency effect.

Contact resistances were found generally to be high so that additional electrode preparation was necessary. Although only low current could be injected into the ground on some electrodes, the sensitivity of the Geoscience receiver was sufficient to allow reliable results to be obtained.

A dipole length of 200 ft. was used on all areas with four separations giving a depth of penetration of the order of 400 ft.

DISCUSSION OF RESULTS

O'Donohue's Castle Area.

Five traverses were run across this area with separations of 200 and 400 ft. The centre part of line AA was at survey point 24N and had a bearing of 33 degrees magnetic.

The results will firstly be discussed line by line and then summarized.

Traverse AA: This traverse shows two well-defined anomalies with the highest point on the fourth separation in both resistivity and metal factor corresponding approximately to the anomalies in the other two parameters. The anomaly on the eastern side appears to be much better defined. The anomalous area appears to be cut off very sharply on both the eastern and western sides. The occurrence of negative figures in both the metal factor and frequency effects are quite often found at the sides of anomalous areas and have no significance.

Traverse AB: On this line there are two anomalies in both the resistivity and metal factor. The frequency effect again shows a wide band with slightly higher metal factors corresponding to the anomaly in the first two parameters. Again the anomalous areas are sharply cut off on either side.

Traverse AC: Again there are two anomalous areas, but the western anomaly has reduced in significance in all three parameters. The eastern anomaly appears to be somewhat shallower than on the previous lines and does not seem to have the depth extent into the fourth separation as on previous lines. The frequency effect still exhibits a wide band with a branching into two centres but like the resistivity and metal factor the western anomaly has been very much reduced in size. Again there is a sharp cut off on both sides of the anomalous areas.

Traverse AD: On this line the eastern anomaly is persisting and has branched upwards into the second separation at the extreme eastern end of the spread. It is also present on the fourth separation under 4E either as a separate source or as a continuation of the shallower source under 6E. The western anomaly has all but disappeared with a small deeply seated residual anomaly under 1W. The frequency effects show a very wide zone but of generally lesser intensity than the previous line. The frequency effects on the eastern side seem to indicate that there are two definite anomalous sources in the metal factor under pegs 4E and 6E respectively. There is a high frequency effect on the fourth separation at the western end of the spread with a corresponding high resistivity, giving a net metal factor low. A resistivity low on the third separation at the western end is likewise not present as anomalously as the metal factor and if this represents mineralisation it is contained in a highly resistive rock. This centre may not be significant but the possibility of mineralisation here must not be overlooked.

..3/

Traverse AE: The eastern low resistivity is persisting with a corresponding metal factor high and a frequency effect which is markedly cut off from the western end effects. The anomaly here is distinctly that of a single source. This means that the results of Traverse AD must be treated with caution on the comments of dual sources to the eastern anomaly. There is a shallow seated anomaly in metal factor under pegs 2W to the base line with accompanying low or lows in the resistivity. There is also an accompanying frequency effect. There is a small rise in metal factors at the extreme west end on the 3rd and 4th separation and an accompanying rise in frequency effects. This again could indicate sulphide mineralisation in electrically resistive rocks.

The results show that there are two distinct lines of anomalies going right through the traverses. The anomaly on the eastern end is well defined on all traverses with a hint of complexity on Traverse AD. This anomaly is sharply cut off on its eastern side with a feature that suggests a change of environment such as a fault or a contact with a highly resistive rock type. The eastern anomaly is quite definite on lines AA to AC and is present in a less well-defined manner on the two more southerly traverses. These two anomalies blend into each other to give wide frequency effect zones but on examination of individual values it is apparent that there are two centres corresponding to the two anomalies in resistivity and metal factor. Considering the two anomalies as a wide zone it is cut off sharply on its eastern side as mentioned early and also cut off sharply on its western extremity on line AA to AC. On lines AD and AE the resistance cut off is still apparent but is not well-defined as on the more northerly lines.

On all lines there is a small increase in metal factor in the deepest separations in frequency effect and metal factor but not in resistivity. It is possible that this represents some sulphide mineralisation in a rock which is electrically resistive.

..4/

Consideration should be given to the possibility of mineralisation at this western extremity and it could be of value to continue the I.P. on all traverses to the west.

CONCLUSIONS AND RECOMMENDATIONS

The results indicate that there are two separate sources of the I.P. anomalies with a chance of a 3rd anomaly appearing at depth of the western extremity of traverses.

The change in character of the eastern anomaly in that it is definitely a deep source on the northern traverses changing to a possibility of two sources on line AD and back to 1 source on line E suggests that whereas we have a continuous anomalous zone right through all traverses it could be composed of several pods of mineralisation along a contact rather than one continuous zone of mineralisation. It is therefore possible that more than one drill hole may be necessary to test this zone.

The eastern anomaly discussed above could also be due to pods of mineralisation and the effect of several sources of mineralisation could account for the very wide zone of anomalous frequency effects. The recommendations for both anomalies are given below.

1. Line AB Design hole to intersect target 400 ft. below 1W.
2. Line AE Design hole to intersect target 300 ft. below 2W.
3. Line AE Design hole to intersect target 400 ft. below 5E. If this hole can be collared at 8E and depressed 45° to the west (grid) it would also test the shallow extension of this anomalous area.
4. Line AA Design hole to intersect target 400 ft. below 4E.

..5/

McLeashes Area:

One line only was run over this area using 200 ft. dipoles. The resistivity reuslts show two distinct lows, one at depth under 3W and the other at less depth immediately under the base line. There is very little of interest in the frequency effect except for one high zone at depth at the extreme western edge. There is no appreciable frequency effects coinciding with the resistivity anomalies.

The metal factors show one shallow high centre corresponding approximatel with the shallow resistivity centre but this metal factor is due entirely to resistivity and one shallow frequency effect reading of 2%. This is not considered indicative of appreciable sulphide mineralisation.

At the extreme western end, as mentioned earlier, there is a high frequency effect centre with a corresponding large metal factor and the medium resistivity. This could be the eastern end of a further anomalous zone possibly due to sulphide mineralisation at depth and it is strongly recommended that the traverse be extended towards the West.

Conclusion and Recommendations

The results indicate that the mineralisation intercepted near the surface of this area is mainly of a non-sulphide material and, therefore, not a good target for the Induced Polarization method. It would be possible to trace the shallow mineralisation on resistivity results alone if this should be necessary. The traverse should be extended towards the west to further examine the deep anomaly described above.

No drilling recommendation is made on the result of this single Induced Polarization line.

20'

25'

139°30'

30°15'

HUMANITY SEAT 2152

Cu Lady Buxton Mine

Woolaggoolaoona Hill

Gordon Springs Ck.

Radium Ck.

BOB KNOB

GREENWOOD HILL

Bolla Bollana Spring

Old Bolla Bollana Smelters

The Pinnacles

DINNER TIME HILL 1691 (Ft)

Arkaroola

Ar aroola

Arkaroola Bore

WYWHYANA

Spring Bull

Wywyana Park

Quarpot Bore

Wywhyana Bore

Wywhyana Ck.

ARKAROOLA

"Arkaroola"

Cu Oraldana

KINGSMILL

ARRARANNA GORGE

Cu Barrallanna

Picnic Point Prospect

Great Boulder

Welcome Mine

Welcome-Mine

Wheal Hancock

Pebble Prospect Cu

Boulder Bore

Mill

Golden Rule Mine (Lively First)

CLARET

Wall Prospect

MT WARREN HASTINGS

Hut

Coxcomb Prospect

Nudlamutana Hut & Well

Mc Leashes Prospect

FAULT

PARALANA

MUNYALLINA

LEVEY

W.

Munyallina Ck.

O'Donohue Castle Mine

O'Donohue Castle Well

AREA SAMPLED BY Mc PHAR

Mt Mc TAGGART

COUP

Lady Buxton Creek

Groan Ck.

GROAN

KINGSMILL ?

Arkaroola Prospect

WOOLNOUGH CRAG

Pbt?

VERMICULITE VALLEY

BLEACHMORE

Woodlamulka Mine

Copper Mine Ck.

AREA SAMPLED BY AUSTRALIAN SELECTION TRUST. Cu ONLY AVAILABLE.

Woodnamoka Ck.

Woodnamoka Well

Red Bank

NICK

MT JACOB

Pbt?

Woollana

Woollana Ck.

FLOOD

Niniglaria Ck.

Asb

Merinjina Well

Airstrip

Munyallina Bore

Munyallina Creek

Yards

Nepouie Spring

NEPOUIE PEAK

Nepouie Creek

Run

Run 2

Run 3

Run 4

Run 4A

CALDWELL

20'

25'

SA. DEPT. OF MINES

WOOLTANA

60 CHNS TO 1 INCH

ENV 1226 (I)-1

AREA OF CUPRIC ANOMALY

BLUE MINE CONGLOMERATE

INDUSTRIAL VOLCANICS

FAULT

NORTH FLINDERS MINES N.L.

S.M.L. 234

MAP TO ACCOMPANY MEMORANDUM DATED SEPT. 22nd, 1969

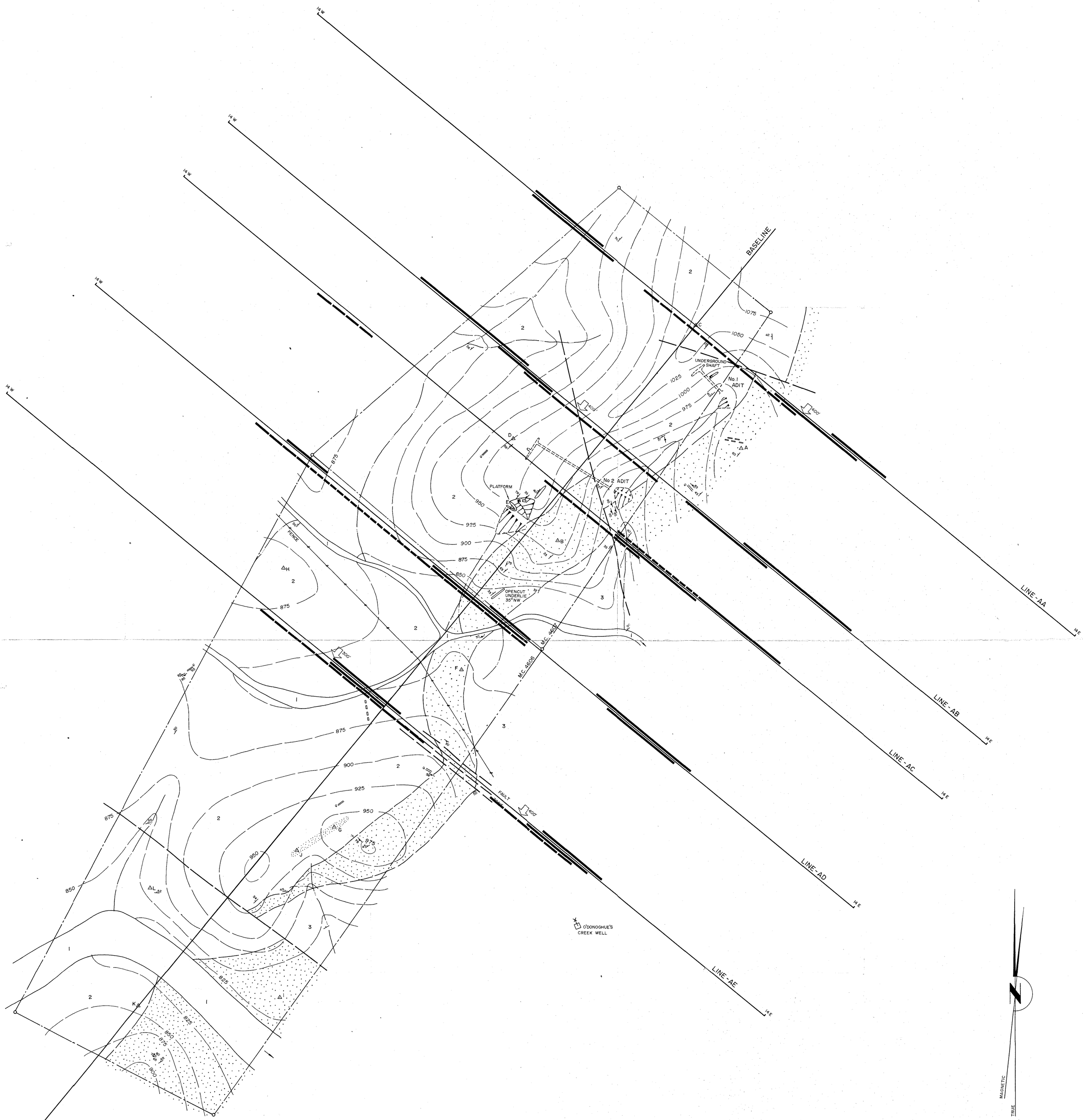
DR. P. G. DONOVAN

Mc PHAR GEOPHYSICS PTY. LTD.

ENV 1226

RECEIVED 17 FEB 1970 DEPT. OF MINES REGISTRY

RECEIVED 17 FEB 1970 DEPT. OF MINES REGISTRY



EXPLANATION OF I.P. SURVEY

METHOD OF INDICATING ANOMALIES

POSSIBLE | DEFINITE

- I.P. LINE — $Pa/2\pi$
- M.F.
- F.E.

400' - DRILLING TARGET (DEPTH BELOW SURFACE)

SCALE

FEET 100 0 100 200 300 400 500 FEET

1 INCH EQUALS 100 FEET

LEGEND

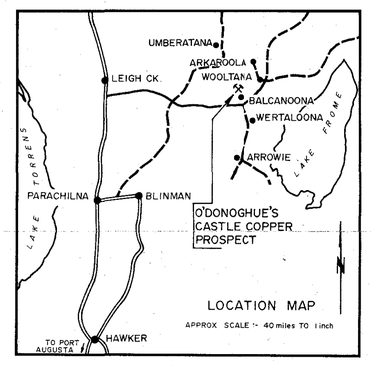
RECENT	1	ALLUVIUM - MANY BOULDERS OF TILLITE
ADELAIDE SYSTEM BURRA GROUP (TORRENSIAN SERIES)	2	DOLOMITES; LAMINATED SHALES AND SILTSTONE; BANDS OF PALE QUARTZITE
		COPLEY QUARTZITE EQUIVALENT
	3	BLUE-GREY MUDSTONE AND SILTSTONE (CALCAREOUS IN PLACES). BANDS OF DOLOMITE.

- STRIKE AND DIP OF BEDDING
- STRIKE AND DIP OF JOINTS
- VERTICAL JOINTS
- STRIKE AND DIP OF SHEAR
- QUARTZ VEINS
- BRECCIA ZONE
- PROBABLE FAULT
- FACE OR DUMP
- ADIT
- OPEN CUT
- SHAFT
- SURVEY STATION
- FENCE
- LEASE PEG

ARBITRARY DATUM, CONTOURS AT 25 FT INTERVALS, STADIA SURVEY BY B. FROST 1965

SKETCH MAP OF REGIONAL GEOLOGY

AFTER R.P. COATS



North Flinders Mines N.L.

GEOLOGIC MAP OF

O'DONOGHUE'S CASTLE COPPER PROSPECT

BALCANOONA STATION, SOUTH AUSTRALIA

MINERAL CLAIMS 4606 & 4607, S.M.L. 294

SHOWING

INDUCED POLARIZATION RESULTS

SURVEY BY AUSTRAL EXPLORATION SERVICES PTY. LTD. - AUG. 1969

DRN:- M.C.C.	DATE:- SEPT. 1969	SCALE:- 1 INCH EQUALS 100 FEET

ENV 1226

AUSTRALIAN EXPLORATION SURVEYS PTY. LTD.

RECEIVED 17 FEB 1970 DEPT. OF MINES & INDUSTRY

INDUCED POLARIZATION SURVEY

CLIENT: NORTH FLINDERS MINES NL.

LOCALITY: ARKAROOLA
O'Donahue's Castle

DATE: 5th August, 1969

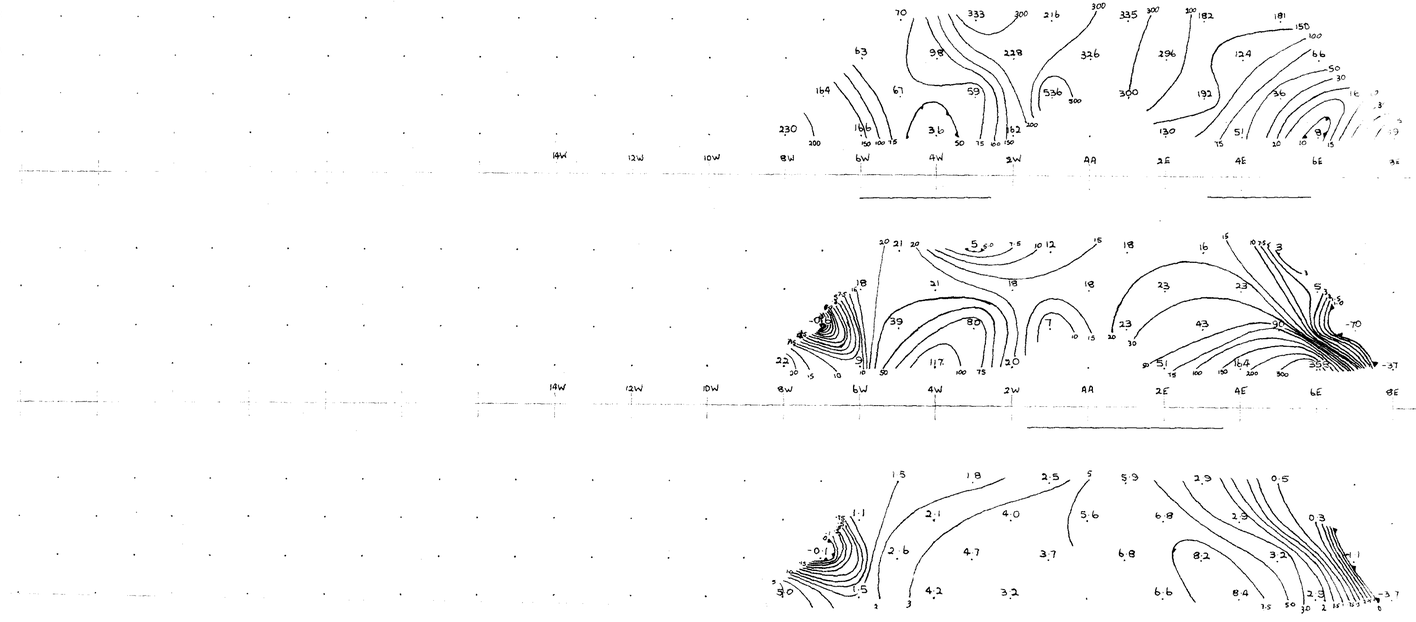
LINE: AA

ELECTRODE INTERVAL: 200 ft

FREQUENCY: 3, 0.3 c.p.s.

SCALE: 1" = 200 ft

DRAWN BY: B.G



ENV 1226 (1) - 8(a)

ENV 1226

AUSTRAL EXPLORATION
SERVICES PTY. LTD.

INDUCED POLARIZATION
SURVEY

CLIENT: North Flinders Mines N.L.

LOCALITY: Arkaroola
D'Donahue's Castle

DATE: 6th August, 1969

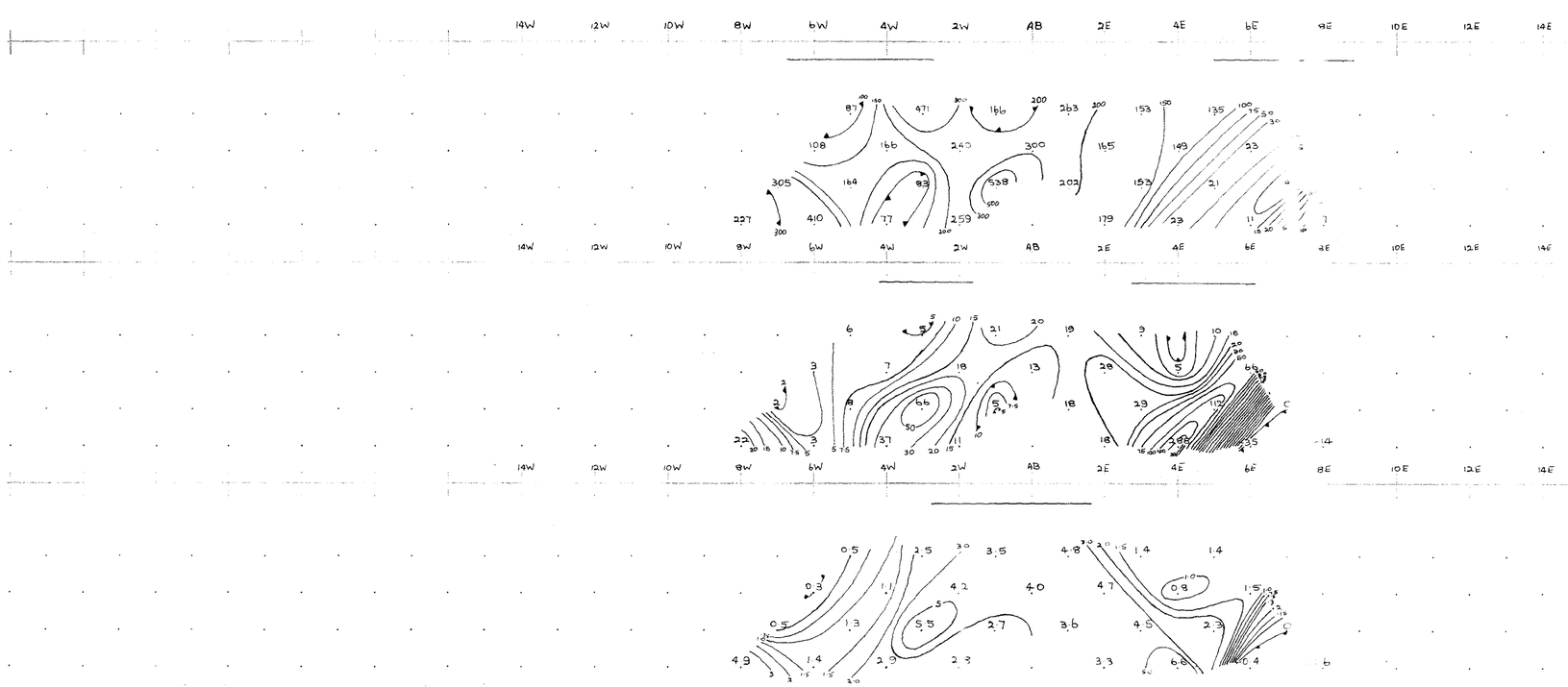
LINE: AB

ELECTRODE INTERVAL: 200 ft

FREQUENCY: 3, 0.3 c.p.s.

SCALE: 1" = 200 ft

DRAWN BY: B.G



P(a) / 2π

M.F.

F.E.

ENV 1226 (I) -803

ENV 1226

AUSTRAL EXPLORATION SERVICES PTY. LTD.

INDUCED POLARIZATION SURVEY

CLIENT: North Flinders Mines N.L.

LOCALITY: Arkaroola
O'Donahues Castle

DATE: 7th August, 1969

LINE: AC.

ELECTRODE INTERVAL: 200ft

FREQUENCY: 3, 0·3 c.p.s.

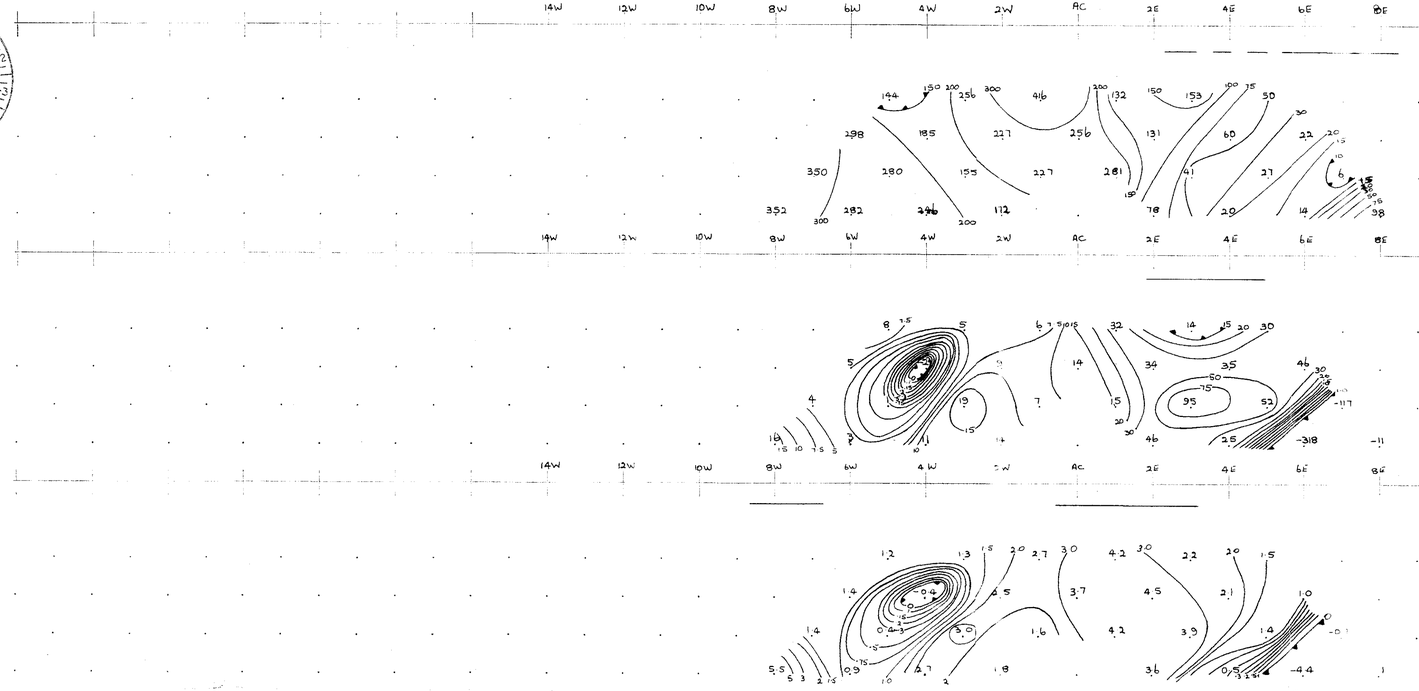
SCALE: 1" = 200ft

DRAWN BY: B.G.

$\rho_a / 2\pi$

M.F.

F.E.



ENV 1226(2)-8C

636/69

EMV 1226

North Flinders Mines N.L.

25 GREENHILL ROAD WAYVILLE, S.A. 5034,
PHONE 72 2463

REGISTERED OFFICE:
134 WAYMOUTH STREET ADELAIDE, S.A.

030

14/7/70 - GHS:JEU

DIRECTOR OF MINES

Department of Mines,
169 Rundle Street,
ADELAIDE 5000
SOUTH AUSTRALIA

SUBJECT: S.M.L. 294 - Progress Report for six months ending 18/5/70

Dear Sir,

The following summary of activity in SML.294 for the 6 month period 20/5/69 to 18/5/70 is herewith forwarded to accompany our Exploration report, which has already been submitted to you --

Dr. P. Donovan has reported on reconnaissance stream sediment surveys and has made several recommendations. Extensive ground follow-up surveys have located many outcrops showing secondary copper minerals, and although the significance of many of these has not yet been assessed, the most interesting were considered to be associated with the Blue Mine Conglomerate and the Wooltana Volcanics respectively.

Induced Polarization Surveys and subsequent reconnaissance rotary percussion drilling have since been carried out on two prospects associated with the Blue Mine Conglomerate in the vicinity of the major Paralana Fault. Reports on these projects, carried out after 18/5/70 are not yet available

Shallow percussion drilling on the McLeashes Prospect outlined a small tonnage of secondary copper mineralization with an average Cu. content of between 1 and 1.5% Cu. Deeper rotary percussion drilling on this prospect, since 18/5/70 has failed to prove any extensions in depth of the shallower, marginally economic, secondary copper mineralization

...../2

Follow-up work on Zinc stream sediment anomalies by M.Garman (Watts, Griffiths & McQuat) in the area to the north of O'Donoghues Castle Mine, has located thin dolomitic beds which carry anomalous Zinc values.

Ian Pontifex (McPhar Geophysics Pty.LTd.) mapped the McLeashes / O'Donoghues area as a basis for follow-up Induced Polarization surveys (carried out since 18/5/70)

Soil geochemical surveys have been conducted over the Coup Prospect in the Wooltana Volcanics and the Wheal Hancock Prospect in the Blue Mine Conglomerate in the northern part of the area. Extensions to these surveys and follow-up geological mapping, reconnaissance drilling and/or I.P. surveys are planned for these areas in the near future.

Low level colour air-photography has been completed over several areas of interest within SML.294 since the end of the period (18/5/70)

ENV 1226.

032

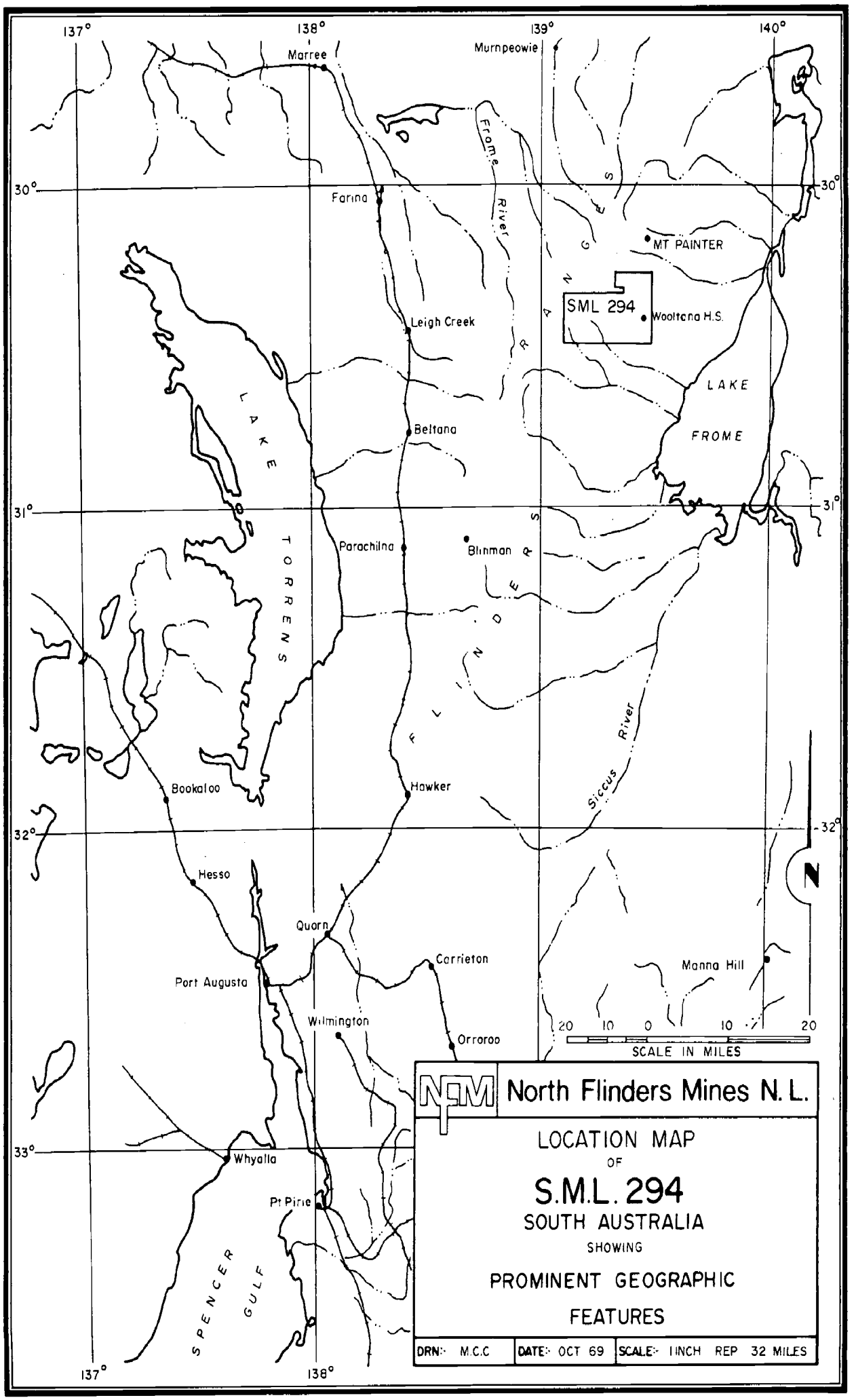
NORTH FLINDERS MINES N.L.

EXPLORATION REPORT

S.M.L. 294

For six month period ending May 19th, 1970

CONTENTS:


137°
138°
139°
140°
30°
31°
32°
33°
Marree
Murnpeowie
Farina
Frome River
RANGES
MT PAINTER
SML 294
Wooltana H.S.
Leigh Creek
LAKE FROME
Beltana
LAKE TORRENS
Parachilna
Blinman
FLINDERS
Siccus River
Bookaloo
Hawker
Hesso
Quorn
Carrieton
Manna Hill
Port Augusta
Wilmington
Orroroo
Whyalla
Pt Pirie
SPENCER GULF
N
20 10 0 10 20
SCALE IN MILES
NFM
North Flinders Mines N. L.
LOCATION MAP
OF
S.M.L. 294
SOUTH AUSTRALIA
SHOWING
PROMINENT GEOGRAPHIC
FEATURES
DRN:- M.C.C
DATE:- OCT 69
SCALE:- 1INCH REP 32 MILES

140 E | 144 E | 148 E | 152 E | 156 E | 160 E

583 N
20 | 10 | 35 | 30 | 20 | 20
30 | 15 | 15 | 30 | 15 | 20
50 | 10 | 10 | 25 | 20 | 30
45 | 25 | 10 | 25 | 5 | 45
40 | 30 | 15 | 20 | 5 | 15
578 N
25 | 15 | 20 | 20 | 5 | 10
25 | 10 | 15 | 20 | 20 | 10
20 | 25 | 10 | 15 | 50 | 15
30 | 60 | 35 | 15 | 25 | 20
90 | 40 | 20 | 15 | 65 | 35
573 N
120 | 40 | 35 | 0 | 95 | 80
120 | 30 | 30 | 25 | 70 | 25
180 | 70 | 45 | 40 | 40 | 30
180 | 45 | 65 | 0 | 15 | 20
110 | 10 | 40 | 95 | 15 | 35
BASELINE
140 | 90 | 110 | 110 | 55 | 5 | 25 | 15 | 20 | 55 | 100 | 80 | 110 | 75 | 30 | 10 | 5 | 10 | 35
160 | 25 | 85 | 45 | 10 | 25
240 | 45 | 500 | 55 | 10 | 30
210 | 330 | 390 | 85 | 15 | 70
90 | 280 | 350 | 35 | 25 | 45
563 N
35 | 280 | 220 | 70 | 15 | 45
150 | 90 | 290 | 40 | 30 | 25
70 | 75 | 310 | 85 | 20 | 10
85 | 25 | 35 | 140 | 40 | 15
100 | 35 | 65 | 140 | 65 | 15
558 N
35 | 15 | 45 | 400 | 140 | 20
10 | 25 | 200 | 20 | 130 | 20
15 | 20 | 30 | 10 | 70 | 15
15 | 40 | 95 | 20 | 55 | 10
15 | 55 | 55 | 20 | 25 | 20
553 N
15 | 10 | 45 | 0 | 40 | 25

164 E | 166 E

20 | 20
25 | 40
20 | 25
15 | 25
15 | 25
10 | 15
20 | 40
65 | 20
160 | 35
100
50
20 | 35

SHEET 'A' ADJOINS | SHEET 'B'

THRESHOLD TAKEN AT 50 P.P.M.

100 0 100 200 300 400
FEET FEET
SCALE

1) later survey over the same area (see Env 1673) produced different results. Enquiry with N.F.M. suggests that earlier sampling be disregarded.

North Flinders Mines N. L.

COUP PROSPECT Sheet B.

SUB-SURFACE GEOCHEMICAL GRID SURVEY

SML 294

COPPER RESULTS - P.P.M.

DRN:- D. K. L. | DATE:- 15·4·70 | SCALE:- 1" = 100'

RECEIVED 12 JUN 1970 DEPT. OF MINES REGISTRY

ENV 1226(B)-1

108 E | 112 E | 116 E | 120 E | 124 E | 128 E | 132 E | 136 E

583 N

578 N

573 N

BASELINE 568 N

563 N

558 N

553 N

SHEET 'A' | SHEET 'B' ADJOINS

THRESHOLD TAKEN AT 50 PPM

FEET 100 0 100 200 300 400 FEET

SCALE

A later survey over same area (see Env 1673) produced different results. Enquiry with N.F.M. suggests that earlier sampling be disregarded

North Flinders Mines N. L.

COUP PROSPECT Sheet A

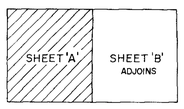
SUB-SURFACE GEOCHEMICAL GRID SURVEY

SML 294

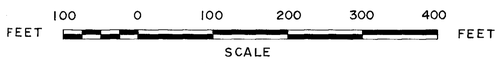
COPPER RESULTS - P.P.M.

DRN:- D.K.L. | DATE:- 15 · 4 · 70 | SCALE:- 1" = 100'

	108 E	112 E	116 E	120 E	124 E	128 E	132 E	136 E
583 N	020	0-20	0-20	0-20	0-20	0-20	0-20	0-20
	030	0-20	0-20	0-20	0-20	0-20	0-20	0-20
	030	0-20	0-20	0-20	0	0	0	0-20
	030	0-20	0-20	0-20	0-20	0	020	0-20
	0-20	0-20	0-20	0-20	0-20	0-20	0-20	0-20
578 N	0-20	020	020	0-20	0-20	0-20	0-20	0-20
	0-20	0-20	020	0-20	0-20	0	0-20	0-20
	0-20	020	0-20	0-20	025	0	0-20	0-20
	0-20	0-20	0-20	0-20	0	0	0-20	0-20
	0-20	0-20	020	020	020	0-20	020	0-20
573 N	020	0-20	020	0-20	020	0-20	030	0-20
	020	0-20	0-20	0-20	0-20	0-20	030	020
	020	0-20	0-20	0-20	0-20	020	0-20	0-20
	020	0-20	0-20	0-20	020	020	0-20	030
	020	0-20	0-20	0-20	0-20	020	020	020
BASELINE 568 N	020 025	0-20 0-20	0-20 0-20	0-20 0-20	0 0-20	0-20 0-20	020 020	020 0-20
	020	0-20	0-20	0-20	0-20	020	020	020
	0-20	0-20	0-20	0-20	0-20	0-20	020	0-20
	020	020	0	0-20	0-20	020	020	0-20
	020	0-20	0-20	0-20	0-20	0-20	0-20	0-20
563 N	0-20	030	0-20	0-20	0-20	020	020	0-20
	0-20	020	0-20	0-20	0-20	0-20	020	0-20
	0	0-20	0-20	0-20	0-20	0-20	0-20	020
	0-20	0-20	0-20	0-20	0-20	0-20	0	030 020
	0-20	0-20	0-20	0-20	0-20	0-20	0-20	020
558 N	0-20	0-20	0-20	0-20	0-20	0-20	0-20	0-20
	0-20	0-20	0-20	0-20	0-20	0-20	0-20	020
	020	030	0-20	020	0-20	020	0-20	020
	025	020	0-20	0-20	0-20	0-20	0-20	0-20
	020	020	0-20	0-20	0-20	020	0-20	0-20
553 N	0-20	020	0-20	020	0-20	0	0-20	0-20



THRESHOLD TAKEN AS 80 P.P.M.



North Flinders Mines N. L.

COUP PROSPECT Sheet A

SUB-SURFACE GEOCHEMICAL GRID SURVEY

SML 294

LEAD RESULTS - P.P.M.

DRN:- D. K. L. | DATE:- 15 · 4 · 70 | SCALE:- 1" = 100'

ENV 1226(II)-5

140 E | 144 E | 148 E | 152 E | 156 E | 160 E

583 N

578 N

573 N

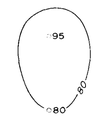
BASELINE

563 N

558 N

553 N

164 E | 166 E



SHEET 'A' ADJOINS | SHEET 'B'

THRESHOLD TAKEN AT 80 P.P.M.

100 0 100 200 300 400
FEET FEET
SCALE

North Flinders Mines N. L.

COUP PROSPECT Sheet B

SUB-SURFACE GEOCHEMICAL GRID SURVEY

SML 294

LEAD RESULTS - P.P.M.

DRN:- D.K.L. | DATE:- 15·4·70 | SCALE:- 1" = 100'

EMN 1226(2)-4

	108 E	112 E	116 E	120 E	124 E	128 E	132 E	136 E
583 N	075	090	080	085	0140	075	045	045
	090	085	0100	0130	0110	090	055	050
	0110	065	0150	0120	0	0	0	040
	0110	060	0150	0120	0110	0	030	040
	080	060	0180	0160	0120	055	035	035
578 N	085	085	0150	085	0120	0110	020	040
	055	0140	0180	095	0130	0	035	040
	060	0100	0150	085	0110	0	035	050
	075	0120	090	0120	0	0	035	040
	050	0120	090	0140	0130	065	035	045
573 N	080	0100	095	0120	0100	060	035	040
	080	085	060	0100	0100	060	040	030
	0100	080	065	065	075	045	035	030
	0140	050	070	0140	070	055	050	030
	0140	055	085	0130	050	050	045	035
BASELINE 568 N	0120	095	070	090	035	060	055	055
	080	065	090	0120	0	080	070	0110
	0100	060	085	090	045	055	030	030
	080	055	065	075	050	045	040	040
	095	075	0	060	055	040	035	050
	065	075	085	040	045	035	035	050
563 N	080	080	070	040	060	035	030	055
	080	065	0100	035	040	035	030	045
	0	075	050	055	040	050	050	040
	0100	055	035	055	035	045	0	065 035
	0120	045	035	065	040	060	055	045
558 N	0170	035	050	055	045	060	035	050
	070	070	055	035	050	055	035	060
	065	065	045	035	065	070	030	050
	040	055	050	040	055	060	035	040
	025	050	045	045	055	080	040	030
553 N	035	040	065	0100	050	0	040	035

100 150 100 100 100

SHEET 'A' | SHEET 'B' ADJOINS

THRESHOLD TAKEN AS 100 P.P.M.

100 0 100 200 300 400 FEET — FEET

SCALE

North Flinders Mines N. L.

COUP PROSPECT Sheet A

SUB-SURFACE GEOCHEMICAL GRID SURVEY

SML 294

ZINC RESULTS - P.P.M.

DRN:- D.K.L. | DATE:- 15 · 4 · 70 | SCALE:- 1" = 100'

RECEIVED 12 JUN 1970 DEPT. OF MINES ADELAIDE

EHV 1226(71)-5

	140 E	144 E	148 E	152 E	156 E	160 E
583 N	030	040	025	035	015	040
	035	030	025	030	020	035
	030	035	015	025	025	035
	040	040	025	030	015	040
	035	035	025	025	010	025
578 N	040	030	030	035	025	030
	040	035	020	035	030	025
	030	035	025	030	025	020
	040	040	030	020	040	025
	035	040	025	015	045	030
573 N	030	040	040	0	055	050
	040	035	025	020	030	025
	040	035	050	025	030	030
	030	040	050	0	030	035
	040	035	080	020	030	045
BASELINE	035 040	040 040	040 040	045 030	035 060	030 030 035 025 035 035 030 035 040
	045	035	055	030	030	035
	035	040	050	030	030	035
	035	040	055	025	035	055
	030	045	075	025	030	055
563 N	025	035	045	025	035	040
	025	035	070	030	045	045
	035	030	050	030	050	040
	035	040	035	035	050	040
	035	040	045	035	045	030
558 N	050	040	045	035	040	045
	020	060	085	030	040	055
	030	040	070	035	025	055
	035	025	050	055	040	060
	035	030	045	045	035	040
553 N	035	030	040	0	040	035

164 E	166 E
040	045
040	035
150 180 100	035
065	040
040	040
025	035
030	030
040	030
040	045

SHEET 'A' ADJOINS | SHEET 'B'

THRESHOLD TAKEN AS 100 P.P.M.

100 0 100 200 300 400
FEET FEET
SCALE

North Flinders Mines N. L.

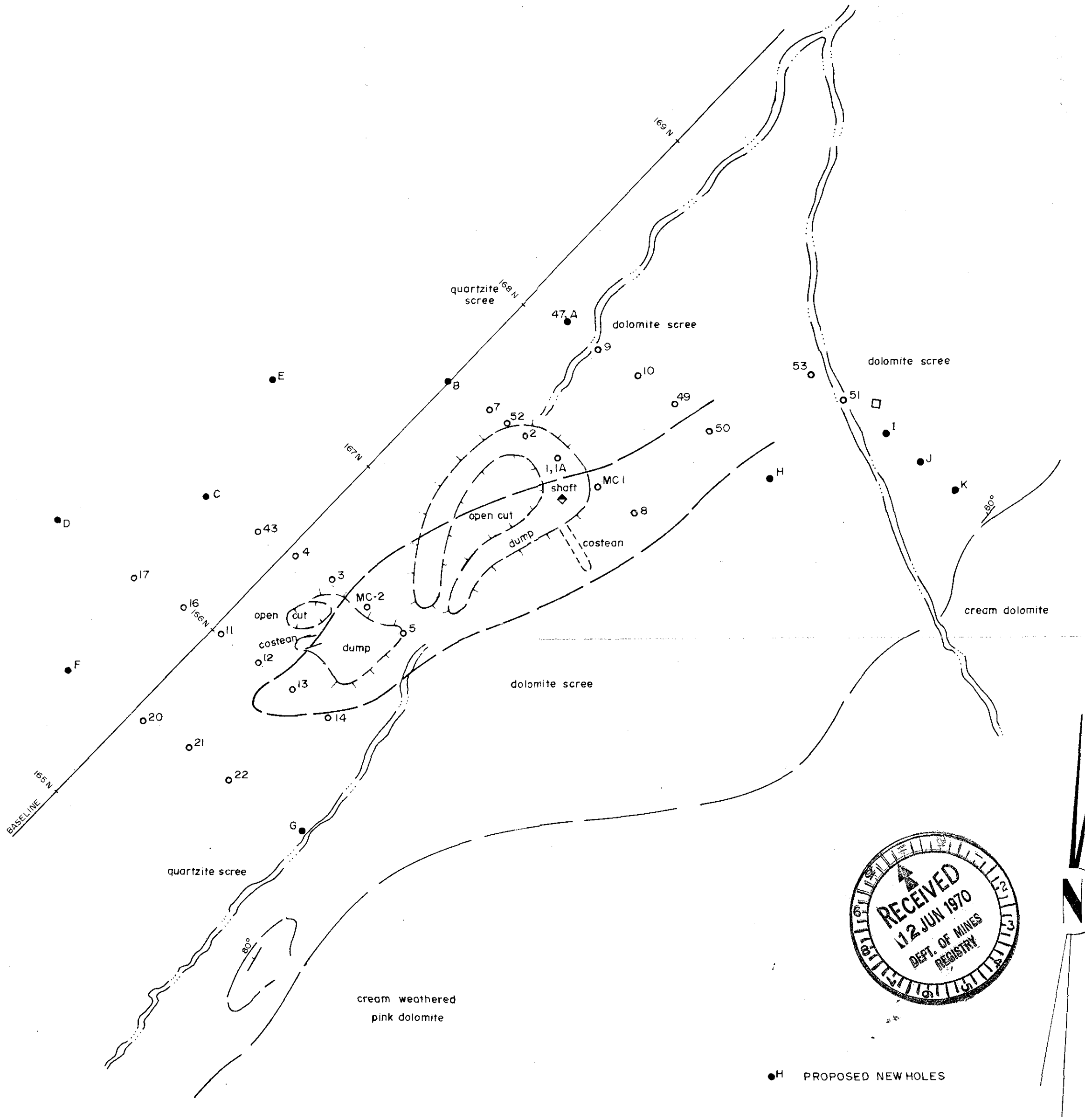
COUP PROSPECT Sheet B

SUB-SURFACE GEOCHEMICAL GRID SURVEY

SML 294

ZINC RESULTS - P.P.M.

DRN:- D. K. L. | DATE:- 15 · 4 · 70 | SCALE:- 1" = 100'



NFM	North Flinders Mines N. L.

MAP OF

Mc LEASHES COPPER PROSPECT

SML 294

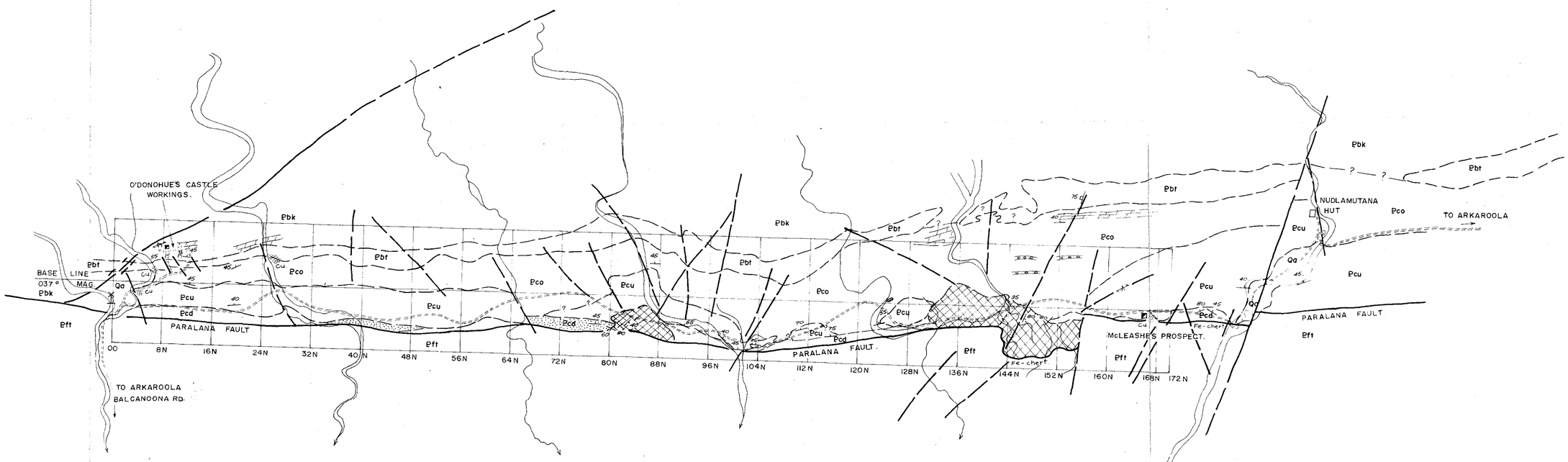
SHOWING

DRILL HOLE LOCATIONS

DRN - M.C.C.	DATE - FEB 1970	SCALE:- 1 INCH = 40-FEET

EHN 1226(II)-7

McPHAR GEOPHYSICS PTY. LTD.



Qa Alluvium.

Pbk SKILLOGALEE DOLOMITE:
Commonly massive dolomites at base (eg at O'Donohue's Castle upper adit.) In places, hard, blue dolomitic shales at base. Generally interbedded dolomites and dolomitic siltstone. Dolomite commonly recrystallised with carbonate veining.

Pbt WORTUPA QUARTZITE:
Bedded felspathic quartzite, minor grit bands, ripple-marked. Quartz veins, rare Cu staining near O'Donohue's Mine.

Pco OPAMINDA SHALE:
Dark grey dolomitic siltstone and shale, interbedded conglomerate bands, (similar to the lithology of the Blue Mine Conglomerate.) common, thick, interbedded dolomite bands, common in northern half of area. Rare Chalcopyrite in some dolomite, (at 126 N and near O'Donohue's Mine.)

Pcu BLUE MINE CONGLOMERATE:
Conglomeratic, gritty sandstone, massive to thick bedded. North of McLeashes consists almost entirely of Coarse, gritty, massive sandstone. Heavy mineral laminations in places.

Pcd WOODNAMOKA PHYLLITE: ?
Dark grey phyllitic siltstones. At 44N and 72N, band of arkosic sandstone band with abundant heavy mineral laminations.

Eft TAPLEY HILL FORMATION:
Thick bedded, buff to light brown dolomite. Recrystallised in places along Parlana Fault where it may also be associated with ferruginous chert.

Dip and strike of bedding.

Dip and strike of foliation or schistosity.

Fault observed.

Fault inferred.

Diapir, beds have variable altitude, minor brecciation, amphibole-mica rock with secondary $CaCO_3$.

Cu. Copper staining (malachite.)

Copper mineralisation, (apart from mine workings.)

Zinc anomaly.

Adit entrance.

Shaft

Trench.

Track.

Windmill on bore.

(Rock Unit names after DTM. "MT. PAINTER PROVINCE." 1:125000 Geological Sheet – lithology description refers to this 1000ft map only.)

M/N

GEOLOGY: I.R. PONTIFEX.

MAP BASED ON 70 CHAIN AIR PHOTO ENLARGEMENTS.

NFM North Flinders Mines N.L.

GEOLOGICAL MAP.

O'DONOHUE'S CASTLE MINE AND NUDLAMUTANA HUT.

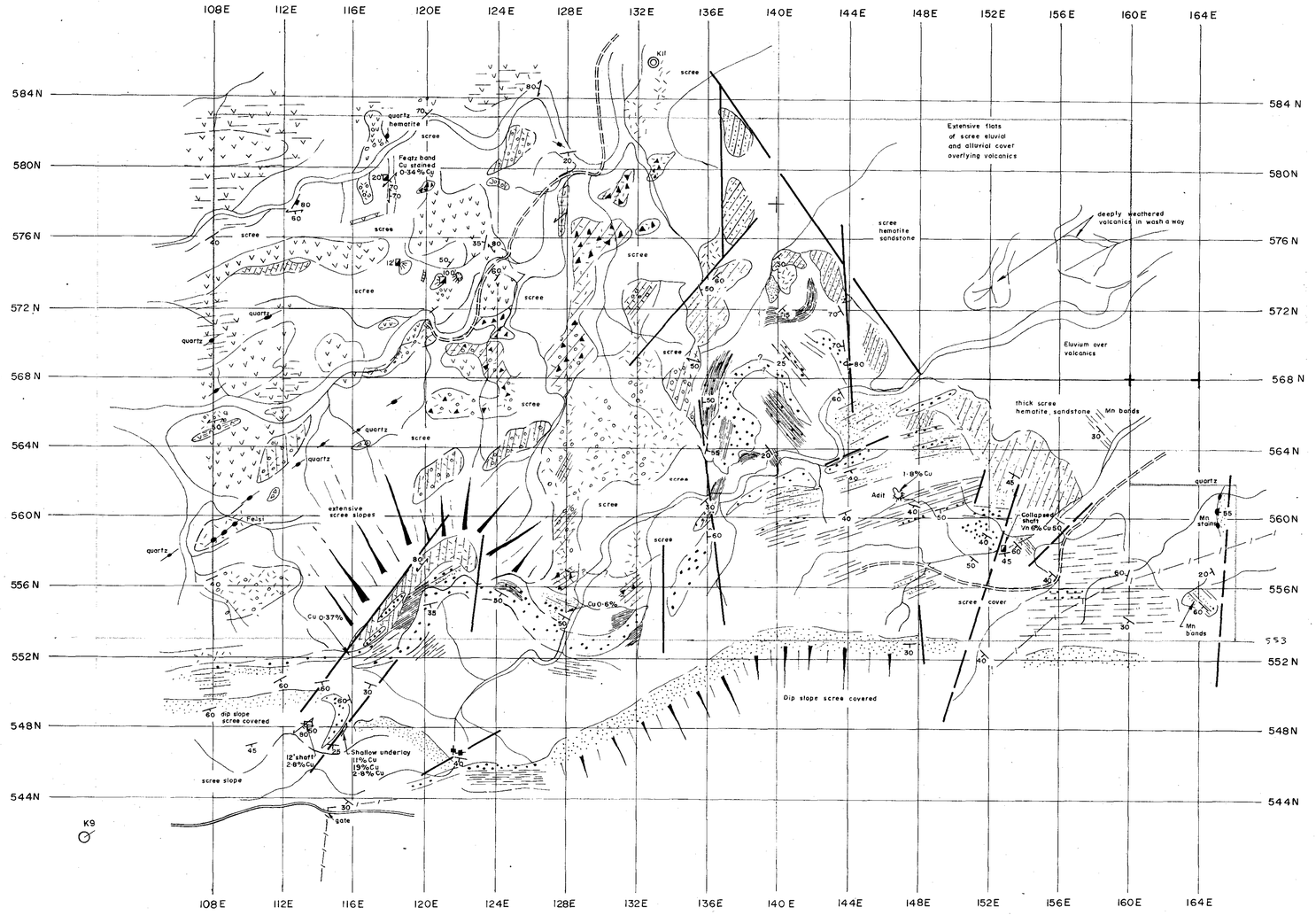
SML. 294.

DRN:- I. S.	DATE:- 10·12·69.	SCALE:- 1000 feet = 1inch.

ENV 1226(II)-9

DWG: G. 3017 A.

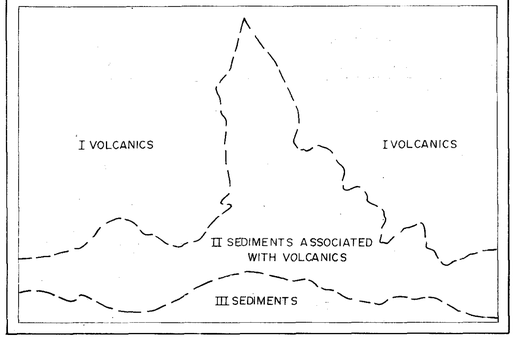
McPHAR GEOPHYSICS PTY. LTD.



REFERENCE

- III Sediments
  - Siltstone with conglomerate bands
  - Sandstone (Wortupa Quartzite)
- II Sediments assoc. with volcanics
  - Siltstone - various colours, brown, grey, buff
  - Siltstone with pebble bands and sandstone bands
  - Sandstone
  - Ferruginous (or hematite) sandstone
  - Conglomerate
  - Dark brown shale
- I Volcanics
  - Trachyte
  - Trachyte ferruginous
  - Trachyte vesicular
  - Trachyte brecciated - and silicified
  - Andesite, commonly epidote rich medium grained extensively chloritised
  - Andesite
- Fault definite - interpreted
- Dip and strike of bedding
- Dip and strike of jointing
- Dip and strike of foliation
- Dyke or reef
- Air photo markers
- Survey points, marked
- Track
- Graded track
- Shaft and dump, showing depth
- Trench or pit

STATIGRAPHIC-TECTONIC SUBDIVISIONS



NORTH FLINDERS MINES N.L.

THE COUP PROSPECT

WOOLTANA VOLCANICS S.A.

GEOLOGICAL MAP

S.M.L. 294

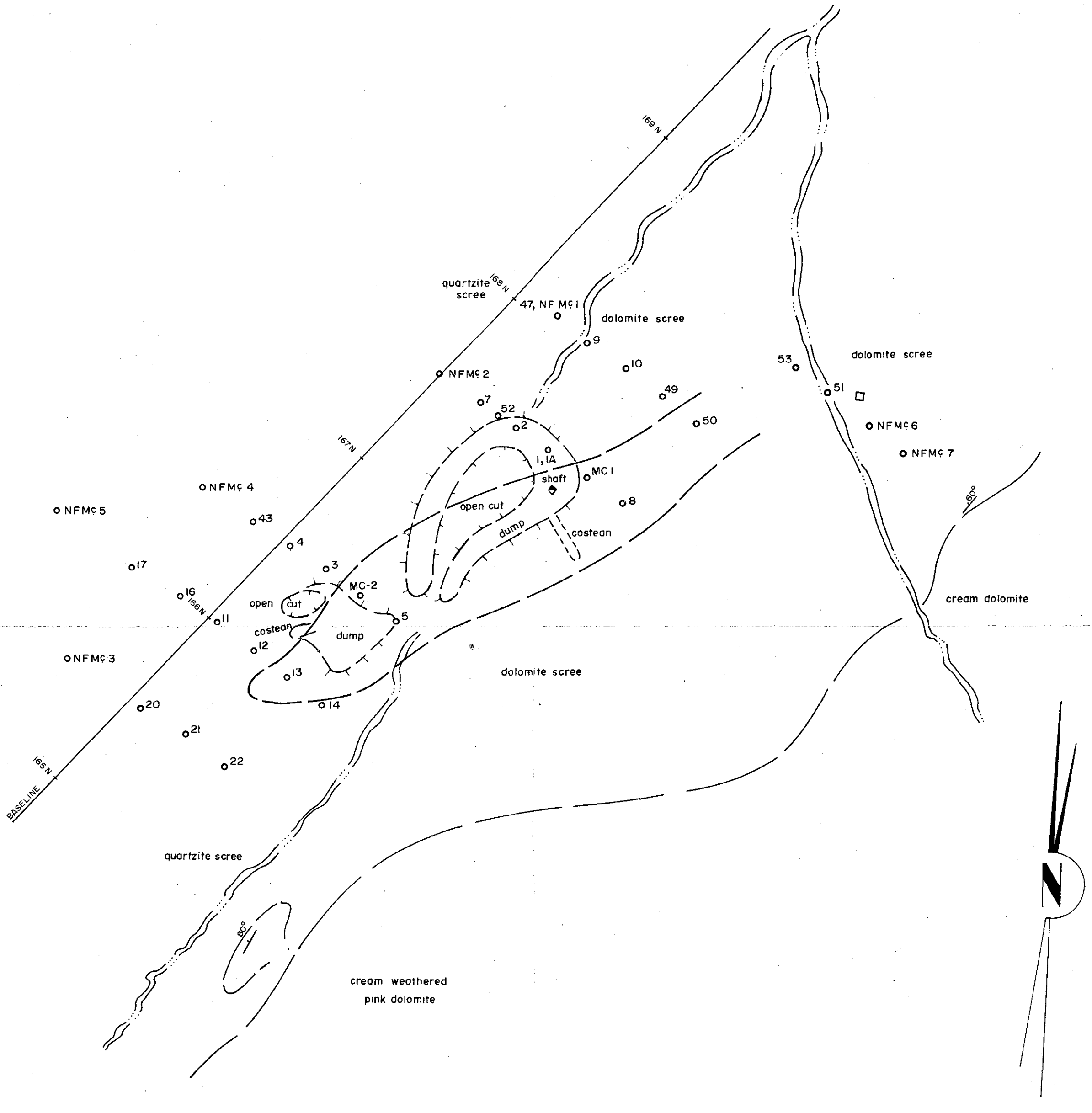
SCALE: 1 INCH TO 400 FEET

GEOLOGY BY I.R. PONTIFEX JULY 1970

DRAWN: P.G.S.
DATE: 18·8·70
APPROVED:

DATE:

ENV 1226(W)-10 DWG.G 3066 A 1226



50 0 50 100

SCALE IN FEET

North Flinders Mines N. L.

MAP OF

Mc LEASHES COPPER PROSPECT

SML 294

SHOWING

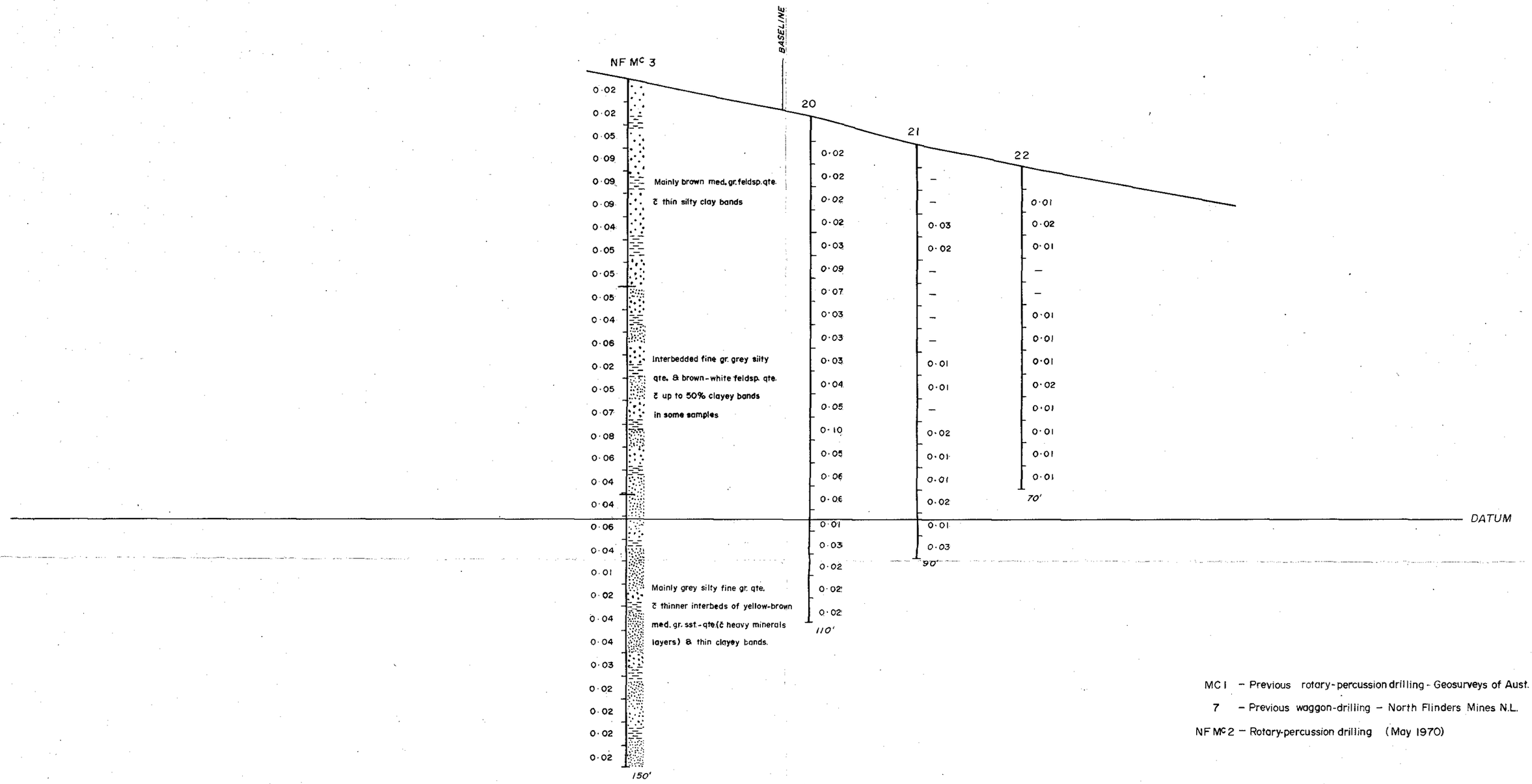
DRILL HOLE LOCATIONS

DRN:- M.C.C.	DATE:- OCT. 1970	SCALE:- 1 INCH = 40 FEET

1226

ENV 1226(III)-1

DWG : 294 - 4



MC 1 – Previous rotary-percussion drilling - Geosurveys of Aust.

7 – Previous waggon-drilling – North Flinders Mines N.L.

NF Mc 2 – Rotary-percussion drilling (May 1970)

0·19 % Cu - A.A.S. analysis on pulverised small grab samples of 0·25gm leached in hot 25% HNO_3 for 1 hour by McPhar

North Flinders Mines N. L.

Mc LEASHES COPPER PROSPECT

SML 294

CROSS-SECTION 16548 N

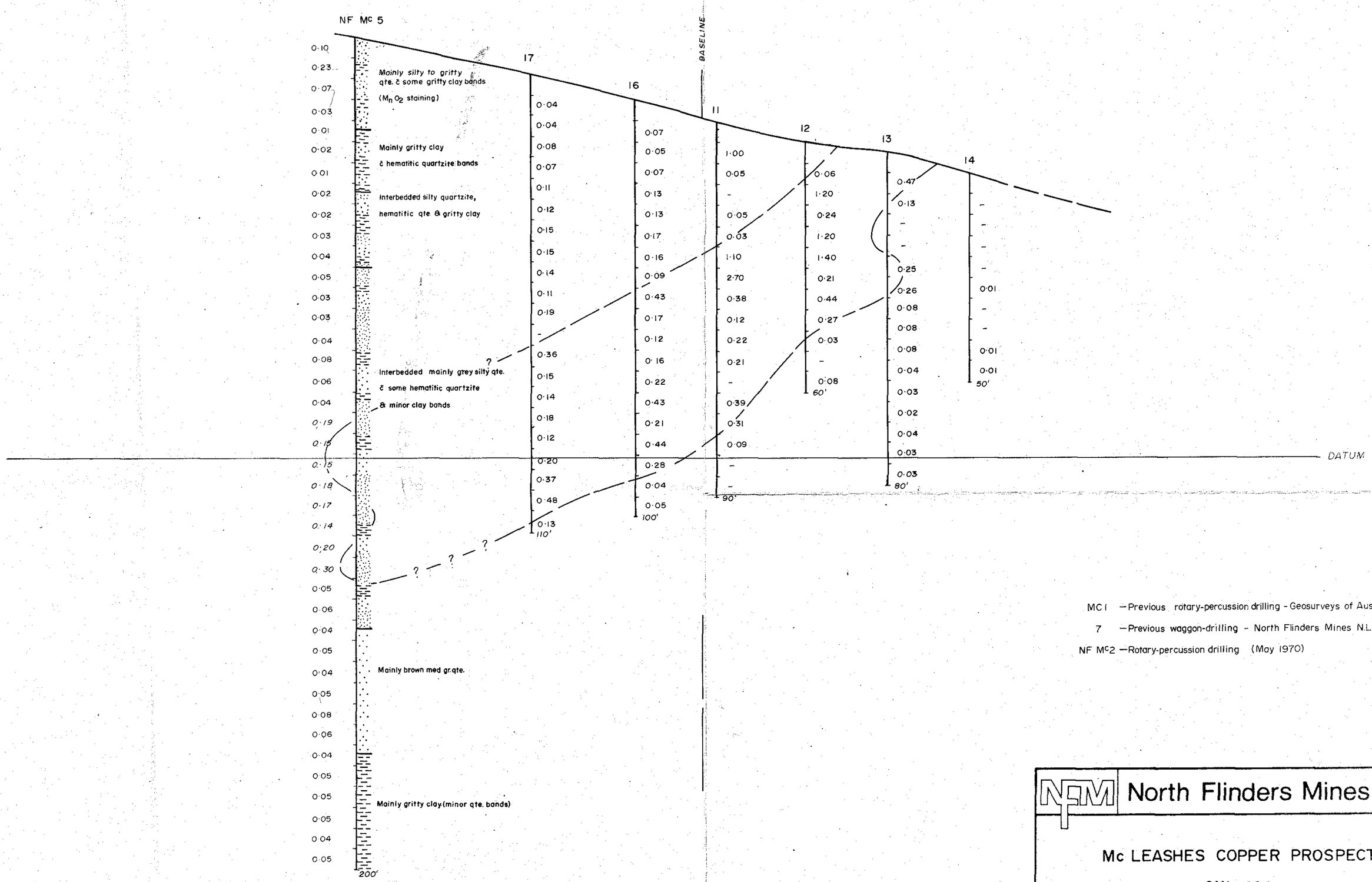
COPPER ASSAYS IN %

GEOLOGY BY B. WILSON

DRN:- MCC	DATE:- JUNE 1970	SCALE:- 1 INCH = 20 FEET

ENV 1226(III)-2

DWG:- 294-17
1226



0·19 %Cu - A.A.S. analysis on pulverised small grab samples of 0·25gm leached in hot 25% HNO_3 for 1 hour by McPhar

0·19 %Cu - Scheme F1 on full split sample by Amdel

MC1 — Previous rotary-percussion drilling - Geosurveys of Aust.

7 — Previous waggon-drilling - North Flinders Mines N.L.

NF Mc2 — Rotary-percussion drilling (May 1970)

10 0 10 20 30 40 50

SCALE IN FEET

North Flinders Mines N.L.

Mc LEASHES COPPER PROSPECT

SML 294

CROSS-SECTION 16600N

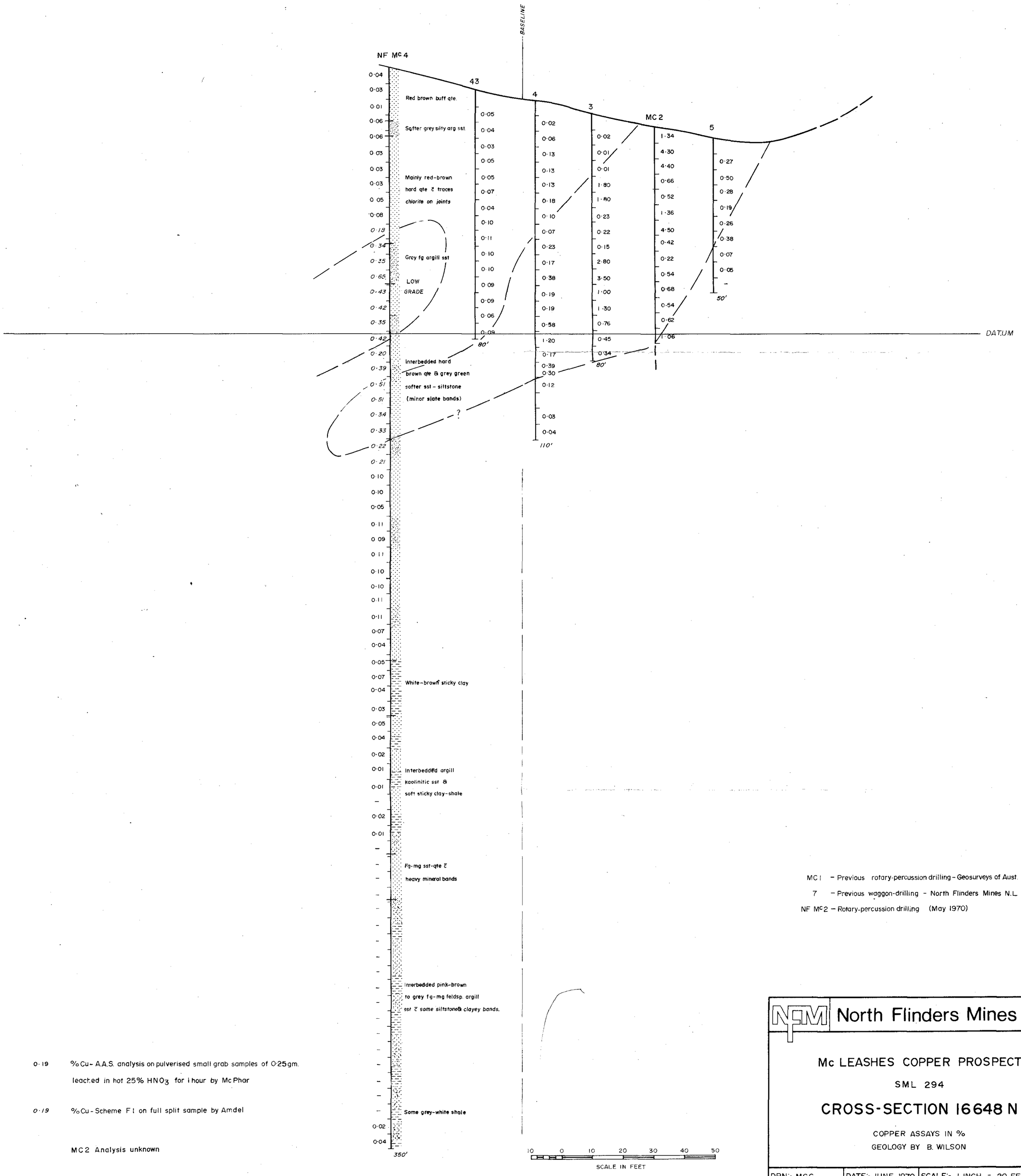
COPPER ASSAYS IN %

GEOLOGY BY B. WILSON

DRN:- MCC	DATE:- JUNE 1970	SCALE:- 1 INCH = 20 FEET

ENV 1226(III)-3

DWG: 294·18



0·19 %Cu - A.A.S. analysis on pulverised small grab samples of 0·25gm. leached in hot 25% HNO_3 for 1 hour by Mc Phar

0·19 %Cu - Scheme F1 on full split sample by Amdel

MC2 Analysis unknown

MC 1 – Previous rotary-percussion drilling - Geosurveys of Aust.

7 – Previous waggon-drilling - North Flinders Mines N.L.

NF Mc2 – Rotary-percussion drilling (May 1970)

North Flinders Mines N. L.

Mc LEASHES COPPER PROSPECT

SML 294

CROSS-SECTION 16648 N

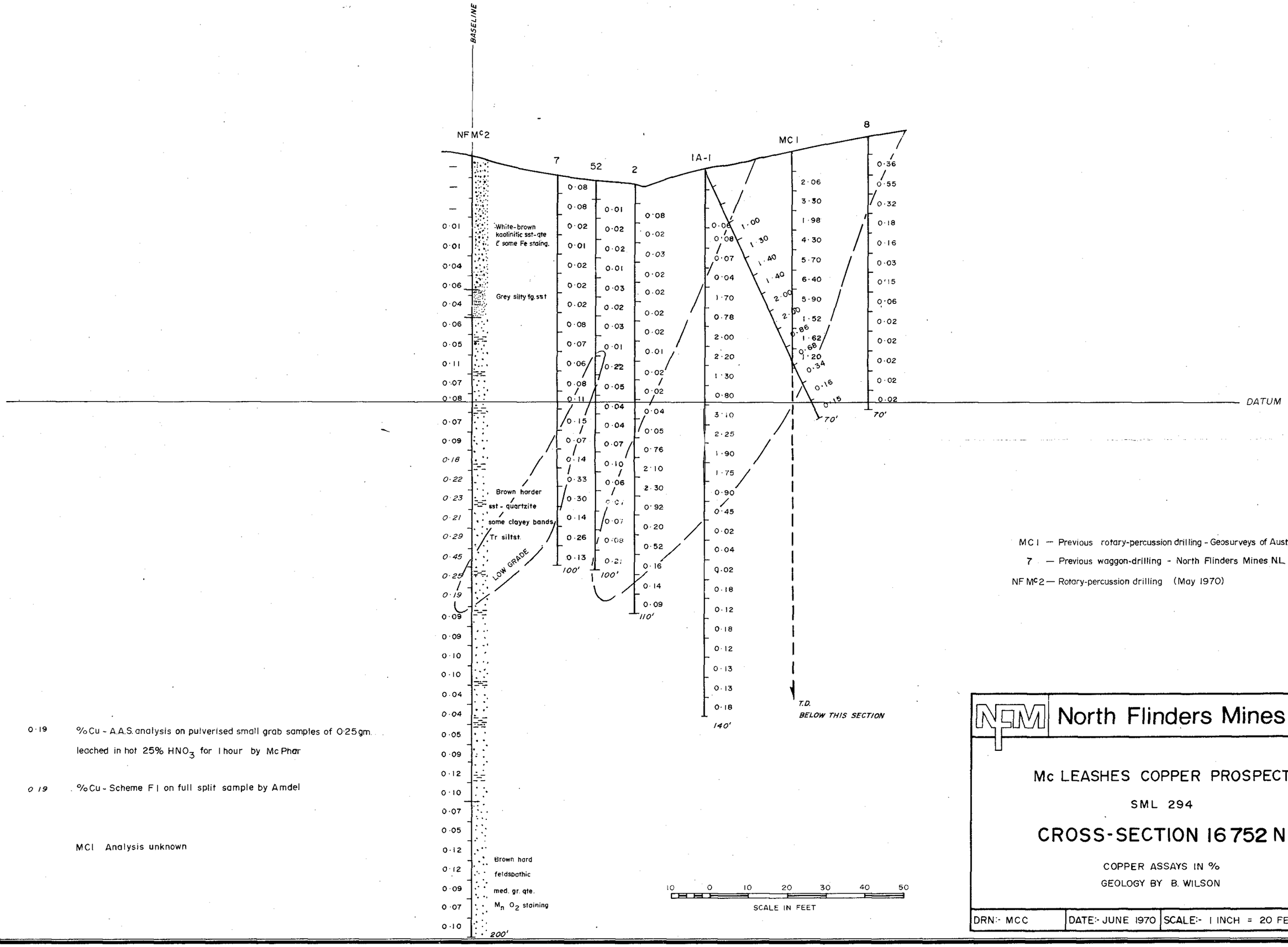
COPPER ASSAYS IN %

GEOLOGY BY B. WILSON

DRN:- MCC	DATE:- JUNE 1970	SCALE:- 1 INCH = 20 FEET 1226

DWG: 294-19

ENV 1226 (Tas)-4



MC1 — Previous rotary-percussion drilling - Geosurveys of Aust.

7 — Previous waggon-drilling - North Flinders Mines N.L.

NFMc2 — Rotary-percussion drilling (May 1970)

0·19 %Cu - A.A.S. analysis on pulverised small grab samples of 0·25gm. leached in hot 25% HNO_3 for 1 hour by Mc Phar

0 19 %Cu - Scheme F1 on full split sample by Amdel

MC1 Analysis unknown

North Flinders Mines N. L.

Mc LEASHES COPPER PROSPECT

SML 294

CROSS-SECTION 16752 N

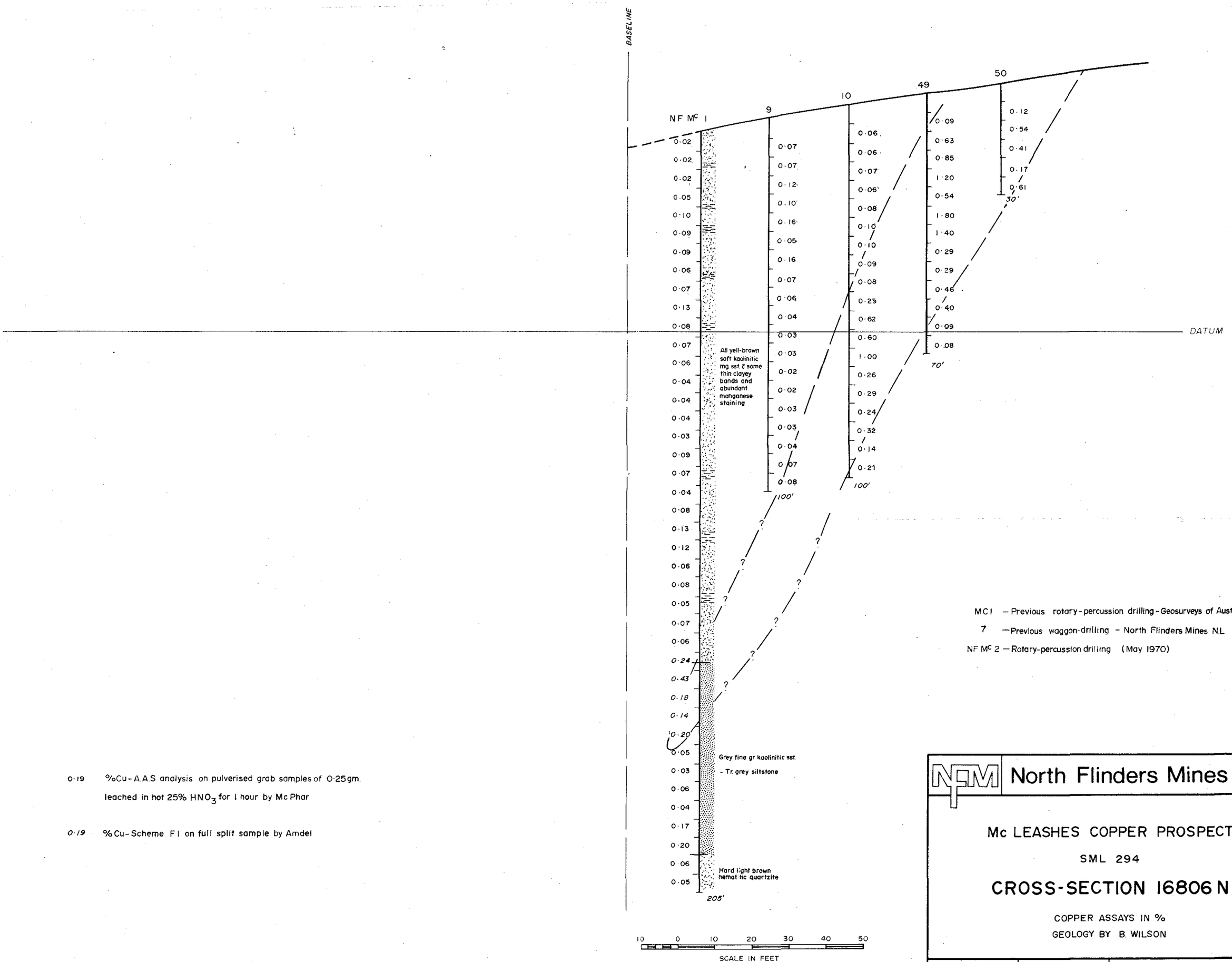
COPPER ASSAYS IN %

GEOLOGY BY B. WILSON

DRN:- MCC	DATE:- JUNE 1970	SCALE:- 1 INCH = 20 FEET 1226

DWG: 294-20

ENV 1226(W) - 5



MC1 — Previous rotary-percussion drilling - Geosurveys of Aust

7 — Previous waggon-drilling - North Flinders Mines N.L.

NF Mc 2 — Rotary-percussion drilling (May 1970)

0·19 %Cu - A.A.S analysis on pulverised grab samples of 0·25gm. leached in hot 25% HNO_3 for 1 hour by Mc Phar

0·19 %Cu - Scheme F1 on full split sample by Amdel

North Flinders Mines N. L.

Mc LEASHES COPPER PROSPECT

SML 294

CROSS-SECTION 16806 N

COPPER ASSAYS IN %

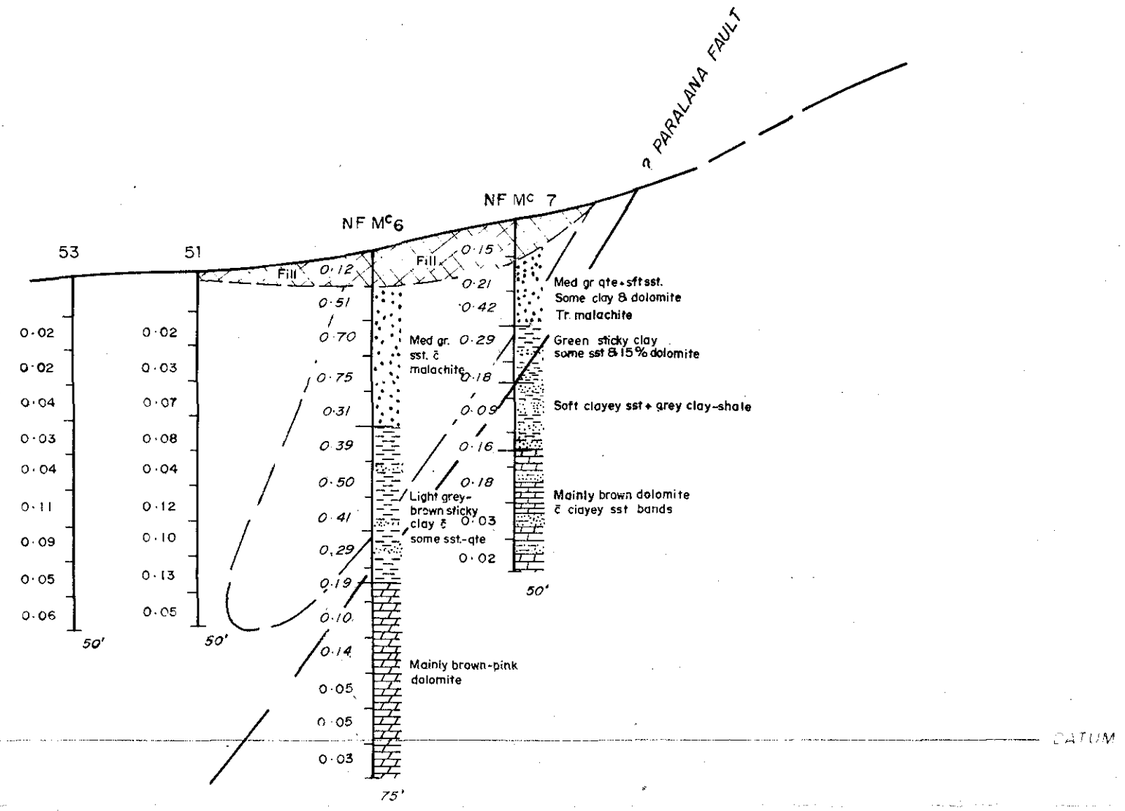
GEOLOGY BY B. WILSON

DRN:- MCC	DATE:- JUNE 1970	SCALE:- 1 INCH = 20 FEET

1226

ENV 1226(TN) - 6

DWG: 294 - 21



MC1 – Previous rotary-percussion drilling Geosurveys of Aust

7 – Previous waggon-drilling – North Flinders Mines NL.

NF Mc 2 – Rotary-percussion drilling (May 1970)

0·19 % Cu-A.A.S. analysis on pulverised small grab samples of 0·25gm leached in hot 25% HNO_3 for 1 hour by McPhar.

0·19 % Cu-Scheme F1 on full split sample by Amdel

North Flinders Mines N. L.

Mc LEASHES COPPER PROSPECT

SML 294

CROSS-SECTION 16856 N

COPPER ASSAYS IN %

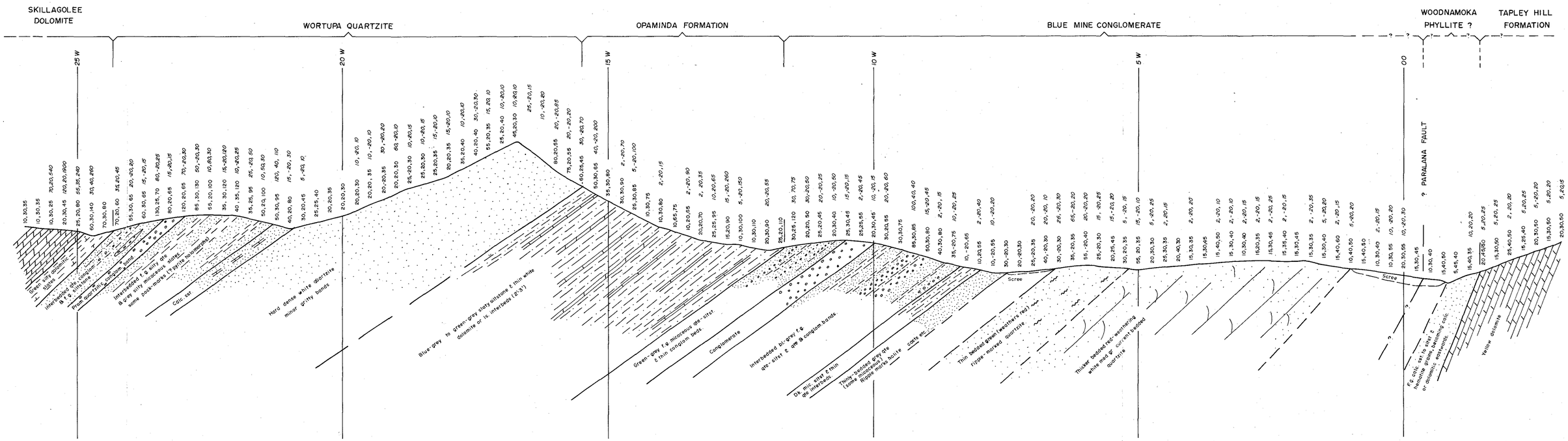
GEOLOGY BY B WILSON

DRN MCC DATE JUNE 1970 SCALE 1 INCH = 20 FEET

DWG 294-22

ENV 1226 (III)-7 1226

200' spreads —I.P. ANOMALOUS ZONES



NOTE :- lithologic bands within major units are shown diagrammatically only

METHOD OF INDICATING SURFACE GEOCHEM. VALUES

10, 20, 30 — Zn, Pb, Cu — Rock chip samples

10, 20, 30 — Zn, Pb, Cu — Soil samples

— Surface

VALUES IN P.P.M.

METHOD OF ANALYSIS

Rock chips & drill cuttings pulverized, Soils sieved to - 80 mesh. 0·25 gm samp. leached in hot 25% HNO_3 for 1 hour. Analysis by AAS, by McPhar Geophysics Pty. Ltd.

FEET 100 0 100 200 300 400 FEET

SCALE 1 INCH EQUALS 100 FEET

North Flinders Mines N. L.

Mc LEASHES COPPER PROSPECT

CROSS SECTION 16200N

GEOLOGY BY B WILSON

N.B. PROFILE BY ABNEY LEVEL ONLY

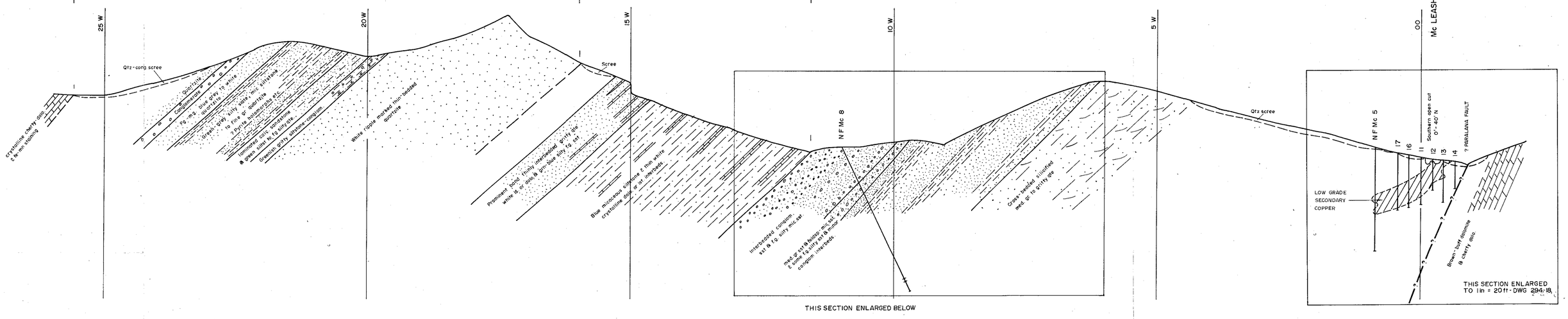
DRN:- M.C.C.	DATE:- JUNE 70	SCALE:- MAIN - 1 INCH = 100 FEET

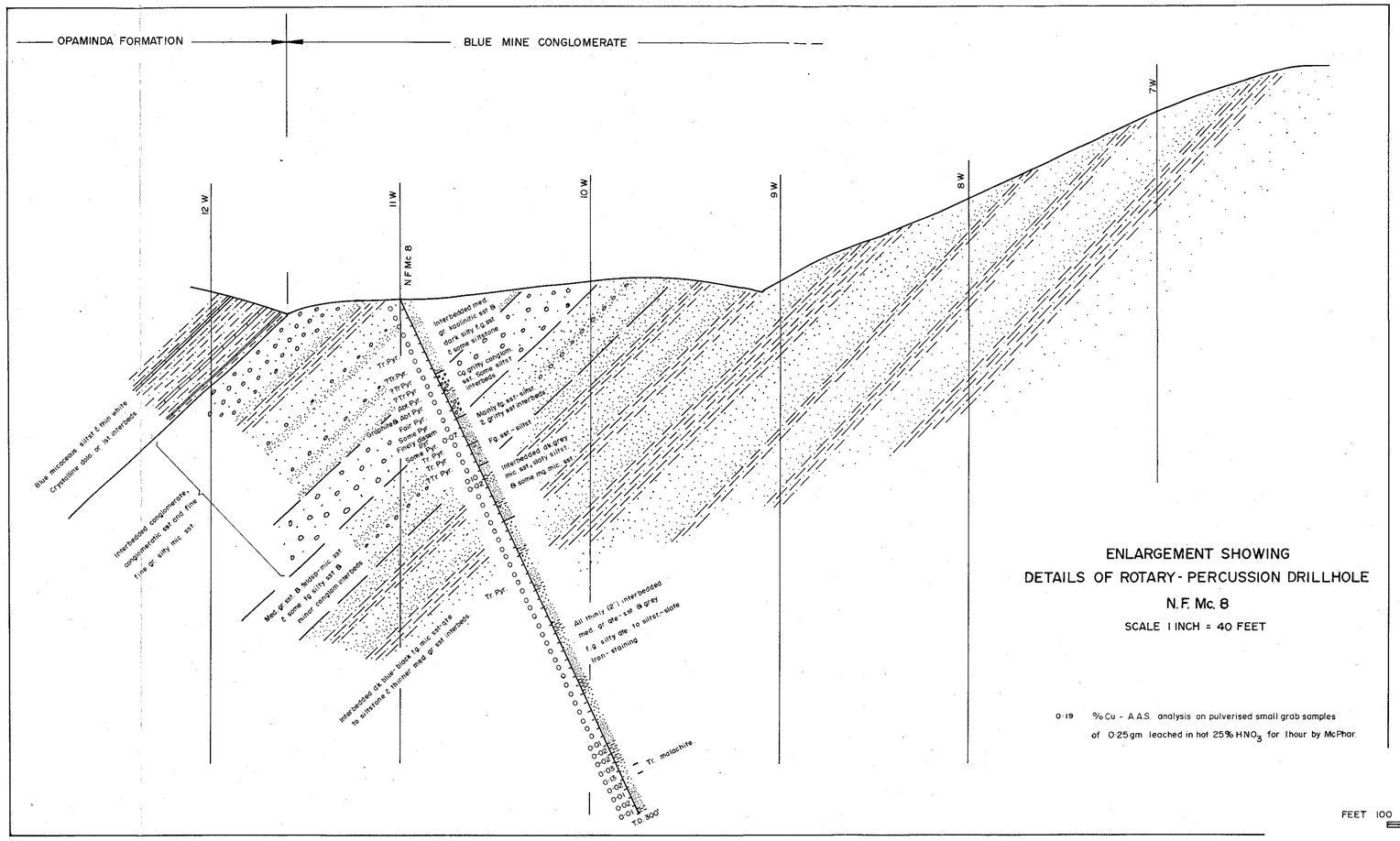
ENV 1226 (IV)-8

1226 DWG : 294 - 24

? ——— ——— 200' spreads 100' spreads —— I. P. ANOMALOUS ZONES

SKILLAGOLEE DOLOMITE | WORTUPA QUARTZITE | OPAMINDA FORMATION | BLUE MINE CONGLOMERATE





ENLARGEMENT SHOWING
DETAILS OF ROTARY - PERCUSSION DRILLHOLE
N.F. Mc. 8
SCALE 1 INCH = 40 FEET

0·19 %Cu - A.A.S. analysis on pulverised small grab samples of 0·25gm leached in hot 25% HNO_3 for 1hour by McPhar.

FEET 100 0 100 200 300 400 FEET
SCALE 1 INCH EQUALS 100 FEET

NFM North Flinders Mines N. L.

Mc LEASHES COPPER PROSPECT

CROSS SECTION 16600N

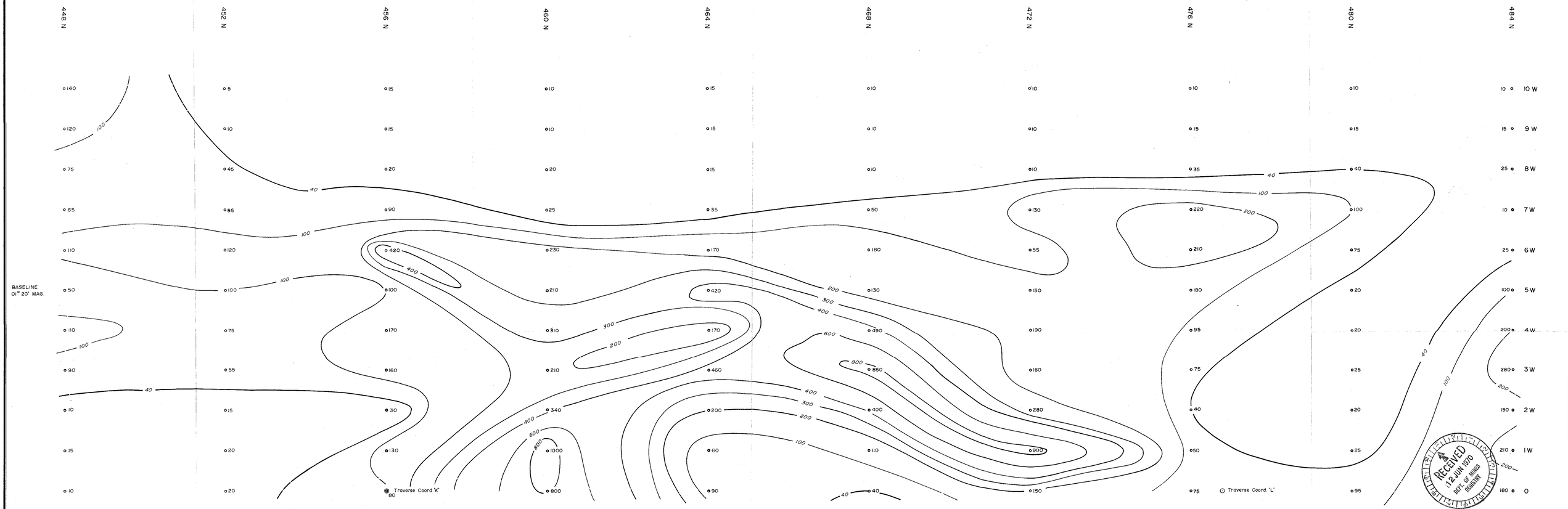
GEOLOGY BY B WILSON
COPPER ASSAYS IN %

N.B. PROFILE BY ABNEY LEVEL ONLY

DRN:- M.C.C.	DATE:- JUNE 70	SCALE:- MAIN - 1 INCH = 100 FEET

ENV 1226(III) - 9

1226 DWG : 294 - 25



PRELIMINARY ONLY

THRESHOLD TAKEN AT 40 P.P.M.

FEET 100 0 100 200 300 400 FEET

SCALE 1 INCH EQUALS 100 FEET

North Flinders Mines N.L.

WHEAL HANCOCK PROSPECT

SUB-SURFACE GEOCHEMICAL GRID SURVEY

SML 294

COPPER VALUES - PPM

DRN:- M C C	DATE:- MAY 1970	SCALE:- 1 INCH = 100 FEET

EM 1226(M) -10

448 N	452 N	456 N	460 N	464 N	468 N	472 N	476 N	480 N	484 N	
15	40	30	25	25	30	30	20	30	25	10 W
25	60	35	20	30	30	25	25	30	30	9 W
20	20	30	15	30	30	25	30	35	25	8 W
15	25	40	25	30	40	30	40	40	25	7 W
20	50	110 / 100	30	40	70	35	35	30	30	6 W
15	50	45	25	40	40	25	40	35	30	5 W
55	60	45	35	50	40	25	35	35	50	4 W
30	50	45	35	50	30	20	50	30	35	3 W
85	50	40	55	20	40	30	50	25	30	2 W
30	45	45	1000 / 10000	30	35	35	50	25	35	1 W
40	40	Traverse Coord 'K' 25	75	25	30	30	35 Traverse Coord. 'L'	35	40	0

BASELINE
01° 20' MAG.

THRESHOLD TAKEN AT 100 P.P.M.

FEET 100 0 100 200 300 400 FEET

SCALE 1 INCH EQUALS 100 FEET

PRELIMINARY ONLY

NFM North Flinders Mines N. L.

WHEAL HANCOCK PROSPECT

SUB-SURFACE GEOCHEMICAL GRID SURVEY

SML 294

ZINC VALUES - PPM

DRN:- M.C.C.	DATE:- MAY 1970	SCALE:- 1 INCH = 100 FEET

448 N	452 N	456 N	460 N	464 N	468 N	472 N	476 N	480 N	484 N	
o -20	o 20	o 20	o -20	o 20	o 20	o 20	o 20	o -20	20 o	10 W
o 20	o 20	o 20	o -20	o 20	o 20	o 20	o 25	o 20	20 o	9 W
o -20	o 20	o -20	o 20	o 20	o 25	o 20	o 20	o -20	-20 o	8 W
o 20	o -20	o -20	o 20	o 25	o 20	o 20	o 25	o 20	-20 o	7 W
o 20	o 20	o 30	o -20	o 25	o 30	o -20	o 20	o 25	-20 o	6 W
BASELINE 01° 20' MAG. o -20	o 20	o 20	o -20	o -20	o 20	o -20	o 20	o -20	20 o	5 W
o 20	o 20	o -20	o -20	o -20	o 20	o 20	o 20	o 20	-20 o	4 W
o 25	o 20	o -20	o -20	o -20	o 20	o -20	o -20	o 30	-20 o	3 W
o 20	o -20	o -20	o 20	o -20	o -20	o -20	o -20	o 25	20 o	2 W
o 20	o 20	o -20	o 20	o -20	o -20	o 20	o 20	o 25	20 o	1 W
o 20	o 20	⊗ Traverse Coord 'K' 20	o 20	o 20	o -20	o 20	o 20 ⊙ Traverse Coord. 'L'	o 20	-20 o	0

THRESHOLD TAKEN AT 80 P.P.M.

FEET 100 0 100 200 300 400 FEET

SCALE 1 INCH EQUALS 100 FEET

PRELIMINARY ONLY

NFM North Flinders Mines N. L.

WHEAL HANCOCK PROSPECT

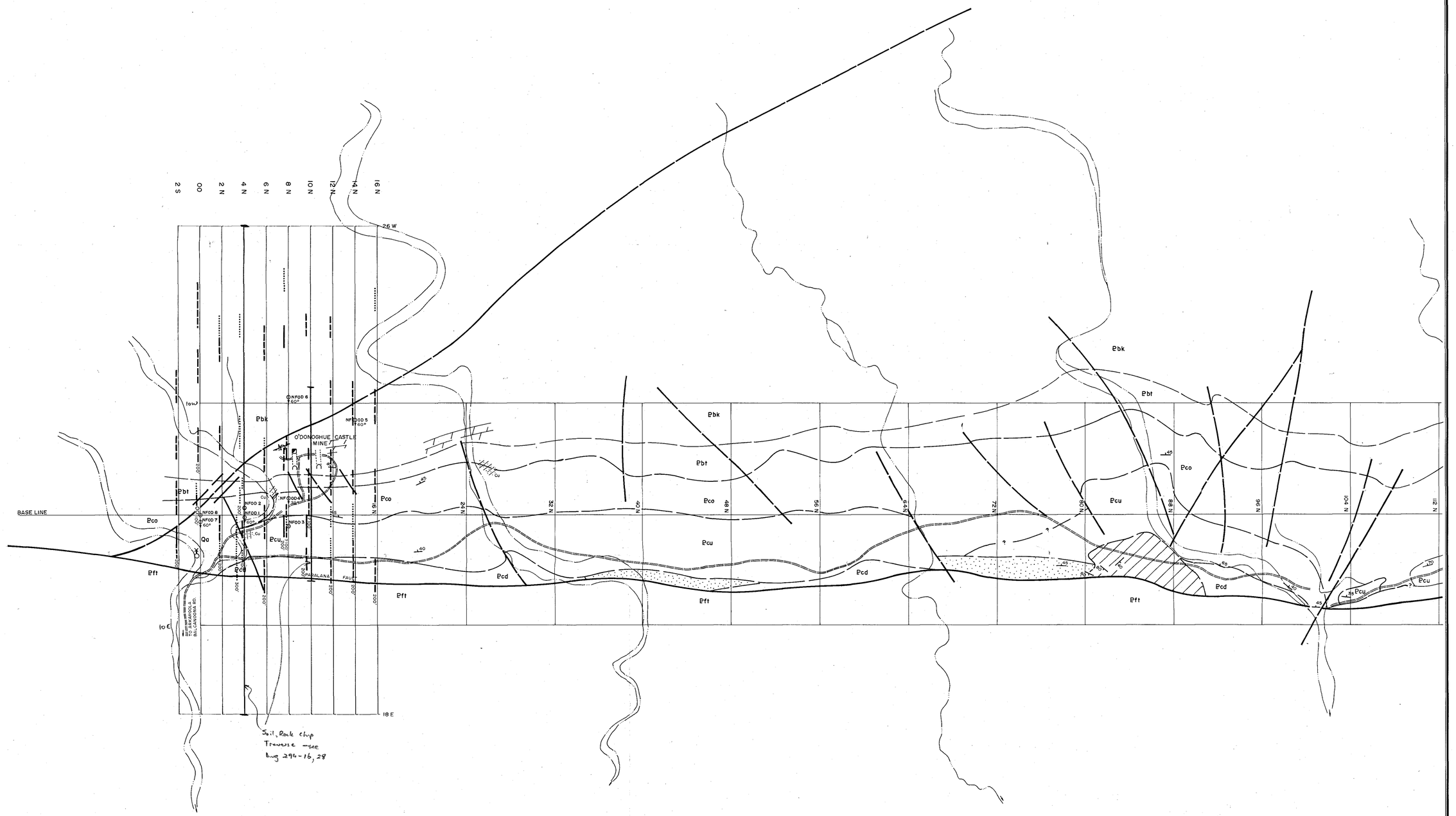
SUB-SURFACE GEOCHEMICAL GRID SURVEY

SML 294

LEAD VALUES - PPM

DRN:- M.C.C.	DATE:- MAY 1970	SCALE:- 1 INCH = 100 FEET

ENV 1226 (III) -12



NFOD 6 60° ROTARY PERCUSSION DRILL-HOLES

I.P. SURVEY RESULTS

SURFACE PROJECTION OF ANOMALOUS ZONES

——— DEFINITE
– – – – PROBABLE
..... POSSIBLE

THE FIGURE AT THE END OF THE ANOMALY SYMBOL INDICATES THE ELECTRODE SPREAD

LEGEND

Qa Alluvium

Pbk SKILLOGALEE DOLOMITE Commonly massive dolomites at base (e.g. at O'Donoghue Castle upper adit) In places, hard, blue dolomitic shales at base. Generally interbedded dolomites and dolomitic siltstone. Dolomite commonly recrystallised with carbonate veining

Pbt WORTUPA QUARTZITE Bedded felspathic quartzite, minor grit bands, ripple-marked. Quartz veins, rare Cu staining near O'Donoghue Castle Mine.

Pco OPAMINDA SHALE Dark grey dolomitic siltstone and shale, interbedded conglomerate bands, (similar to the lithology of the Blue Mine Conglomerate) common, thick, interbedded dolomite bands, common in northern half of area. Rare chalcopyrite in some dolomite, (at 126N and near O'Donoghue Mine)

Pcu BLUE MINE CONGLOMERATE Conglomeratic, gritty sandstone, massive to thick bedded north of Mc Leashes consists almost entirely of coarse, gritty, massive sandstone. Heavy mineral laminations in places.

Pcd WOODNAMOKA PHYLLITE ? Dark grey phyllitic siltstones. At 44N and 72N, band of arkosic sandstone band with abundant heavy mineral laminations.

Pft TAPLEY HILL FORMATION Thick bedded, buff to light brown dolomite. Recrystallised in places along Paralana Fault where it may also be associated with ferruginous chert.

Rock Unit names after DIM "Mt Painter Province" 1:125,000 Geological Sheet - lithological description refers to this 400 ft map only.

- Dip and strike of bedding
- Dip and strike of foliation or schistosity
- Fault observed
- Fault inferred
- Diapir, beds have variable attitude, minor brecciation, amphibole-mica rock with secondary $CaCO_3$
- Copper staining (malachite)
- Copper mineralisation, (apart from mine workings)
- Zinc anomaly
- Adit entrance
- Shaft
- Trench
- Track
- Windmill on bore

Geology by I.R. Pontifex of Mc Phar Geophysics Pty. Ltd.
Map enlarged from original compilation at 1" = 1000', based on 70 chain air photo enlargements.

SCALE
FEET 500 0 500 1000 1500 FEET
ONE INCH EQUALS FOUR HUNDRED FEET

NFM North Flinders Mines N. L.

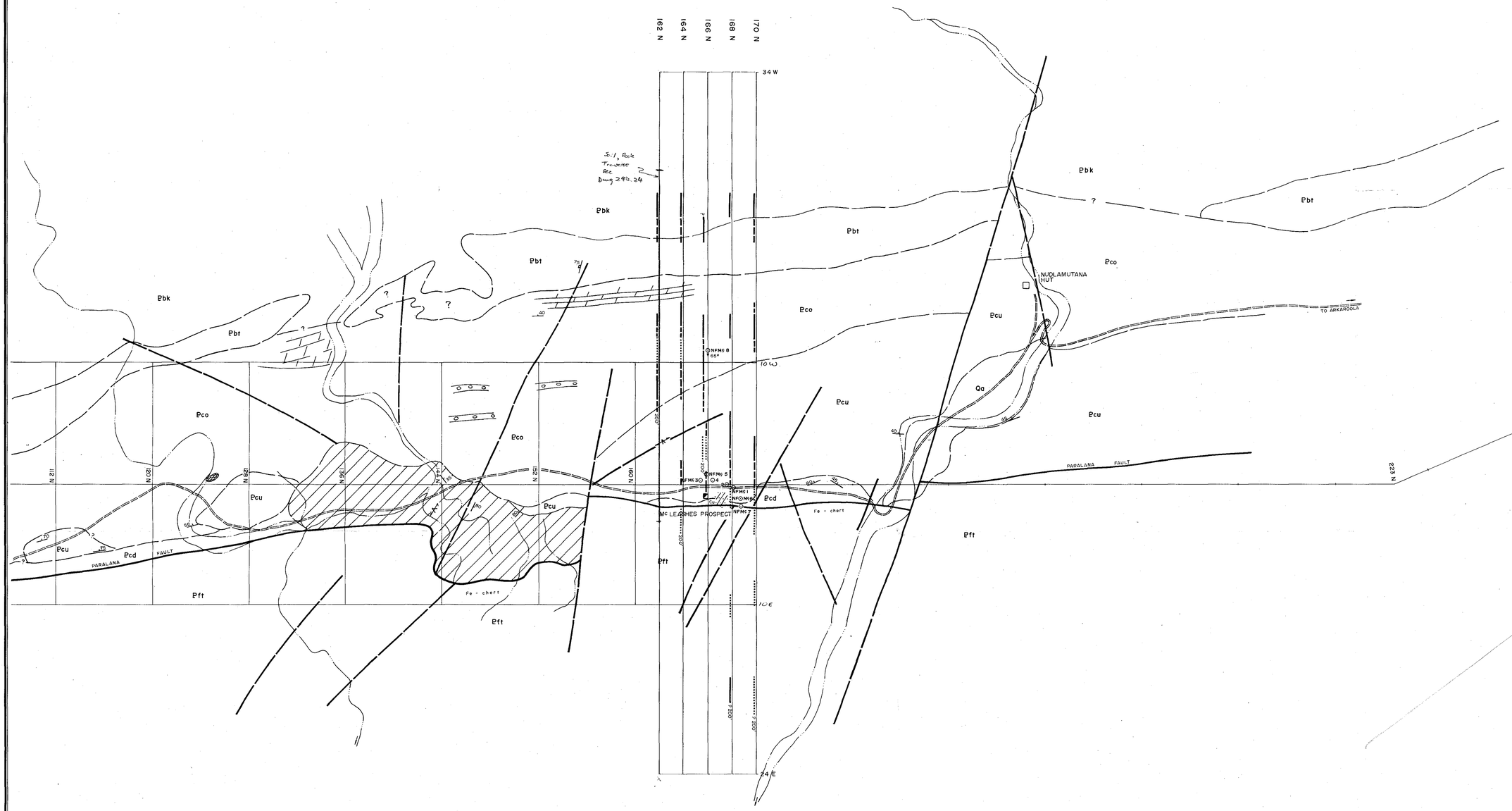
SHEET A
MAP SHOWING AREA BETWEEN
O'DONOGHUE CASTLE - POOH CORNER
AND
Mc LEASHES PROSPECT
SML 294
GEOLOGY

DRN:- M.C.C. | DATE:- APRIL 1970 | SCALE:- 1 INCH = 400 FEET

1226

ENV 1226 (IV)-1

DWG: 294-11A



NFMC 8 65° ROTARY PERCUSSION DRILL-HOLES

I.P. SURVEY RESULTS

SURFACE PROJECTION OF ANOMALOUS ZONES

——— DEFINITE
– – – – PROBABLE
..... POSSIBLE

THE FIGURE AT THE END OF THE ANOMALY SYMBOL INDICATES THE ELECTRODE SPREAD

LEGEND

Qa Alluvium

Pbk SKILLOGALEE DOLOMITE Commonly massive dolomites at base (e.g. at O'Donoghue Castle upper adit) In places, hard, blue dolomitic shales at base. Generally interbedded dolomites and dolomitic siltstone. Dolomite commonly recrystallised with carbonate veining

Pbt WORTUPA QUARTZITE Bedded felspathic quartzite, minor grit bands, ripple-marked. Quartz veins, rare Cu staining near O'Donoghue Castle Mine.

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- Fault inferred
- Diapir, beds have variable attitude, minor brecciation, amphibole-mica rock with secondary $Ca\,CO_3$
- Copper staining (malachite)
- Copper mineralisation, (apart from mine workings)
- Zinc anomaly
- Adit entrance
- Shaft
- Trench
- Track
- Windmill on bore

Geology by I.R. Pontifex of Mc Phar Geophysics Pty. Ltd.
Map enlarged from original compilation at 1" = 1000', based on 70 chain air photo enlargements.

SCALE
FEET 500 0 500 1000 1500 FEET
ONE INCH EQUALS FOUR HUNDRED FEET

NORTH

NFM North Flinders Mines N. L.

SHEET 8
MAP SHOWING AREA BETWEEN
O'DONOGHUE CASTLE - POOH CORNER
AND
Mc LEASHES PROSPECT
SML 294
GEOLOGY

DRN:- M.C.C.	DATE:-APRIL 1970	SCALE:- 1 INCH = 400 FEET

9271

ENV1226(IV)-2 DWG:294-11B

STREAM SEDIMENT RECONNAISSANCE SURVEY, WOOLTANA AREA, S.M.L. 294, SOUTH AUSTRALIA.

for

NORTH FLINDERS MINES N.L.

ENV 1226 -I

by

P.R. DONOVAN.

McPHAR GEOPHYSICS PTY. LTD.

TELEPHONE 72 2133

50-52 MARY STREET, UNLEY, SOUTH AUSTRALIA
Postal Address: P.O. Box 42, UNLEY, SOUTH AUSTRALIA 5061

CABLE "PHARGEO" ADELAIDE
TELEX AA82 · 623

JR

MEMORANDUM TO: NORTH FLINDERS MINES N.L.

MEMORANDUM FROM: DR. P.R. DONOVAN, McPHAR GEOPHYSICS PTY. LTD.

SUBJECT: STREAM SEDIMENT RECONNAISSANCE SURVEY, WOOLTANA AREA, S.M.L. 294, SOUTH AUSTRALIA.

DATE: 20TH FEBRUARY, 1970.

INTRODUCTION

A previous memorandum by the writer on stream sediment work in this S.M.L. is dated September 22nd 1969.

A decision was made to cover most of that part of the S.M.L. 294 which had not been covered previously by Australian Selection (Pty.) Ltd. and also to follow up some of A.S.P.L's Cu anomalies within their original S.M.L. 66 with closely spaced sampling at the same time. The boundary between these two areas is shown on the accompanying plans.

A total of 2265 samples were collected by two two-man crews. These were indexed 910001 - 911734 and 915001 - 915531.

ANALYSIS

All samples were sieved to minus 80-mesh and analysed by AAS for Cu, Pb and Zn following a hot 25% HNO_3 leach on a 0.25g. sample.

The results are given in the following Batches:

G 1499 (4/11/69)
G 1524 (13/11/69)
G 1562 (19/11/69)
G 1563 (20/11/69)
G 1593 (24/11/69)
G 1655 (9/12/69)

/.....2

For convenience the following discussion is divided into two parts:

1. The New Area (outside A.S.P.L.'s S.M.L. 66)
2. The Old Area (within A.S.P.L.'s S.M.L. 66)

1. THE NEW AREA

This area of approximately 220 square miles was covered entirely except for (a) the area of Quaternary sediments in the south-east corner and (b) the outcrop area of the Pound Quartite in the south west corner.

These omitted areas totalled approximately 100 square miles leaving a total of 120 square miles surveyed.

The strip of Blue Mine Conglomerate running NE-SW of O'Donohue's Castle Mine was covered in more detail than the rest of the area, being a prime target for copper mineralization.

Copper

Values ranged from 2 - 430 ppm.

A value of 40 ppm Cu was selected as threshold.

There is a well defined string of anomalous values, running northeast-southwest through the O'Donohue Castle Mine and Mt. McTaggart. The anomalies are apparently related to the Paralana fault system as well as the Blue Mine Conglomerate, since this formation dies out about 1 mile north of Mt. McTaggart. The O'Donohue Castle Mine itself was not picked up, probably because of the width of the stream below the workings.

There is a second well defined group of anomalies associated with the diapiric intrusions around the Loch Ness Mine. This mine had a long dispersion train.

Apart from these there are a number of isolated anomalies which have been checked by reanalysis,

These are:

1. Samples 911613 (40 ppm) and 911620 (50 ppm) east of "Yadnina" in the northern part of the area. These occur in the Ulupa Siltstone.
2. Sample 910569 (40 ppm) in the southern part of the area. The geology here is not known.

/.....3

3. Sample 910595 (40 ppm) again possibly related to the Paralana fault system.

4. Sample 901938 (40 ppm) some distance north of the Loch Ness diapir within the Ulupa Siltstone.

Zinc

Zinc values ranged from 15 - 380 ppm.

A value of 100 ppm was selected as threshold.

There are three zones of anomalous zinc values and three isolated one-sample anomalies.

(a) There is an anomalous zone running north-eastwards from the O'Donohue Castle Mine. The maximum value here is 380 ppm. This is perhaps somewhat west of the copper anomaly in this area. It is interesting that the Zn anomaly dies out southeast of the O'Donohue Castle Mine whereas the Cu anomaly continues for another 4 miles. There are, however, definite isolated Zn anomalies in Sample 910706, (also anomalous in Cu and Pb), just north of Mt. McTaggart, and sample 910728, (also anomalous in Pb) on the continuation of the Paralana fault zone.

(b) There is an anomalous zone (maximum value 240 ppm) probably associated with the Loch Ness diapir and coextensive with part of the larger Cu anomaly in this area. The Loch Ness Mine itself does not give rise to a Zn anomaly.

(c) Sample 910838 (100 ppm) is approximately $\frac{3}{4}$ mile north of the Loch Ness Mine but probably not related to the diapir. It lies within the Wonoka formation. Sample 910826 (210 ppm) occurs approximately 2 miles southwest of the Loch Ness Mine. This is also within the Wonoka formation.

(d) There are three anomalous values 910206, 910216 and 910218 south of the Wooltana homestead. These may be derived from the Wooltana Volcanics.

Lead

Lead values ranged from 20 to 320 ppm.

A value of 80 ppm was selected as threshold.

There were only two isolated one-sample Pb anomalies both of which have been checked by reanalysis.

/.....4

(a) 910706, north of Mt. McTaggart, which was also anomalous in Cu and Zn.

(b) 910728, just west of Mt. McTaggart. This was anomalous in Zn but not Cu.

These have been discussed under Zinc above.

Recommendations

(1) Initially all the one Cu and Zn sample anomalies should be checked by resampling with additional sampling upstream. If these anomalies do not check out or show much importance this will enable the company to drop off a considerable area of its S.M.L. whenever necessary.

(2) The area of copper (and partially zinc) anomalies around Loch Ness is worthy of a concentrated effort, and a first step would be to obtain larger scale base maps and airphotos. The geology should be related to the sediment anomalies in more detail when these have been obtained.

(3) The Paralana fault - Blue Mine Conglomerate Zone is discussed further below.

2. THE OLD AREA

This work consisted essentially of detailed sampling along the outcrop of the Blue Mine Conglomerate as far north as Quartpot Bore and detailed sampling at ASPL's Nick, Bleachmore and Warren-Hastings anomalies.

Blue Mine Conglomerate

Copper anomalies were found along the entire length of the area surveyed, and values reached a maximum of 1700 ppm. Several new zones of copper mineralization have been visually located as a result of this survey, and one of these is currently being tested by drilling.

The behaviour of Zn is interesting in that anomalous values of this metal are confined to two zones, one just northwest of the Coxcomb Prospect (maximum 340 ppm), the other being the northeastward continuation of the Cu-Zn zone north of O'Donohue's Castle Mine mentioned previously above. The Zn anomalies appear to be more sporadic in their distribution than those of Cu. The reason for this is not known at this stage.

There were no Pb anomalies in this zone.

Bleachmore

This A.S.P.L. anomaly, which included the Woodlamulka copper mine, checked out with anomalous Cu and Zn values.

Surprisingly the known copper mineralizations were not picked up by a threshold of 40 ppm Cu. There were two values of 35 ppm Cu associated with the northern Cu mineralization, and there may be a case for lowering the Cu threshold to this value over the whole S.M.L. at a later stage.

Cu values of 200 and 160 ppm were detected in the two samples furthest upstream. These appear to be derived from the Blue Mine Conglomerate or Wortupa Quartite.

There were also Zn anomalies in the latter location, as well as in the Wooltana Volcanics themselves, where there are no Cu anomalies.

Warren-Hastings

This A.S.P.L. Cu anomaly did not check out, and there were no anomalous Pb or Zn anomalies.

Nick

This A.S.P.L. anomaly showed one anomalous Cu value and four anomalous Zn values. These are again apparently within the Wooltana Volcanics.

Recommendations

1. The Paralana fault/Blue Mine Conglomerate Cu (-Zn) anomalous zone will obviously require a great deal of detailed geological, geochemical and geophysical work in the future. As far as geochemical work is concerned an attempt should be made to visually locate Cu mineralization upstream from each anomalous stream sediment sample. Where this is not possible, additional closely spaced sediment samples and possibly soil samples should be used as an aid to locate the sources.

2. The western end of the Bleachmore anomaly should be prospected to find a source and a grid should be laid out through the Woodlamulka zone of copper workings. Detailed geological mapping and soil sampling should be applied here.

3. The Cu anomaly at Nick should be followed up by prospecting.

Signed
McPHAR GEOPHYSICS PTY. LTD.

c.c. North Flinders (2)
File

P.R. DONOVAN Ph.D.
CHIEF GEOCHEMIST

McPHAR GEOPHYSICS PTY. LTD.

N

Yadnina

Main Water Well

Hut

Quartcot Bore

Boulder Bore

Arkaroola

Golden Rule Mine

Wall Prospect

Coxcomb Prospect

WARREN-HASTINGS

Nudlamutana Hut

McLeashes Prospect

Woodlamulka Mine

BLEACHMORE

NICK

BOUNDARY OF ORIGINAL A.S.P.L. S.M.L.66

Woolfana

Munyalina Ck.

O'Donohues Co

O'Donohue Castle Well

Castle 59 Mine

Merinjina Well

Ash

MT McTAGGART

Nepouie Spring

NEPOUIE PK.

LOCH NESS MINE

Grindell Hut

Balcanoona

THE DEANS HILL

S.M.L. 294.

5/7 = 9/10 5/7
5/72 = 9/15 7/2

ENLARGMENTS NOT DRAWN TO SCALE

ENV 1226

RECEIVED 12 JUN 1970 DEPT. OF MINES REGISTRY ADELAIDE

North Flinders Mines N. L.

WOOLTANA AREA

S.M.L.–294.

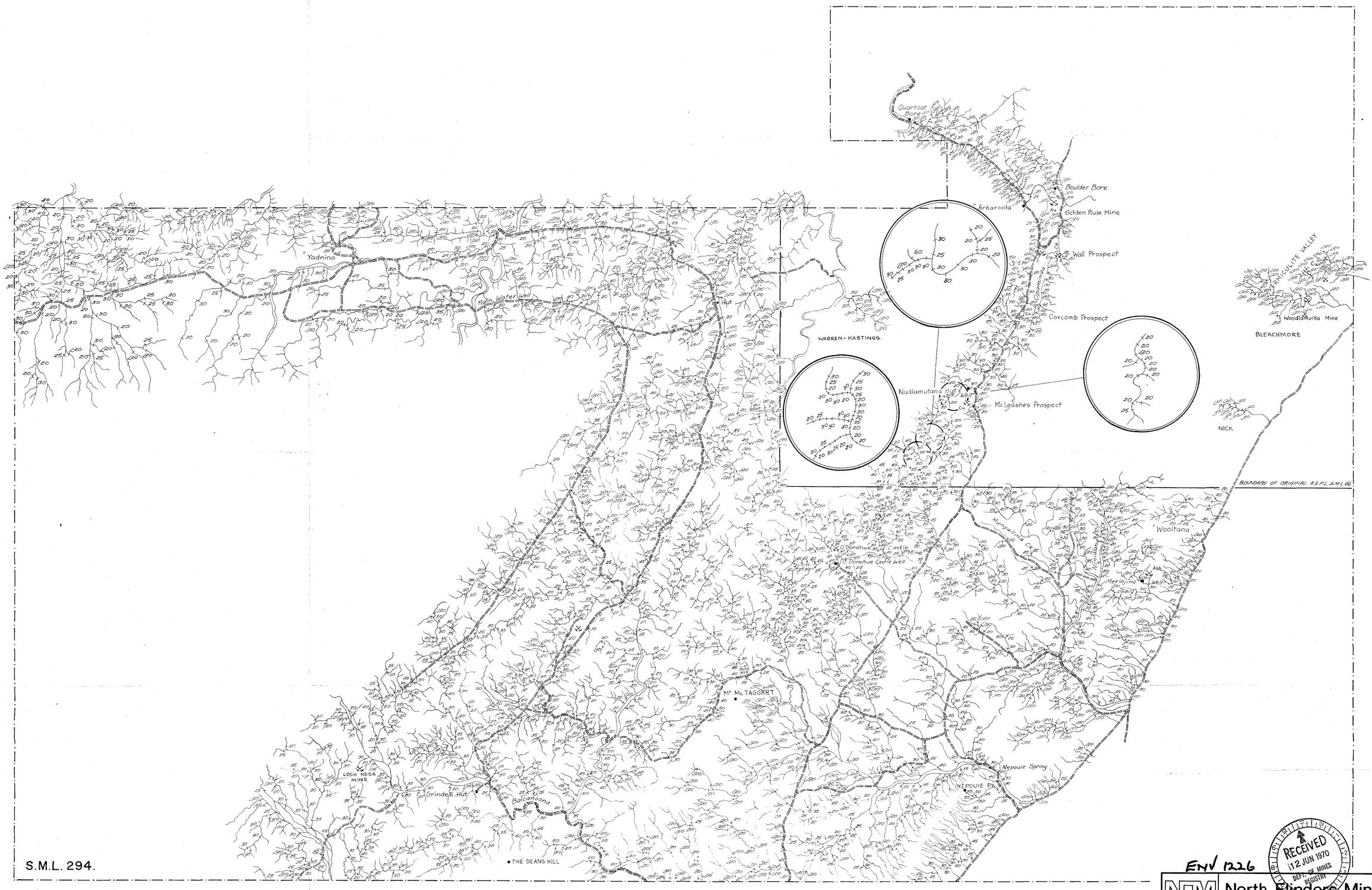
STREAM SEDIMENT RECONNAISSANCE AND FOLLOW UP SURVEY.

SAMPLE LOCATION MAP.

DRN:- I.S.	DATE:- 25·11·69·	SCALE:- 60 chains = 1inch.

ENV 1226 (1) - 3

DWG: G.C. 3013-A



ENV 1226

RECEIVED 12 JUN 1970 DEPT. OF MINES REGISTRY

NfM North Flinders Mines N. L.

WOOLTANA AREA

S.M.L.—294.

STREAM SEDIMENT RECONNAISSANCE AND FOLLOW UP SURVEY.

LEAD RESULTS p.p.m.

DRN:- I.S.	DATE:- 25·11·69·	SCALE:- 60 chains = 1 inch.

Pb. by AAS following hot 25% HNO3 leach. for 1 hour on 0.25 gm sample of minus 80 mesh.

ENLARGMENTS NOT DRAWN TO SCALE

ENV 1226(6)-5 DWG : G.C. 3015—A.

Cu by AAS following hot 25% HNO3 leach. for 1 hour on 0.25 gm sample of minus 80 mesh.

ENLARGMENTS NOT DRAWN TO SCALE

ENV 1226

RECEIVED 12 JUN 1970 DEPT. OF MINES ADELAIDE

North Flinders Mines N.L.

WOOLTANA AREA

S.M.L.—294.

STREAM SEDIMENT RECONNAISSANCE AND FOLLOW UP SURVEY.

COPPER RESULTS p.p.m.

DRN:- I.S.	DATE:- 25·11·69	SCALE:- 60 chains = 1 inch.

Same as 1226 (W)-7

ENV 1226 (R)-4

D.WG: G.C. 3014-A.

McPHAR GEOPHYSICS PTY. LTD.

ENV 1226

RECEIVED 12 JUN 1970 DEPT. OF MINES REGISTRY ADELAIDE

North Flinders Mines N.L.

WOOLTANA AREA

S.M.L.—294.

STREAM SEDIMENT RECONNAISSANCE AND FOLLOW UP SURVEY.

ZINC RESULTS p.p.m.

DRN:- I.S.	DATE:- 25·11·69	SCALE:- 60 chains = 1 inch.

Zn by AAS following hot 25% HNO_3 leach.
for 1 hour on 0.25 gm sample of minus 80 mesh.

ENLARGMENTS NOT DRAWN TO SCALE

ENV 1226(2)-6 DWG: G.C. 3016—A.

REPORT ON

INVESTIGATION OF ZINC ANOMALY

O'DONOHUES CASTLE MINE AREA

S.M.L. 294

Sydney
December, 1969

M.R.W. Garman, B.Sc.(Geol.)
Watts, Griffis & McQuat (Aust.) Pty. Lt

INTRODUCTION

The anomalous zinc area north of O'Donohue's Castle Mine was visited on November 19, 1969, with a view to finding the cause of the zinc anomaly that had been detected, and to determine whether there were any zinc rich beds which may indicate a starting point for further exploration for zinc deposits of the willemite or smithsonite type.

INVESTIGATION OF ZINC ANOMALY

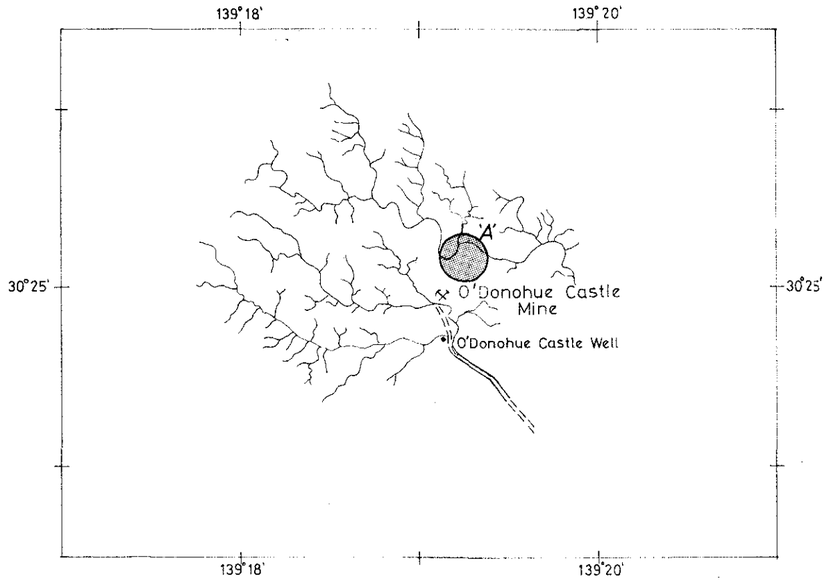
An interesting zinc anomaly had been indicated by a programme of geochemical stream sediment sampling. The anomaly has its southern end at O'Donohue's Castle Mine and extends for approximately three miles in a north-easterly direction along the bedded dolomite sequence, situated stratigraphically above the Wortupa Quartzite. A series of chip samples of the dolomite in the anomalous area was taken in the [illegible] creek immediately north of the Castle Mine, see Drawing No. [illegible]16/20. This sampling showed that there were two zinc rich beds and a third area with high zinc values located very close to a fault. Sample F74 was taken from a dark brown dolomitic rock outcropping in the creek, approximately where the fault, as shown on the Mines Department map, would be expected. Also, alongside this sample location two large rocks, which were probably outcrops were noted to contain veins and cracks with a malachite infilling. The outcrops looked similar to the surface material from O'Donohue's Castle Mine but they are on the wrong side of the hill if they were derived from the mine area. These rocks may indicate that the fault, which starts in the diapir to the west of the mine, bears copper mineralization. This observation would be worth checking on when more work is contemplated for O'Donohue's Castle Mine.

Two samples 78A and 78B are both from rather dark brown dolomitic beds in the sequence. The bed from which 78A was taken is only about 2 feet thick but 78B was taken from a bed about 15 feet thick and this could be most significant if the right situation for concentration of zinc was found. This occurrence may be a situation similar to the zinc rich Cambrian limestone-dolomite sequence which contains willemite.

It is interesting to note that although much older, the rock sequence observed is very similar to the Cambrian sequence, i.e., there is a massive, white quartzite situated stratigraphically below a zinc rich limestone-dolomite sequence although the sequence behind O'Donohue's Castle does contain interbedded shales. This formation, which is the lower un-named member of the

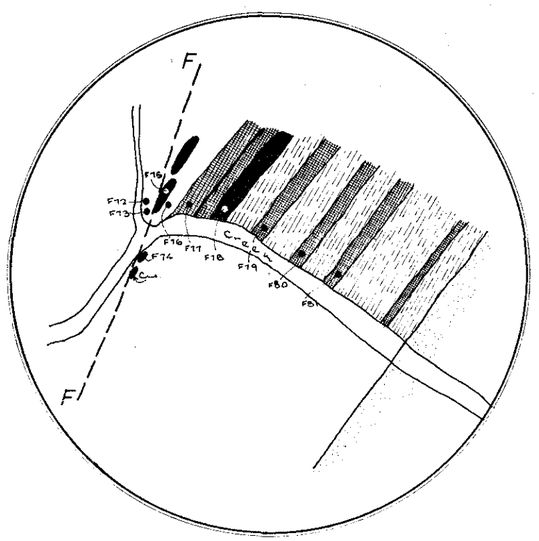
Skillogalee Dolomite, may be worth exploring for concentrations of zinc of the willemite or smithsonite types. If it can be established that this dolomite is zinc rich in other areas a geochemical stream sediment sampling programme over this part of the sequence might lead to the discovery of a concentration of zinc that is sufficiently high to warrant mining.

As this is probably a completely unexplored avenue for the occurrence of zinc mineralization it has unlimited scope and it is recommended that it be followed-up.



LOCALITY SKETCH

Taken from S.A. Dept Mines map - 'Wooltana' - scale: 1" = 60ch.



INSET 'A'

Not to scale

REFERENCE:

- Dark brown dolomite
- Grey dolomite
- Shale
- Wortupa quartzite
- F — — Approximate position of fault
- Cu Copper-malachite in dolomite
- F79 Sample location

Sample No.	Cu ppm	Pb ppm	Zn ppm.
F 72	25	20	85
F 73	30	20	130
F 74	170	30	4500
F 75	25	30	100
F 76	20	35	75
F 77	15	75	100
F 78 A	1400	500	1300
F 78 B	15	40	1300
F 79	45	40	75
F 80	15	120	200
F 81	20	35	100

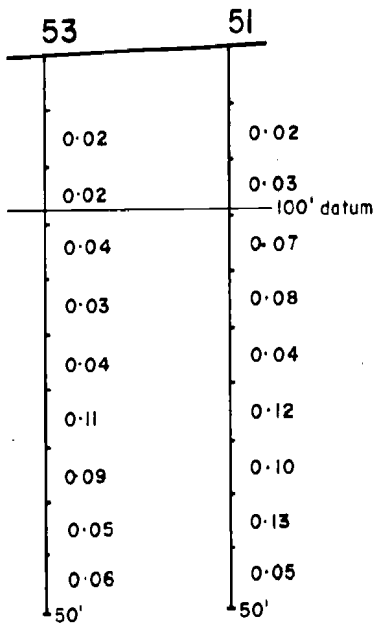
WATTS, GRIFFIS & McOUAT (AUSTRALIA) PTY. LIMITED
CONSULTING GEOLOGISTS & ENGINEERS
1ST FLOOR—56 PITT STREET, SYDNEY

NORTH FLINDERS MINES N. L.

— O'DONOHUE CASTLE MINE AREA —

ZINC ANOMALY INVESTIGATION

SCALE: As shown	DATE: 20.11.69	DRAWING No.: 1610 / 20
DRAWN: WO.	APPROVED:	



North Flinders Mines N. L.

SECTION THROUGH HOLES

53-51

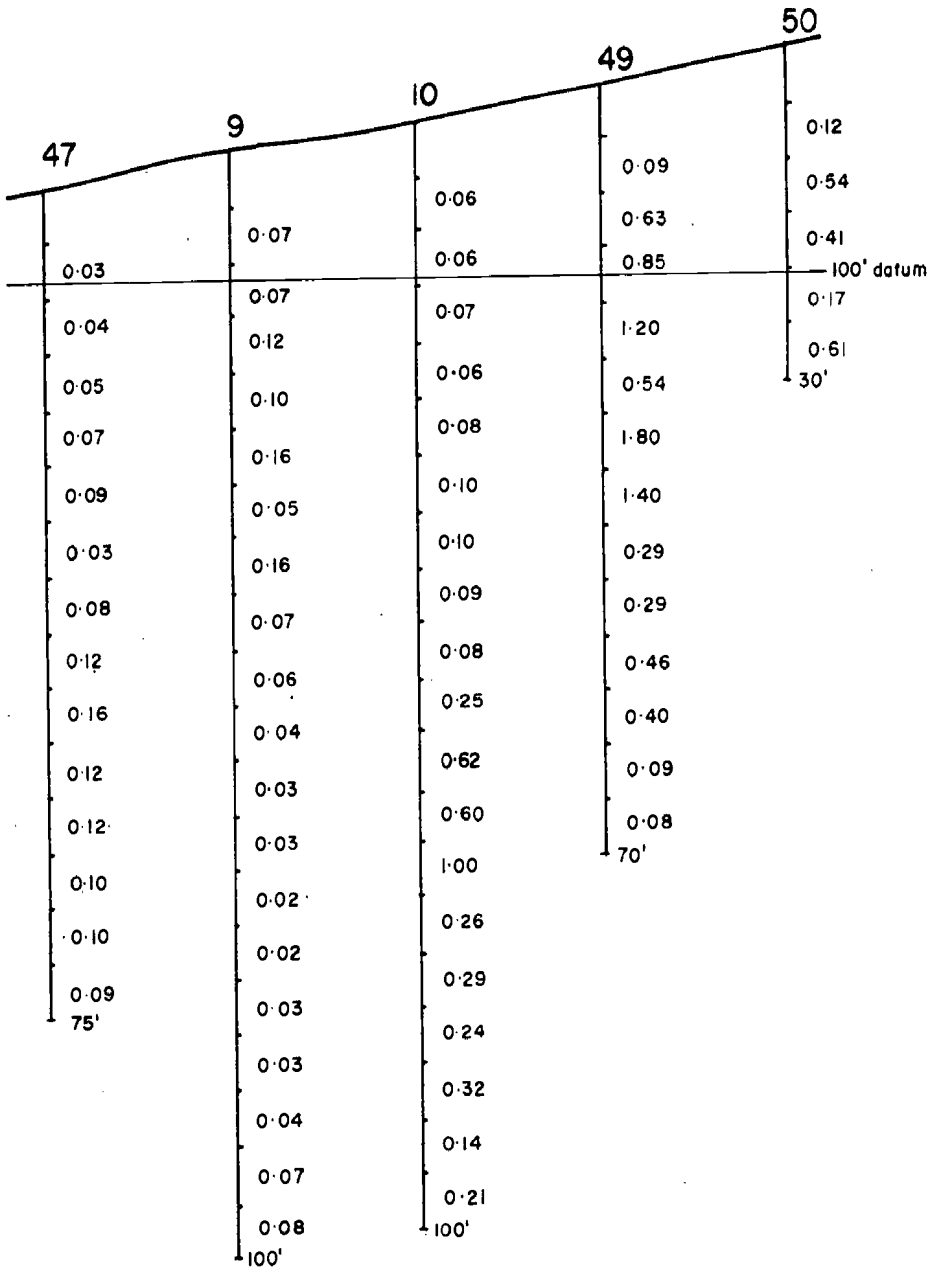
Mc LEASHES COPPER PROSPECT

SML 294

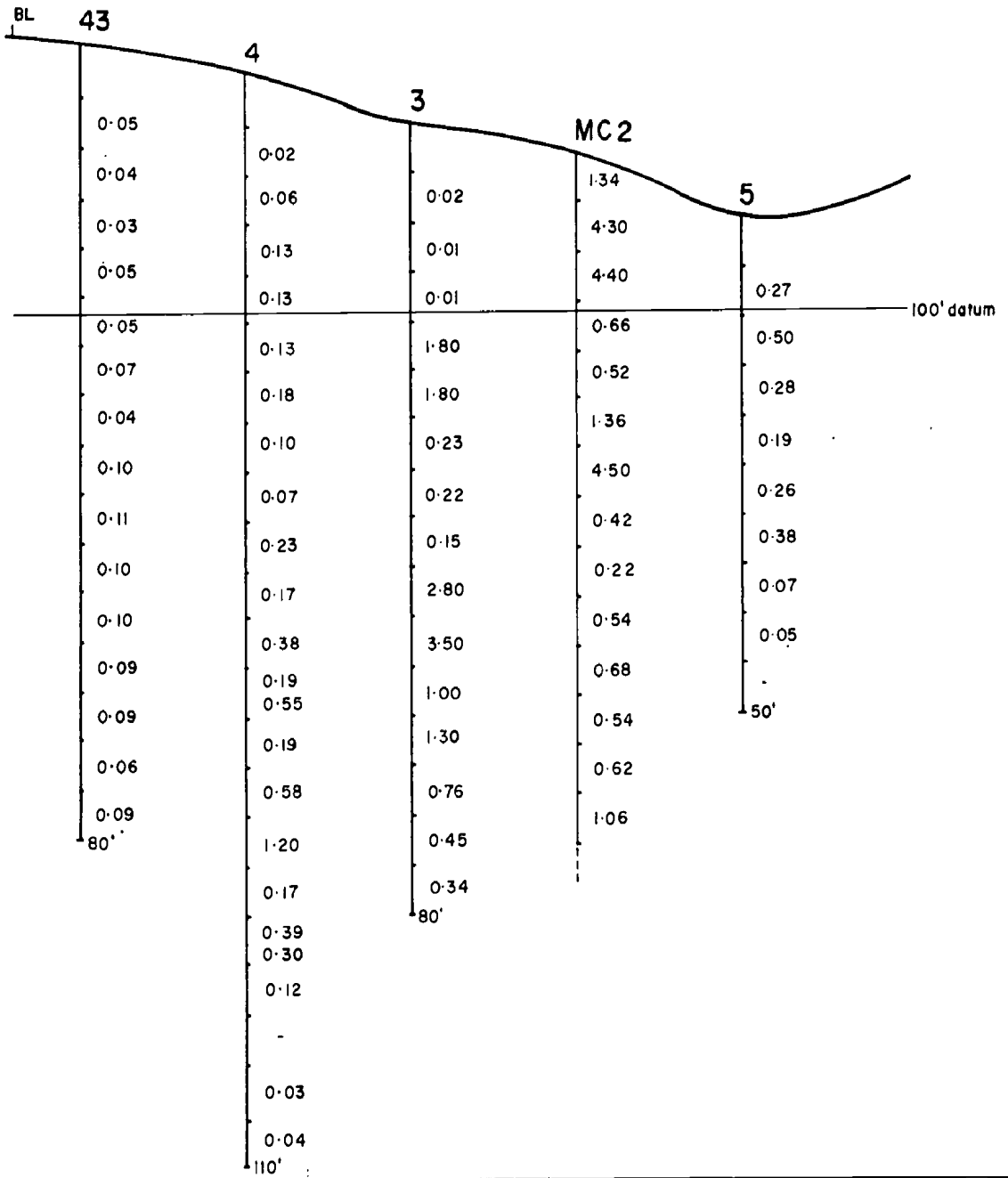
SHOWING

COPPER ASSAYS (%)

DRN: MCC	DATE: FEB 1970	SCALE: 1 INCH = 20 FEET



NFM	North Flinders Mines N. L.
SECTION THROUGH HOLES	
47-9-10-49-50	
Mc LEASHES COPPER PROSPECT	
SML 294	
SHOWING	
COPPER ASSAYS (%)	
DRN:- MCC	DATE:- FEB 1970 / SCALE:- 1 INCH = 20 FEET



North Flinders Mines N. L.

SECTION THROUGH HOLES

43-4-3-MC2-5

Mc LEASHES COPPER PROSPECT

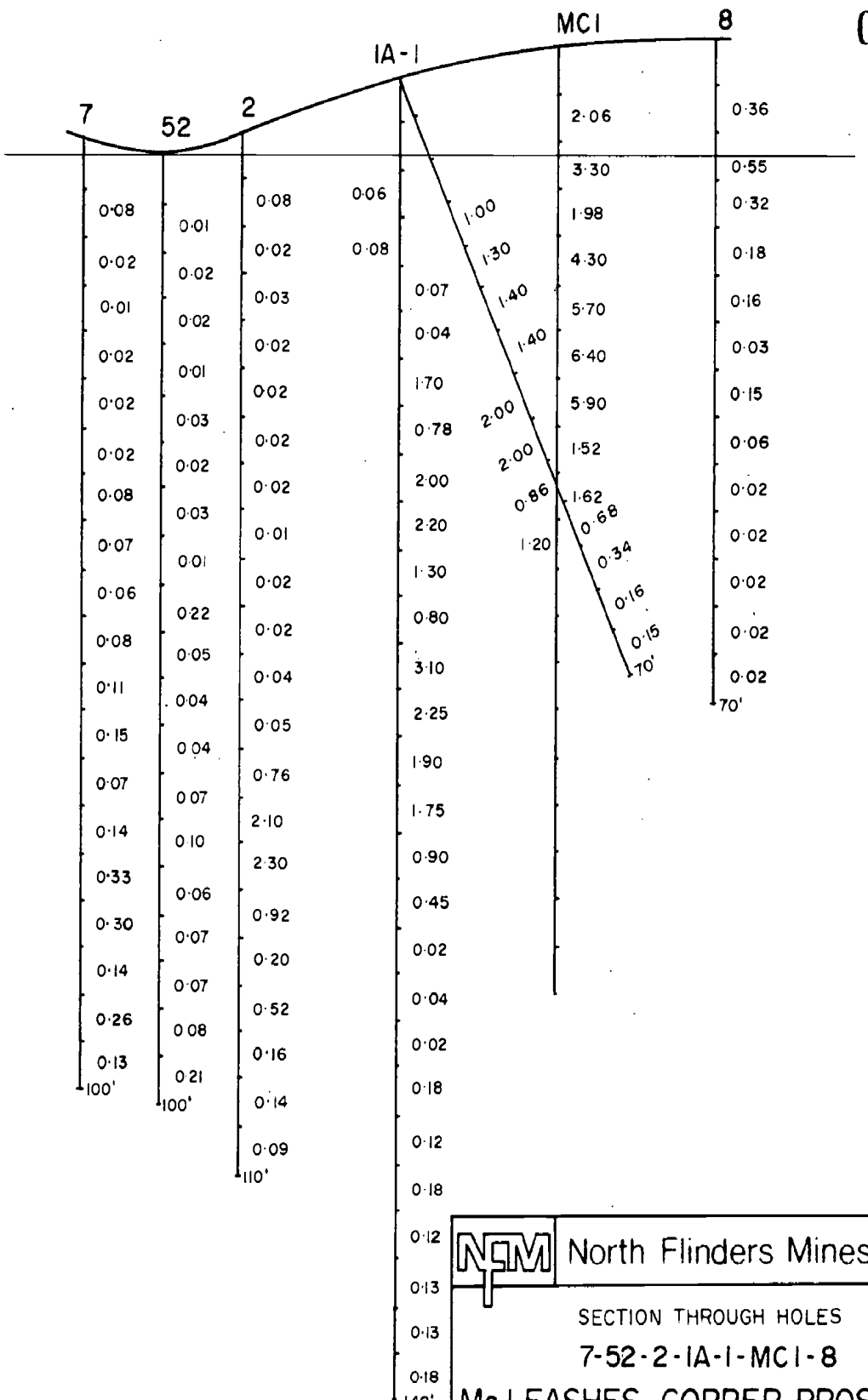
SML 294

SHOWING

COPPER ASSAYS (%)

DRN · MCC	DATE · FEB 1970	SCALE · 1 INCH = 20 FEET

047



North Flinders Mines N. L.

SECTION THROUGH HOLES

7-52-2-IA-1-MC1-8

Mc LEASHES COPPER PROSPECT

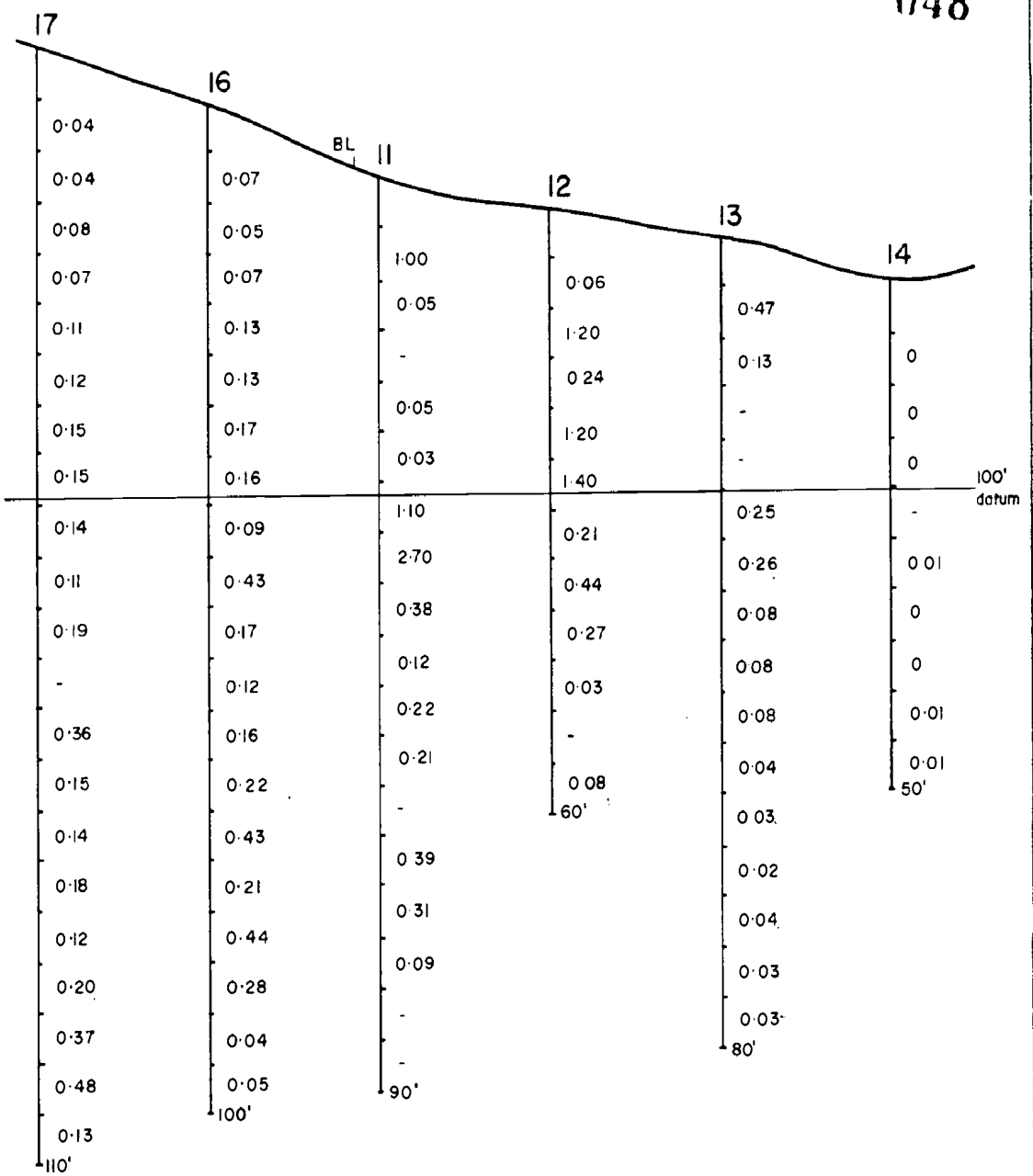
SML 294

SHOWING

COPPER ASSAYS (%)

DRN MCC	DATE FEB 1970	SCALE 1 INCH = 20 FEET

048



North Flinders Mines N. L.

SECTION THROUGH HOLES

17-16-11-12-13-14

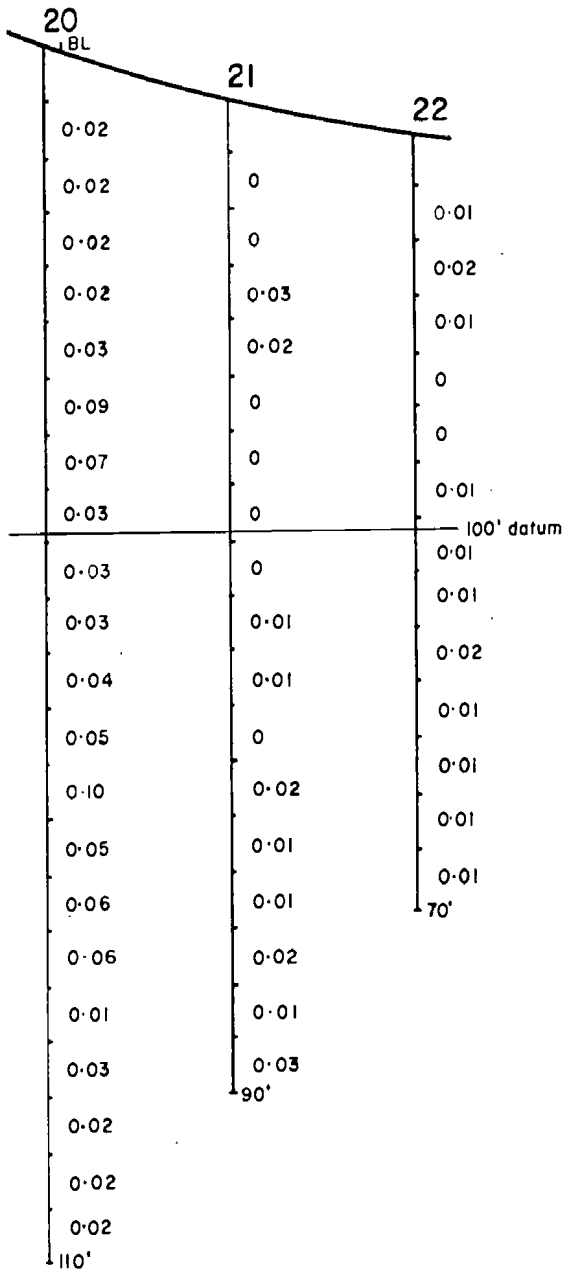
Mc LEASHES COPPER PROSPECT

SML 294

SHOWING

COPPER ASSAYS (%)

DRN MCC	DATE FEB 1970	SCALE 1 INCH = 20 FEET



NFM	North Flinders Mines N. L.
SECTION THROUGH HOLES 20-21-22 Mc LEASHES COPPER PROSPECT SML 294 SHOWING COPPER ASSAYS (%)	
DRN MCC	DATE FEB 1970 / SCALE 1 INCH = 20 FEET

REPORT ON A ROTARY-PERCUSSION DRILLING PROGRAMME -

MAY 1970

McLEASHES COPPER PROSPECT

SML 294 - SOUTH AUSTRALIA

R.B. WILSON.

NORTH FLINDERS MINES N.L.

SEPTEMBER 1970

ACCOMPANYING PLANS

Drawing No.	Title	Scale.
294-4	Map of McLeashes Copper Prospect showing drillhole Locations.	1 inch = 40 feet.
294-11B	Map of Area between O'Donoghue Castle - Pooh Corner and McLeashes Prospect showing geology (I.Pontifex) and I.P. results. Sheet B (Eastern Half)	1 inch = 400 feet.
294-17	McLeashes Copper Prospect Cross Section.16548N.	1 inch = 20 feet.
294-18	McLeashes Copper Prospect Cross Section.16600N.	1 inch = 20 feet.
294-19	McLeashes Copper Prospect Cross Section.16648N	1 inch = 20 feet.
294-20	McLeashes Copper Prospect Cross Section.16752N	1 inch = 20 feet.
294-21	McLeashes Copper Prospect Cross Section.16806N.	1 inch = 20 feet.
294-22	McLeashes Copper Prospect Cross Section.16856N	1 inch = 20 feet.
294-24	McLeashes Copper Prospect Cross Section.16200N	1 inch = 100 feet.
294-25	McLeashes Copper Prospect Cross Section.16600N	1 inch = 100feet.

C O N T E N T S

REPORT ON A ROTARY-PERCUSSION DRILLING PROGRAMME

McLEASHES COPPER PROSPECT, S.H.L. 294 - SOUTH AUSTRALIA

MAY, 1970

I. INTRODUCTION

McLeashes Copper Prospect is located adjacent to the Paralana Fault some 4 miles south of Arkaroola Homestead, portion of which serves as a base camp for field operations of North Flinders Mines N.L. Arkaroola Homestead, may be reached by graded roads, some 80 miles east from Copley or 100 miles northeast from Blinman.

A rotary-percussion drilling programme of 8 holes totalling 1530 feet was carried out in the McLeashes area during May 1970. Seven of the holes (NFMc 1 to NFMc 7) were designed to further explore a zone of secondary copper mineralisation which had been indicated from a previous waggon drilling programme. Hole NFMc 8 was drilled as a preliminary test of a zone of Induced Polorisation anomalies located near the top of the Blue Mine Conglomerate some 1000 feet west of the McLeashes Prospect.

II. REGIONAL GEOLOGY

McLeashes Copper Prospect is located in the lowermost beds of the Blue Mine Conglomerate and probably trangresses into the uppermost beds of the Woodbamuka Phyllite, adjacent to the Paralana Fault System.

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The Woodnamoka Phyllite, Blue Mine Conglomerate and the overlying Opaninda Formation, are the upper units of the Callana Beds, which are succeeded above by the Wortupa Quartzite, the basal unit of the Burra Group, all of Proterozoic age. The Burra Group is succeeded and transgressed by glacial sediments of the Yudnamutna Sub-group.

Broadly, these units form the southeastern limb of a southwest plunging syncline whose axis culminates in the rugged Gammon Ranges composed of Pound Sandstone.

The sequence is repeated to the east of the Paralana Fault, a presumably west-dipping complex fault zone, along which several thousand feet of movement has occurred. Numerous lesser faults and irregular diapiric intrusions associated with the Paralana Fault, combine to create a structurally complex area.

The Blue Mine Conglomerate in the area consists essentially of relatively soft, argillaceous and ferruginous sandstone below with conglomerate, arkose and sandstone above. Heavy mineral laminations and slaty to silty interbeds are common throughout.

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III. PREVIOUS INVESTIGATIONS

Two rotary-percussion holes were drilled in 1968 by Geosurveys of Australia Pty. Ltd. Interesting values, ranging from 0.5% to greater than 6% Copper, were obtained from two intersections of a zone of secondary copper mineralisation which had been indicated at the surface by several old collapsed workings.

In late 1969 a programme of waggon-drilling using an airtrack-type rig was carried-out by Investigation Drilling Limited for North Flinders Mines N .L. This programme comprised 26 holes for a total of 2155 feet of drilling. Copper values (A.A.S. analysis) were considerably lower than those obtained by Geosurveys. A west--dipping lens of secondary copper mineralisation some 250 feet in length and averaging 20 feet in thickness was outlined by this programme. Indicated ore-reserves of between 40,000 and 50,000 tons with a grade of near 1.0% copper were calculated from the results of this programme. No systematic geological field logging of drill-cuttings was employed for this programme.

Regional stream-sediment geochemical results, covering most of SML 294, showed a marked correlation of anomalous copper values with the Blue Mine Conglomerate, which outcrops as part of the eastern limb of a major broad syncline in close proximity to the Paralana Fault. Later follow-up work by S. Carthew, M. Garman and I. Pontifex has located numerous surface showings of secondary copper minerals closely related to the Blue Mine Conglomerate.

The McLeashes and O'Donoghues Castle areas, where outcropping secondary copper mineralisation is associated with the Blue Mine Conglomerate, were selected for I.P. coverage. At McLeashes Prospect,

...../4

I.P. coverage at various electrode-spacings, was run on survey lines 200' apart to give full coverage to the Blue Mine Conglomerate, Opaminda Formation, Wortupa Quartzite and the Paralana Fault System. Narrow zones of possible to probable I.P. anomalies were located on two lines across the McLeashes Prospect. Stronger I.P. anomalies are associated with the upper members of the Blue Mine Conglomerate and Wortupa Quartzite, some 1000 feet and 2400 feet respectively to the west of McLeashes Prospect.

Soil sampling along the 16,200N line indicated anomalous copper and zinc values associated with the upper beds of the Blue Mine Conglomerate and Wortupa Quartzite respectively.

From these results, a limited drilling programme was designed to :-

1) Further test any possible down-dip projections of the previously delineated secondary copper mineralisation at McLeashes Prospect

2) To test the I.P. anomaly at the top of the Blue Mine Conglomerate.

3) To test the I.P. and associated copper-zinc anomalies near the top of the Wortupa Quartzite. In this case, owing to the extremely rugged nature of the terrain, the limited time available and the limited capacity of the D4 - bulldozer, the construction of access roads could not be completed while the drill was in the area.

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IV. ROTARY-PERCUSSION DRILLING PROGRAMME

A. McLeashes Copper Prospect

As stated, seven rotary-percussion holes totalling 1230 feet were drilled as a follow-up test programme to an earlier programme of relatively shallow percussion holes (Air-track). This programme was carried out with an Ingersoll-Rand down-the-hole-hammer "Drillmaster" rig by Boring Enterprises Pty. Limited. Complete samples were collected at 5 feet intervals and split into a final sample of approximately 8-lb. weight by a rotary-splitter. Small grab samples from the reject - heaps were submitted to McPhar Geophysics for rapid A.A.S. analysis. From the results, full samples (8-lb) of "mineralized-zones" were re-submitted to AMDEL for copper analysis (scheme F1). Details of the holes are shown in APPENDIX I. while APPENDIX II consists of lithologic descriptions and assay data.

Holes NFMc 1 to 5 inclusively were designed to test any possible down-dip projections of the previously outlined west-dipping lens of secondary copper mineralization. Holes NFMc 6 and 7 were shallow holes located near the Paralana Fault to "round-off" the northern margin of the mineralized zone.

Because of scree-cover in the area, there is some doubt as to whether the mineralized zone occurs in the lowermost beds of the Blue Mine Conglomerate or in the uppermost portion of the underlying Woodndmoka Phyllite. In most cases, the lithologies penetrated comprised relatively soft interbedded kaolinitic sandstone with some harder quartzite bands and clayey to silty interbeds. Below this was generally a relatively soft fine-grained to medium-grained sandstone - quartzite with both disseminated hematite and heavy mineral bands (? hematite), which is characteristic of the lowermost beds of the Blue Mine Conglomerate, further to the south in the O'Donoghue's Castle

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area. Slight traces of pyrite were apparent in a few samples.

Assay results were generally disappointing, the highest value recorded being 0.65% Cu. in hole N.F.Mc. 4 (65-70'). Zones of anomalous copper values in these holes can generally be correlated as a down-dip projection of the mineralised zone, although in all holes, grades are well below those of economic interest.

Holes NFMc 6 and 7 (Section 16,856N), close to the Paralana Fault, encountered low to moderate copper values (visible malachite) near the northern margin of the mineralized zone. In these holes disseminated malachite occurs both in medium-grained sandstone and in an underlying sticky-clay interval, which probably represents gouge material associated with the Paralana Fault. Brown-Pink dolomite of the Umberatana Group (? Balcanoona Formation) was encountered beneath the Paralana Fault in both of these holes. The disposition of the above lithologies in holes 6 and 7 indicates a westerly dip both for bedding and for the Paralana Fault. The mineralized intervals averaged 35 feet at 0.51% Cu. (5 ft. to 40 ft.) and 20 feet at 0.27% Cu. (0 ft - 20 ft.) in holes NFMc 6 and 7, respectively.

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B. I.P. ANOMALIES

1. BLUE MINE CONGLOMERATE

A consistent zone of I.P. anomalies, some 1000 feet to the west of the McLeashes Prospect, was found to correlate with the upper beds of the Blue Mine Conglomerate. While no definite surface copper mineralisation was known in this vicinity a preliminary hole was planned to test the cause of the I.P. anomaly.

This hole (N.P.Mc 8) was drilled to total depth 300 feet on cross-section 16,600N, sited at 1100 W and depressed at 65° easterly. The hole intersected interbedded medium-grained kaolinitic sandstone, quartzite and conglomerate with siltstone-slate interbeds. Pyrite was encountered from 25 to 100 feet with abundant pyrite and some graphite present from 50 to 75 feet depth. No significant copper values were associated with this mineralisation. Traces of malachite were observed from 275 ft. to 280 feet which interval assayed 0.14% copper. Groundwater was not encountered in this hole, while no sulphides were observed below 100 feet.

It would appear that the I.P. anomaly has been at least partly explained by the presence of pyrite - graphite (?) at shallow depths in this hole.

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2. WORTUPA QUARTZITE

Soil and rock-chip sampling along cross-section 16,200N indicated that the topmost 150 feet or so (stratigraphic thickness) of the Wortupa Quartzite is moderately anomalous in copper, while the lowermost 50 feet of the Skillagolee Dolomite is anomalous in zinc.

A consistent strong I.P. anomaly is indicated in the vicinity of 2000 to 2400W on several lines.

Lithologically, the upper portions of the Wortupa Quartzite comprise interbedded quartzite, conglomerate, silty quartzite and silty micaceous slate. (?) Pyritic holomorphs were observed in several dark slaty bands.

Although the principal cause of the zone of strong I.P. anomalies in this situation is expected to be related to black pyritic slates, the drilling of at least one preliminary scout-hole was planned. However, extremely difficult access conditions and lack of time precluded the drilling of such a test-hole during this programme.

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V. SUMMARY AND CONCLUSIONS

Five rotary-percussion holes were drilled to test possible down-dip extensions of a previously - delineated lens of secondary copper mineralization, known as McLeashes Prospect. Although low copper values generally confirm a westerly dip for the mineralized lens, the grades of mineralization intersected in these deeper holes are far below the level of economic interest.

Two shallow holes which intersected low copper values were drilled to "round off" the mineralized zone to the north.

Previously calculated "indicated ore reserves" for the lens of secondary copper mineralization were not significantly increased by this drilling programme. They remain at between 40,000 and 50,000 tons with a grade of approximately 1% Copper.

One hole, drilled to test the source of I.P. anomalies within the topmost members of the Blue Mine Conglomerate, showed the presence of pyrite and graphite at shallow depths. Later drilling of the equivalent stratigraphic interval in the O'Donoghues Castle area, also produced disappointing results. However the persistent occurrence of surface showings of secondary copper minerals within the Blue Mine Conglomerate, suggests that investigations of this problem and also the zone of related geochemical and I.P. anomalies at the top of the Wortupa Quartzite be continued.

R B Wilson

R.B. Wilson.

NORTH FLINDERS MINES N.L.

SUMMARY OF ROTARY-PERCUSSION DRILLHOLES.

McLEASHES COPPER PROSPECT - SML 294

APPENDIX 1

MAY 1970

Hole No.	COORDS	AZIMUTH-DIP	SAMPLE NOS.	TOTAL DEPTH.
NPMc 1	16809N 020E	Vertical	2526-2566	205
NPMc 2	16752N 00E	Vertical	2567-2606	200
NPMc 3	16543N 033W	Vertical	2607-2636	150
NPMc 4	16641N 043W	Vertical	2637-2706	350
NPMc 5	16587N 083W	Vertical	2707-2746	200
NPMc 6	16871N 117E	Vertical	2747-2761	75
NPMc 7	16872N 178E	Vertical	2762-2771	50
NPMc 8	16,600N 1,100W	Dep: 65° E.	2772-2831	300

APPENDIX II

McLeashes Copper Prospect
Rotary-Percussion Drilling Programme
MAY, 1970

DRILL-LOG FORMS
with
LITHOLOGIC DESCRIPTIONS and
ASSAY DATA.

Note on Assays:-

Column 1 - Represents A.A.S. Analysis following 25% HNO_3 Leach on small 'grab' sample. Values in p.p.m. Analysis by McPhar Geophysics Pty. Ltd.

Column 2 - Check assay on accurate split 6-lb. sample - AMDEL Code F1 Analysis.

NORTH FLINDERS MINES N. L.

DRILL LOG FORM

PROJECT McLeashes

Drill Hole No. NFMc 1 Sheet 1 of 2 Grid Co-ords 16809N 020E

Azimuth _____ Dip Vertical

Type of Drill Drillmaster

Driller P. Nitschke Collar Datum _____

Logged by B. Wilson. Depth of Hole 205 ft.

Commenced 18.5.70 Completed 18.5.70

Depth Water Struck DRY ft. G. P. H. _____

Depth Water Struck _____ ft. G. P. H. _____

Depth Water Struck _____ ft. G. P. H. _____

% Core Recovered _____ Length of Casing in hole _____ ft.

LOG				ASSAYS		
From (ft)	To (ft)	Sample No	Lithology	ppm Paas	ppm Cu.	
0	5	2526	-	160		
5	10	2527	-	190		
10	15	2528	Yell-brown kaolinitic sst. (?dolomitic?)	170		
15	20	29	" " " " thin calcite veins & manganese	480		
20	25	2530	Ditto. c few modules MnO2	950		
25	30	31	ditto. c some MnO2	880		
30	35	32	Ditto.	930		
35	40	33	Ditto - very kaolinitic	630		
40	45	34	Ditto.	670		
45	50	35	Ditto. - must be yellow clayey partings.	1300		
50	55	36	Ditto. c some soft yellow clay (Kaolinitic ?)	830		
55	60	37	Ditto. c abundant Mn-coatings	660		
60	65	38	Ditto. c Mn	590		
65	70	39	Ditto. c Mn. Tr. Qtz.	400		
70	75	2540	Ditto. c Mn & 5% Grey Silstone	380		
75	80	41	Ditto. above " " "	440		
80	85	42	Ditto. Yellow-brown feldsp. Mg. sst, kaolinitic c some Mn.	280		
85	90	43	Ditto. - Tr. Grey siltstone	880		
90	95	44	Ditto. c some red ocheous clay (5-10%)	670		
95	100	45	All yell-brown fy-/? sst - kaolinitic	440		
100	105	46	Ditto. above	810		

NORTH FLINDERS MINES N. L. DRILL LOG FORM CONTINUATION SHEET

Drill Hole No. NFMc 1 Sheet 2 of 2

Project McLEASHES

LOG				ASSAYS	
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu.
105	110	2547	Ditto. above	1300	
110	115	2548	Ditto. above c some Mn02	1200	
115	120	2549	Ditto. " " "	630	
120	125	2550	Ditto. " " "	800	
125	130	2551	Ditto. c Tr. fg.sst + hematite. quartzite.	540	
130	135	2552	Ditto	680	
135	140	2553	Ditto - Tr. grey slate	560	
140	145	2554	Ditto c 30% Dark grey fg. sst.	2000	2400
145	150	2555	Mainly dark grey fine gr. Kaolin sst c hematite. Tr. grey sl/st	3800	4300
150	155	2556	Ditto. above Tr. grey silst.	1400	1800
155	160	2557	Ditto. above	1100	1400
160	165	2558	Ditto - fg - ? dark sst.	1700	2000
165	170	2559	Ditto " " "	490	
170	175	2560	Ditto " " "	300	
175	180	2561	Blue-grey dark kaolinitic sst c hematite grain	560	
180	185	2562	As above - dark grey micaceous & hematite sst	440	
185	190	2563	As above c brown sst.	1700	
190	195	2564	As above " "	2000	
195	200	2565	V.hard light brown hematite quartzite	630	
200	205	2566	Ditto. above	550	
			T.D. 205'		

NORTH FLINDERS MINES N. L.

DRILL LOG FORM

PROJECT McLEASHES

Drill Hole No. NFMc 2 Sheet 1 of 2 Grid Co-ords 16752 00E

Azimuth _____ Dip Vertical.

Type of Drill Drillmaster

Driller P. Nitschke Collar Datum _____

Logged by _____ Depth of Hole 200 ft.

Commenced 18.5.70 Completed 18.5.70

Depth Water Struck DRY ft. G. P. H. _____

Depth Water Struck _____ ft. G. P. H. _____

Depth Water Struck _____ ft. G. P. H. _____

% Core Recovered _____ Length of Casing in hole _____ ft.

LOG				ASSAYS		
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu	%
0	5	2567	-	75		3
5	10	2568	White kaolinitic sst. c̄ Tr.white silstone	55		3
10	15	9	Yell-white kaolin, med.gr. sst c̄ some white sst.	70		4
15	20	2570	Yell-brown qte-sst.	100		5
20	25	1	Yell-brown to white kaolin sst c some Fe staining	100		5
25	30	2	Ditto	410		4
30	35	3	Ditto. c̄ 5% White silstone	620		4
35	40	4	50% Sst as above. 50% Grey silty fg. sst. Some Fe, Mn.	380		5
40	45	5	20% Grey-black silty fg. sst. as above. 80% Yellow-white Mg.	580		5
45	50	6	Brown Kaolin Qte. 30% manganese oxides staining			
			+ pink Fe. stain.	500		4
50	55	7	Ditto.above. 30% Heavily Mn - stained	1100		5
55	60	8	Brown fairly hard Kaolin sst - qte c̄ 20% Mn-stained.	730		4
60	65	9	Ditto. above	800		4
65	70	2580	Ditto. ? Tr. Pyrite	740		4
70	75	1	Brown siliceous sst - qte. c̄ MnO2 Fe. Staining	920		4
75	80	2	Ditto. c̄ some white qtz.Tr.White Slst.	950	1800	4
80	85	3	Ditto. above - some clay.	1100	2200	5
85	90	4	Ditto. above	1200	2300	4
90	95	5	Ditto. above; white quartzite	1400	2100	4
95	100	6	Ditto. above, some white qte & clay	1600	2900	4

NORTH FLINDERS MINES N. L. DRILL LOG FORM CONTINUATION SHEET

Drill Hole No. NFMc 2 Sheet 2 of 2

Project McLEASHES

LOG				ASSAYS		
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu	
100	105	2587	Ditto. above, some white qte & clay	1600	4500	4
105	110	8	Ditto. above	2000	2500	
110	115	9	Ditto. above - brown quartzite.	1300	1900	
115	120	2590	Ditto. above	860		
120	125	1	Ditto. above - brown quartzite & clay	920		
125	130	2	Ditto. above, some darker fine gr.			
			qte + Tr. clay	1000		
130	135	3	Brown yellow sst - qte c̄ some grey finer gr. qte. Tr. Manganese	1000		
135	140	4	Ditto. above	440		
140	145	5	Brown-yellow sst c̄ Tr. white clay	400		
145	150	6	Ditto c̄ 30% White Clay	480		
150	155	7	Brown-yellow clayey sst.	900		
155	160	8	Ditto above c̄ 20% White clay	1200		
160	165	9	Ditto c̄ yellow clay Tr. Manganese	1000		
165	170	2600	Ditto c̄ 10% White clay	730		73
170	175	1	Brown qte. some white clay some MnO_2	450		
175	180	2	All brown hard quartzite (feldspathic) c̄ some MnO_2. Tr. White clay	1200		
180	185	3	Brown qte - some white qte, MnO_2, yellow			
			clay	1200		
185	190	4	Brown hard med.gr. qte. (feldpathic) c̄ some yellow clay. fair amount MnO_2.	940		
190	195	5	Brown quartzite, some grey qte, MnO_2	680		
195	200	6	Brown qte - sst c̄ Tr. white to grey argillaceous qte, more Mn staining	1000		
			T.D. 200			

NORTH FLINDERS MINES N. L.

DRILL LOG FORM

PROJECT McLEASHES

Drill Hole No. NFMc 3 Sheet 1 of 2 Grid Co-ords 16543N 033W

Azimuth _____ Dip Vertical

Type of Drill Drillmaster

Driller P. Nitschke Collar Datum _____

Logged by _____ Depth of Hole 150 ft.

Commenced 19.5.70 Completed 19.5.70

Depth Water Struck DRY ft. G. P. H. _____

Depth Water Struck _____ ft. G. P. H. _____

Depth Water Struck _____ ft. G. P. H. _____

% Core Recovered _____ Length of Casing in hole _____ ft.

LOG				ASSAYS		
From (ft)	To (ft)	Sample No	Lithology	ppm AAS		
0	5	2607	Brown quartzite, manganese-iron stained	220		
5	10	8	Ditto.	200		
10	15	9	Ditto. 5% Greyish silty-quartzite, clay	510		
15	20	10	Ditto. 5-10% Greyish silty quartzite.	930		
20	25	11	Ditto. 15-10% Greyish silty-quartzite, clay	880		
25	30	12	Ditto. Clay	880		
30	35	13	Ditto. Clay	410		
35	40	14	Ditto. Clay	550		
40	45	15	Ditto. 5-10% Greyish silty quartzite + 2% Clay	510		
45	50	16	50% Brown Quartzite. 50% Fg silty Qte. c̄ dark heavy mineral layers			
			Tr. Qtz.	500		
50	55	17	30% Brown argill. Qte. 20% Grey siltstone shale 50% Grey fine gr. qte. c̄ hematite?	440		
55	60	18	60% Yell-brown arkose qte. 40% Grey-silty fine gr. qte. c̄ heavy			
			mineral layers.	590		
60	65	19	Ditto. above - c̄ Tr. White Clay	210		
65	70	2620	10% Brown qte. 40% White Clay 40% Grey fg. arg. qte.	460		
70	75	21	50% Dark grey fg. arg. qte. 20% White feldsp. qte. 30% Grey-white Clay.	700		
75	80	2	5% Brown Qte. 50% Arg. 40% Grey silty qte.	850		
80	85	3	30% Grey fg. qte. as above. 70% Sandy yellow-grey clay.	580		
85	90	4	10% Brown Qte. 30% White-Grey gritty clay 60% Grey silty qte.	420		
90	95	5	45% Grey silty qte (fg)			
			55% Grey-white gritty clay.	450		

NORTH FLINDERS MINES N. L. DRILL LOG FORM CONTINUATION SHEET

Drill Hole No. NFMc 3 Sheet 2 of 2

Project McLEASHES

LOG				ASSAYS		
From (ft)	To (ft)	Sample No	Lithology	ppm AAS		
95	100	2626	15% Brown Qte. 35% Grey silty qte-sst. 50% Grey-white clay.	650		
100	105	7	80% Gritty clay to argill. sst. 20% Feldsp. sst.	420		
105	110	8	10% Brown Qte. 30% Clay. 60% Silty Grey Qte.	110		
110	115	9	40% Grey argill. fg. sst - qte - silty. 50% Clay - very gritty. 10% Brown qte.	170		
115	120	2630	60% Brown qte. c̄ Fe-Mn. 20% Clay (Gritty) 20% Grey silty sst-silst.	440		
120	125	1	30% Dark Mn - stained fg. qte. 50% Yell-Brown grey sst.-qte.			
			20% White Gritty Clay.	360		
125	130	2	45% Brown Qte. 10% Gritty Clay. 45% Grey silty qte.	280		
130	135	3	Hard grey-pink qte c̄ some clay	220		
135	140	4	50% Brown-pink hard qte. 10% Clay 40% Grey finer grained Qte c̄ Heavy Min. layers	210		
140	145	5	50% Brwon qte. 20% Gritty Clay. 30% Grey silty qte.	220		
145	150	6	20% Brown qte. as above. 80% Very argillac. & clayey white-grey fg. sst.	160		
			TD 150'			

NORTH FLINDERS MINES N. L.

DRILL LOG FORM

PROJECT McLEASHES

Drill Hole No. NFMc 4 Sheet 1 of 3 Grid Co-ords 16641 N 043 W

Azimuth _____ Dip Vertical

Type of Drill Drillmaster.

Driller G. Russell Collar Datum _____

Logged by _____ Depth of Hole 350 ft.

Commenced _____ Completed May 1970

Depth Water Struck DRY ft. G. P. H. _____

Depth Water Struck _____ ft. G. P. H. _____

Depth Water Struck _____ ft. G. P. H. _____

% Core Recovered _____ Length of Casing in hole _____ ft.

LOG				ASSAYS	
From (ft)	To (ft)	Sample No	Lithology	ppm AAs	ppm Cu
0	5	2637	Red qte, some Mn Staining.	390	
5	10	8	Brownish - buff qte.	340	
10	15	9	95% Brown Qte. 5% Clay.	120	
15	20	2640	40% Brown hard qte. 60% Soft grey argill. laminated qte.	560	
20	25	1	60% Brown hard qte. 35% Grey silty argill. sst. 5% Clay.	600	
25	30	2	All brown hard qte.	300	
30	35	3	95% Brown hard qte c̄ tr. chlorite on joints. 5% Grey-green sst.	300	
35	40	4	80% Brown hard qte. 20% Chloritic softer qte.	340	
40	45	5	Mainly red-brown hard qte.	500	
45	50	6	Hard brown qte - ? Tr. v.fine dissem pyrite		
			c̄ Speck ? Chalco.	800	
50	55	7	Ditto. above Tr.v.fine Pyrite?	1300	1800
55	60	8	40% Brown qte as above. 50% Grey finer gr. argillaceous sst. 10% Clay.	3100	3400
60	65	9	30% Brown hard qte. 10% White clay. 60% Grey softer fg. argillac. Sst.	2600	3500
65	70	2650	Very soft dark grey, micaceous (chloritic) sst. Some Clayey patches	4800	6500
70	75	1	Light to dark grey fairly micaceous & feldspathic sst. Fairly hard c̄ hematite	2800	4300
75	80	2	Ditto. fairly micaceous c̄ hematite	3000	4200
80	85	3	50% As above. 50% Dark red-brown fairly hard qte. Some hematite	3100	3500
85	90	4	Dark grey-green feldsp.sst (micaceous) as above - some hematite	3700	4200
90	95	5	60% Grey green micaceous sst - qte as above 40% Brown hard qte c̄ hematite	1600	2000
95	100	6	35% Hard brown qte.as above. 20% Grey-		
			green slate. 45% Grey-green softer sst. as above.	1800	3900

NORTH FLINDERS MINES N. L. DRILL LOG FORM CONTINUATION SHEET

Drill Hole No. NFMc 4 Sheet 2 of 3

Project McLEASHES

LOG				ASSAYS	
From (ft)	To (ft)	Sample No	Lithology	PPM AAS	PPM Cu
100	105	2657	70% Grey-green sst. as above. 30% Hard brown qte as above.	2800	5100
105	110	8	50% Hard brown qte. as above. 50% Grey-green softer sst. as above.	3600	5100
110	115	9	50% Grey-green feldsp. sst. as above. 50% Light brown limonitic gritty soft sst.	2600	3400
115	120	2660	10% Grey feldsp.sst as above. 10% Brown shale or claystone. 80% Light brown sst. - some	2400	3300
			Cg. Soft gritty. some fg. hard micaceous.		
120	125	1	70% Light brown limonitic sst. as above. 30% Light grey siltstone - slate.	1500	2200
125	130	2	70% Light brown limonitic qte.as above. 30% Grey softer fg-sst. c̄ Tr. grey shale.	1400	2100
130	135	3	30% Light brown grey shale-slate. 20% Grey fg. sst. as above.		
			50% Light brown qte-sst. as above	1000	
135	140	4	60% Light brown qte-sst. 20% Light brown shale-silst. 20% Grey sst-shale.	1000	
140	145	5	80% Light brown qte-sst. Tr.Grey sst. 20% @ " shale-silst.	520	
145	150	6	80% Light brown sst - qte. as above. 20% Grey sst - qte. as above.	1100	
150	155	7	70% Light brown qte-sst. 30% Grey qte - sst.	900	
155	160	8	90% Light brown qte-sst as above - med.gr. 10% Grey sst.	1100	
160	165	9	Ditto. above	1100	
165	170	2670	80% Qte - sst. as above. 20% Grey sst & grey silty shale	1000	
170	175	1	90% Yell-brown qte. sst. as above. 10% Blue-grey sst - siltstone.	1100	
175	180	2	60% sst. as above. 40% Yellow-grey shale.	1100	
180	185	3	50% Sst. as above. 50% Soft, puggy shale as above.	700	
185	190	4	80% Brown to pink - red sst. as above. 20% Soft white clay-shale	400	
190	195	5	20% Brown sst-qte as above. 60% White sticky gritty clay. 20% Grey silts-sst		
			c̄ heavy mineral bands.	450	
195	200	6	Brown-grey stickly sandy clay.	750	
200	205	7	Ditto. c̄ some sst.	400	
205	210	8	Mainly white-blue-grey clay & soft shale with c̄ some harder sst.	300	
210	215	9	50% Weathered clay-shale. 50% Sst.	500	
215	220	2680	Ditto.	400	
220	225	1	70% Soft argill. sst. 30% Soft sticky clay.	200	
225	230	2	Ditto.	150	
230	235	3	Ditto.	100	
235	240	4	Mainly argillaceous sst. c̄ clayey interbeds.	80	
240	245	5	Mainly argill.sst c̄ some white shaley clay.	160	

NORTH FLINDERS MINES N. L. DRILL LOG FORM CONTINUATION SHEET

Drill Hole No. NFMc 4 Sheet 3 of 3

Project McLEASHES.

LOG				ASSAYS		
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu	
245	250	2686	Mainly white-pink kaolinitic sst c 5% Grey argill. mic. sst + 1)% White shale.	100		
250	255	755	As above.	70		
255	260	8	Mainly white-pink clayey sst-qte c some hematite grains disseminated throughout			
			& heavy mineral layers	60		
260	265	9	Ditto. above.	40		
265	270	2690	Mainly fg.-mg. sst-qte as above 10% White clayey shale	75		
270	275	1	Mainly pink-brown, some grey fg-mg sst, feldspathic as above c few heavy mineral			
			bands. 10-15% Grey shale.	60		
275	280	2	Ditto. above c some micaceous sst. + 30-40% grey siltst. - shale	85		
280	285	3	Ditto. above.	65		
285	290	4	Ditto. above	45		
290	295	5	Ditto. above + some grey sst-siltst.	40		
295	300	6	Ditto. above + 15-20% blue-grey siltst.	50		
300	305	7	Ditto. above.	55		
305	310	8	Ditto. above.	70		
310	315	9	50% Pink mg-fg sst, argillaceous as above. 50% Grey fine gr-sst. & siltst.	65		
315	320	2700	Ditto. above.	35		
320	325	1	Mainly pink-white argill.qte.	40		
325	330	2	Pink to grey fairly argillaceous qte c lot of clayey coatings. Fair amount			
			of hematite grains	50		
330	335	3	Ditto above - some fg grey sst & 15% Grey shale.	45		
335	340	4	Mainly pinkwhite argill.sst as above. Some clay.	35		
340	345	5	20% Grey shale. 40% White-pink argillaceous sst. 40% Grey sst.	190		
345	350	6	50% Qte. as above. 50% Brown sticky clay.	430		
			T.D. 350'			

NORTH FLINDERS MINES N. L.

DRILL LOG FORM

PROJECT McLEASHES

Drill Hole No. NFMc 5 Sheet 1 of 2 Grid Co-ords 16587N 083W

Azimuth _____ Dip Vertical

Type of Drill Drillmaster

Driller G. Russell Collar Datum _____

Logged by S.J. Carthew Depth of Hole 200 ft.

Commenced _____ Completed May 1970

Depth Water Struck DRY ft. G. P. H. _____

Depth Water Struck _____ ft. G. P. H. _____

Depth Water Struck _____ ft. G. P. H. _____

% Core Recovered _____ Length of Casing in hole _____ ft.

LOG				ASSAYS		
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu	
0	5	2707	60% Gritty silty quartzite. 35% gritty clay 5% Fe. Mn.	1000		
5	10	8	70% " " " 20% " " 10% " " "	2300		
10	15	9	80% " " " 10% " " 10%Fe. Chert	750		
15	20	2710	90% " " " 5% " " 5% Fe-Mn	290		
20	25	11	50% " " " 45% " " 5% " "	150		
25	30	12	70% Gritty clay 30% hematite Quartzite.	240		
30	35	13	80% " " 15% " " 10% Fe Mn	150		
35	40	14	60% grey silty quartzite. 35% gritty clay 5% hematite Qtz.	180		
40	45	15	60% hematite quartzite 40% gritty clay	240		
45	50	16	40% " " 60% " "	290		
50	55	17	30% " " 70% " "	420		
55	60	18	45% Silty grey Quartzite. 45% hematite quartzite. 10% Gritty Clay	460		
60	65	19	70% " " 5% " " 25% " "	330		
65	70	2720	60% " " 5% " " 35% " "	320		
70	75	1	70% " " 30% Gritty clay with Fe.stain.	420		
75	80	2	70% " " 10% Hematite Quartzite 20% Gritty clay.	800		
80	85	3	70% " " 25% Hematite quartzite 5% Clay	600		
85	90	4	70% " " 5% Hematite quartzite 25% Gritty clay.	380		
90	95	5	80% " " 15% Hematite Quartzite. 5% Gritty Clay	1300	1900	
95	100	6	45% " " 45% " " 10% " "	1100	1500	
100	105	7	70% " " 25% " " 5% " "	1300	1500	

NORTH FLINDERS MINES N. L. DRILL LOG FORM CONTINUATION SHEET

Drill Hole No. NFMc 5

Sheet 2 of 2

Project McLEASHES

LOG				ASSAYS	
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu
105	110	2728	60% Grey silty Qtzite. 35% hematite qtz. 5% Clay	1400	1800
110	115	9	80% Grey silty Quartzite. 15% Hematite Quartzite. 5% Clay.	950	1700
115	120	2730	45% " " 45% " " 10% "	750	1400
120	125	1	60% " " 30% " " 10% Gritty Clay & Qtzite.	1400	2000
125	130	2	60% " " 30% " " 10% Clay	2100	3000
130	135	3	80% " " 15% " " 5% "	540	
135	140	4	70% " " 25% " " 5% "	560	
140	145	5	30% " " 5% " " 5% "		
			60% Brown Qtzite.	450	
145	150	6	85% Brown Qtzite. 15% grey silty Qtzite.	460	
150	155	7	75% " " 20% Grey silty Qtzite. 5% clay	400	
155	160	8	90% " " 9% " " " " 1% "	460	
160	165	9	80% " " 20% " " "	850	
165	170	2740	80% " " 19% " " " 1% clay	600	
170	175	1	30% " " 10% " " " 60% Gritty Clay	450	
175	180	2	20% " " 10% " " " 70% " "	540	
180	185	3	90% Gritty Clay. 10% Brown Qtzite.	490	
185	190	4	90% " " 10% Brown-grey Qtzite.	480	
190	195	5	100% Clay with iron staining	440	
195	200	6	100% Clay with iron staining.	460	
			T.D. 200'		

NORTH FLINDERS MINES N. L.

DRILL LOG FORM

PROJECT McLEASHES

Drill Hole No. NFMc 6 Sheet 1 of 1 Grid Co-ords 16871 N 117 E

Azimuth _____ Dip Vertical

Type of Drill Drillmaster

Driller G. Russell. Collar Datum _____

Logged by _____ Depth of Hole _____ ft.

Commenced _____ Completed May 1970

Depth Water Struck DRY ft. G. P. H. _____

Depth Water Struck _____ ft. G. P. H. _____

Depth Water Struck _____ ft. G. P. H. _____

% Core Recovered _____ Length of Casing in hole _____ ft.

LOG				ASSAYS	
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu
0	5	2747	Scree	1900	1200
5	10	8	Med. gr. sst c̄ Malachite & malachite staining.	4200	5100
10	15	9	Ditto. above c̄ Malachite.	5000	7000
15	20	2750	50% Sst. as above c̄ Malachite. 50% Yellow-brown clay - silstone.	7%	7500
20	25	1	Light grey, some brown-white Mg sst. (Argillaceous) c̄ some Malachite.	3400	3100
25	30	2	Mainly light grey, some brown-white sticky clay c̄ some sst and little Malachite.		
			(?Cavings)	2100	3900
30	35	3	Mainly light brwon clay c̄ some quartzite & Malachite (? Cavings)	3400	5000
35	40	4	Ditto.above - some Malachite (? Cavings)	2800	4100
40	45	5	Ditto. above " " "	1700	2900
45	50	6	50% Clay shale & clay. Tr. Malachite 50% Brown hard dolomite. (Cavings ?)	1400	1900
50	55	7	Mainly brown dolomite, some clay shale	750	1000
55	60	8	Mainly brown-pink fine gr. dense fine gr. dolomite c̄ 50% White Shale.		
			Some Malachite (Cavings ?)	1100	1400
60	65	9	Ditto - mainly brown-pink dolomite	550	
65	70	2760	Ditto.	510	
70	75	1	Still some sst c̄ Malachite Ditto. (? Cavings ?)	340	
			T.D. 75'		

NORTH FLINDERS MINES N. L.

DRILL LOG FORM

PROJECT McLEASHES

Drill Hole No. NFMc 7 Sheet 1 of 1 Grid Co-ords 16872 N 178 E

Azimuth _____ Dip Vertical

Type of Drill Drillmaster

Driller G. Russell Collar Datum _____

Logged by _____ Depth of Hole _____ ft.

Commenced _____ Completed _____

Depth Water Struck _____ ft. G. P. H. _____

Depth Water Struck _____ ft. G. P. H. _____

Depth Water Struck _____ ft. G. P. H. _____

% Core Recovered _____ Length of Casing in hole _____ ft.

LOG				ASSAYS	
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu
0	5	2762	Rubbish.	1300	1500
5	10	3	Grey Pink med. gr. Qte - soft sst c some clay. 30% Brown dolomite	800	2100
	15	4	Mainly as above. sst - some clay, brown dolomite.	2500	4200
	20	5	Mainly green sticky, sandy clay c some sst. & dolomite bands. Tr. Malachite		
			(Where from ??)	1700	2900
	25	6	50% Soft grey sticky, sandy clay or clayey sst. 25% Hard grey argill.sst.		
			25% Yell-brown dolomite.	1400	1800
	30	7	Mainly soft grey very clayey sst. + grey clay-shale. c 10% Brown dolomite.	500	900
	35	8	60% Sandy Clay or clayey sst. Tr. Malachite (Cavings) 40% Brown dolomite.	1200	1600
	40	9	60% Sandy clay or clayey sst. Tr. Malachite(cavings) 40% Brown dolomite.	1400	1800
	45	2770	As above	340	
	50	1	60% Brown dolimite as above. 40% Clay c sst. Tr. Malachite (Cavings??)	220	
			T.D. 50 '		

NORTH FLINDERS MINES N. L.

DRILL LOG FORM

PROJECT McLEASHES

Drill Hole No. NFMc 8 Sheet 1 of 3 Grid Co-ords 16600N 1100W

Azimuth 090° Dip Depressed 65° E.

Type of Drill Drillmaster

Driller G. Russell Collar Datum

Logged by R.B.Wilson. Depth of Hole 300 ft.

Commenced Completed May 1970

Depth Water Struck DRY ft. G. P. H.

Depth Water Struck ft. G. P. H.

Depth Water Struck ft. G. P. H.

% Core Recovered Length of Casing in hole ft.

LOG				ASSAYS		
From (ft)	To (ft)	Sample No	Lithology	PPM AAS	PPM Cu	
0	5	2772	Rubbish	20		
	10	3	50% Dark grey micaceous siltstone 50% White - grey fg. mic. sst.	15		
	15	4	Ditto.	20		
	20	5	70% Dark grey-black mic. silts-fg.sst. 30% White-grey mg. sst.	10		
	25	6	60% Slate-silst- as above. 40% Pink-grey med.gr. kaolinitic sst.	10		
	30	7	50% Sst. as above. 50% Slate-silst. - as above. Tr. Pyrite.	15		
	35	8	60% Sst. as above. med. gr. micaceous 40% light buff-grey slate-silst.	10		
	40	9	Mainly dark grey gritty feldsp. mic.sst. c Tr. Pyrite. Some dark silty slate.	10		
45	45	2780	70% Brown & grey sst. as above. 30% Silty slate as above. ? Tr. Pyrite.	15		
	50	1	50% Black mic. siltst.-slate. 10% light Brown soft shale. Tr. Qtz. ? Tr. Pyrite.			
			40% Light to dark black sst. as above.	5		
	55	2	As above - abundant Pyrite.			
			10% Qtz c abundant Pyrite.	25		
	60	3	40% Slst. as above. 10% White Qtz -abundant. 50% Sst " " Scum on Water,? Graphite.	50		
	65	4	40% Fine gr. dark sst - siltst. 10% Qtz. 50% Light grey gritty sst - qte-weathered			
			Pyrite	35		
	70	5	Ditto above - Cg. Conflomeratic sst.very weathered - light brown. Less Pyrite.	60		
	75	6	Mainly dark grey fine gr. sst - silst. Finely dissem. Pyrite throughout.	45		
	80	7	50% Dark grey siltst.-sst. as above. 50% Red brown weathered gritty sst.			
			Little Pyrite	700	0.12%	
	85	8	80% Dark grey siltst.-sst as above. 20% Light weathered gritty sst.as above			
			Tr. Pyrite	50		

NORTH FLINDERS MINES N. L. DRILL LOG FORM CONTINUATION SHEE

Drill Hole No. NFMc 8 Sheet 2 of 3

Project McLEASHES

LOG				ASSAYS	
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu
85	90	2789	All dark grey fg. sst - siltst. - only Tr. Pyrite.	10	
	95	2790	As above-siltst-slate- fg. sst. Tr.Pyrite?	10	
	100	1	70% As above, lighter grey sl-fg sst. 30% Brown coarser weathered sst.	10	
	105	2	80% Mainly light-dark grey fg-mg.sst (? Pyrite) 20% Dark slate - siltst.	1000	30
	110	3	70% Dark grey mic. sst. 30% Dark slate - siltst.	230	30
	115	4	60% Light grey-pink mg. mic. sst. 40% sst-silst - dark grey	35	
	120	5	40% Light Grey-pink sst. as above. 60% Dark grey siltst -sst as above.	30	
	125	6	50% Dark grey slate-siltst. 50% Brown Fe-stained clayey slate-siltst.	25	
	130	7	60% Grey slate-siltst. 40% Brown fe-stained weathered Mg. impure sst.	25	
	135	8	Mainly grey, some pink, fg-mg micaceous sst.	10	
	140	9	70% Grey to pink mic. sst. as above. 30% Grey shale-siltst.	10	
	145		Ditto.above.	5	
	150		As above	5	
	155		As above c some yellow clay and lot of lamanitic staining.	5	
	160		Mainly grey silty mic. fg sst - some grey slate.	10	
	165		50% Grey-pink silty mic. qte-sst. 50% Grey slate-silts. ? Tr. Pyrite.	5	
	170		Ditto. above	5	
	175		50% Brown Mg. feldsp. sst & micaceous (Fe) 50% Blue-grey siltst. slate.	10	
	180		50-50 as above	5	
	185		35% Brown mg. sst as above. 65% Grey fg.mic.st-siltst.-?slate Fe staining.	5	
	190		30% Brown sst. as above. 70% Black mic. silt-grey sst. (Fe)	10	
	195		Ditto above - sst - fairly micaceous, thinly interbedded c very siltstone.	10	
			F.E. staining.		
	200		Ditto. above. - 70% Black silts-slate (micaceous)	15	
	205		60% Black mic. siltst.-slate 40% Brown to grey fissile mic. sst.		
			Fe staining	5	
	210		20% Brown mic. mg. sst. 80% Dark grey-black siltst-slate Fe staining.	10	
	215		60% Brown mic & clayey Mg. sst. 40% Dark sst - siltst.	15	
	220		50% Brown mic & clayey Mg. sst. 50% Dark grey-black sst-silst. Fe-staining.	10	
	225		40% Brown sst as above. 60% Dark black slate-siltst. Fe. staining	20	
	230		Ditto.above. c Fe staining.	15	
	235		Ditto. above " " "	10	
	240		Ditto. above " " "	10	

NORTH FLINDERS MINES N. L. DRILL LOG FORM CONTINUATION SHEE

Drill Hole No. NFMc 8 Sheet 3 of 3

Project McLEASHES

LOG				ASSAYS	
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu
240	245		Ditto. above c̄ Fe staining.	55	
	250		60% Brown sst. as above. 40% Grey-black silts-slate	50	
	255		70% Brown-pink micaceous mg. sst. 30% Dark siltst-slate	40	
	260		Ditto. above 50-50%	100	
	265		Ditto. above " "	160	
	270		60% Brown Fe-stained med.gr.sst.		
			40% Dark slate-siltst.	200	
	275		Ditto. above c̄ slight Tr. 2ndry Copper (Malachite)	260	600
	280		Ditto. above c̄ V. slight ditto. (Malachite)	1300	140
	285		Ditto. above No Cu.	210	30
	290		Ditto above " "	80	
	295		Ditto above " "	250	
	300		Ditto above " "	150	
			T.D. 300'		

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20 August, 1970

MEMORANDUM TO: Managing Director,
North Flinders Mining Co.,
25 Greenhill Road,
WAYVILLE. S.A. 5034

MEMORANDUM FROM: I.R. Pontifex,
McPhar Geophysics Pty. Ltd.,
50 Mary Street,
UNLEY S.A. 5061

SUBJECT: Geological Map The Coup Prospect, including summary and conclusions re the economic geology, and recommendations for further work.

DATE: 4 August, 1970

Introduction

Following the recent field mapping of the grid covering "The Coup" area, SML 294, a geological map,was compiled on the scale of 1" = 400 feet. This is based mainly on the mapping of the grid lines 108E to 166E (spaced 400 ft. apart), with geological boundaries more-or-less "eye-balled" in between these lines, together with limited assistance from the proof copies of 400 ft. air photos.

Some 21 rock samples were examined petrologically to obtain a more accurate definition of various rock types, than was possible from hand specimen examination. The petrographic descriptions of these are appended to this memo.

Geology, including Economic Geology

The authors ideas on the geology of this area have been very briefly discussed with B. Wilson. The stratigraphy of the rock sequence exposed at The Coup, between 589N and about 544N, and 108E and 166E, can be divided into three basic units as follows:
(The names assigned to these units on the S.A. Mines Department Mount Painter Province Geological Sheet are shown in brackets, but these names generally are not considered further in this report.

III	Sediments: not necessarily related to the volcanics, but the "normal" sequence of the Burra Group.	(Un-named member) (of Skillogalee) (Dolomite.) (Wortupa Quartzite)	Youngest
II	Sediments: closely related to volcanics.	(? Humanity Seat) (Formation.) (? Blue Mine) (Conglomerate) (? Opaminda) (Formation)	
I	Volcanics	(Wooltana Volcanics)	Oldest

I Volcanics

An attempt was made initially to map the different rock types in this unit in some detail. It was soon found however that at 400 ft. scale, the rapid variations in the different types of volcanic rocks both across strike, and laterally along the strike of apparent beds or flows determined that some generalisations had to be made.

It was considered adequate to map only the dominant 2 different volcanic rock types, and to delineate varieties of these such as vesicular, brecciated, ferruginised and silicified, as shown on the map.

Undoubtedly more specific units could be delineated, but since variations even of the main types, appear to have no bearing on the small amounts of known mineralisation in the volcanics, and since these variations can in no way be correlated with the geochemical pattern, a more detailed break down was not considered warranted.

The petrological examinations indicate that the main rock types are trachyte and andesite. The trachyte is fine to medium grained, dark brown (ferruginous) and it is variably vesicular, brecciated and silicified. Quartz is the most common vesicle fill.

The andesite may be very fine grained, dark grey-green with blocky, dense outcrop, commonly giving rise to blocky scree. This is commonly epidotised, generally with the epidote along fractures. The andesite is rarely vesicular. Rocks classified as andesite, may also be medium grained, and characteristically weather crumbly, light-green. In many respects they have the features of extensively uralitised dolerites or diorites, but since they are interbedded with volcanics they are classified as the volcanic equivalents. Rarely however do they appear (petrologically) to be basalts.

There is no clear definition of flows in the sequence, however most contacts between the various rock types are more-or-less conformable to the regional bedding attitude. An exception is the ferruginised trachyte breccia, which have a knob-like outcrop, and occur more-or-less as discrete units within otherwise, crudely "bedded" volcanics. These are conceivably volcanic rocks, as for example between 130E, 581N, 130E, 570N.

Local shears occur in the volcanics, shown by fairly continuous buck quartz reefs and veins and by iron-quartz reefs and veins of variable dimensions.

These seem responsible for very local, but apparently very small showings of copper, as for example at 118E, 579N, 118.5E, 574N and 121E, 573.5N. (A sample of 0.34% Cu is representative of the small amount of dump material, at 118E, 579N) Although at the latter locality a shaft of some 100 ft. depth has been sunk on a quartz reef with copper staining, only traces of copper appear on the quartz-volcanic fragments on the dump, which assayed 230 ppm Cu. It seems highly unlikely that significant copper is associated with any specific rock type with the volcanics, or with any structure cutting through this sequence. No disseminated mineralisation was seen.

II Sediments, apparently related to the volcanics

In places, notably on lines 108E, 112E and 116E and 128E at about 553N, upper "beds" of the volcanics are extensively altered and weathered. On these lines the volcanics grade imperceptibly into, and are apparently intercalated with, over some 30 ft., heterogeneous, gritty and pebbly sandstone beds and darkish shale up to several feet thick.

In the area of 118E to 126E, 552N to 557N, a massive scarp-forming bed consists of a heterogeneous, indurated mixture of volcanics and poorly sorted sandstone. (Extensive scree slopes form an apron to the north, down dip from this.) Immediately overlying this for some 50 ft. thickness is intercalated conglomerate and dark brown shale.

On line 136E between about 565N and 570N conglomerate and intercalated shale overlie volcanics. These rocks occur on the western side of a large block of similar interbedded sediments, faulted into the volcanics. (See map) All of the sandstones in this block are either conglomeratic, or fairly extensively ferruginised. They are notably felspathic, and of the several examined in section they contain fairly abundant fragments of volcanic rock, particularly of trachyte.

These relationships suggest that toward the end of the formation of the volcanic sequence some clastic sediments were interbedded. Also following this the volcanics underwent a period of weathering and denudation with very rapid follow up of the deposition of coarse unsorted sediments. The sediments are largely derived from the volcanics and intercalated with ferruginous siltstones which may or may not also be largely derived from the volcanics.

East of about 144E, i.e. east of the faulted block thrust into the volcanics, the sequence consists mainly of siltstones, buff, maroon, and light colored, in addition to the dark ferruginous siltstones, but with fairly abundant intercalated conglomerate bands. This sequence is below the Wortupa Quartzite, therefore between the volcanics and this Quartzite, and although much thicker than this part of the sequence further to the west, it can probably be correlated with it, and probably has a similar association at least in part, with the volcanics. The conglomerates certainly are similar throughout this part of the section. It is in these sediments, immediately overlying the volcanics in which the greatest number, and probably the most significant copper occurrences in the area are found. The copper is probably derived from the volcanics. It is also this part of the sequence which gives rise to about 80% of the anomalous copper areas, outlined by the geochemical soil survey. (Part of the anomalous zones are obviously due to "aprons" of scree derived from outcrop, particularly from the conglomerates on tops of several hills.)

The prominent anomaly at 137E, 567N lies over massive conglomerates of the type described. The anomaly at 148E, 565N lies over a grit-conglomerate band

Copper occurrences which have not previously been mined, and found as staining, mainly in conglomerates, but also in adjacent shale interbeds were found at the following locations: (assays shown where analysed)

116E	552.3N	0.37% Cu
128E	554.5N	0.6% Cu
136E	560.5N	0.14% Cu
144E	564N	No Assay - staining in dark brown shale
150E	561N	0.13% Cu (in grit band)
148E	566N	350ppm (in grit band)

It is likely that similar occurrences may be found within the geochemical anomaly covering this part of the sedimentary sequence.

Copper occurrences which have been mined occur at

(a) 146.8E, 561.5N, ore in situ assays 1.8% Cu
(b) 153E, 558N, ore from 3" vein assays 6% Cu

No. (a) occurrence consists of malachite along bedding and fractures in a leached, light grey siltstone. The siltstone lies above a conglomerate-ferruginous shale band but has no apparent association with these rocks. Mineralisation occurs over a maximum of 4 ft. thickness but cannot be traced for greater than 15 ft. strike length (bearing of 50° magnetic). It may continue down dip (30°) and along strike under cover. The deposit is not in a structurally disturbed zone. This has been mined by an adit 12 ft. wide, 10 ft. high and 4 ft. into the side of the hill, a small ore dump remains.

No. (b) is a 3" vein in laminated light colored siltstone interbedded with grit and conglomerate bands. Local variations in bedding indicate some faulting. It occurs just below a massive conglomerate which itself appears unmineralised. This deposit has been mined from a collapsed shaft, but there is no indication of the extent of the workings or the amount of ore won.

Numerous faults cut and have displaced this part of sequence, (and the sediments overlying it). These are related to the regional fold structure seen on the S.A. Mines Department Mt. Painter Province Sheet. Their main effect is to thrust the block of sediments into the volcanics. They do not appear to be mineralised, in fact in places they effectively form the cut off, or boundary to the geochemical anomalies.

The small wash-aways and minor quartz reefs, more-or-less within this part of the sequence, on about lines 164E and 166E look interesting by virtue of the quartz veining, the black manganese and reddish iron staining. These contain no obvious copper mineralisation. Two samples of the most likely looking material, from within a minor geochemical anomaly, assayed 210 and 220 ppm. Cu, confirming the lack of potential in this local area.

III Sediments above, and including "Wortupa Quartzite"

These may be in general considered as a normal part of the sedimentary succession as mapped by the S.A. Department of Mines.

The Wortupa Quartzite forms a fairly prominent ridge overlooking The Coup area to the north, and this unit, or siltstones overlying it, commonly form a dip slope of about 30° to the south, to about the Barraranna Creek - Groan Creek road.

An exception to this 'normal' sequence is a small remnant bed of massive conglomerate, 3 ft. thick, overlying grey shale and laminated siltstones which in turn appear to be overlying the Wortupa Quartzite. This occurs between 114E to 116E, and 547N to 550N. This conglomerate gives rise to a southern extension of the geochemical anomaly at 120E, 553N, and the scree down dip from this probably is responsible for this anomaly extending south to about 543N.

Copper has been mined from two small workings associated with local shears in grey shale, and in the very base of this conglomerate. Single grab samples at the following localities in a trench assayed as follows:

(a) 115.5E, 547.5N, malachite and minor chalcocite extensively impregnating conglomerate, 11% Cu.

(b) 115E, 547.5N, conglomerate impregnated with malachite assays 2.8% Cu.

(c) 115E, 547.5N, minor chalcocite extensively impregnating conglomerate assays 19.0% Cu.

A single grab sample from a narrow vein exposed in a shear intersected by a 10 ft. shaft at

113.5E, 548.5N, assays 2.8% Cu.

Interbedded conglomerate bands slightly higher in the sequence at about 124E, 546N do not appear to have copper associated with them.

Summary and Conclusions

The geological mapping has revealed three basic stratigraphic "units".

I Volcanics a sequence of trachytes and andesites, variably ferruginised, brecciated and vesicular. These show rapid facies variations across and along strike.

It is not practical to map all of these variations on 400 ft. scale, and generalisations have been made into two basic rock types, with sub divisions of variations in textures where these cover significant areas.

Minor, localised occurrences of copper occur along shears in the volcanics. These are economically insignificant. Two geochemical anomalies occur over the volcanics, the main one is centred at 124E, 578N. No mineralisation was found within these anomalies either as concentrated lode type or disseminated type. No correlation could be made between the anomaly, specific rock types or structures. This lack of correlation, makes the anomalies almost impossible to assess and very difficult to investigate.

In view of this, and of the likely insignificant concentrations of copper in the volcanics it is suggested that this anomaly, and in fact the volcanics as a whole are not worthy of further investigation for copper.

II Sediments immediately overlying and related to the Volcanics Conglomerates and poorly sorted ferruginous sandstones, commonly interbedded with dark brown shales occur:

(I) intercalated with the uppermost volcanics,

(ii) disconformably overlying the volcanics

(iii) within a block faulted into the volcanics, but immediately overlying them.

These consist largely of volcanic detritus, also they contain the greatest abundance, and possibly most significant copper occurrences in the area. The copper is probably derived from the volcanics.

It is over this part of the sequence ,notably the conglomerate beds within it, (and some scree slopes derived fromthem), that the most significant copper anomalies occur.

Two small workings within this section have mined very localised copper deposits containing lumps of ore up to 6% Cu, an average of about 1.8% Cu. Six, dispersed, unworked occurrences average about 0.2% Cu, and at this stage should perhaps be considered to be geochemically anomalous centres only.

None of these occurrences can be traced along strike or down dip for more than some tens of feet. Most appear to be controlled by bedding although the deposit at 153E, 557N is localised on a fault.

These deposits, and anomaly centres in this part of the geological sequence justify further investigation.

III Sediments overlying those associated with volcanics.
The base of these is taken as a prominent sandstone marked, coincident with the Wortupa Quartzite.

These are of little interest with the notable exception of a conglomerate band forming part of a dip slope at about 115E, 549N. Copper mineralisation at the base of this bed, and mined from small workings in two places, consists of malachite, and malachite and disseminated chalcocite extensively impregnating conglomerate, the latter assaying up to 19% Cu. This mineralisation is primarily stratigraphically controlled although minor shears are coincident with the maximum concentrations of copper.

These are also worthy of further investigation, particularly within the area of the eastern working.

Recommendations

1. That the following copper occurrences, and/or copper anomalies are considered worthy of further investigation, given in approximate order of priority.

(a)	153E,	558.5N	(old working)
(b)	115.5%	548N	(old working)
(c)	146.5E	561.3N	(old working)
(d)	137E	566.5N	anomaly centre
(e)	119E	553N	anomaly centre, with Cu staining.

2. Each of these areas should be looked at and preferably mapped at 100 ft. to 1 in., possibly with topographic control.

3. The main aim of the mapping is to determine the likely extensions of the exposed mineralisation, or anomalous zone.

4. The interpreted extensions should be drilled, by at least three percussion drill holes in each, to an initial depth of say 100 ft. Further holes should be drilled in each area if mineralisation is intersected.

5. At the completion of this drilling the results should be assessed and decisions made to:

(a) continue the investigation of these prospects possibly by further drilling, possibly by induced polarisation surveys.

(b) to investigate other copper showings and anomalies in the area.

APPENDIX I

Petrographic descriptions of selected samples from the Coup SML 294.

108E, 572N.

Field term: light green (crumbly) volcanic.

Petrological name: quartz-andesite, extensively chloritised, vesicular.

Comments.

This rock consists of an interlocking aggregate of interlocking plagioclase crystals (20-25%). Contains abundant interstitial light green chlorite (50-60%) with subordinate pale brown biotite. Minor patches of quartz are scattered (7-10%). Minor vesicles contain quartz-chlorite.

108E, 560N.

Rock name: quartz andesite or trachyte extensively chloritised. Vesicular in chlorite and quartz.

108E, 552N.

Rock name: ? trachyte, extensively argillitised, and sericitised.

This rock consists of irregular patches of clay and sericite, scattered through patches of aphanitic quartz, and patches of opaques.

108E, 562N.

Rock name: andesite.

This rock consists of an extremely fine crystalline aggregate of plagioclase, (60-70%), diopside (20-25%) with subordinate indefinable interstitial matrix. Fine patches of epidote (5-7%) and accessory carbonate are scattered. Accessory interstitial patches of quartz are scattered.

108E, 578.5N.

Rock name: trachyandesite or andesite, vesicular in chlorite.

The rock consists of an interlocking aggregate of plagioclase crystals (oligoclase to andesine), and lesser (chloritised) amphibole prisms. Chlorite is interstitial and also forms irregular vesicles. Subordinate magnetite is dispersed. Accessory quartz is interstitial.

112E, 556N.

Rock name: Trachyte, amygdaloidal, ferruginous.

This rock consists of (40-50%) a finely crystalline aggregate of potash felspar, showing carlsbad twin the felspar is only dusted with iron oxides, imparting the red-brown color to the rock. Interstitial opaques, almost certainly iron oxide (40-50%) and minor quartz 7-10%) are ubiquitous. Vesicles (15-20%) contain felspar and a core of quartz.

112E, 566N.

Rock name: Epidote bearing andesite.

112E, 568N.

Rock name: Epidote bearing andesite.

Contains up to 7% scattered magnetite, and also accessory ? pyrite.

112E, 573N.

Rock name: Pyroxene rich andesite, extensively altered to amphibole and chlorite.

This rock consists of coarse interlocking crystals of actinolite (45-50%) with abundant, interstitial, very fine chlorite (40-45%). Magnetite is scattered, particularly associated with chlorite. Accessory granules of epidote and traces of quartz are dispersed. There is little evidence of pre-existing felspar.

This is a chlorite-amphibole rock derived by the retrograde metamorphism (or uralitisation) of an original hornblende or pyroxene rich andesite.

116E, 574.5N.

Rock name: Epidote bearing andesite.

118E, 552N.

Rock name: Sandstone, poorly sorted, contaminated with volcanic detritus, and probably genetically related to the volcanics.

This is a sedimentary rock containing subrounded grains of quartz (60%), felspar (7-10%), in a fine matrix consisting of clay and fine detritus of the above varieties of composition.

It may be classified as a coarse poorly sorted quartz sandstone to grit, contaminated with volcanic detritus. The amount of volcanic detritus suggests that this is a sandstone interbedded with the volcanic sequence.

118E, 571N.

Rock name: uralitised andesite.

This rock consists mainly of coarse interlocking actinolite, with abundant interstitial aggregates of fine chlorite. Small patches of quartz (5%) are scattered. Chlorite in part replaces original plagioclase, although there is very little evidence of original felspar.

This rock is essentially the same as 112E, 573N. It is classified as an extensively amphibolitised (uralitised) andesite.

120E, 579N.

Rock name: Volcanic breccia, or trachyte breccia.

This rock consists of irregular shaped fragments of a wide variety of sizes and having the composition of a ferruginous, chloritised fine grained trachyte. These are contained in a matrix of cryptocrystalline quartz and potash felspar.

128E, 561N.

Rock name: ferruginous trachyte, vesicles filled with quartz, potash felspar and minor carbonate and phlogopite.

130E, 576N.

Rock name; breccia of ferruginous trachyte, vesicles filled with quartz, potash felspar, minor carbonate and mica.

136E, 564N (B)

Rock name: ferruginous quartz siltstone as at 140E, 566N. Almost certainly not genetically related to the volcanics.

136E, 564N (A)
137E, 567N.

Rock name: Conglomeratic sandstone, largely of volcanic origin.

Extremely poorly sorted heterogeneous detrital aggregate of the following components, all contained in a fine grained quartz-clay matrix.

fragments of trachyte (commonly ferruginous)	30-40%
fragments of ?chert (or acid volcanic rock	10-15%
fragments of ? meta quartzite	10-15%
quartz grains	30%
felspar grains	10-12%
ferruginous siltstone	10-15%
sericitic siltstone	5-7 %

This is similar to the sample from 118E, 552N. The abundance of volcanic detritus suggests that it is closely associated with the volcanics, but is made up partly of material from other sources. It possibly represents a stage of denudation and deposition immidiately following the formation of the volcanic sequence.

Since it is interbedded with the ferruginous quartz siltstone, this rock too, obviously formed in a similar geological situation.

140E, 573N.

Rock name: felspathic sandstone, probably not directly related to the volcanics. Very similar to the sample from 144E, 569N.

140E, 566N.

Rock name: ferruginous quartz-siltstone.

This rock consists of an extremely fine grained aggregate of felspar (5-10%), muscovite-chlorite (10-15%), iron oxide (30-40%), and quartz (40-50%). The micas have a common orientation, parallel to fine sedimentary (detrital) banding.

Almost certainly not related to the volcanics.

144E, 569N.

Rock name: felspathic gritty sandstone, not necessarily genetically related to the volcanics.

This rock consists of subrounded poorly sorted detrital grains of quartz, (60%) felspar (10-15%), accessory tourmaline, rock fragments, and iron oxide, in a matrix of sericite and clay.

REPORT ON A ROTARY-PERCUSSION DRILLING PROGRAMME O'DONOGHUE CASTLE AREA MAY - JUNE 1970

S.M.L. 294 - SOUTH AUSTRALIA

R.B. Wilson.

North Flinders Mines N.L.

OCTOBER, 1970

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APPENDICES

ACCOMPANYING PLANS

Drawing No.	Title	Scale.
294-11A	Map of area between O'Donoghue Castle - Pooh Corner and McLeashes Prospect showing geology (I.Pontifex) and I.P. results. Sheet A (Western half)	1" = 400 feet.
294-26	O'Donoghue Castle Copper Prospect Cross Section 00N	1" = 100 ft.
294-16	O'Donoghue Castle Copper Prospect Cross Section 400N.	1" = 100 ft.
294-23	O'Donoghue Castle Copper Prospect Cross Section 800N.	1" = 100 ft.
294-28	O'Donoghue Castle Copper Prospect Cross Section 1000N.	1" = 100 ft.
294-27	O'Donoghue Castle Copper Prospect Cross Section 1400N	1" = 100 ft.
294-29	O'Donoghue Castle Copper Prospect Cross Section on Lines 1600N, 1200N, 600N and 200N.	1" = 100 ft.

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I. INTRODUCTION

A rotary-percussion drilling programme, comprising eight holes for a total of 1730 feet, was completed during the period 22/5/70 to 2/6/70 in the area of the O'Donoghue Castle Copper Prospect, which is located 6½ miles southwest from Arkaroola Homestead and approximately 1½ miles west of the graded road between Balcanoona and Arkaroola Stations.

Six holes totalling 1175 feet of drilling were drilled to test a zone of I.P. anomally associated with the Blue Mine Conglomerate while two angle-holes were drilled down-dip from the old workings of the O'Donoghue Castle Copper Mine. The detailed geology of the O'Donoghue Castle Prospect is the subject of a published report by A.H. Blissett, 1965 (S.A. Dept. of Mines, Mining Review No. 122).

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II. REGIONAL GEOLOGY AND PREVIOUS INVESTIGATIONS

The O'Donoghue Castle Copper Mine is located within the lowermost units of the Skillogalee Dolomite, although some mineralization occurs in outcrop within broken Wortupa Quartzite.

Regionally, units of the Callana Beds form part of the southeastern limb of a broad southwest - plunging syncline and are faulted against units of the Tapley Hill Formation along the major northeast-trending Paralana Fault. The Callana beds are overlain by the Burra Group, of which the prominent Wortupa Quartzite is the basal member. This is in turn succeeded by a thin unit of mixed lithology, quartzite, slate and dolomite (termed the Transition Beds on the accompanying cross-section), which grade into the overlying thick Skillagolee Dolomite. The Burra Group is overlain unconformably by the Umberatana and Wilpena Groups respectively.

The sequence is repeated to as high as the Tapley Hill Formation, to the east of the presumably west-dipping Paralana Fault, along which several thousand feet of movement has probably occurred. Numerous lesser faults and irregular diapiric intrusions associated with the Paralana Fault, combine to create a structurally complex area.

The Blue Mine Conglomerate, belonging to the Callana Beds, consists, in this area, essentially of relatively soft, argillaceous and ferruginous sandstone below with conglomerate, arkose and sandstone above. Heavy mineral laminations and slaty to silty interbeds are common throughout.

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Two surface showings of secondary copper mineralization associated with the Blue Mine Conglomerate had previously been exposed near section-line 400N (POOH CORNER) and on line 00N. Poor outcrop in this vicinity precludes the drawing of any conclusions as to whether the mineralization is associated with a particular bed or whether it may be related to cross-faulting or some other structural feature. A consistent zone of I.P. anomalies was found to correlate with the uppermost members of the Blue Mine Conglomerate and drilling was programmed to test this horizon on three section-lines, along two of which (00 and 400N) some secondary copper mineralisation had been exposed.

Lesser I.P. anomalies were found on several lines across the O'Donoghue Castle Prospect itself, possibly associated with the uppermost portion of the Wortupa Quartzite or with the lower members of the Skillagolee Dolomite, which is host-rock to the O'Donoghue Castle mineralization. As stated the O'Donoghue Castle Mine is the subject of a comprehensive report by A.H. Blissett, 1965 (S.A. Dept. of Mines, Mining Review No. 122)

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III. ROTARY-PERCUSSION DRILLING PROGRAMME

As stated, six holes totalling 1175 feet were drilled as a test of I.P. anomalies associated with the Blue Mine Conglomerate, while two holes totalling 555 feet were drilled below the workings of the O'Donoghue Castle Copper Prospect.

The programme was carried out by Boring Enterprises Pty. Ltd., using an Ingersoll-Rand "Drillmaster" rig equipped with a 1200 c.f.m. compressor. Full samples were split to approximately 8-lb. weight, using a rotary - splitter supplied by the contractor. Small grab-samples were submitted to McPhar for A.A.S. analysis. Full samples showing anomalous copper values from A.A.S. analysis were re-submitted to AMDEL for accurate copper analysis (Scheme F1).

A. BLUE MINE CONGLOMERATE PROSPECTS.

1. SECTION 400N.

Hole N.F.O.D.1. was depressed eastwards at 60° E. beneath the exposed secondary copper mineralization of Pooh Corner. The hole intersected medium grained quartzite, fine-grained silty quartzite to siltstone with many bands of conglomerate and gritty to conglomeratic quartzite. Traces of pyrite were recorded throughout the hole while fairly abundant pyrite was encountered over the interval 30 to 75 feet. Slight traces of malachite and ? chalco-pyrite were recorded in a few samples. The highest assays recorded were from 35 to 45 ft., which interval averages 0.23% Copper.

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Hole N.F.O.D. 2 was drilled vertically at coordinate 060W to test this pyritic zone down-dip from the intersection in hole N.F.O.D.1. Traces of pyrite were again recorded throughout to a depth of 190 feet, while fairly abundant pyrite associated with conglomeratic quartzite was encountered over the interval 110 ft. to 130 ft. The highest copper value over this latter interval is 30 ppm, while the highest value in the hole is 60 ppm. (A.A.S.).

The correlation between the two holes (see cross-section 400N) appears in conformity with the measured surface-dips (40° to 50° W).

2. SECTION 00N.

Hole N.F.O.D. 7 was depressed eastwards at 60° E. beneath disseminated secondary copper mineralization in conglomerate - sandstone outcropping at about coordinate 100E. Traces of malachite in quartzite - conglomerate were recorded from 30 feet to 60 feet with maximum development from 35 ft. to 40 ft., which interval assayed 0.43% copper. The average value for the interval 30 to 45 ft. (15 ft.) is 0.24% Copper. Disseminated malachite was again recorded from 75 ft. to 90 ft. and this interval assayed 0.2% Copper (15 ft.). It was suspected during drilling of the hole that this may have been cavings from the higher zone of disseminated malachite.

Hole N.F.O.D. 8 was drilled vertically at coordinate 00E to test any possible down-dip projection of this mineralization. Abundant pyrite was recorded from 40 ft. to 85 ft. although A.A.S. assays showed the whole of this interval to contain less than 100 ppm copper.

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3. SECTION 800N.

Although no surface copper-mineralization had been recorded within the Blue Mine Conglomerate in the vicinity of section-line 800N, two holes were drilled to obtain as wide a stratigraphic coverage as possible of this formation. A zone of pronounced I.P. anomaly had again been mapped from 00 to 200E.

Hole N.F.O.D. 3 was drilled vertically to 250 feet at coordinate 100E, to intersect the poorly-outcropping lower members of the Blue Mine Conglomerate, which comprise, in sporadic outcrop, soft pink-brown-grey micaceous and argillaceous, feldspathic sandstone with some gritty bands. Similar lithologies with some interbeds of grey siltstone-slate were intersected to total depth 250 ft. in hole N.F.O.D. 3. The presence of disseminated black opaque grains (? hematite or ? magnetite) was recorded from 60 ft. to 250 ft. Only slight traces of pyrite were noted in a few samples, while the highest copper value was 0.02% from 35 to 40 ft.

Hole N.F.O.D. 4 was depressed at 70° easterly from coordinate 150W to test the upper members of the Blue Mine Conglomerate. Lithologies were again dark grey, fine to medium-grained, hard quartzite with some siltstone-slate interbeds and several prominent gritty conglomeratic quartzite interbeds. Soft argillaceous sandstone with disseminated hematite or magnetite, thought to correlate with the lower portion of the Blue Mine Conglomerate horizon as intersected in hole N.F.O.D. 3, was penetrated from 225 ft. to total depth 245 ft. Only trace amounts of copper (maximum value 500 ppm.) were recorded from A.A.S. assaying of samples. The anomalous copper values appear to be related to samples with more abundant disseminated pyrite.

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B. O'DONOGHUE CASTLE COPPER MINE

Although very little further geological work has been carried out on the O'Donoghue Castle Prospect since that by A.H. Blissett (1965), it was considered to be worthwhile to drill at least two holes as a deeper test of the exposed copper mineralization, while the drilling-rig was in the area.

An extract from A.H. Blisset's Summary is as follows:-

"Irregular oxidized orebodies up to about 3 ft. thick, containing copper carbonates, quartz, sphaerocobaltite (cobalt carbonate) and wad (hydrated manganese oxide), occupy shear zones parallel with the bedding and crush zones across the bedding. There are also many veins of barren quartz or jasper associated with iron oxides. The host-rocks are a shattered dolomitic sequence overlying the equivalent of the Copley Quartzite (Burra Group) and lying within the Paralana Fault Zone, 9½ miles north of Balcoracona H.S."

1. SECTION 1400N.

Hole N.P.O.D. 5 was angled eastward at a depressed angle of 60° E to probe possible down-dip extensions of the mineralization exposed in the workings from Adit No. 1. The hole intersected Skilogallee Dolomite to 155 ft. and then a transition zone, comprising interbedded dolomite, quartzite and silty slate from 155 ft. to 265 ft. Very hard, white dense, fine-grained to medium-grained quartzite (Wortupa Quartzite), was penetrated from 265 ft. to total depth 300 ft. Pyrite traces were logged from 85 ft. to 265 ft. with occasional samples containing greater than trace amounts. A trace of malachite colours in limonite was observed in the sample from 110 ft. to 115 ft., which

...../10

interval assayed 700 ppm. copper. Some traces of pyrite were also logged within the Wortupa Quartzite and the interval 280 ft. to 290 ft. assayed 0.14% Copper.

Iron oxides (limonite) are associated with the above mentioned traces of secondary copper colours around 110 ft. to 120 ft. and were again present at about 150 ft. depth.

2. SECTION 800N.

Hole N.F.O.D. 6 was drilled eastwards at a depressed angle of 60° E. to penetrate the Skillogallee Dolomite down-dip from the southern workings on the O'Donoghues line of secondary copper mineralization. It was hoped to again at least partly penetrate the Wortupa Quartzite but loss of air circulation in fractured ground at 250 feet, caused the hole to be abandoned at 255 feet.

Hole N.E.O.D. 6 penetrated Skillogallee Dolomite to 225 feet and then interbedded quartzite and silty dolomite (? Transition Beds) to total depth 255 ft. Traces of pyrite were logged throughout, while fair amounts of pyrite were present from 220 to 225 feet. The highest value recorded from this hole was 15 ppm copper (A.A.S.).

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IV. SUMMARY AND CONCLUSIONS

The Upper portion of the Blue Mine Conglomerate with which is associated a consistent zone of anomalous I.P. values, was tested by rotary-percussion drilling methods on three cross-sections, some 400 ft. apart in the O'Donoghue Castle Area. On two of these sections (00N and 400N), low grade disseminated secondary copper mineralisation within conglomerate-sandstone, had been recorded in outcrop.

The drilling demonstrated the presence of a strongly pyritic zone in the upper members of the Blue Mine Conglomerate and also suggests this as the probable cause of the strong I.P. anomalies. Only very slightly anomalous copper values were obtained from the deeper intersections of this pyritic zone.

While the results are discouraging from the viewpoint of the possible discovery of large low-grade "bedded-type" deposits, such possibilities have not been completely eliminated. Further air photo- and structural interpretations, together with probable follow-up field-work, are considered necessary in an endeavor to explain the consistent surface showings of secondary copper mineralization associated with the Blue Mine Conglomerate. Recent thinking is that many of these surface showings may be related to minor cross-faulting. The development of several low grade secondary copper deposits (even if of more restricted tonnage-potential), could possibly result from such further work and may collectively contribute to the copper potential of the general area.

Two holes were drilled to intersect in depth the secondary copper mineralization of O'Donoghue Castle Prospect and also produced disappointing results. While it cannot be claimed that these two holes constitute an exhaustive test of any such depth-possibilities, the results do not encourage the undertaking of a more comprehensive drilling programme at this time.

R.B. Wilson.

NORTH FLINDERS MINES N.L.

SUMMARY.

APPENDIX I

ROTARY-PERCUSSION DRILLING PROGRAMME - O'DONOGHUES CASTLE AREA - MAY/JUNE 1970

HOLE NO.	COORDS E-W	COORDS N.	HOLE SIZE	ANGLE	DEPTH OF WATER-CUT.	WATER SUPPLY (Approx)	SAMPLE NOS.	TOTAL DEPTH
NFOD 1	020E	400N.	6"	Dep. 60° E.	115'	1500-2000 gph.	2832-2864	165 feet.
NFOD 2	060W	400N	6"	Vertical	30'	<500 gph	2865-~~3014~~ 2914	250 feet.
NFOD 3.	10CE	800N	6"	Vertical.	80-85' 140'	300 gph. 1000 gph.	3015-3064	250 feet.
NFOD 4	150W	800N	6"	Dep. 70° E	150'	300 gph	3066-3114	245 ft.
NFOD 5	850W	14[illegible]0N	6"	Dep. 60° E	265'-270' 300'	200 gph 1800-200 gph	3115-3174	300 feet.
NFOD 6	1052W	800N	6"	Dep. 60° E	115'-120' 190'-195'	300 gph 1000 gph	3175-3225	255 feet.
NFOD 7	060E	00N	6"	Dep. 60° E	115'	300 gph	3226-3248	115 feet.
NFOD 8	00E (Baseline)	00N	6"	Vertical	80' 145'	500 gph 700 gph	3249-3278	150 feet.

17 30

APPENDIX II

Rotary Percussion Drilling Programme, O'Donoghue Castle Area.

MAY-JUNE 1970

DRILL-LOG SHEETS

Lithological Descriptions and Assay Results.

Holes NPOD 1

" 2

" 3

" 4

" 5

" 6

" 7

" 8

Note on Assays.

Column 1. Represents A.A.S. Analysis following 25% HNO_3 Leach on small 'grab' sample. Analysis by McPhar Geophysics Pty. Ltd.

Column 2. Check assay on 'accurate split' 6-lb. sample AMDEL Code F.1. Analysis.

NORTH FLINDERS MINES N. L.

DRILL LOG FORM

PROJECT O'DONOGHUES

Drill Hole No. NFOD 1 Sheet 1 of 2 Grid Co-ords 020E 400N

Azimuth 090° Dip Depressed 60° E

Type of Drill Drillmaster

Driller G. Russell. Collar Datum

Logged by Depth of Hole ft.

Commenced 22.5.70 Completed 23.5.70

Depth Water Struck 115-120 ft. G. P. H. 1500-2000 gph

Depth Water Struck ft. G. P. H.

Depth Water Struck ft. G. P. H.

% Core Recovered Length of Casing in hole ft.

LOG				ASSAYS		
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu	
0	5	2832	Silstone & siltstone & silty Qte	40		
	10	33	40% Hard white-gren qte, some gritty. 60% Grey-green-black siltstone.	100		
	15	34	40% Hard grey-white qte, some gritty. 60% Dark grey-green siltstone. Tr. Pyrite.	55		
	20	35	50% Dark grey-black fg-mg dense silty qte 50% Dark grey-black slaty siltst.			
			Tr. Pyrite.	90		
	25	36	20% Coarse gr. feldspathic grit (light coloured) 40% Dark grey hard qte. Tr Pyrite. 40% Finely rounded qte +			
			dark silty qte- siltst.	65		
	30	37	As above but no grit. Tr. dissem Pyrite.	30		
	35	38	Dark slaty to silty banded qte. V.hard c dissem pyrite.	160	300	
	40	39	40% Ditto. above c Pyrite. 60% Mainly white qtz (conform pebbles ?)			
			c fair amt. Pyrite	1900	3000	
	45	2840	Mainly qtz-pebble conglomerate c dissem pyrite & odd traces of dissem. CHALCO.			
			Some dark slaty qte.	540	1600	
	50	41	60% Qtz-pebble Conglom. c dissem pyrite & ? Chalco. 40% Dark slaty fine gr.qte.-			
			quartzitic siltst. Dissem Pyrite.	400	400	
	55	42	10% Qtz-pebble conglom c dissem pyrite. 90% Dark fg.silty qte-quartzite siltst.	220		
	60	43	15% Qtz-conflom? c dissem pyrite & Tr.CHALCO 85%Gritty to silty grey fine gr. hard qte.			
			c dissem pyrite ? Tr. MALACHITE.	220		
	65	44	Hard gritty qte c dissem Pyrite & Traces of?CHALCO.	540		
	70	45	Ditto. above c only Tr. Pyrite.	25		
	75	46	40% Light brown hard qte. 60% Dark grey-black qte (fg) dissem pyrite.	75		

NORTH FLINDERS MINES N. L. DRILL LOG FORM CONTINUATION SHEET

Drill Hole No. NFOD 1 Sheet 2 of 2

Project O'Donoghues

LOG				ASSAYS		
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu	
75	80	47	Ditto. above c̄ sl. Tr. qtz. Only slight Tr. Pyrite..	100		
	85	48	Light Brown, some dark grey dense hard qte. Only slight Tr. dissem pyrite. Some Qtz.	230		
	90	49	Mainly red, some grey dense, hard qte.- some gritty qte. Fair amt. qtz-pebble conglom			
			Tr. Dissem Pyrite.	290		
	95	2850	Asabove, not much qtz. Tr. dissem Pyrite ? Slight trace. Chalco ??	75		
	100	51	Mainly reddish-brown to grey - black qte/ hard/dense. 20% Hard black siltst-slate			
			Tr. dissem pyrite.	20		
	105	52	30% Light speckled hard qte. 70% Dark black fg. qte - quartzite siltst.			
			not much pyrite.	15		
	110	53	40% Light brown-fawn med.gr.qte. 60% Dark gritty sst c̄ some dark			
			quartzitic silst.	10		
	115	54	As above - no pyrite or only slight Tr.	10		
	120	55	Pink-grey gritty qte c̄ few qtz-pebbles. 20% Dark black fg. qtzitic-siltstone.	75		
	125	56	Reddish-pink gritty qte. matrix c fair amt white qtz (pebble) i.e. Gritty qtz-conglom.			
			Sl. Tr. dissem pyrite.	110		
	130	57	Ditto. slight Tr. dissem pyrite.	100		
	135	58	Ditto - c̄ 20-30% Dark silty fine gr. qte. to siltstone	110		
	140	59	Med.gr. red-grey micaceous sst c̄ dark grey fine silty qte. Trace dissem pyrite.	130		
	145	2860	Mixture of gritty red-grey hard qte & fg. V.hard dark grey silty qte c̄ some dissem			
			pyrite.	130	200	
	150	61	As above c̄ 20% White qtz (? pebbles) conglomerate. Not much Pyrite.	110		
	155	62	Mainly red brown gritty to conglomeratic quartzite. Tr. mica c̄ some qtz &			
			heavy minerals (? hematite).	85		
	160	63	Ditto. above.	45		
	165	64	Pink-grey-brown argillaceous med.gr.sst. some qtz, No sulphide.	40		
			T.D. 165'			

NORTH FLINDERS MINES N. L.

DRILL LOG FORM

PROJECT O'Donoghues

Drill Hole No. NFOD 2 Sheet 1 of 2 Grid Co-ords 400N 0060W

Azimuth _____ Dip Vertical.

Type of Drill Drillmaster.

Driller G. Russell. Collar Datum _____

Logged by _____ Depth of Hole 750 ft.

Commenced _____ Completed _____

Depth Water Struck 30 ft. G. P. H. 200 ?

Depth Water Struck _____ ft. G. P. H. _____

Depth Water Struck _____ ft. G. P. H. _____

% Core Recovered _____ Length of Casing in hole _____ ft.

LOG				ASSAYS		
From (ft)	To (ft)	Sample No	Lithology	ppm AAS		
0	5	2865	Scree	70		
	10	66	Scree	60		
	15	67	Grey-brown dense hard fine gr.qte.	80		
	20	68	Ditto. some qtz.	40		
	25	69	Ditto - may be some slate or fine gr. slaty qte.	45		
	30	2870	Ditto- Brown hard slaty qte.	75		
	35	71	Brown-grey dense fine gre. qte c̄ some qtz. Dissem Pyrite.	30		
	40	72	Ditto c̄ 30% Qtz. or white qte (? pebbles) Some dissem PYRITE.	20		
	45	73	Grey-white to light grey v.dense fine gr.qte. c̄ very finely dissem pyrite & coarser			
			Pyrite. Sand qtz.	15		
	50	74	Ditto. above c̄ some qtz - finely dissem Pyrite.	15		
	55	75	Light to dark grey, mg. speckled, hard, med. gr. qte.	10		
	60	76	Light grey, med. gr, speckled qte.-very hard. some qtz. Dissem Pyrite.	10		
	65	77	Ditto, c̄ finely dissem Pyrite.	15		
	70	78	" " "	35		
	75	79	" " "	20		
	80	2880	" " "	25		
	85	81	" " "	15		
	90	82	Ditto. above. Some deeper coloured qte. Some dissem Pyrite	5		
	95	83	Med.gr. very dense hard qte (some speckled) c̄ finely dissem pyrite throughout.			
			Lots of coarser Pyrite.	10		
	100	84	Grey-White laminated qte. c̄ some silty to slaty qte. Some Qtz (?pebbles ?) c̄ dissem	20		
			pyrite.			

NORTH FLINDERS MINES N. L. DRILL LOG FORM CONTINUATION SHEET

Drill Hole No. NFOD 2 Sheet 2 of 2

Project O'Donoghues.

LOG				ASSAYS		
From (ft)	To (ft)	Sample No	Lithology	ppm AAS		
100	105	2885	Ditto. some finely dissem pyrite.	5		
	110	86	Ditto. with some finely dissem pyrite (getting less).	5		
	115	87	Ditto above - light grey and dary grey banded qte c̄ fair amount v. finely			
			dissem PYRITE.	10		
	120	88	Ditto- fair amt. dissem fine pyrite.	10		
	125	89	Ditto above - 40% 60% Gritty Qte c̄ qte pebbles conglom.			
			Fair amt. dissem Pyrite.	15		
	130	2890	Ditto - more qtz - pebbles conglom? Only v. finely dissem pyrite.	30		
	135	91	40% Conglom as above.) Tr. dissem 60% Spotted slaty qte.) Pyrite.	15		
	140	92	Grey-brown speckled qte. & gritty qte. Only Tr. Pyrite.	15		
	145	93	Light grey to white qte. some spotted qte. Some Qtz. Only Tr. Pyrite.	10		
	150	94	Grey-white qte c̄ fair amt. qtz. No Pyrite.	5		
	155	95	Fairly dark grey, hard, some lighter coloured qte. Tr. Pyrite.	10		
	160	96	Dark to light grey fairly gritty Qte. 20% Qtz (Pebble ?) No pyrite.	10		
	165	97	Dark - light grey fairly gritty Qte. 20% Qtz (Conglom) No Pyrite.	70		
	170	98	Light Grey gritty hard qte. 5% Qtz. Grit No Pyrite.	= 10		
	175	99	As above + 20% Qtz. No visible pyrite conglomeratic-grit.	5		
	180	2900	Ditto. above. ? conglom-grit. Slight Tr. Pyrite.	5		
	185	01	Ditto. above. ? Conglom grit. Slight Tr. Pyrite.	10		
	190	02	Mainly very coarse gritty conglom. - No Pyrite.	10		
195	195	03	Ditto - v. coarse gritty conglom - no pyrite.	10		
	200	04	Mainly grey-buff spotted, dense, hard qte.	5		
	205	05	Mainly grey-buff some pink, spotted qte as above.	10		
	210	06	50% As above, some pink 50% Pink-grey med. gr. qte.	10		
	215	07	Mainly hard dense pink-grey spotted qte	5		
	220	08	Ditto - may be v. slight Tr. fine dissem pyrite.	5		
	225	09	50% Deitto above. 50% Dark grey to pink gritty qte. q	5		
	230	2910	50% Gritty qte, as above. 50% Dark pink-grey med. gr.hard qte.	5		
	235	11	50% Pink-grey gritty qte c̄ some manotite. 50% Dark pink-grey-brwon fg-mg.qte	10		
	240	12	Pink-grey med. to coarse gr. qte.	5		
	245	13	Ditto above - v. hard Tr. fine dissem Magnetite.	5		
245	250	14	Ditto. c̄ dissem v. fine magnetite.	5		
			TD. 250'			

NORTH FLINDERS MINES N. L.

DRILL LOG FORM

PROJECT O'Donoghues

Drill Hole No. NFOD 3 Sheet 1 of 3 Grid Co-ords 800N 100E

Azimuth _____ Dip Vertical

Type of Drill Drillmaster

Driller G. Russell. Collar Datum _____

Logged by B. Wilson. Depth of Hole 250 ft.

Commenced 25.5.70 Completed _____

Depth Water Struck 8-85' ft. G. P. H. 300

Depth Water Struck 140 ft. G. P. H. 1000

Depth Water Struck _____ ft. G. P. H. _____

% Core Recovered _____ Length of Casing in hole 6 ft.

LOG				ASSAYS	
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu
0	5	3015	Rubbish.	10	
	10	16	Soft brownish med. gr. to fine gr. micaceous sst.	30	
	15	17	60% Ditto - pink grey brown argill.sst. 40% Hard grey finer gr. sst c̄ dissem Pyrite.	40	
	20	18	20% Hard sst-qte c̄ Pyrite. 20% Soft mg-lg.mic. argill sst. 60% Granite dark	25	
			black slate - siltst. Fe staining.		
	25	19	50% Black dense fg silty qte to silts-slate (Fe stain). 50% Soft argill.sst + shale.	5	
	30	3020	Mainly greenish to brown soft argill.mic sst. c̄ some magnetite or hematite grains.	20	
	35	21	60% Ditto above. 40% Soft greenish silt - shale.	60	
	40	22	Mainly soft green-brown micaceous & argill. soft sst.	160	200
	45	23	Ditto - some pink coloured.	85	
	50	24	As above - green-brown, v. soft.	40	
	55	25	Ditto. as above.	30	
	60	26	As above, sst contains fair proportion dissem magnetite or hematite.	40	
	65	27	As above c̄ 60% Dark grey slate.	10	
	70	28	60% Green v. micaceous soft argill. sst. 40% Grey-green slate.	10	
	75	29	Soft clayey pink-white grey hematite mic. sst c̄ thin (1/8th) grey shale bands -		
			very argill.	10	
	80	3030	80% Dark grey slate c̄ thin sandy beds (1/8th - ¼) 20% Mg-lg argill. soft sst.	10	
	85	31	60% Slate-siltst as above. 40% Soft white grey argill mic.sst.	10	
	90	32	V. Soft pink clayey sst.	15	
	95	33	60% Dark grey siltst-slate c̄ Fe 40% Soft greenish argill-mic.mg.-fg.sst.	15	
	100	34	40% Dark silty slate as above 60% Green-pink ar-mic. soft sst.	50	

NORTH FLINDERS MINES N. L. | DRILL LOG FORM | CONTINUATION SHEE

Drill Hole No. NFOD 3

Project O"Donoghues.

Sheet 2 of 3

LOG				ASSAYS	
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu
100	105	3035	Ditto. above.	25	
	110	36	50% Dark silty slate - fg.qte as above. Tr. Pyrite. 50% Soft brown-green arg.		
			mic. sst.	35	
	115	37	As above- Tr. Pyrite in slaty qte.	20	
	120	38	Soft white-grey Mg-lg loosely consolidated sst c̄ some dissem magnetite-lamatite	15	
	125	39	80% Sst as above. 20% Dark grey mg. soft to hard sst.	20	
	130	3040	As above -Tr.black slate (Cavings ?)	20	
	135	41	Pink Mg.soft sst. c̄ fair % hematite or magnetite -lot of red Fe staining.		
			20% Dark grey fg. sst-siltst.	15	
	140	42	Pink soft sst. as above 20% Grey harder qtzitic sst.	10	
	145	43	Mainly pink soft saccharoidal sst as above c̄ dissem hematite ? some 1/8" Heavy		
			mineral bands.	15	
	150	44	As above c̄ 40% Darker grey harder fg qte-slate. Fe oxide staining	5	
	155	45	50% Pink sst. as above. 50% Darker grey harder gritty qte c̄ (?magnatite)	5	
	160	46	Mixture of dark pink grey gritty to mg. qte. & dark grey silty fg qte to siltst.	5	
	165	47	50% Soft brown arg. sst. 50% Pink hard mg. qte - still some magnatite	5	
	170	48	Fairly clean pink-purple sst-qte c̄ some mica & heavy mineral bands.	5	
	175	49	Pink-grey quartzitic micaceous sst. qte c̄ some hematite - magnatite	5	
	180	50	Ditto above c̄ finely dissem magnetite & some heavy mineral bands	5	
	185	51	Ditto above c̄ 50% Darker grey-pink gritty qte. Hem - Magnetite ?	5	
	190	52	Ditto.	5	
	195	53	30% Dark grey as above. 70% Light pink feldsp-mic. sst c̄ ~~dissem~~		
			magnetite ?	5	
	200	54	All light to darker pink mg-lg sst c̄ dissem magentite ?	5	
	205	55	50% Light pink as above. 50% Dark grey hard finer gr. mic. qte.	5	
	210	56	50% Dark grey hard qte c̄ abt magnetite? 50% Green-grey siltst-silty qte-micaceous.	5	
	215	57	As above - not so much silty qte.	5	
	220	58	Grey-green v. micaceous & argilleceous med. gr. soft sst - still c̄ some magnetite.	5	
	225	59	50% Grey-green arg-mic. sst. 50% Hard pink qte c̄ magnetite.	5	
	230	60	Dark grey-black hard feldsp & magnetite-rich. fairly hard qte.	5	
	235	61	Pink-red micaceous mg-lg.sst c̄ dissem magnetite. Some greenish mic. sst.	5	
	240	62	Dark grey-pink fairly hard mg qte c̄ some magnetite. Tr. Pyrite. Some greenish mic.		
			sst. to silty qte.	5	

NORTH FLINDERS MINES N. L.   DRILL LOG FORM   CONTINUATION SHEE

Drill Hole No. NFOD 3   Sheet 3 of 3

Project O'Donoghues.

LOG				ASSAYS		
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu	
240	245	3063	Mainly dark grey to greenish grey mic. & slightly hematitic qte c v. Sl. Tr.	5		
			Pyrite ? Some greenish mic. sst.			
	250	64	Mainly dark grey hard to soft qte - sst c̄ speck or two of pyrite & some magnetite.			
			Dark soft mic. siltst interbeds.	5		
			T.D. 250'			

NORTH FLINDERS MINES N. L.

DRILL LOG FORM

PROJECT O'Donoghues.

Drill Hole No. NFOD 4 Sheet 1 of 3 Grid Co-ords 800N 150W

Azimuth _____ Dip 70° Angle East (Dep)

Type of Drill Drillmaster

Driller G. Russell. Collar Datum _____

Logged by B. Wilson. Depth of Hole 245 ft.

Commenced 26.5.70 Completed 27.5.70

Depth Water Struck 150 ft. G. P. H. 300

Depth Water Struck _____ ft. G. P. H. _____

Depth Water Struck _____ ft. G. P. H. _____

% Core Recovered _____ Length of Casing in hole _____ ft.

LOG				ASSAYS	
From (ft)	To (ft)	Sample No	Lithology	ppm ASS	ppm Cu
0	5	3066	Rubbish	100	
	10	67	Blue fg. silty qte.	140	
	15	68	Ditto.	75	
	20	69	Ditto - Tr. mg. gritty qte.	85	
	25	3070	Ditto + 10% Mg. gritty qte c PYRITE.	120	
	30	71	Mainly slaty qte to quartzitic siltst. Tr. Pyrite.	65	
	35	72	Ditto.	60	
	40	73	Blue dense fg. silty qte c buff iron oxides Dissem pyrite.	150	
	45	74	As above - blue to grey dense fg qte c fairly abundant dissem Pyrite.	25	
	50	75	Mainly dense, dark grey to fawn very fg. wi silty qte c v. finely dissem pyrite.		
			10% grey mg-lg qte.	80	
	55	76	As above c v. finely dissem + few coarse Xstalls Pyrite.	250	300
	60	77	Ditto above c 10-15% Mg grey qte c Pyrite.	15	
	65	78	Ditto above c 10% Mg. grey qte. V.finely dissem pyrite throughout	35	
	70	79	As above 10% Mg. grey qte c coarse pyrite Finely dissem pyrite throughout.	60	
	75	3080	As above - finely banded. Some layers consist of v. fine pyrite (1/8" thick)	30	
	80	81	Coarser gr. gritty white qte + 30% Qtz (Pebbles ?) V. abundant coarse pyrite.		
			Qtzitic Conglom.	25	
	85	82	Ditto. above c v. abundant coarse Pyrite. Qtzitic Conglom.	20	
	90	83	Ditto above c 20% Dark fg. silty qte c finely dissem pyrite. Abundant coarse		
			Qtzitic Conglom. Pyrite.	10	

NORTH FLINDERS MINES N. L. DRILL LOG FORM CONTINUATION SHEE

Drill Hole No. NFOD 4 Sheet 2 of 3

Project O'Donoghues.

LOG				ASSAYS	
from (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu.
90	95	3084	20% As above 70% Dark-light grey silty qte to quartzitic siltst. 10% White Qtz c̄ v.	15	
			abundant pyrite (sometimes in thin bands)		
	100	85	Dark black fg-mg. hard qte c̄ fair amt. dissem pyrite some gritty bands.	100	
	105	86	As above c̄ 25% Qtz pebbles. Some coarse CHALCO ?? finely dissem pyrite.	90	
	110	87	Dark Mg to lg gritty feldspathic qte. Some dissem pyrite.	20	
	115	88	Dark to lighter grey gritty conglomeratic quartzite. c̄ some finely dissem pyrite.	120	
	120	89	Ditto above - some scattered Pyrite Xstals.	40	
	125	90	Mainly coarse gritty conglomeratic qte c̄ fairly abundant coarse pyrite (maybe Tr.		
			Chalco ??)	450	500
	130	91	As above - gritty feldspathic sst - qte. Not much visible pyrite.	50	
	135	92	Dark black mg dirty qte. c̄ only tr. dissem pyrite. May be few pebbles.	80	
	140	93	Ditto above with some thin red shale interbeds.	30	
	145	94	Black dense fg. silty slate c̄ some gritty grains. Fe Oxide Staining. May be some v.		
			finely dissem pyrite &/or magnetite	20	
	150	95	Ditto above with much iron oxide staining.	40	
	155	196	40% Ditto above - black silty slate. 60% Brown-grey dirty mg saccharoidal qte.sst.	70	
	160	97	50% Hard gritty dark qte.) May be trace 50% Hard siltst. slate.) finely dissem pyrite.	25	
	165	98	Mainly dark gritty arkosic qte.	15	
	170	99	50% As above. 50% Fairly light brown dense qte c̄ abundant CHLORITE.	15	
	175	3100	Mainly reddish-brown gritty mic.qte-sst c̄ fair amt. red iron oxide.	15	
	180	01	Ditto. micaceous & Fe stained.	20	
	185	02	As above c̄ some fg silty qte interbeds.	10	
	190	03	As above - fair amt. hematite or magnetite.	15	
	195	04	Ditto - slightly more Fg black dense fg qte - siltst.	20	
	200	05	Pink-grey micaceous & fairly feldspathic Mg-cg qte.-sst. Fair amt. dissem hematite		
			(or magnetite ?)	20	
	205	06	As above.	10	
	210	07	Soft pink mic. Cg. gritty sst. c̄ some pebbles. Greenish very micaceous med gr.beds.	30	
	215	08	As above c̄ 30% Dark black spotted slaty siltst.	15	
	220	09	50% Cg. gritty sst as above (small qtz.pebbles) 50% Dark fg. silty qte to siltst.	20	
	225	10	Cg. soft micaceous, fairly saccharoidal sst with some Cg. qte (10%)	15	
	230	11	Grey-green v. micaceous soft sst - some		
			softer silty interbeds.	50	

NORTH FLINDERS MINES N. L.   DRILL LOG FORM   CONTINUATION SHE

Drill Hole No. NFOD 4   Sheet 3 of 3

Project O'Donoghues.

LOG				ASSAYS	
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu
230	235	3112	Ditto above - some Cg. brown mic. sst & minor silty interbeds.	15	
	240	13	Fairly soft pink-grey-brown mic. argill. sst. some dissem hematite.	40	
	245	14	V. Soft mic. sst. as above c̄ minor grey-green silty interbeds.	30	
			T.D. 245 '		

NORTH FLINDERS MINES N. L.

DRILL LOG FORM

PROJECT O'Donoghues

Drill Hole No. NFOD 5 Sheet 1 of 3 Grid Co-ords 1400N 850W

Azimuth _____ Dip 60° Angle

Type of Drill Drillmaster

Driller G. Russell Collar Datum _____

Logged by B. Wilson Depth of Hole 300 ft.

Commenced 27.5.70 Completed _____

Depth Water Struck 265-270 ft. G. P. H. 200

Depth Water Struck _____ ft. G. P. H. _____

Depth Water Struck _____ ft. G. P. H. _____

% Core Recovered _____ Length of Casing in hole 4 ft.

LOG				ASSAYS	
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu
0	5	3115	Blue-grey dolomite.	160	
5	10	16	Ditto - slightly slaty.	280	
10	15	17	Dense finely laminated blue-grey dolte.	140	
15	20	18	Ditto.above.	200	
20	25	19	Grey blue laminated dolte c 10% White-brown qte.	950	1100
25	30	3120	50% Grey-white med.gr. qte. 50% Blue dense dolomite.	180	
30	35	21	80% Grey med. gr. - coarse gr.qte. 20% Grey slaty dolte.	110	
35	40	22	60% Grey-white qte as above. 20% Grey slate or slaty dolte. 20% Blue dolomite.	50	
40	45	23	20% Grey-white qte. 80% Grey slaty dolte.	35	
45	50	24	50% Buff laminated yellow cherty dolte. 50% Blue massive dense dolte c Fe stain.	70	
50	55	25	80% Blue mass. dolte. 20% Grey slate dolte.	55	
55	60	26	50% Blue-grey finely Xne dolte. 50% Light grey dense dolte.	45	100
60	65	27	70% Blue-grey as above. 30% Light grey as above.	65	100
65	70	28	70% Blue-grey dense dolte as above. 30% Buff chert or ? dolte.	55	
70	75	29	80% Buff-brown chert or ? dolte as above. 20% Blue-grey dolte.	35	
75	80	3130	As above.	30	
80	85	31	All grey-Buff-cream dense fg. dol.? (or chert ?)	25	
85	90	32	Ditto. above c 10-15% White Qtz c specks Pyrite.	15	
90	95	33	Ditto above c 20% Light grey dense fg. dolte. + 5% White qtz c Tr. Pyrite.	30	
95	100	34	Mainly white-light grey - buff dense fg.dolte some qtz. c specks pyrite.	35	
100	105	35	As above with 20% Blue dense dolte. 10% Qtz c Tr. Pyrite.	20	

NORTH FLINDERS MINES N. L. DRILL LOG FORM CONTINUATION SHEE

Drill Hole No. NFOD 5. Sheet 2 of 3

Project O'Donoghues.

LOG				ASSAYS		
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu	
105	110	3136	50% White Qte ? qr ? dolte. 30% Brown finely laminated dense fg dolte.			
			20% Grey-blue dolte - specks Pyrite.	340		
110	115	37	White-grey coarsely X'ne dolte - specks po pyrite, limonite pseudomorphy after Pyrite.	700		
			v.slight Tr. Cu colours in limonite.			
115	120	38	30% Limonitic white dolte c some pyrite. 70% White X'ne dolte.	140		
120	125	39	Mainly white-grey (some yellow) dense fg. dolte.	150		
125	130	3140	Ditto above - odd specks & occasional seams (1/8") Pyrite. altering to limonite.	60		
130	135	41	All white to light grey dense dolte - Few scattered specks Pyrite. Tr. blue dolte			
			c specks Pyrite.	110		
135	140	42	Mainly light grey, some white dense dolte Occas. specks Pyrite.	35		
140	145	43	Light grey dense dolte as above. 5% White qtz c odd crystals Pyrite.	50		
145	150	44	All light grey-blue dense dolte as above. Few small specks pyrite.	40		
150	155	45	Mainly darker grey-blue dense dolte as abve. Few tiny specks Pyrite & Limonitic			
			staining.	65		
155	160	46	60% Dense white-grey qte c few specks pyrite. 40% Blue-Grey dolte.	80		
160	165	47	40% Grey-White Qte. 60% Blue-Grey dolte or dolomitic qte.	110		
165	170	48	Mainly white to blue-grey med.gr. very hard.	110		
170	175	49	50% Blue-grey qte. c some specks pyrite. 50% Blue-grey dolte.	200		
175	180	3150	Mainly blue-grey dense dolte ? Chert or fg silty qte. Tr. dissem Pyrite.	280		
180	185	51	As above (dark blue) c reasonable amt. dissem pyrite.	130		
185	190	52	Ditto above, may be some dense fine gr. qte? Specks Pyrite.	170		
190	195	53	Mainly grey-white dense fg-mg. qte. c Specks Pyrite.	95		
195	200	54	Ditto. above - dissem specks Pyrite.	190		
200	205	55	60% Ditto. above - grey qte. FAIR AMT 40% Darker grey-blue dol.or qte? PYRITE.	150		
205	210	56	30% Grey white fg.qte. 30% Blue ? dol. 40% Blue slate or slaty dolte. Tr. Pyrite	55		
210	215	57	Mainly grey-green med.gr. qte (Hard) some silty dolomite. Tr. Pyrite.	150		
215	220	58	Mainly grey, grey-white, dense fg. qte. (some dolomite?)	260		
220	225	59	Mainly grey-white, dense fg. miliceous dolomite or qte ??	70		
225	230	3160	Grey-blue dense siliceous dolomite or qte?? Tr. dissem Pyrite & few odd coarse			
			Xstaks CHALCO ?	55		
230	235	61	Ditto above - appears quartzitic more than dolomitic Dissem Pyrite & some CHALCO	35		
235	240	62	Mainly dark blue fairly hard dense fg. silty qte. to quartzitic dolomite			
			Some dissem Pyrite ? Tr. CHALCO.	35		

NORTH FLINDERS MINES N. L. DRILL LOG FORM CONTINUATION SHEE

Drill Hole No. NFOD 5 Sheet 3 of 3

Project O'Donoghues.

LOG				ASSAYS	
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu
240	245	3163	Mainly dark blue-black dense hard silty qte. c̄ some dissem pyrite.	50	
245	250	64	ditto. Tr. dissem Pyrite.	75	
250	255	65	Ditto c̄ 20% White dense qte.	230	
255	260	66	Ditto c̄ 30% Lighter grey lst-dolte?	260	
260	265	67	Ditto c̄ 40% Lighter grey qte - dolte? Tr. dissem Pyrite.	210	
265	270	68	Yellow-white very dense fg. hard qte. c̄ blue dolomite Cavings.	180	
270	275	69	Ditto above. hard qte.	280	100
275	280	3170	Ditto above - hard white dense qte.	160	200
280	285	71	Ditto above "	1000	1300
285	290	72	Ditto above "	1900	1500
290	295	73	Ditto above "	250	700
295	300	74	Ditto above "	320	300
	At	300' -	Hole abandoned - Water increased to 1800		
			to 2000 gph & hole starting to wash badly		
			from blue - dolomite sections above.		

NORTH FLINDERS MINES N. L.

DRILL LOG FORM

PROJECT O'Donoghues.

Drill Hole No. NFOD 6 Sheet 1 of 2 Grid Co-ords 1052W 800N

Azimuth _____ Dip 60° E. Angle.

Type of Drill Drillmaster

Driller G. Russell Collar Datum _____

Logged by R.B.Wilson. Depth of Hole 255 ft.

Commenced 29.5.70 Completed 30.5.70

Depth Water Struck 115-120' ft. G. P. H. 300

Depth Water Struck 190-195 ft. G. P. H. 1000

Depth Water Struck _____ ft. G. P. H. _____

% Core Recovered _____ Length of Casing in hole 10 ft.

LOG				ASSAYS	
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu
0	5	3175	Fill	15	
5	10	76	Grey dense laminated dolomite	10	
10	15	77	Grey-green-blue dense fg. dolte.	5	
15	20	78	20% Grey silty dolomitic qte? 80% Grey=dark blue dense fine gr. dolte.	5	
20	25	79	20% Light grey silty dolte. 80% Dark blue dense fg. dolte.	5	
25	30	3180	80% Light grey-white silty dolte. 20% Dark blue dense fg. dolte.	5	
30	35	81	Mainly dark blue dense dolte. Tr. Qtz.	5	
35	40	82	Ditto above.	5	
40	45	83	As above c 20% light grey silty dolte. Some Qtz.	5	
45	50	84	Mainly dark blue dense fg dolte.	10	
50	55	85	Light grey sandy (?) dolomite or dolomitic sst. Some dissem Pyrite.	5	
55	60	86	30% As above. 70% Grey-blue dense dolte. Tr. Pyrite.	5	
60	65	87	Grey dense laminated dolte. Tr. Pyrite.	5	
65	70	88	" " Mg. dol.	5	
70	75	89	Mainly dark grey-blue dense fg. dte. c 10% Coarse dolomitic sst orqte ?	5	
75	80	3190	Dark blue dense fg. dolte. Tr. dissem & coarse Pyrite.	5	
80	85	91	Ditto. Tr. Qtz. Tr. Pyrite.	5	
85	90	92	Ditto-light to dark grey dense dolte. Tr Qtz.	5	
90	95	93	Light to dark grey dolte as above.	5	
95	100	94	As above.	5	
100	105	95	Mainly light grey dense ft. dolte. Some dark blue.	5	
105	110	96	Mainly light grey dense fg. dolte - some dark blue - banded.	5	

NORTH FLINDERS MINES N. L. DRILL LOG FORM CONTINUATION SHEE

Drill Hole No. NFOD 6 Sheet 2 of 2

Project O'Donoghues.

LOG				ASSAYS	
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu
110	115	3197	Medium grey dens fg. banded dolomite	5	
115	120	98	As above + 10% light grey gritty dolomite (Cg.)	5	
120	125	99	Med.blue-grey dense fg. banded dolte.	5	
125	130	3200	Ditto. above.	5	
130	135	01	As above c 10% Cg. gritty dolomite. Some darker fine gr. silty dolte. c Tr.dissem Pyrite.	5	
135	140	02	Slightly darker grey dolomite as above. c Tr. Pyrite.	5	
140	145	03	As above - Tr. dissem fine Pyrite.	10	
145	150	04	As above - Tr. dissem Pyrite.	10	
150	155	05	As above " " "	10	
155	160	06	As above " " "	5	
160	165	07	As above + 20% Coarse chloritic grit or qte. Tr. Pyrite.	10	
165	170	08	Slightly darker grey dense fg.-mg. dolte.	5	
170	175	09	As above- Tr. qtz + V.slight Tr. Pyrite.	10	
175	180	3210	As above - some med.gr. grey dense dolte. Tr. Pyrite + Tr. dissem CHALCO ?	5	
180	185	11	As above - only v. sl. Tr. dissem sulphide.	5	
185	190	12	Mainly dark blue-grey dense fg. dolte. Some dark fusile siltstone or silty dolomite.	10	
190	195	13	30% Dark blue dolte as above. 70% light - med.grey dense siliceous dolte. V.Sl. Tr. dissem sulphide.	5	
195	200	14	Mainly dark blue-grey dense dolomite as above. c Tr. dissem pyrite.	10	
200	205	15	50% Dark blue dolte as above. Tr. Dissem 50% Light med-grey Mg.dolte. Pyrite.	10	
205	210	16	Lighter grey dense fg-mg. dolte c Tr. Dissem Pyrite.	10	
210	215	17	Ditto above with Tr. dissem Pyrite.	5	
215	220	18	60-70% As above c some Pyrite. 30% White Quartzite - Qtz c some Pyrite.	5	
220	225	19	20% Coarse reXse'd gritty qte c Tr. Pyrite 80% Dark silty fg. dolte c fair amount Pyrite.	10	
225	230	3220	Mainly white dolomitic ? fg. qte & silty qte. c Tr. dissem Pyrite throughout.	10	
230	235	21	60% Grey-white silty or dolomitic qte. 40% Darker siltstone - silty dolte.	5	
235	240	22	As above -fair amt. dissem Pyrite. Tr. Chalco ??	10	
240	245	23	Mainly dark siltstone, silty qte & silty dolte ? Some white Qtz. Tr. dissem Pyrite. ?? Graphite	5	
245	250	24	40% White dense qte. Tr. finely dissem Pyrite. 60% Dark blue-black dense siltst. or silty dolte. ? Graphite??		
	255		Loss of Air - Hole Fractured - No SAMPLE.		
			TD 255'		

NORTH FLINDERS MINES N. L.

DRILL LOG FORM

PROJECT O'Donoghues.

Drill Hole No. NFOD 7 Sheet 1 of 2 Grid Co-ords 0060E 00N

Azimuth _____ Dip 60° Angle E.

Type of Drill Drillmaster.

Driller G. Russell Collar Datum _____

Logged by R.B.Wilson. Depth of Hole 115 ft.

Commenced 30.5.70 Completed 1.6.70

Depth Water Struck 115 ft. G. P. H. 300

Depth Water Struck _____ ft. G. P. H. _____

Depth Water Struck _____ ft. G. P. H. _____

% Core Recovered _____ Length of Casing in hole 15 ft.

LOG				ASSAYS	
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu
0	5	3226	Filling	70	
5	10	27	Grey-green silty laminated qte.	55	
10	15	28	Grey-green black silty laminated fg.qte.	50	
15	20	29	" " " " " " " (some buff-coloured bands)	40	
20	25	3230	As above - some light grey siltstone	40	
25	30	31	As above - some fawn qte. Some silty bands.	65	
30	35	32	40% Grey-black silty fg.qte - siltstone. 60% Qte + Qtz. (Conglom. ?)	300	1300
35	40	33	40% Dense fawn -grey black dense silty qte. 60% Coarse gritty qte c̄ fairly abundant		
			dissem Malachite.	3100	4300
40	45	34	Black to grey gritty qte c̄ some Malachite staining.	1500	1600
45	50	35	Dark grey gritty to Mg.qte c̄ Tr. Malachite.	700	700
50	55	36	Dark grey dens fg-mg qte c̄ Tr. Malachite.	170	
55	60	37	50% As above c̄ Tr. Malachite. 50% Qtz + qte. (Conglom ?)	240	
60	65	38	Mainly dark gritty conglomeratic qte. c̄ Tr. Malachite (? Cavings ?)	110	
65	70	39	Grey-pink feldsp.gritty qte. c̄ Fe.staining.	75	
70	75	3240	Pink-grey feldsp. gritty qte.	100	
75	80	41	As above.	1800	1600
80	85	42	Large quantites of Malachite. Grey-fawn spotted fg.-qte. (Cavings ?)	1400	3000
85	90	43	50% As above Conglomeratic 50% Pink-grey gritty feldsp. qte.	1300	1200
90	95	44	30% Conflom. qte. as above. 70% Pink-grey dense mg. qte.		
95	100	45	Mainly dark dense fg-mg qte. Still Tr. Malachite Cavings ?	330	

NORTH FLINDERS MINES N. L. DRILL LOG FORM CONTINUATION SHEE

Drill Hole No. NFOD 7

Sheet 2 of 2

Project O'Donoghues.

LOG				ASSAYS	
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu
100	105	3246	As above - some thin bands of gritty qte & some buff speckled qte.	290	
105	110	47	40% As above. 60% Pink-grey gritty feldsp. Qte.	160	
110	115	48	As above. Struck Water..	150	
			T.D.115'		

NORTH FLINDERS MINES N. L.

DRILL LOG FORM

PROJECT O'Donoghues

Drill Hole No. NFOD 8 Sheet 1 of 2 Grid Co-ords 00E

Azimuth _____ Dip Vertical 00N

Type of Drill Drillmaster

Driller G.Russell Collar Datum _____

Logged by R.B.Wilson. Depth of Hole _____ ft.

Commenced 1.6.70 Completed _____

Depth Water Struck 80 ft. G. P. H. 500

Depth Water Struck 145 ft. G. P. H. 700

Depth Water Struck _____ ft. G. P. H. _____

% Core Recovered _____ Length of Casing in hole _____ ft.

LOG				ASSAYS		
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu	
0	5	3249	Filling	35		
5	10	3250	Greenish clayey siltstone c̄ some Black-green Mg. qte.	10		
10	15	51	Light grey to white conglomeratic (?) Qte.	20		
15	20	52	Ditto c̄ Tr. Pyrite.	15		
20	25	53	Brown to grey speckled Mg-Cg gritty (?) Qte. No Pyrite.	10		
25	30	54	Ditto. above	140	200	
30	35	55	Ditto. above + 10% Qtz c̄ Tr. Pyrite.	20		
35	40	56	Fawn - grey speckled qte - hard - Only Tr. Qtz.	20		
40	45	57	80% Speckled Qte as above. 20% Dense fg. grey qte (speckled) c̄			
			abundant dissem pyrite	75		
45	50	58	Grey-fawn to dark grey mg qte c̄ 30% dark grey speckled qte c̄ abundant			
			dissem pyrite.	25		
50	55	59	Grey-fawn laminated qte (med.gr.)-some dark grey qte (laminated) c̄ fair amt.			
			dissem pyrite.	35		
55	60	3260	As above - some bands c̄ fair amt. dissem Pyrite.	20		
60	65	61	Grey laminated & speckled qte c̄ 30% White Calcite - abundant coarse and finely			
			dissem pyrite.	25		
65	70	62	Lightish grey dense Mg. Qte c̄ some qtz. pebbles (?) Very abundant dissem Pyrite			
			throughout (? chalco ?)	15		
70	75	63	Grey qte c̄ some quartz & abundant Pyrite.	20		
75	80	64	Cg. gritty qte c̄ 50% Qtz (Pebbles ??) Abundant Pyrite.			
			?Tr. Chalco?	20		

NORTH FLINDERS MINES N. L. DRILL LOG FORM CONTINUATION SHEET

Drill Hole No. NFOD 8 Sheet 2 of 2

Project O'Donoghues.

LOG				ASSAYS		
From (ft)	To (ft)	Sample No	Lithology	ppm AAS	ppm Cu	
80	85	3265	Mainly white dense qte c̄ abundant doiss dissem Pyrite.	10		
85	90	66	Grey dense med.gr. qte - not much Pyrite.	5		
90	95	67	Grey-fawn med.gr. qte c̄ 30% White Qtz.	15		
95	100	68	Ditto above c̄ 30% White Qtz.	15		
100	105	69	Ditto above c̄ 30% White qtz.	10		
105	110	3270	Dark grey-pink very gritty qte -some qtz.	10		
110	115	71	As above.	10		
115	120	72	Ditto c̄ 20% White calcite.	15		
120	125	73	Gritty coarse conglomerate (30% White qtz)	10		
125	130	74	Dense Mq-Cq.gritty qte (Pink-grey)	10		
130	135	75	Pink-grey conglomeratic gritty, v.hard qte. 10% Calcite.	10		
135	140	76	Pink-grey to green-black dense med.gr.qte V. Hard. No Pyrite.	5		
140	145	77	Grey-fawn v.fq. hard dense qte.	10		
145	150	78	10% Qte - as above. 90% Conglomeratic quartzite (20% White Qtz)	15		
			T.D. 150'			

REPORT ON
INVESTIGATIONS OF S. M. L. 294
FOR
NORTH FLINDERS MINES N. L.

J Mullins (for)

Sydney
August 12, 1970

M. R. W. Garman, B. Sc.
Watts, Griffis & McOuat (Australia) Pty. Ltd.

CONTENTS

SUMMARY

This report describes the investigation of the zinc-rich Skillogalee Dolomite between O'Donoghue's Castle Mine and Arkaroola Homestead. After an assessment of the results of the chip sampling of this formation, it was concluded that further exploration for zinc, except possibly in the area around O'Donoghue's Castle Mine, was not warranted.

One of two zinc anomalies near Mt. McTaggart was investigated but the source was not located. Further investigation of these anomalies should be undertaken.

REPORT ON INVESTIGATIONS OF S.M.L. 294

INTRODUCTION

At the request of North Flinders Mines N.L. the writer spent five days investigating geochemical anomalies and other areas of interest within S.M.L. 294.

The purpose of the visit was to determine the significance of the anomalies and recommend further work.

INVESTIGATIONS

Zinc Anomalies North of O'Donoghue's Castle Copper Mine

The stream sediment samples that contain anomalous zinc and trend northeast from O'Donoghue's Castle Copper Mine have their origin in the lower part of the Lower Proterozoic formation known as the Skillogalee Dolomite. In this area the lower part of the Skillogalee Dolomite consists of dark grey siltstones with occasional beds of light grey to dark brown dolomite.

In an effort to try to determine the exact source of the anomalous zinc values in the stream sediments, six lines of chip samples were taken across the strike of the rocks between O'Donoghue's Castle Mine and Arkaroola Homestead.

The chip samples showed that some of the dolomite beds were zinc-rich and in a few places some shales were slightly anomalous in zinc. However, no definite, continuous zinc-rich bed of dolomite was present.

Now that it is known that there are zinc-rich dolomites in the lower part of the Skillogalee Dolomite, it is felt that other areas containing this part of the formation could be thought of as potential exploration targets, particularly where faulting parallel or sub-parallel to the strike of the rocks is known.

Zinc Anomalies near Mt. McTaggart

Two individual anomalies are situated within about a mile of Mt. McTaggart. One is to the north and the other about half a mile to the west. Three samples were taken from the northern anomalous zone: numbers F-291 and F-292 were analysed for copper, lead and zinc but they were not anomalous in any of the three elements.

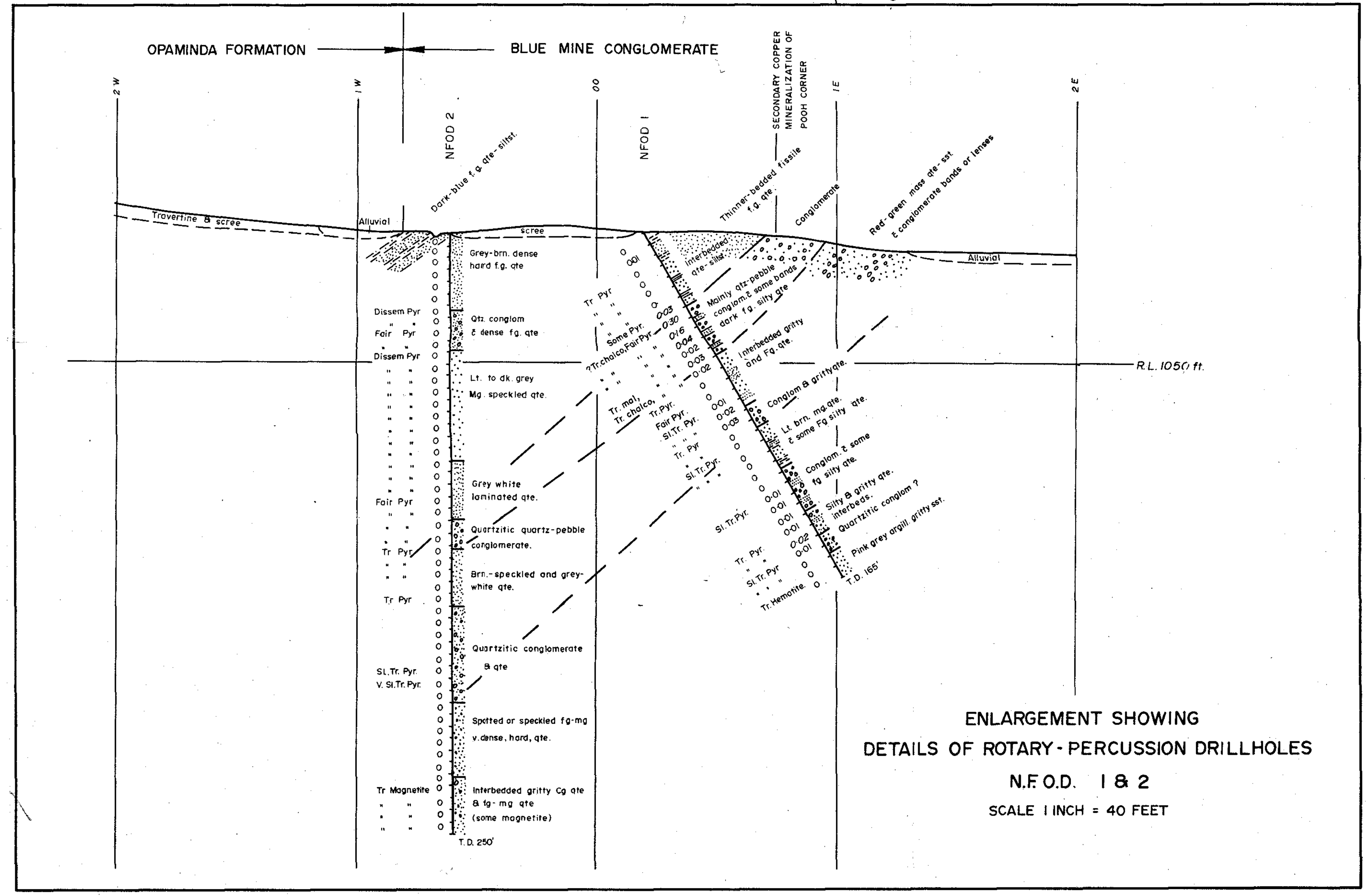
Sample F-291 was from a small carbonate vein and contained about 50% opaque minerals. A polished section was made from part of the sample and examined by Mr. D. H. McColl of McPhar Geophysics Pty. Ltd. It is described in Mineralogical Report No. 210 dated May 28, 1970. The report states that the rock contains about 50% goethite and less than 1% pyrrhotite in a basically carbonate matrix.

The third sample, number F-293, contained a white encrustation which, it was thought, might have been a zinc salt. However, x-ray diffraction analysis proved conclusively that it was calcite.

As none of the three samples taken contain any anomalous zinc values, the area should be inspected again along with the anomalous stream sediment location to the west of Mt. McTaggart.

CONCLUSIONS

It is not considered that there is much potential in the area between O'Donoghue's Castle Mine and Arkaroola Homestead for further zinc exploration, except possibly around O'Donoghue's Castle Mine itself. The rest of the area contains mainly irregularly distributed low zinc values, and there are no suitable mineral concentrating structures. Other areas within the S.M.L. which are anomalous in zinc should be investigated. Any areas taken up in the future which contain Skillogalee Dolomite should be stream sediment sampled for zinc, as it is considered that there is a possibility of willemite or smithsonite deposits occurring in this formation similar to the willemite deposits that occur in the Cambrian limestones.



NOTE:- On 1"=100' section lithologic bands within major unit are shown diagrammatically only.

DRILL HOLE ASSAYS

0·19 = % Cu - by AAS on small grab sample - Mc Phar

0·19 = % Cu - scheme F_1 on full split sample - Amdel

METHOD OF INDICATING RESULTS

10, 20, 30 Zn, Pb, Cu — Rock chip samples

10, 20, 30 Zn, Pb, Cu — Soil samples

Surface

VALUES IN P.P.M.

METHOD OF ANALYSIS

Rock chips & drill cuttings pulverized, soils sieved to -80 mesh. 0·25 gm samp. leached in hot 25% HNO_3 for 1 hour. Analysis by AAS, by Mc Phar Geophysics Pty. Ltd.

FEET 100 0 100 200 300 400 FEET

SCALE 1 INCH EQUALS 100 FEET

North Flinders Mines N. L.

O'DONOGHUE CASTLE COPPER PROSPECT

CROSS-SECTION 400 N

GEOLOGY BY B. WILSON

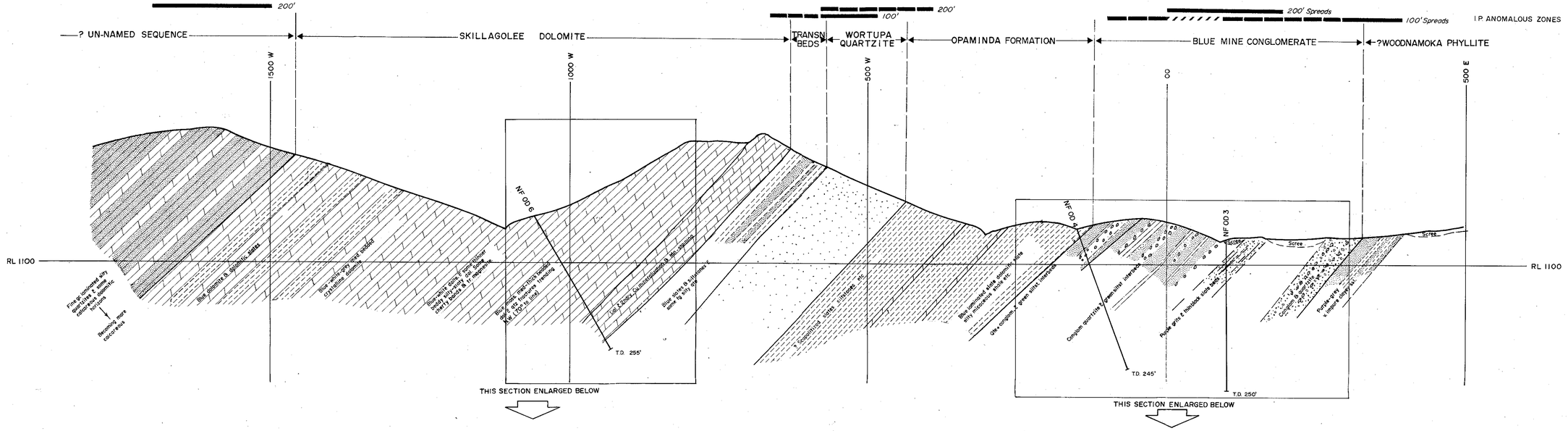
SURFACE GEOCHEM VALUES IN P.P.M.

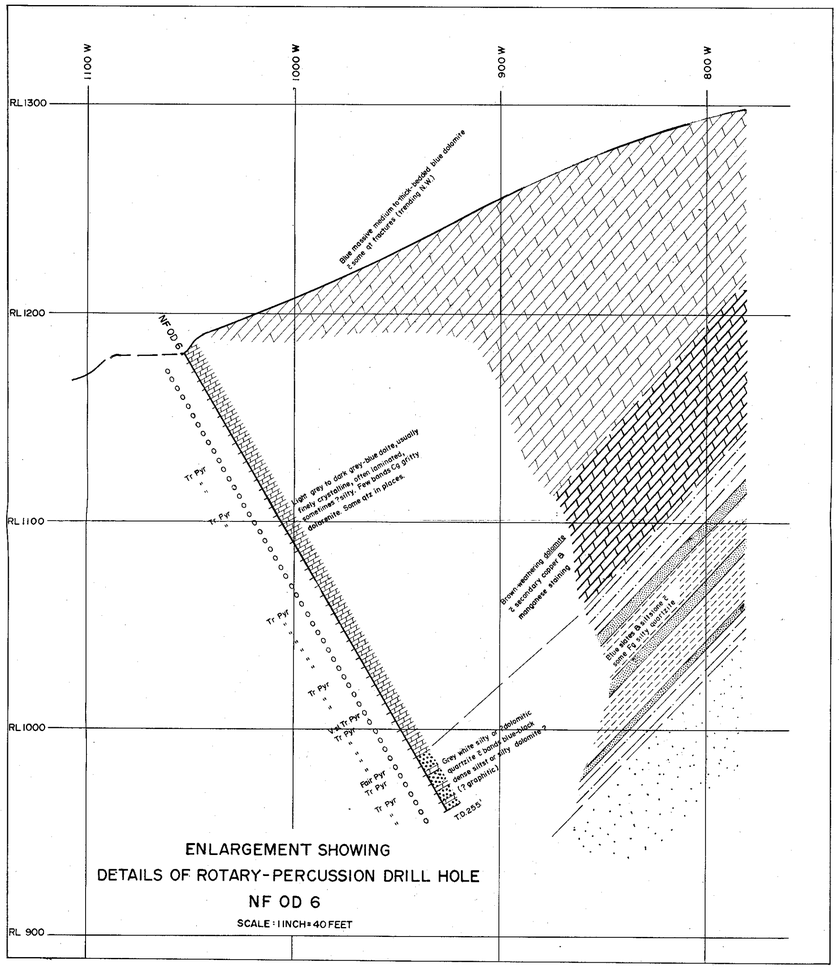
DRILLHOLE ASSAYS - % COPPER

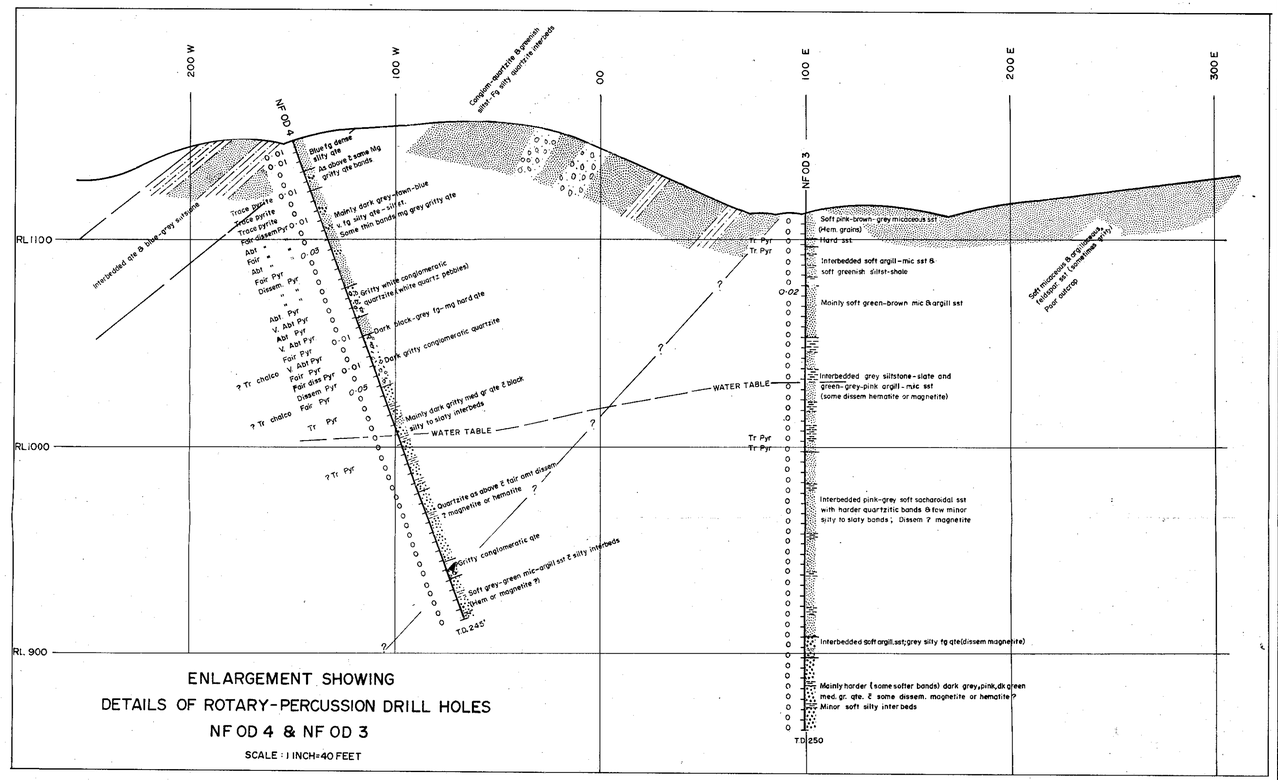
DRN:- MCC	DATE:- MAY 1970	SCALE:- 1 INCH = 100 FEET 1226

ENV 1226 (IV) - 3

DWG: 294 - 16







DRILL HOLE ASSAYS

0·19 % Cu – A.A.S analysis on pulverised small grab samples of 0·25gm leached in hot 25% HNO_3 for 1 hour by McPhar.

0·19 % Cu – Scheme F1 on full split sample by Amdel

NOTE : Lithologic bands within major units are shown diagrammatically on 1"=100' scale section.

FEET : 100 0 100 200 300 400 FEET

SCALE 1 INCH EQUALS 100 FEET

North Flinders Mines N.L.

O'DONOHUE CASTLE COPPER PROSPECT

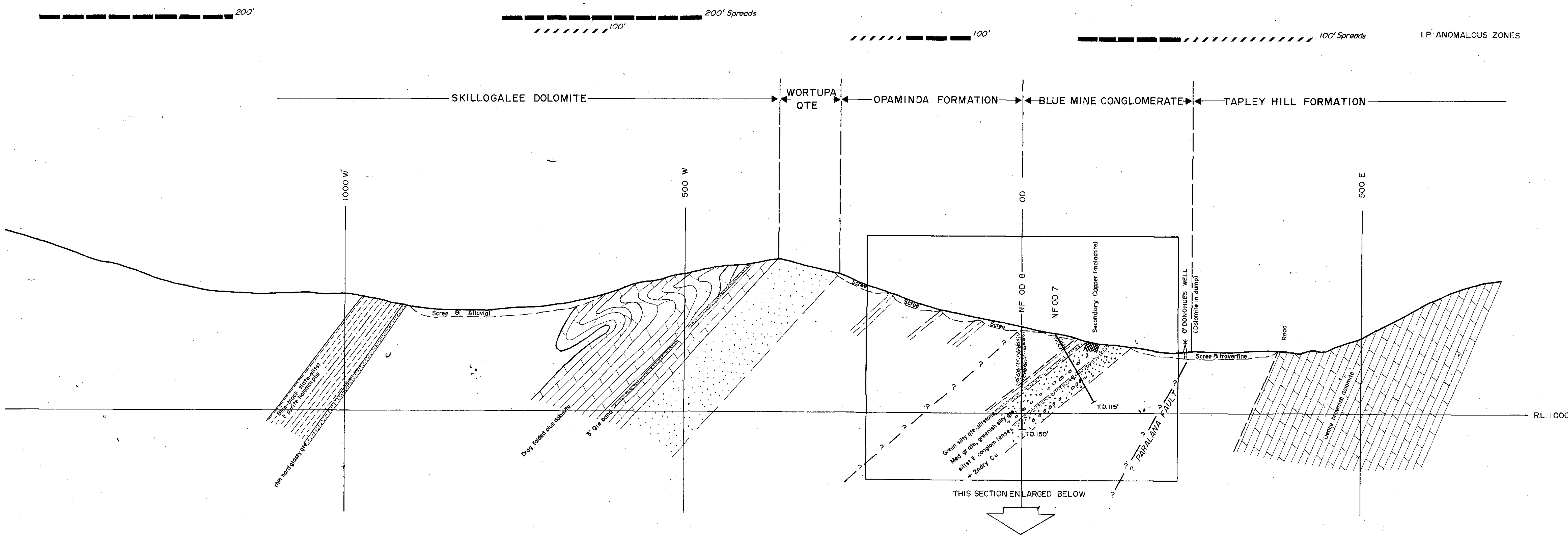
CROSS SECTION 800 N

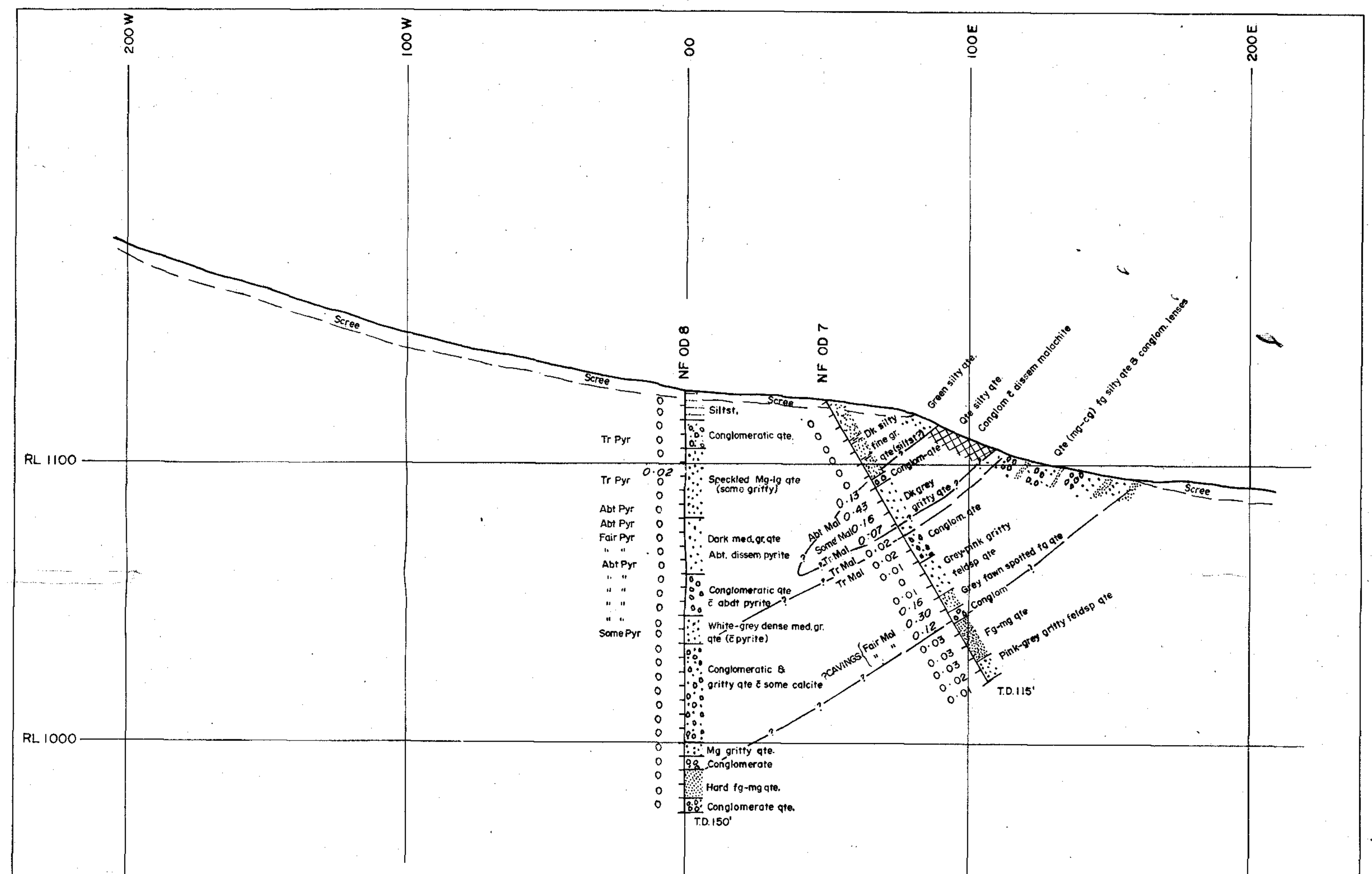
GEOLOGY BY B WILSON
COPPER ASSAYS IN %

DRN:- M.C.C.	DATE:- JUNE 70	SCALE:- MAIN - 1 INCH = 100 FEET

ENV 1226 (Ry) - 4

DWG : 294 - 23





ENLARGEMENT SHOWING
DETAILS OF ROTARY-PERCUSSION DRILL HOLES
NFOD 7 & NFOD 8
SCALE : 1 INCH = 40 FEET

DRILL HOLE ASSAYS

0·19 — %Cu – A.A.S. analysis on pulverised small grab samples of 0·25gm. leached in hot 25% HNO_3 for 1 hour by McPhar

0·19 — %Cu – Scheme F1 on full split sample - Amdel

NOTE Lithologic bands within major units are shown diagrammatically on 1"=100' scale section.

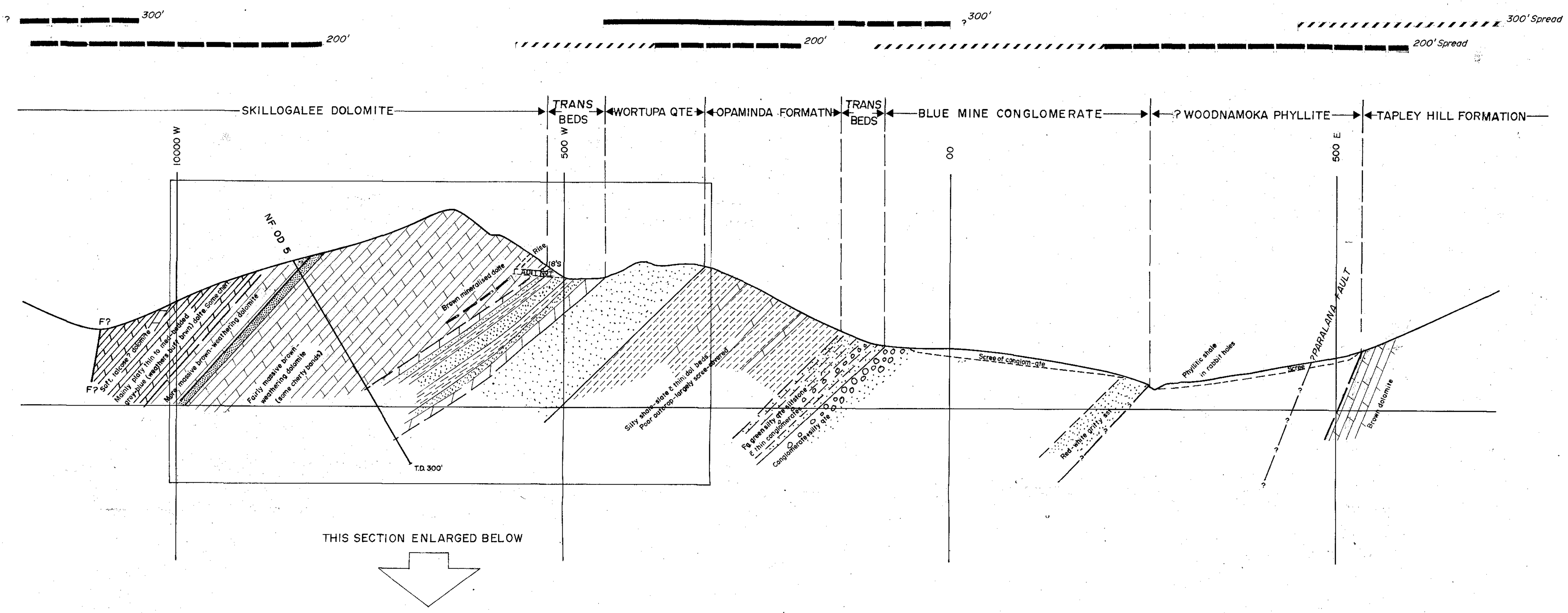
FEET 100 0 100 200 300 400 FEET

SCALE 1 INCH EQUALS 100 FEET

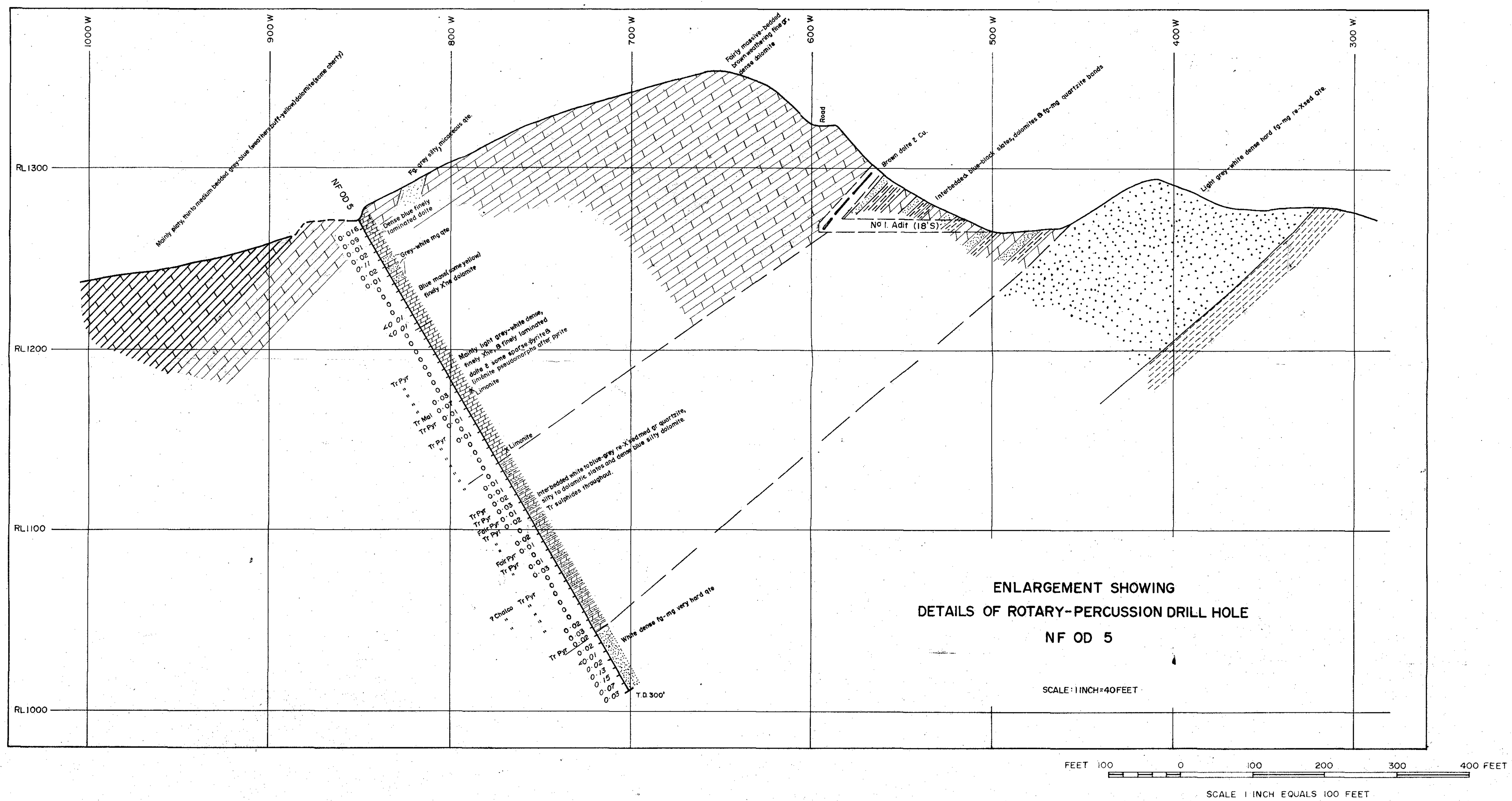
NFM North Flinders Mines N.L.		
O'DONOHUE CASTLE COPPER PROSPECT		
CROSS SECTION 00 N		
GEOLOGY BY B WILSON COPPER ASSAYS IN %		
DRN:- M.C.C.	DATE:- JUNE 70	SCALE:- MAIN - 1 INCH = 100 FEET

ENV1226(IV)-5

DWG : 294 - 26



I.P. ANOMALOUS ZONE



DRILL HOLE ASSAYS

0·19 %Cu- Pulverised small grab samples, analysed by A.A.S. on 0·25gm. sample leached in hot 25% HNO_3 for 1 hour. Analysis by McPhar. Geophysics Pty.Ltd.

0·19 %Cu- Scheme F1 on full split sample Analysis by Amdel.

NOTE: Lithologic bands within major units are shown diagrammatically only. on 1" = 100' scale.

North Flinders Mines N. L.

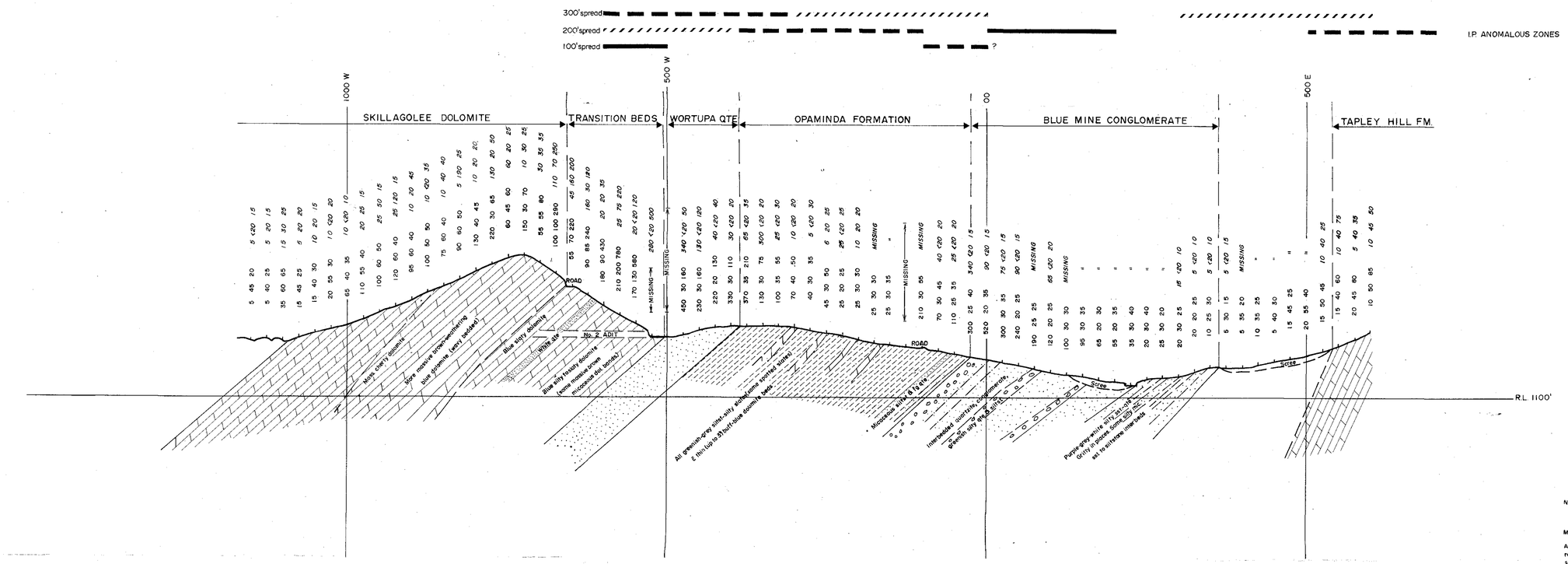
O'DONOHUE CASTLE COPPER PROSPECT

CROSS SECTION 1400 N

GEOLOGY BY B WILSON
COPPER ASSAYS IN %

DRN:- M.C.C.	DATE:- JUNE 70	SCALE:- MAIN - 1 INCH = 100 FEET

ENV1226(IV)-6 DWG 294 - 27



NOTE Lithologic bands within major units are shown diagrammatically only.

METHOD OF ANALYSIS

A.A.S. /analysis on pulverised rock chip samples and soil samples sieved to −80 mesh.
0·25gm. samples leached in hot 25% HNO_3 for 1hour by McPhar Geophysics Pty. Ltd.

METHOD OF INDICATING RESULTS

Rock chip samples: Zn / Pb / Cu
Soil samples: Zn / Pb / Cu
Surface location

FEET 100 0 100 200 300 400 FEET

SCALE 1 INCH EQUALS 100 FEET

North Flinders Mines N. L.

O'DONOHUE CASTLE COPPER PROSPECT

CROSS SECTION 1,000 N

GEOLOGY BY B WILSON
SECTION SHOWS
SURFACE GEOCHEM VALUES IN P.P.M

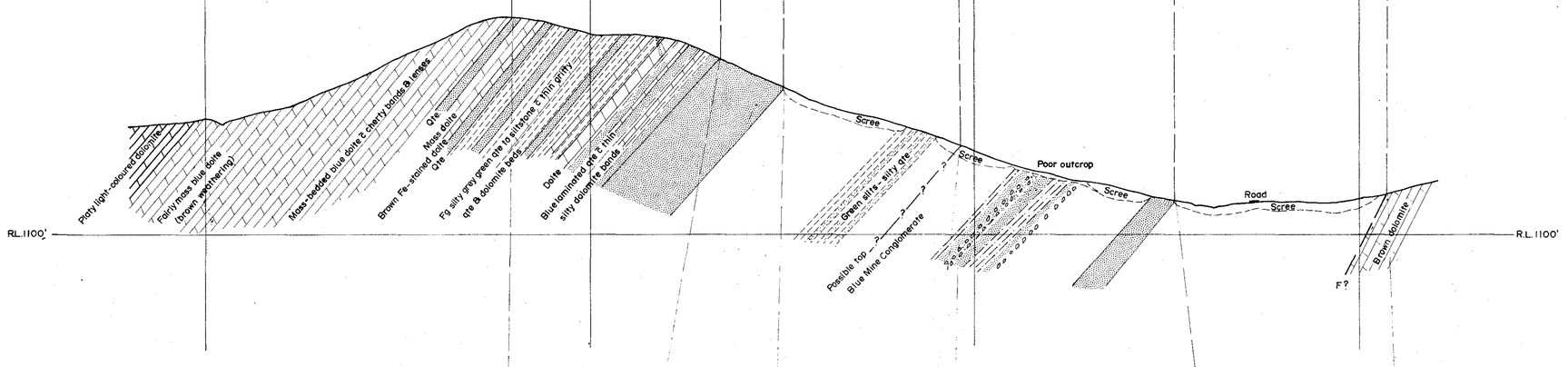
DRN:- D.K.T.	DATE:- AUGUST '70	SCALE:- 1 INCH = 100 FEET

ENV1226(IV)-7 1226 DWG:294-28

SKILLOGALEE DOLOMITE — TRANSITION BEDS — WORTUPA QTE — OPAMINDA FORMATION — BLUE MINE CONGLOMERATE — WOODNAMOKA PHYLLITE — TAPLEY HILL FORMATION

200' SPREADS I.P. ANOMALOUS ZONES

1000 W 500 W 00 500 E



1600 N

SEE DWG: 294-27

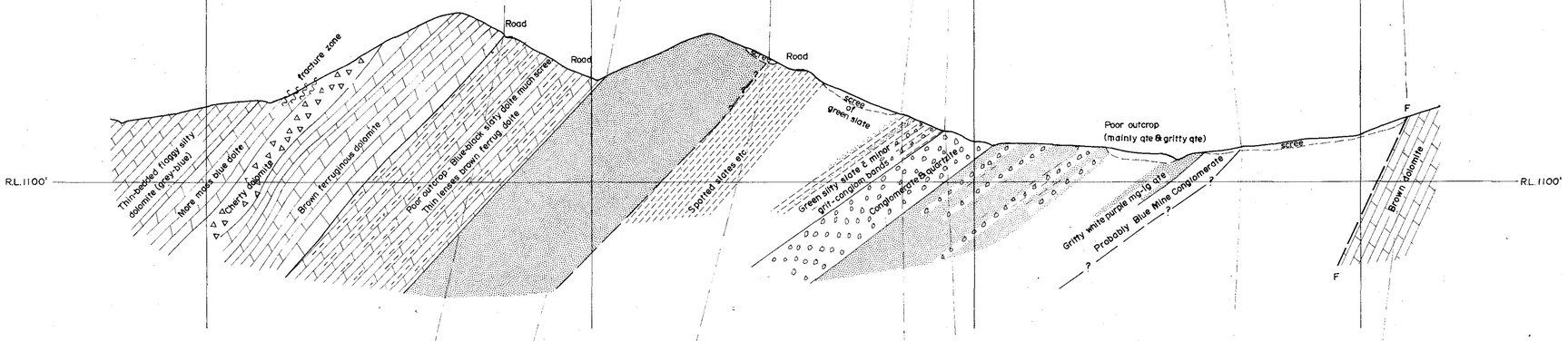
1400 N

.300' SPREADS

200' SPREADS I.P. ANOMALOUS ZONES

? 100' SPREADS

1000 W 500 W 00 500 E



1200 N

SEE DWG: 294-28

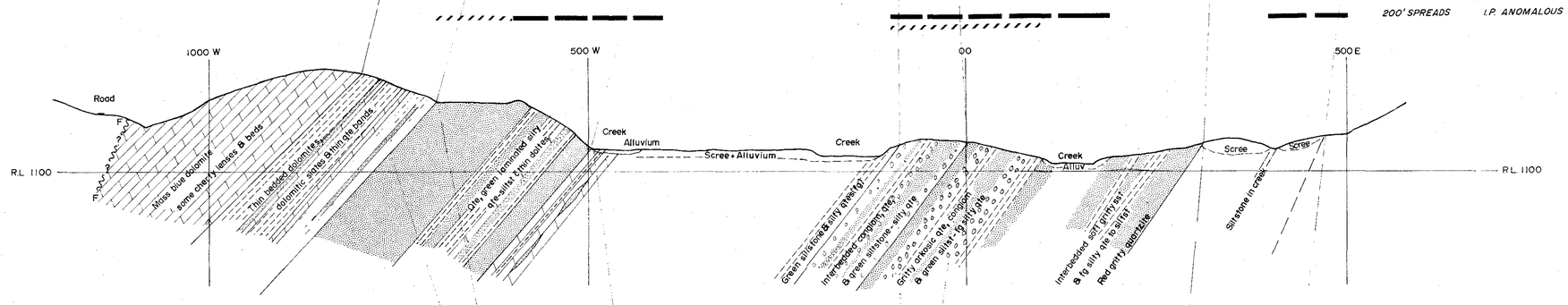
1000 N

SEE DWG: 294-23

800 N

200' SPREADS I.P. ANOMALOUS ZONES

1000 W 500 W 00 500 E



600 N

SEE DWG: 294-16

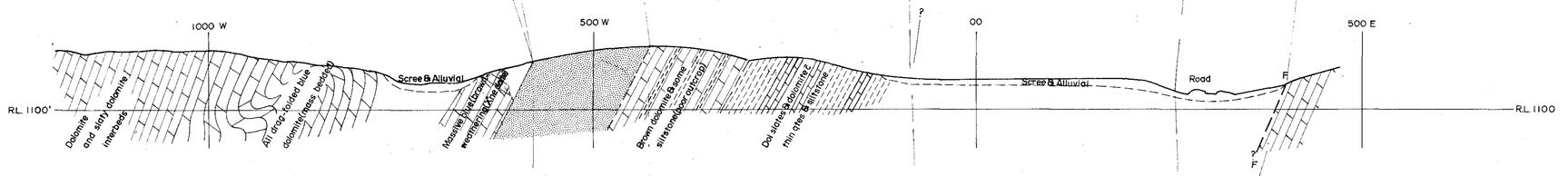
400 N

200' SPREADS

100' SPREADS

I.P. ANOMALOUS ZONES

1000 W 500 W 00 500 E



200 N

SEE DWG: 294-26

00 N

SKILLOGALEE DOLOMITE — WORTUPA QTE — OPAMINDA FORMATION — BLUE MINE CONGLOMERATE — TAPLEY HILL FORMATION

WOODNAMOKA PHYLLITE

NFM North Flinders Mines N. L.

O'DONOHUE CASTLE COPPER PROSPECT

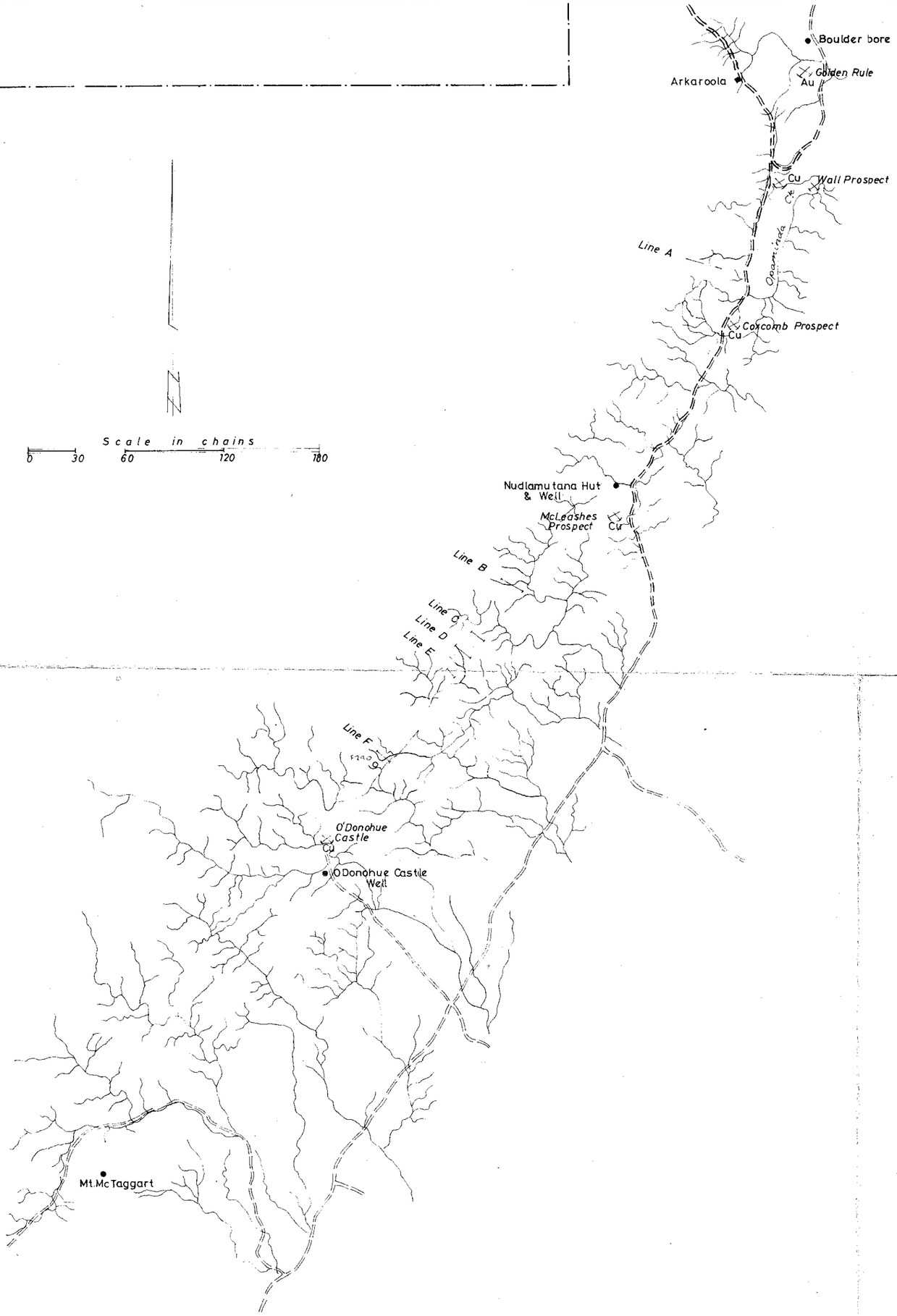
CROSS SECTION ON LINES 1600 N, 1200N, 600N, & 200 N

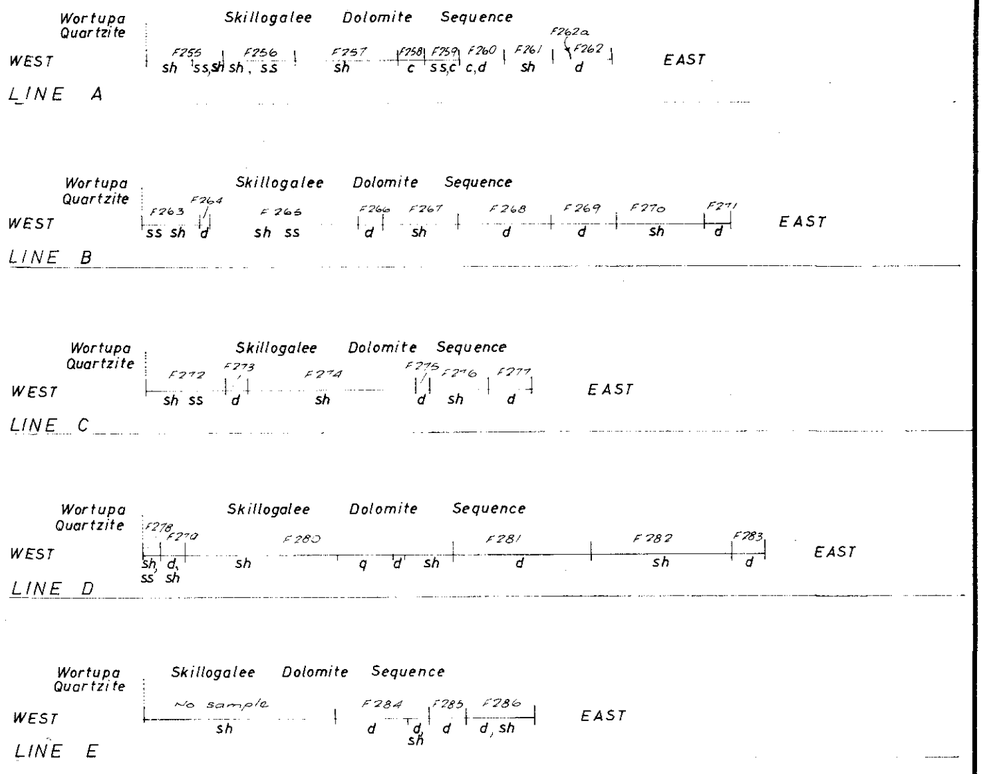
GEOLOGY BY R.B. WILSON

DRN:- D.K.T.	DATE:- 21-8-70	SCALE:- 1 INCH = 100 FEET

ENV1226(FY)-8 1226

DWG: 294-29





LEGEND

sh = shale
c = conglomerate
d = dolomite
ss = sandstone
q = quartzite

Sample locations of lines A - F shown in section

SCALE: 1" = 200'

WATTS, GRIFFIS AND McOUAT (AUSTRALIA) PTY. LIMITED
CONSULTING GEOLOGISTS & ENGINEERS
1ST FLOOR—56 PITT STREET, SYDNEY

NORTH FLINDERS MINES N. L.

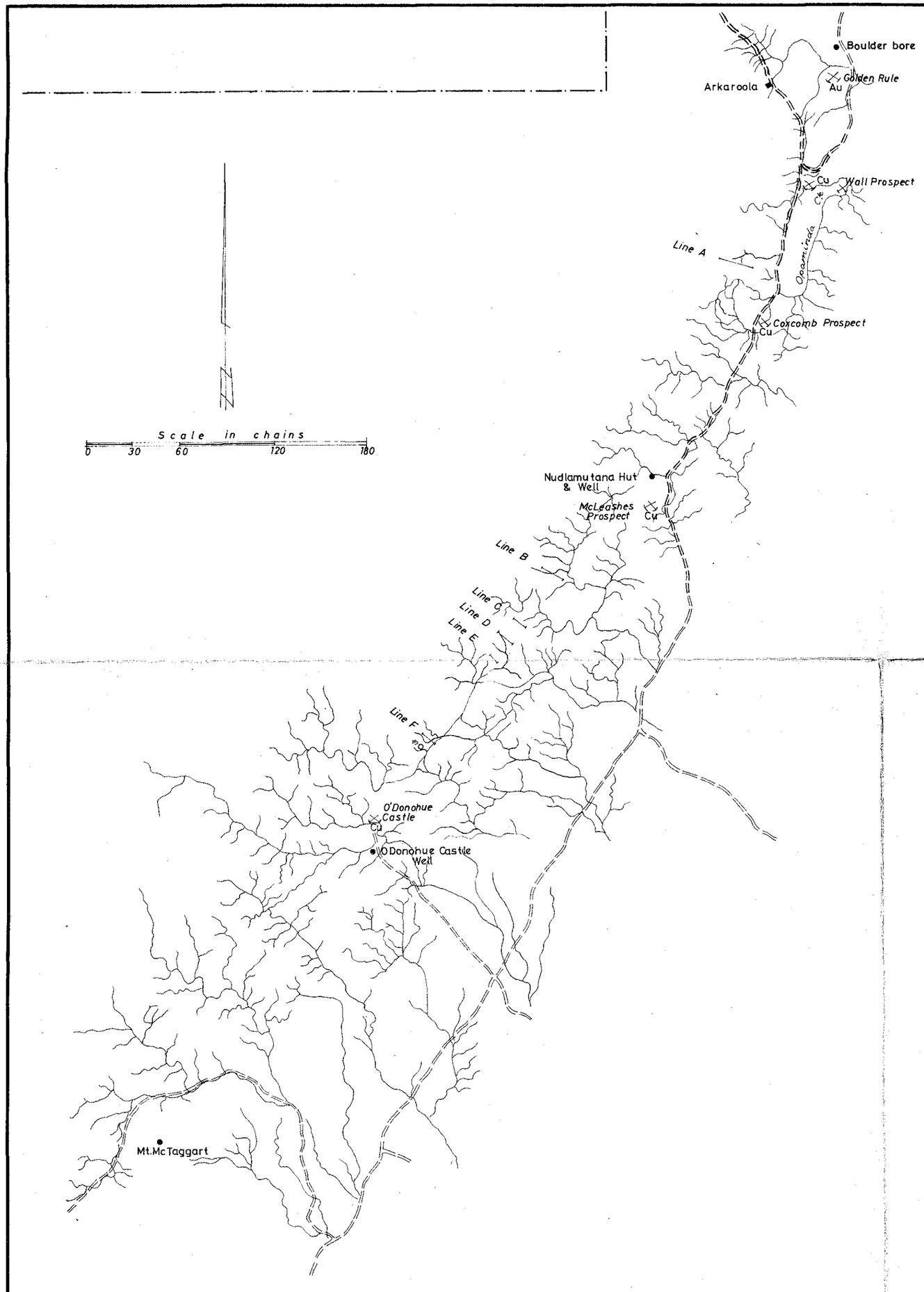
— WOLTANA AREA - S.M.L.294. —

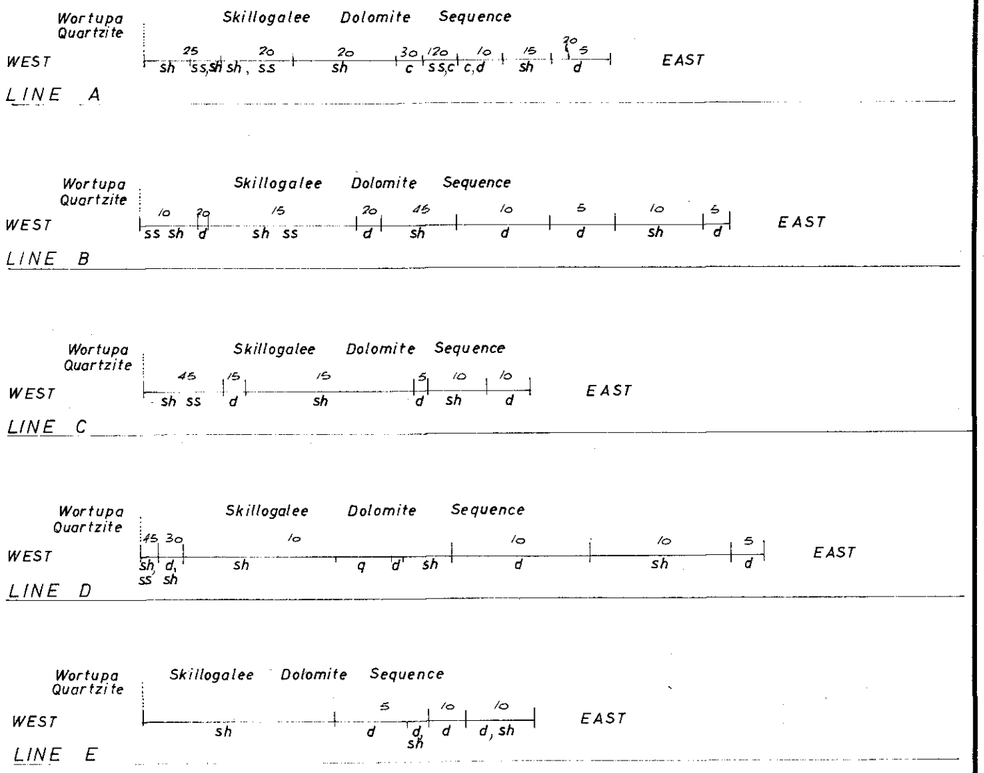
ANOMALY INVESTIGATION SAMPLING

SAMPLE LOCATIONS

SCALE: 1" = 60 chains	DATE: 24.8.70	DRAWING No.: 1610 / 28
DRAWN: SE	APPROVED:	

ENV1226(5)-716





LEGEND

sh = shale
c = conglomerate
d = dolomite
ss = sandstone
q = quartzite

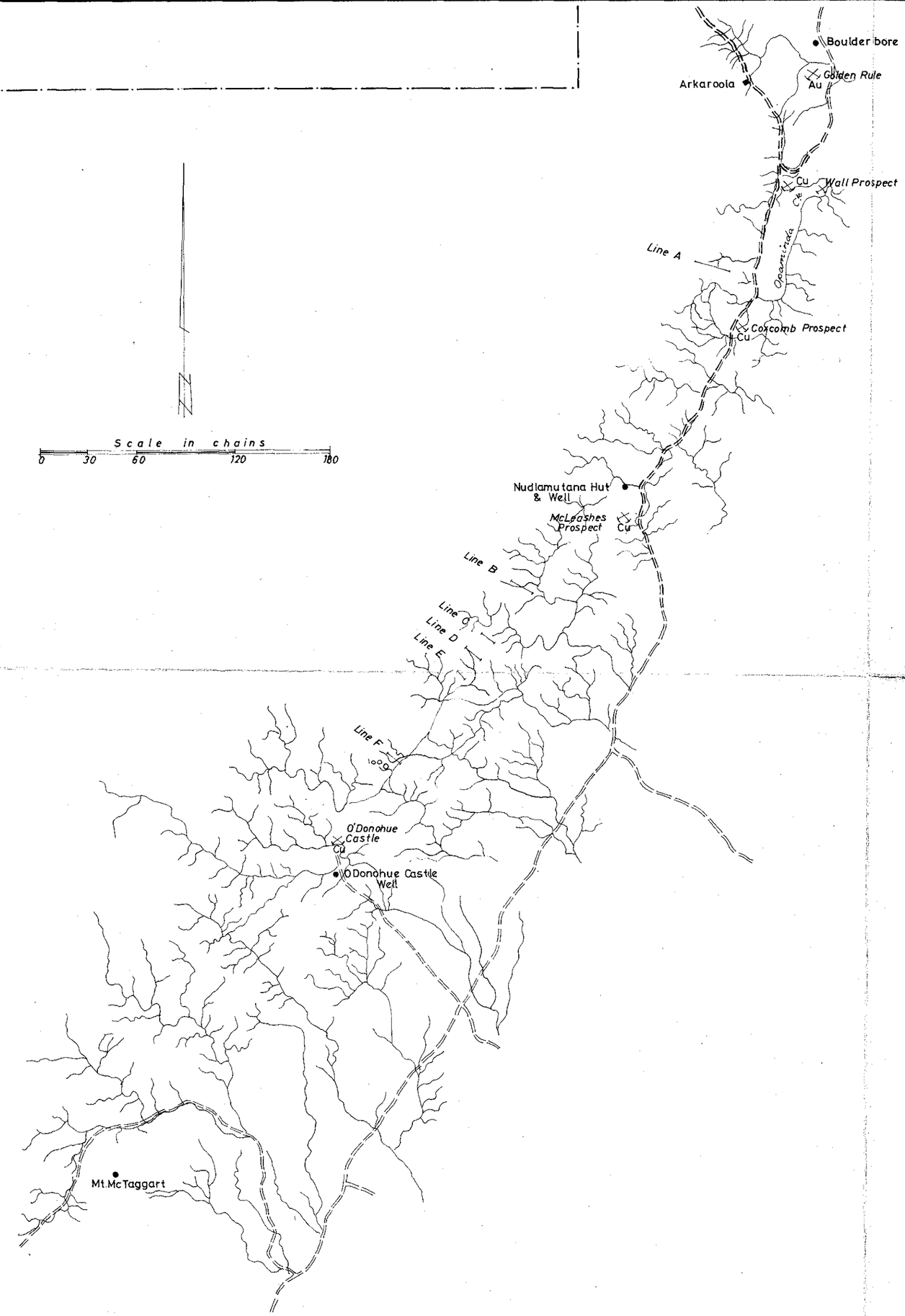
Copper values of lines A - F shown in section

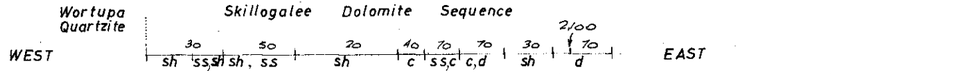
SCALE: 1" = 200'

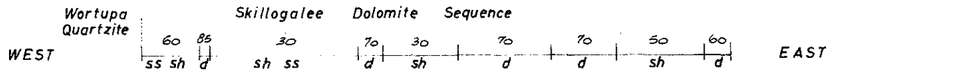
WATTS, GRIFFIS AND McOUAT (AUSTRALIA) PTY. LIMITED CONSULTING GEOLOGISTS & ENGINEERS 1ST FLOOR—56 PITT STREET, SYDNEY	
NORTH FLINDERS MINES N. L. — WOLTANA AREA - S.M.L.294. — ANOMALY INVESTIGATION SAMPLING COPPER RESULTS ppm.	
SCALE: 1" = 60 chains	DATE: 24.8.70
DRAWN:	APPROVED:
	DRAWING No.: 1610 / 29

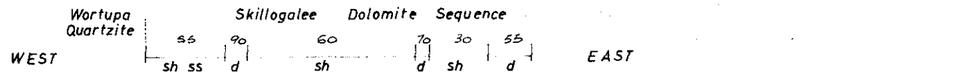
ENV 1226 (5)-2

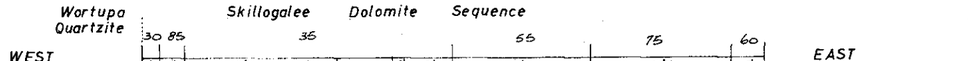
1226

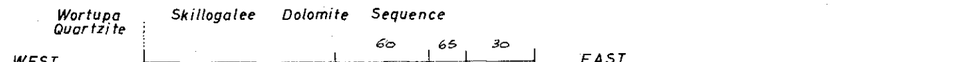


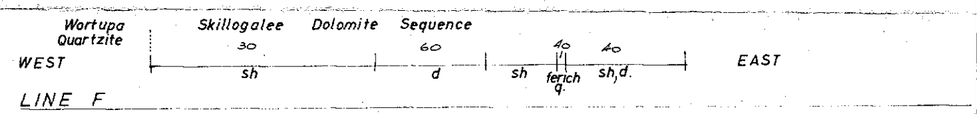












LEGEND

sh = shale
c = conglomerate
d = dolomite
ss = sandstone
q = quartzite

Lead values of lines A - F shown in section

SCALE: 1" = 200'

WATTS, GRIFFIS AND McOUAT (AUSTRALIA) PTY. LIMITED
CONSULTING GEOLOGISTS & ENGINEERS
1ST FLOOR—56 PITT STREET, SYDNEY

NORTH FLINDERS MINES N. L.

— WOLTANA AREA - S.M.L.294. —

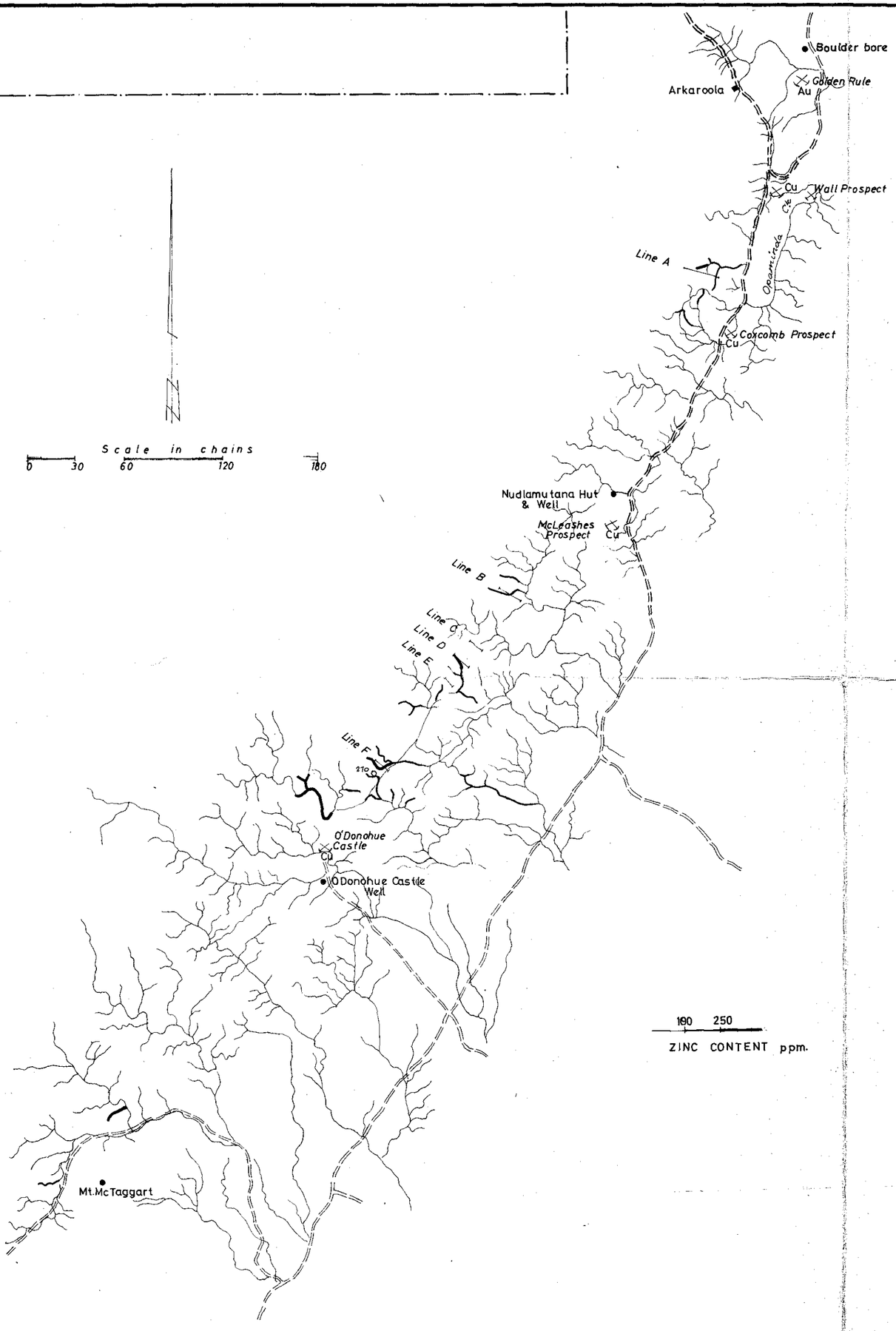
ANOMALY INVESTIGATION SAMPLING

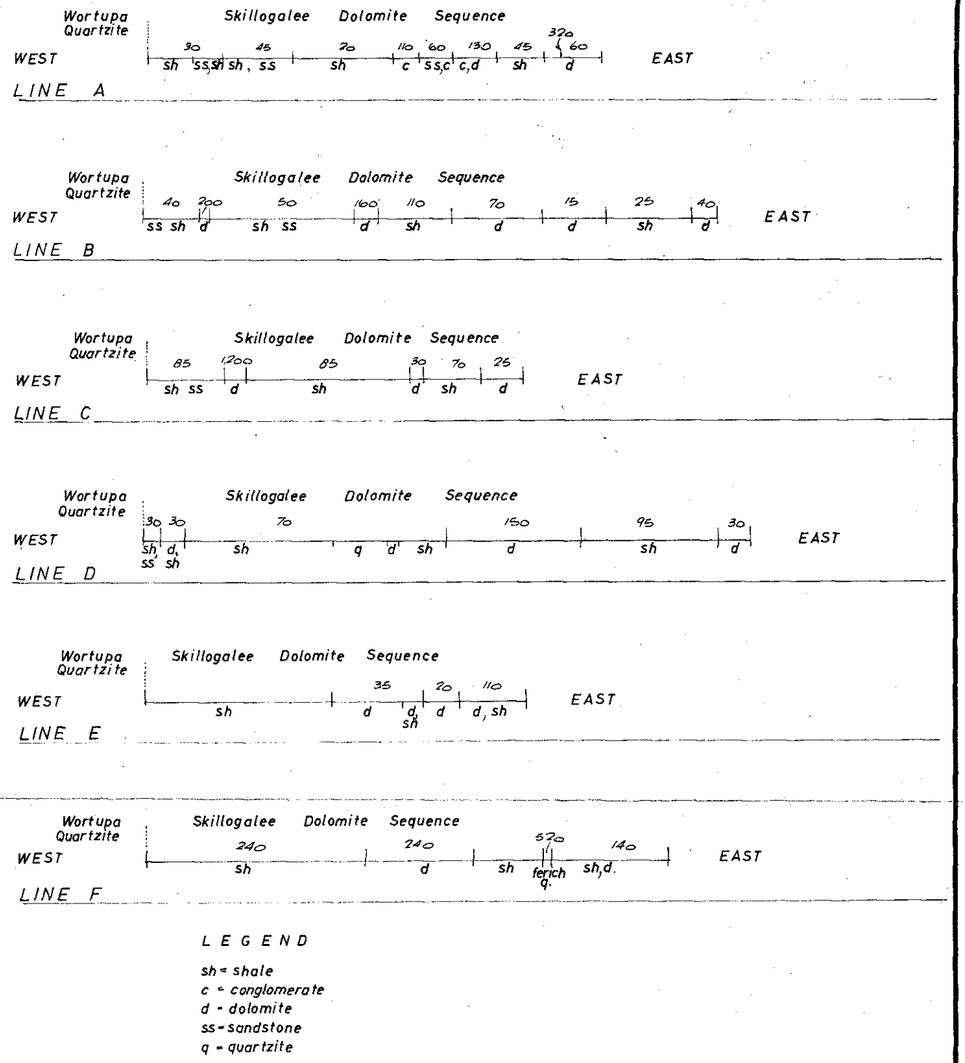
LEAD RESULTS ppm.

SCALE: 1" = 60 chains	DATE: 21.8.70	DRAWING No.: 1610 / 30
DRAWN:	APPROVED:	

ENV 1226 (V) - 3

1226





LEGEND

sh = shale
c = conglomerate
d = dolomite
ss = sandstone
q = quartzite

Zinc values of lines A - F shown in section

SCALE: 1" = 200'

WATTS, GRIFFIS AND McOUAT (AUSTRALIA) PTY. LIMITED CONSULTING GEOLOGISTS & ENGINEERS 1ST FLOOR—56 PITT STREET, SYDNEY			
NORTH FLINDERS MINES N. L. — WOLTANA AREA - S.M.L.294. — ANOMALY INVESTIGATION SAMPLING ZINC RESULTS ppm.			
SCALE: 1" = 60 chains	DATE: 24.8.70	DRAWING No.: 1610 / 31 1226	
DRAWN:	APPROVED:		

ENV 1226(D)-4

FINAL SUMMARY EXPLORATION REPORT

S.M.L. 294

NORTH FLINDERS RANGES, S.A.

by R.B. WILSON

NORTH FLINDERS MINES LIMITED

April, 1971

CONTENTS:

I INTRODUCTION AND PREVIOUS WORK

Special Mining Lease 294, in the Northern Flinders Ranges of South Australia, covers an area of approximately 290 square miles, and is located some 60 miles east of the township of Copley.

The lease had previously been partly explored by Australian Selection Trust and Geosurveys of Australia Pty. Ltd.

The following progress exploration reports (North Flinders Mines Limited) on S.M.L. 294 have previously been submitted to the Director of Mines:-

i. EXPLORATION REPORT S.M.L. 294 For 6-month Period ending 19.11.69

This report contains:-

1) Location Map of S.M.L. 294
2) Report of Activities by W.R.K. Jones, Consulting Geologist.
3) Suggested initial programme by Dr. P.R. Donovan, McPhar Geophysics Pty. Ltd.
4) Resume of Aust. Selection Trust's Regional Geochemical Survey in N.E. part of S.M.L. 294, by Dr. P.R. Donovan, McPhar Geophysics Pty. Ltd.
5) Notes on the Lady Buxton Copper Mine, O'Donoghues Castle Copper Mine, and the Blue Mine Conglomerate by Dr. P.R. Donovan, McPhar Geophysics.
6) Mineralogical Report No. 76 (O'Donoghues Castle) by I.R. Pontifex, McPhar Geophysics Pty. Ltd.

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7) Mineralogical Report No. 37 (Lady Buxton and O'Donoghues Castle) by I.R. Pontifex, McPhar Geophysics Pty. Ltd.

8) Report on Induced Polarization Surveys at O'Donoghues Castle Mine and McLeashes Prospect by J.E. Webb of Austral Exploration Services Pty.Ltd.

ii. EXPLORATION REPORT S.M.L. 294 for 6 month period ending 19.5.70

The report contains:-

1) Location Map S.M.L. 294

2) Report on Stream Sediment Reconnaissance Survey, Wooltana Area, S.M.L. 294, by P.R. Donovan, McPhar Geophysics Pty. Ltd.

3) Report on investigation of zinc anomaly, O'Donoghue Castle Mine Area by M. Garman, B.Sc., Watts, Griffis, & McQuat (Aust) Pty. Ltd.

4) Results of Shallow Percussion Drill Programme at McLeashes Prospect.

5) Preliminary results of Coup Prospect Geochemical Grid-survey.

6) Geological map of O'Donoghues Castle Mine and Nudlamutana Hut Area by I.R. Pontifex - McPhar Geophysics Pty. Ltd.

7) Preliminary Results of Wheal Hancock Geochemical Grid-survey.

iii. EXPLORATION REPORT S.M.L. 294 for period ending 19.11.70 (Letter-form)

This report contains:-

1) Report on the Geological map of the Coup Prospect by I.R. Pontifex - August, 1970.

2) Report on a Rotary-percussion drilling programme

...../3

O'Donoghue Castle Area by R.B. Wilson - Sept.1970.

3) Report on a Rotary-percussion drilling programme McLeashes Copper Prospect by R.B. Wilson - Sept.1970.

4) Report on Investigation of S.M.L. 294 by M.R.W. Garman, Watts, Griffis, McQuat Pty. Ltd.

iv. EXPLORATION REPORT S.M.L. 294 For period 19.11.70 - 19.5.71

Additional Reports received during this period are included herewith and comprise:-

1) 'Prospecting of Anomalous Zones as a Follow-Up to Reconnaissance Stream-Sediment Sampling - S.M.L. 294' by S. Carthew (Student Geologist), January, 1971.

2) ''Geology, Arkaroola Grid Area, Wooltana Volcanics, S.M.L. 294 (with comments on Soil Geochemistry)' by I.R. Pontifex, McPhar Geophysics Pty. Ltd.

3) 'Geology, Woodlamulka Grid Area, Wooltana Volcanics, S.M.L. 294 (with comments on Soil Geochemistry)' by I.R. Pontifex, McPhar Geophysics Pty.Ltd.

...../4

II SUMMARY OF EXPLORATION S.M.L. 294 (Period May 1969 - January 1971)

Compilation of existing data from previous exploration programmes in the area was carried out by P.R. Donovan of McPhar Geophysics Pty. Ltd., in association with Mr. R. Jones (Consultant Geologist) and Geosurveys of Aust. Pty. Ltd.

From his review of Australian Selection Trust's geochemical results, Dr. Donovan concluded that this Company had located several anomalous areas which had been followed up by soil-sampling but that no geological mapping, geophysics or drilling had been carried out on any of the prospects. Dr. Donovan recommended reconnaissance stream-sediment sampling of areas not covered adequately by previous explorers. This was subsequently carried out and delineated several anomalous areas related to the Blue Mine Conglomerate, Wooltana Volcanics and Bella Bollana Formation respectively. Trial Induced Polarization surveys were run in the D'Donoghues Castle and McLeashes Copper Prospects by Austral Exploration Services Pty. Ltd.

Extensive follow-up work using the stream-sediment reconnaissance maps of Australian Selection Trust and North Flinders Mines Limited was carried out by student-geologist S. Carthew. This work resulted in the discovery of several previously unknown copper-carbonate outcrops and showings, as well as many others which had been investigated by potholing etc., by former prospectors. Many of these showings are related to the Blue Mine Conglomerate while others were found within the Wooltana Volcanics. Other prospects such as the Coup, Woodlamulka, Arkaroola and Mt. McTaggart Prospects were investigated also during this follow-up work. Some of these, apparently unrecorded

in the early mining records, had been the loci of more intense former prospecting and mining activities.

Survey grids and geochemical soil surveys have since been conducted over several of these prospects, and further work is planned on at least two of these.

A programme of shallow percussion drillholes was completed on the McLeashes Copper Prospect and outlined an approximate 'indicated' tonnage of between 40,000 and 50,000 tons of carbonate - ore grading approximately 1% Cu. A later programme of deeper rotary-percussion holes on this prospect did not significantly up grade the above carbonate tonnage and also did not intersect any sulphides of economic significance.

A rotary-percussion drilling programme, comprising eight holes for a total of 1730 feet, was completed in the vicinity of the O'Donoghues Castle Copper Mine. Six holes totalling 1175 feet of drilling were drilled to test a zone of I.P. Anomaly associated with the Blue Mine Conglomerate, while two angle-holes were drilled down-dip from the old mine workings. The drilling demonstrated the presence of a strongly pyritic zone in the upper members of the Blue Mine Conglomerate and also suggests this as the cause of the strong I.P. anomalies. Only very slightly anomalous copper values were obtained from the deeper intersections of this pyritic zone. The two holes drilled to test the low Skillagolee Dolomite members of the O'Donoghue Castle Mine also indicated only very sparsely disseminated sulphides

...../6

with minor anomalous copper values.

Geological mapping combined with soil geochemical surveys of the Arkaroola and Woodlamulka Prospects within the Wooltana Volcanics, indicates that the known copper mineralization occurs as thin, fault-controlled veins of small tonnage-potential. Several areas of brecciated volcanic rocks were investigated for possible low-grade disseminated mineralization with no success. No immediate further work on these prospects is proposed.

An area of 5600 feet by 4000 feet was gridded by north-south lines spaced 400 feet apart, in the vicinity of the Coup Prospect, geologically mapped and soil-sampled. Several anomalous areas associated with conglomerates and poorly-sorted ferruginous sandstones immediately overlying and related to the volcanics, are worthy of further work, leading up to a preliminary rotary-percussion drilling programme.

...../7

III PROPOSED FURTHER PROGRAMMES FOR NEW S.M.L. under current application

The principle programmes proposed for this area are:-

1) Completion of detailed geological and geochemical surveys of the Mt. McTaggart Copper Prospect - at present in progress. Preliminary rotary-percussion drilling later in year.

2) Detailed geological and geochemical surveys of the three principle anomalous areas within the Coup Copper Prospect, as defined by earlier broader geological mapping and geochemical sampling. Follwed by preliminary rotary-percussion drilling later in year.

3) Broad Study of the Blue Mine Conglomerate

Correlation of detailed photogeology and field-mapping with the known outcrops of secondary copper mineralization with a view to overall appraisal of the potential of the Blue Mine Conglomerate and possible further drilling. Results of drilling of the McLeashes and O'Donoghue Castle Prospects suggest the absence of economic sulphide deposits in depth although neither prospect was exhaustively tested. However, the prosposed appraisal study of the Blue Mine Conglomerate will also look into the possibility of shallow bodies of copper-carbonate ores, which could conceivably warrant the establishment of a small leaching or solvent-extraction plant in the area.

4) Reappraisal of know copper prospects on which some drilling had been carried out by previous lease-holders.

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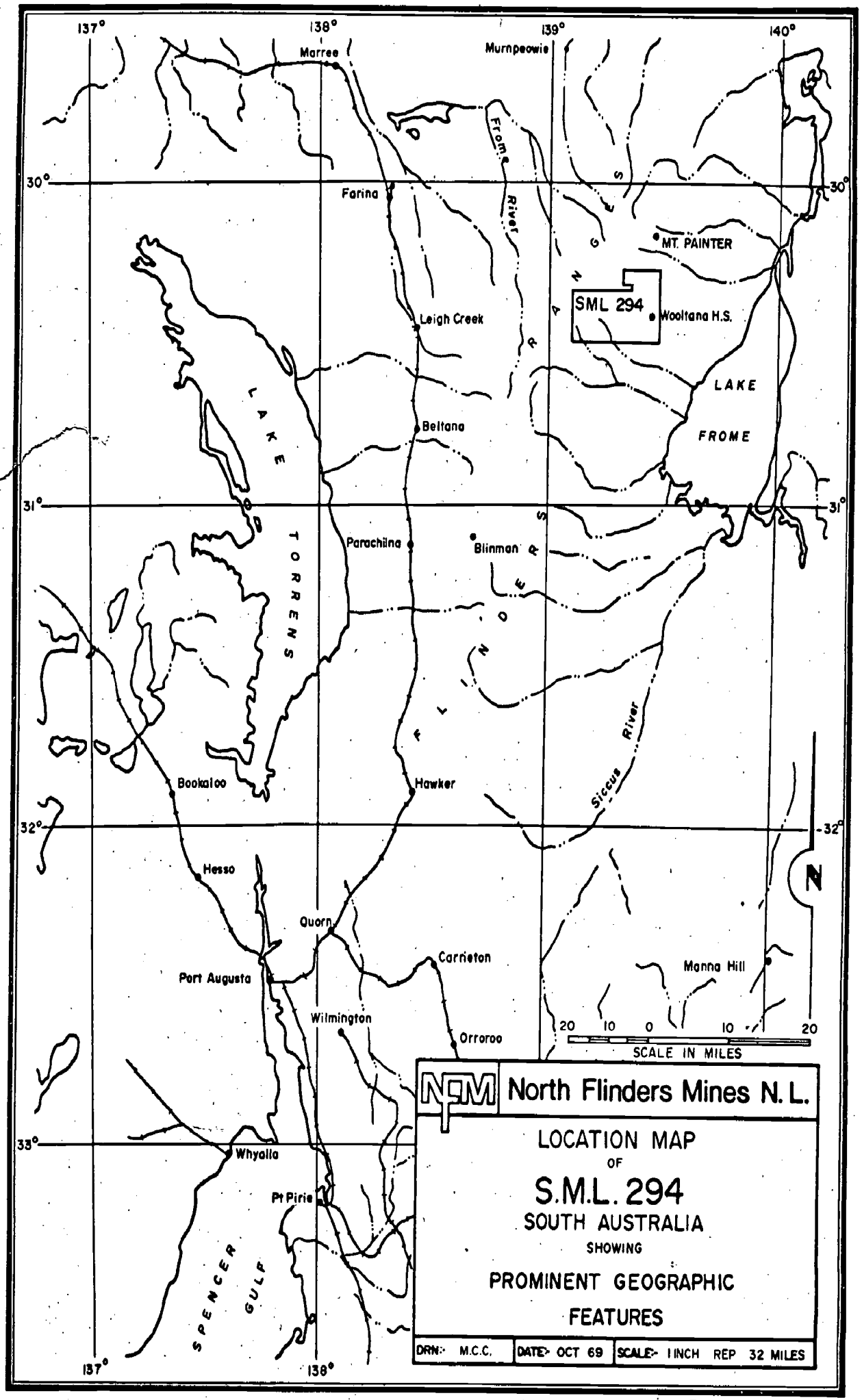
R.B. WILSON

NORTH FLINDERS MINES LIMITED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Wooltana H.S.
Leigh Creek
LAKE FROME
Beltana
LAKE TORRENS
Parachilna
Blinman
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LOCATION MAP
OF
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SOUTH AUSTRALIA
SHOWING
PROMINENT GEOGRAPHIC
FEATURES
DRN:- M.C.C.
DATE:- OCT 69
SCALE:- 1 INCH REP 32 MILES

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060

PROSPECTING OF ANOMALOUS ZONES AS A FOLLOW-UP TO RECONNAISSANCE STREAM-SEDIMENT SAMPLING

SPECIAL MINING LEASE - 294

SOUTH AUSTRALIA

S. CARTHEW
(Student-Geologist)
NORTH FLINDERS MINES LIMITED

January, 1971

CONTENTS

ACCOMPANYING MAPS

Plan showing location of Mines and Prospects.
S.M.L. 294 - S.J.Carthew - July, 1970 DWG 294-39
1226 (V)-5

Sketchmap Arkaroola Prospect Area, Wooltana Volcanics. S.M.L. 294 (1" = 500 ft. scale) by S.J.Carthew DWG 294-40
1226 (V)-6

I INTRODUCTION

During the vacation periods in 1970, stream-sediment anomalies in Special Mining Lease 294 were followed-up, using results of the stream sampling by McPhar Geophysics and Australian Selection Trust. This work had indicated three principal anomalous zones in :-

(1) The 'Wooltana Volcanics' outcropping in the eastern portion of S.M.L. 294.

(2) The 'Blue Mine Conglomerate Unit' and associated units along the Paralana fault system.

(3) The 'Whywyana Formation' and the nearby 'Ulupa Siltstone' in the south-west portion of S.M.L. 294.

Of all anomalies followed-up, some twenty per cent could not be directly accounted for. In many cases, the anomalies led to outcropping secondary copper mineralization, which had previously been located by prospectors, although no records of such workings or scratchings were known.

Several areas of known mineralization had been named by previous workers. Some of the present discoveries have been given local names.

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II WOOLTANA VOLCANICS

Australian Selection Trust did the initial geochemical stream sediment sampling in the Wooltana Volcanics. Their maps indicated the areal extent of anomalous zones in the volcanics but plots of individual analysis of the stream sediments samples were not available.

MERINJINA WELL
Longitude 139° 24.4'
Latitude 30° 25.6'
Copper Anomaly 35 Stream sample location 216

ASBESTOS

Shallow diggings expose asbestos (chrysotile) along the Wooltana Volcanics - Bolla Bollana Formation contact and along minor calcite or quartz filled shear zones within the volcanics. Similar occurences are associated with faults, some two and a half miles and two miles north-east of Merinjina Well, respectively.

MERINJINA WELL
Longitude 139° 24.4'
Latitude 30° 25.6'
Copper Anomaly 35 Stream sample location 216

COPPER

Within the minor shear zones, malachite is associated with ferruginous quartz and also occurs along joint planes of the volcanics. Surface findings indicate that the copper occurs spasmodically and is not in any lode formation.

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Longitude 139° 25.2'

Latitude 30° 24.4'

Copper Anomaly 40 Stream sample location 191

Two copper deposits have been located in the Blue Mine Conglomerate unit, one and a quarter miles north-west of Wooltana Homestead. One is located at the head of a small stream just below the ridge of a steep slope, about eight hundred feet above the general plain level. .The width of the lode formation is ten feet, with an east-west strike length of about fifty feet, and the dip is fifty degrees. In the costean, the cross-section of the lode from south to north is:-

1) Copper Minerals diffused in green shales.
2) Veins of copper minerals in a three foot wide ferruginous quartzite.
3) Copper minerals diffused in soft-weathering red conglomerate.
4) The conglomerate-tillite contact zone is the northern boundary of the lode formation.

The second occurence is situated on the shale-conglomerate contact zone of the Blue Mine Conglomerate unit, on a ridge four hundred yards south of the above-mentioned locality. A shallow shaft exposes malachite stains and veins in the joint planes.

NICK PROSPECT

Longitude 139° 26' Sample 2918

Latitude 30° 23' 2.6% Copper.

Within this anomalous area, the old-timers sank two shafts about one hundred and fifty feet apart. The shafts expose similar mineralization to be four feet and two feet wide from which rock chip samples assayed 2.6% copper.

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WOODLAMULKA MINE

Longitude 131° 27' Stream sample location 5466

Latitude 30° 21.5' Copper Anomaly 20

Along a major fault control in the Wooltana Volcanics copper mineralization is found in ferruginous and manganiferous quartz reefs. A number of shafts have been sunk along the one to three foot wide lode, which has a strike length of about eight hundred feet. This prospect has been grid surveyed, and sampled.

Longitude 139° 27' Stream sample locations 5498, 5499

Latitude 30° 21.3' Copper Anomalies 160, 200.

No copper mineralization to account for these anomalous streams was found. Resampling of the streams confirmed them to be anomalous.

W1 - 50 p.p.m. copper, W2 - 80 p.p.m. copper, W3 - 66 p.p.m. copper, W4 - 120 p.p.m. copper, W5 - 30 p.p.m. copper. Samples W2 W3 and W4 drains ferruginous and manganiferous stained brown siliceous limestone. Anomaly W1 is a down float sample to these anomalies and sample W5 drains quartzite and the 'Telford' gravel above the contact zone.

Longitude 139° 27' Sample 2917

Latitude 30° 20.8' 1.8% copper.

A number of shallow shafts, within an area of about $\frac{1}{2}$ square mile, have been sunk on minor shear zones, exposing malachite and chrysolcolla associated with quartz reefs. I was unable to find any respectable lode formation to be worthy of further interest.

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Within an area of about six square miles 35 copper occurrences were located. Copper mineralization is located:-

1) Along the major 'splinter' fault zones of the Paralana Fault System, where they intersect the volcanics.
2) Along the offshoot shear zones to these major splinter faults.
3) On the Wooltana Volcanics - Humanity Seat Formation contact zone.
4) Along the minor fault zones between (1) and (2)
5) Within the volcanics itself <u>without</u> a structural or stratigraphic control.

<u>RONS FIND</u>

Longitude 139^{o} 27'

Latitude 30^{o} 20'

Malachite and azurite has been found diffused along joint planes, 1.5 miles south of the Groan Creek - Arkaroola Creek confluence. The mineralization did not outcrop at the surface but was exposed in dozing a new road along the ridge facing Arkaroola Creek. Five soil samples fifty feet apart were taken just south of the road to avoid 'road' contamination. These results RF1 - 45 p.p.m., copper, RF2 - 65 p.p.m. copper, RF3 - 35 p.p.m. copper, RF4 - 20 p.p.m. copper, and RF5 - 20 p.p.m. copper, possibly indicating one hundred feet grid sampling, with closer sampling to define the anomalous zones.

Along the major fault extending from Woolnough Crag through Arkaroola Prospect to the Lady Buxton Creek, fourteen copper occurrences have been located. Each of these occurrences have a maximum

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width up to three feet with varying strike lengths up to five hundred feet. The most noteworthy of these is located one and a half miles ~~west~~ south - southwest of Groan Creek - Arkaroola Creek confluence. Here the mineralization occurs in an overthrust zone and the samples collected analysed 2.5% copper (sample 2916)and 7.4% copper (sample 2915). Due to the overthrust, the dimensions of the surface copper mineralization are obscure.

One mile south-southeast of the Groan Creek - Arkaroola Creek confluence, the two to three foot wide lode, outcrops with a strike length of five hundred feet. The samples collected at the northern end of the lode analysed 4.1% copper (sample 2914) and in the shaft 12% copper (sample 2913).

At the Arkaroola Prospect, the samples collected analysed 0.8% copper (sample 2911). Four hundred yards north of the Arkaroola Prospect, copper mineralization is associated in a shear zone for about 200 feet. A series of shallow pits expose malachite, accounting for the soil sample copper anomaly 130 p.p.m. at A.K. 4 13 W and rock chips from this zone analysed 16% copper (sample 9905).

On the contact zone between Wooltana Volcanic and the Humanity Seat Formation seven copper occurrences have been located. Of these, three just south of Arkaroola Creek, were chip sampled and assayed 7.6% copper (sample 9904), 7.8% copper (sample 9902), and 14% copper (sample 9903) respectively.

One mile northwest of the Groan Creek - Arkaroola Creek confluence, (Longitude 139° 26.5' and Latitude 30° 21.5'), copper mineralization occurs on the contact of coarse-grained sandstone and

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shale. The mineralization is strongest on the contact itself and diffuses into the two beds. This feature is typical of many of the finds occurring in the Blue Mine Conglomerate. Here the lode is three feet wide, has a strike length of eighty feet dips at forty degrees and is to be found in the Humanity Seat Formation, 100 yards inside the contact zone.

On the fault zones between the contact zone and the major fault, an additional ten copper occurrences have been recorded. Of these at sample location 2909, the rock chips analysed 0.8% copper. On the line A.K.4 16N the soil sample analysed 220 p.p.m. copper. At this anomaly strong copper mineralization trends north-east along a fault for one hundred feet.

Longitude 139° 26.3'
Latitude 30° 18.8'

Malachite is diffused through siltstones of the Skillogalee Dolomite along a fault zone. The mineralization trends north-east with an observed strike length of one hundred feet and is about fifty feet wide. On this same fault zone two other copper occurrences were found in the volcanics. The find is situated one mile northwest of the Arkaroola Creek - Groan Creek confluence.

COUP PROSPECT (covered with survey-grid)
Longitude 139° 26.25' Sample 2910
Latitude 30° 17.5' 2.7% copper.

The Coup Prospect has a shaft 153E, 558N, where ore in three inch veins assays 6% copper and rock chips from the lode formation analysed 2.7% copper. At 146.8E, 561,5N the lode which is four feet thick with a strike length of fifteen feet dipping at thirty degrees has been exposed in an adit. Samples taken from the rock in situ

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analysed 1.8% copper.

Longitude 139° 25.5'
Latitude 30° 16.7'

Three shafts 100, 12 and 20 feet deep respectively have been sunk on shear zones to expose little or no lode formation. Two quartz reefs two feet wide intersect nearly at right angles and may be the source of the scant mineralization observed. 'A sample of 0.34% copper is respresentive of the small amount of dump material at 118E, 579N.' (Pontifex).

Longitude 139° 24.25' Sample 2908
Latitude 30° 17.5' 4.2% copper

Two poppet heads of an old mine can be seen two hundred yards north-west of the double gates in Claude's Pass. Each poppet head exposes malachite with ferruginous and manganiferous mineralization. The mineralization is found in grey shales below the Blue Mine Conglomerate unit.

'Single grab samples at the following localities in a trench assayed as follows:-

a) 115.5E, 547.5N, Malachite and minor chalcocite extensively impregnating conglomerate, 11% copper.

b) 115.5E, 547.5N Conglomerate impregnated with malachite assays 2.8% copper.

c) 115.5E, 547.5N Minor chalcocite extensively impregnating conglomerate assays 19% copper.

A single grab sample from a narrow vein exposed in a shear intersected by a 10 feet shaft at 113.5E, 548.5N assays 2.8% copper' (I. Pontifex). I confirmed this last result when my rock chips

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averaged 2.7% copper.

Copper occurrences were also located at the following coordinate positions:-

116E 552.3N	0.37% copper.
128E 554.5N	0.6% copper.
136E 560.5N	0.14% copper.
144E 564N	-
150E 561N	0.13% copper (in grit band)
148E 566N	350 p.p.m. copper (in grit band)
108E 565N (Edwards find).	
124E 571N	
112E 568N	

At Edwards find, malachite, chrysocolla and gold nuggets have been recorded in the quartz reef.

SUMMARY

Using the aerial photgraphs to plot the numerous fault systems between the Paralana fault system and the Wooltana Volcanics, these systems were followed up. Except for the Mt. Jacob Prospect, no additional copper mineralization was observed outside the Wooltana Volcanics.

Following the Wooltana Volcanics - Humanity Seat Formation contact zone from Woodlamulka Mine to the road in Claude's Pass, no further mineralization apart from sample locations 2915 and 2916 was revealed.

I consider I have exhausted potential follow up areas in the volcanics and that any further surface-mineralization will be found probably in the faults and contact zones of the anomalous areas already outlined.

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III BLUE MINE CONGLOMERATE

INTRODUCTION

All the copper anomalies above 40 p.p.m. in the Blue Mine Conglomerate unit have been followed up. In general the copper mineralization is to be found.

1) Along the Blue Conglomerate - Opaminda Shale contact zone.
2) Along cross faults associated with the major Paralana Fault.
3) In the conglomerate, shale and quartzite beds.
4) The copper mineralization found is TECTONICALLY (fault) controlled.

M. Garman's cross-sectional traverses of the Skillogalee Dolomite sequence, indicates no bedded surface copper or zinc deposits in this unit, but that some beds are anomalous for these elements between O'Donoghue Castle and the Arkaroola Homestead.

Longitude 139° 23.5' Samples 2905, 2907
Latitude 30° 23.4' 2.5% Copper. 1.8% copper.

Two copper occurrences were noted four hundred yards apart in two feet wide quartz reefs which strike northwest-southeast along minor faults. The brecciated zones occur very near to the Wooltana Volcanics - Humanity Seat Formation contact, two and a quarter miles north northeast of the Wheal Hancock Mine.

ARKAROOLA BORE

Longitude 139° 21.5' Sample 9901
Latitude 30° 12.5' 25% copper.

Malachite and chalcopyrite were found associated within these inch bands of calcite or hematite - ilmenite interbeds in the Wooltana Volcanics. These beds strike generally northwest - southeast, parallel to the first, tributary stream east of Arkaroola Bore. The observed strike length of the malachite association is forty feet,

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dipping at ten degrees and follows a minor fault zone. The collected samples from this copper rich vein analysed 25% copper.

Following the faulted structures marked on the "Mount Painter"Special Map, revealed no further finds of copper mineralization but I recorded 'patchy' finds of ilmenite, magnetite, micaceous hematite and some minerals from the zeolite and actinolite-tremolite series.

WYWHYANA

Longitue 139° 20.25' Sample 9906

Latitude 30° 21.25' 15% copper.

Four copper occurrences have been recorded north of the motel at Arkaroola village. These occurrences are found in the conglomerate or along the conglomerate shale contact zones. Of these, malachite azurite and chalcopyrite in gossan material (assaying 15% copper) material follows the Opaminda shale and the Blue Mine Conglomerate contact in a minor shear zone.

QUARTPOT BORE AREA

Longitude 139° 20.25' Sample 9907

Latitude 30° 18.8' 18% copper

Copper Anomaly 110 Stream sample location 5415

Malachite has been introduced by joint solution into dark grey siltstones of the Blue Mine Conglomerate unit. The mineralized bed has a horizontal width of forty feet on the east bank of the Wywhyana Creek near Quartpot Bore. From this zone six samples assayed 1.8% copper. The copper anomalies 60, 50, 75, and 45 which are upstream from copper anomaly 110 represent the strike - extensions of these mineralized beds.

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Longitude 139° 20.8' Sample 9909

Latitude 30° 18.8' 0.6% copper

Copper anomalies 50 and 60 Stream sample location 5416

Malachite is associated again with the dark grey siltstones and also conglomerates, fifty yards north of the road. The cause of copper anomaly 75 (stream sample number 5439), is that the copper mineralization outcrops in the creek bed. Along the strike length, the dark stilstone bed narrows to four feet on copper anomaly 75.

GREAT BOULDER - WELCOME MINE - BARRARANNA GORGE MINES

In an area of one square mile, five mines are located. These are the GREAT BOULDER MINE, the KINGSMILL MINE, the BARRARANNA GORGE MINE, the WELCOME MINE and the WHEAL HANCOCK MINE. Geosurveys of Australia Pty. Ltd., drilled the Welcome Mine and the Pebble Prospect.

At the Welcome Mine, the mineralization consists of veinlets, nodules and stains in shale and impure dolomites, but assay values are greatly reduced in depth, to give 0.44% copper average over ninety feet intersection at two hundred foot depth as compared to 2% copper over five feet intervals at thirty feet depth.

The Pebble Prospect yields no significant copper values in the drill holes, suggesting the copper mineralization to be only a surface concentration (Johnson).

BARRARANNA GORGE MINE

Longitude 139° 24' Sample 53A

Latitude 30° 18' 9.5% copper

Striking north and South along a fault control a two feet wide copper lode can be found on the north 'cliff' face of Barraranna Gorge. The samples taken from a brecciated matrix in the 'Skillogalee

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Dolomite' assays 9.5% copper.

Another fault controlled copper occurrence is to be found on the south face just to the west of the turn off into the gorge.

Longitude 139° 24'

Latitude 30° 19'

Copper mineralization (malachite, azurite, chrysocolla and chalcopyrite) has been introduced along a complex set of faults, which trend in a general northeast - southwest direction. From these fault controls, the mineralization has diffused into shales, siltstones, tillites and quartzite interbeds of the Bolla Bollana and Tapley Hill Formations. The strike length of the observed mineralization (not continuous) along the main fault, is three thousand seven hundred feet. Another fault zone three hundred feet to the north of this one, has diffussed copper mineralization in shales for a strike length of about eight hundred feet. On top of the hill at Longitude 139° 24.1' Latitude 30° 18.9', a well defined lode upto three feet wide is exposed by old shafts, in the crush zone of a drag fold. A crush zone (Longitude 139° 23.6' Latitude 30°.19') six hundred yards south-west of the mine workings, occurs on a fault zone in the outcropping Tapley Hill Shales. In this small crush zone, the strike length is thirty feet, but the copper mineralization (chalcopyrite, azurite and malachite) is high grade, the collected samples assaying 8.5% copper.

About six hundred feet north-west of the turn off into the Great Boulder Mine, a shallow digging exposes diffuse malachite in the siltstones with thin veins of malachite and azurite.

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Between the talus material, other finds one thousand feet west on the ridge and at Picnic Point have similar features. These are associated with the Blue Mine Conglomerate contact zone.

PICNIC POINT

Longitude 139° 23.8' Sample 56A

Latitude 30° 18.3' 1.4% copper.

Malachite has diffused into the siltstones, shales and conglomerate interbeds of the Blue Mine Conglomerate, along the Wooltana Volcanics - Blue Mine Conglomerate contact zones, for about five hundred feet on each side of the valley. The collected samples which analysed 1.4% copper were taken from the waterfall at the end of the road into this site. Similar copper diffusion along the conglomerate and shale contact zones occurs at 460N, i.e. on the Wheal Hancock grid.

WHEAL HANCOCK MINE

Longitude 139° 24' Sample 55A

Latitude 30° 18.5' 1.3% copper

No definite lode formation was observed at this mine, but staining was dominant in the Woodlamulka phylites, along fault controls. An inclined shaft has been sunk to underly the copper outcrop above. The observed strike length of the copper staining is fifty feet, from which my samples analysed 1.3% copper. On the opposite slopes a more pronounced copper rich zone on the dip slope of red slate-phyllite interbeds is in the Wortupa Quartzite. This anomalous zone lies between lines 467.5N and 474N and 4W and the baseline.

At 463N, 5W with an observed strike length of one hundred feet, copper is associated with red slate, and at 483N, 5W copper stains the conglomerate contact zone. Smaller occurrences in the Humanity Seat Formation outcrop three quarters of a mile north northeast and also at one mile further distant.

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Longitude 139° 22.3' Copper Anomaly 30
Latitude 30° 19.8' Sample Location 3587

ORALDANA MINE

Situated ¼ mile East of the Arkaroola Homestead malachite mineralization is to be found in ferruginous and silicified conglomerate and shale beds within the Blue Mine Conglomerate unit. Two highly silicified conglomerate outcrops about 50 yards apart show copper stains and veinlets in the joint systems. Soft-weathering kaolinized clays contain small pockets of malachite crystals irregularly spaced.

The nearby Blue Mine Conglomerate - Woodlamulka phyllite contact is clearly observed. Shallow shafts have been sunk on the line of lode which follows a minor fault zone in a general North - South direction.

Following the ridge Northwards from the mine revealed no further copper occurrences in the conglomerate, shale, quartzite and phyllite beds.

Longitude 139° 22'4" Sample location 5525 & 5526
Latitude 30° 29.6' Copper Anomalies 1700 and 80

MCPHAR (1)

Malachite staining has diffused through the shale and conglomerate beds in the Blue Mine Conglomerate unit. The mineralization which is to be found over 150 yards strike length outcrops in a bold structure. The collected samples analysed 0.44% copper.

Longitude 139° 23'
Latitude 30° 20.3'

Immediately to the East of 'Boulder Bore' malachite stains the bold dyke - like structure of siliceous sandstone. The outcrop has a ferruginous stain with 'washes' of copper mineralization.

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Similar 'dyke' like structures with similar copper mineralization are to be found between the Coxcomb Prospect and the Welcome Mine, a distance of three miles along the Paralana fault system, as at the Pebble Prospect $1\frac{1}{2}$ miles N.E. of the Arkaroola head station.

Longitude 139° 23' Sample location 5027

Latitude 30° 20.7' Copper Anomaly 40

WALL PROSPECT

Heavy manganese and ferruginous staining with slight malachite mineralization is associated with the dolomitic shales of the Tapley Hill formation. On the East bank of the creek the bold 'dyke' like structure outcrops for 180 feet. This prospect, which has been drilled, is situated $1\frac{1}{2}$ miles South East of Arkaroola homestead. 'The main cupriferous body is evidently a bedded structure with very low grade copper mineralization continuing to a depth of 110 feet down a western dip.' (Johnson)

Longitude 139° 22.8' Sample Location 5025

Latitude 30° 19' Copper Anomaly 45

Situated $\frac{1}{4}$ mile south of the Wall Prospect and 2 miles S.S.E. of the Arkaroola homestead, another dyke-like structure is to be found. With a strike length of forty feet, the structure has strong ferruginous and weak malachite staining.

Longitue 139° 22.8'

Latitude 30° 20.7'

A shallow shaft, exposes malachite in the joints of the shale member of the Blue Mine Conglomerate 1 mile S.S.E. of the Arkaroola homestead. The collected specimens analysed 1.35% copper.

Longitude 139° 22.7' Sample Location 5012, 2010

Latitude 30° 20.7' Copper Anomalies 35, 30

In the Creek bed thin veins of malachite and chalcopyrite are to be found associated with blue dolomites.

Longitude 139° 2.15' Sample Location 5343

Latitude 30° 22.7' Enlargement, Nudlamutana Hut

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Along the conglomerate shale contact zone within the Blue Mine Conglomerate unit, minor malachite association is to be found 50 yards from confluence on copper anomaly 70 in the enlargement.

Longitude 139° 21.5' Sample location 5329, 5327

Latitude 30° 22.9' Enlargement McLeashes Copper Anomaly 160, 120

Copper (Malachite and azurite) mineralization is to be found in shale and conglomerate and along the shale-conglomerate contact. The 'patchy' copper outcrops occur along a strike length of about 100 yards and account for the copper anomalies 100 and 120 in the enlargement South of McLeaohes.

Longitude 139° 21.5' Sample locations 5079, 5080, 5081

Latitude 30° 23.1'

The sample 5081 in the original survey analysed 600 p.p.m. Due to incorrect plotting of McLeashes prospect, the streams between the Wooltana Cave in stream 5081 and Nudlamutana Hut 5075 were re-sampled. These streams drain the Blue Mine Conglomerate - Opaminda Shale contact zone. The samples were taken well above the creek confluence to avoid backwash contamination. The results were Mc1 - 15 p.p.m. Copper, Mc2 - 35 p.p.m. Copper, Mc3 - 20 p.p.m. copper, Mc4 - 40 p.p.m. copper, and Mc5 - 65 p.p.m. copper.

The sample Mc2 - 35 p.p.m. copper was taken on the creek draining the McLeashes prospect and this accounts for the anomaly. The Mc4 - 40 p.p.m. copper, and Mc5 - 65 p.p.m. copper were taken from streams draining the Blue Mine Conglomerate units. The high background copper values in this unit may account for these anomalies.

Latitude 30° 24' Sample locations 5200, 5202

Longitude 139° 20.7' Copper Anomalies 85 and 60

Samples 43A and 46A

Situated two miles S.W. of McLeashes Prospect I have located four copper occurrences within an area of $\frac{1}{4}$ square mile. The copper

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mineralization is to be found in the conglomerate and shale units of the Blue Mine Conglomerate. At the junction of stream anomaly 60 and the road, malachite is associated with the Balcanoona dolomite for 50 yards East of this point on the road surface. Cross faults of the Paralana Fault Complex appear to be the original source of the copper mineralization. The copper minerals recognised have been malachite, azurite and chalcopyrite. On the creek with copper anomaly 80, the collected specimens analysed 11.8% (43A) and on the creek with copper anomaly 60 the specimens analysed 0.4% copper and 0.46% copper for the samples 45A and 46A respectively.

Longitude 139° 20.4' Sample location 5190, 5191
Latitude 30° 24.1' Copper Anomaly 40 and 60

Located $1\frac{3}{4}$ miles N.E. of O'Donoghue Castle Mine, malachite is to be found in the creek bed near peg 76 N 2 W in the outcropping Blue Mine Conglomerate.

Longitude 139° 20.2' Sample Location 5183
Latitude 30° 24.2' Copper Anomaly 50

In the outcropping Opaminda shale (near to the contact zone with the Wortupa Quartzite) copper mineralization is diffused through the joint systems. The locality is situated $1\frac{1}{2}$ miles N.E. of O'Donoghue Castle Mine.

Longitude 139° 25' Sample location 5170
Latitude 30° 19.3' Copper Anomaly 130

At the back of O'Donoghue Castle Mine, malachite veins can be found associated with the Wortupa Quartzite and also in gossan material. The collected samples analysed 0.7% copper.

Longitude 139° 17' Sample location 730
Latitude 30° 27.6' Copper Anomaly 40

An 'oldtimer' has exposed malachite and azurite in a ferruginous quartz reef. This two to three foot wide reef strikes for forty yards in a northeasterly and southwesterly direction along a fault

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zone, which extends to the Mount McTaggart Mine. Running parallel to the road, the diggings are about two feet deep. Forty yards Northeast of these diggings another copper occurrence in scree material was found.

Longitude 139° 17'	Sample 59A
Latitude 30° 27.5'	Copper Anomaly 0.38%
Copper Anomaly 60	Sample location 729.

Malachite veinlets were recorded along the distinct brown dolomitic siltstones and slate contact zone on a spur, on the west side of the road. The collected samples from the brown dolomitic siltstone bed assayed 0.38% copper.

MT. McTAGGART MINE

Longitude 139° 16.5'	Sample 9911
Latitude 30° 27.9'	15% copper
Copper Anomaly 120	Sample location 738
Copper Anomaly 90	Sample location 736
Copper Anomaly 120	Sample location 737

Malachite and azurite mineralization is diffused through intertongues of greywacke tillite, sandstones, siltstone, slates and quartzite within the Bolla-Bollana tillite formation. The copper mineralization has been introduced with siliceous material carrying varying amounts of ferruginous and manganiferous minerals, along a complex set of faults.

The surface area of the copper mineralization is along a six hundred yard strike length and about four hundred yards at its greatest width. At the head of a small creek, fifty yards from the road, a small open cut exposes a rich pocket of copper ore(malachite, azurite and chalcopyrite) associated with hematite in the outcropping gossanous sandstone and quartzite. From this zone my collected samples analysed 8.8% copper, sample 9911.

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Longitude 139° 16.3'

Latitude 30° 27.6'

Copper Anomaly 75 Sample location 739

Geologist, Mr. M. Garman, accounted for this anomaly when he found chalcopyrite with NO secondary copper mineralization in gossan material. The gossan material is dispersed in a hematite enriched bed which strikes a general northeast-southwest direction along a minor offshoot shear zone.

Monarch ?

Longitude 139° 14.1' Sample 9912

Latitude 30° 28.3' 8% copper

Copper Anomaly 85 Stream sample location 985

This Prospect is to be found tucked away on a 'knife-edged' ridge, one mile south of the nearest road and one and three quarters mile north-east from Grindell Hut.

In a faulted overfold, copper mineralization outcrops along the slate-brown weathering dolomite contact zone within the Balcanoona Formation. Shallow diggings expose an eight foot wide mineralized zone, which is bounded on the South side by slate but on the north side, the boundary is undefined. Between the north side of the pit and the outcropping dolomite beds is fifteen feet of scree material.

The six rock chips collected from this eight foot wide 'face' analysed 8% copper. In the exposed lode cross-section the following mineral associations have been found (recording from north to south):-

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1) Slate to the south of the mineralization zone with little or no copper diffusion.
2) Half inch wide chalcopyrite vein.
3) Two and half inch wide brown siliceous dolomite.
4) Malachite in a three inch wide quartzite band.
5) Malachite and chalcopyrite associated with calcite, six inches wide.
6) Malachite and chalcopyrite in scapolite and quartzite, forty-two inches wide.
7) Malachite and chalcopyrite associated with ferrgeous and manganiferous veins in dolomite, twenty-one inches wide.
8) Malachite and chalcopyrite associated with calcite, twenty-one inches wide.
9) End of pit cross-section.

The talus 'ridden' strata to the outcropping dolomite may reveal similar mineralization as exposed in this pit. Another pit fifteen feet west of the one just described, exposes part of the lode, consisting here of malachite in scapolite. The mineralization strikes East-West for approximately 120 feet at the surface.

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IV GRINDELL HUT - WORTUPA MINE AREA

A zone of anomalous copper values in the shape of a boot, occurs in the south west corner of the Special Mining Lease 294.

Between the Wortupa Mine and Grindell Hut, the area of the 'boot' has an average copper anomaly of 30.

WORTUPA MINE

Longitude 139° 14.7' Sample 9913

Latitude 30° 16.5' 9% copper.

Along the Ulupa, Nuccaleena and Amberoona contact zones, shafts and diggings are regularly spaced. In many of these workings no copper minerals were recognised, but six hundred yards southwest of the Wortupa Mine, a six inch wide quartz reef reveals copper mineralization. My rock chips from this reef analysed 9% copper.

(Geologist Mr. R.C. Sprigg reported to me that nickel tellurides have been recorded at the Wortupa Mine by Sir Douglas Mawson).

The sole of the boot lies between the Lock Ness Mine and Grindell Hut and has an average copper anomaly of 55. The source of the anomalies is the numerous two inch veins of copper and zinc and other carbonate minerals irregularly dispersed in the 'brecciated' dolomitic Wywhyana Formation.

Chalcopyrite associated with gossan material and malachite with quartzite are found in minor fault zones on copper anomalies 40 (sample location 964) and 60 (sample location 967) respectively.

Longitude 130° 10.25' Sample 9908

Latitude 30° 29.6' 17 % copper

Copper Anomaly 45 Sample location 683

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Malachite, azurite and chalcopyrite associated with ferrugineous quartzite in the dump of a small open cut, which is situated on the northern bank of a tributory, $3\frac{1}{2}$ miles south-east from Grindell Hut. No outcrop containing copper minerals was observed at the surface but digging in the open cut in attempt to locate the source of the copper minerals, I was successful. The surface indications suggests a rich pocket of mineralization in the diapir whose sub-surface dimension may be indicated in a dozer costean.

The 'toe' of the boot is the Lock Ness Mine on copper anomaly 430.

LOCK NESS MINE

Longitude 139° 11' Sample 66A

Latitude 30° 28.4' 8.4% copper

Copper Anomaly 430 Sample location 807

Costeaning in the sandstones and siltstones of the Illuba Formation and in the Wywhyana Formation reveals malachite and azurite. Chip samples taken in the costean in yellow sandstone bed analysed 8.4% copper. A series of shafts and costeans for three hundred feet, gave the following results from east to west.

1) 2.3% copper in dolomitic rafts in the diapir.
   - chalcopyrite and malachite in carbonate veins in chlorite-schist.
2) 10% copper in shaft.
   - disseminated malachite and azurite associated with mica in the diapir.
3) 0.56% copper in the costean.
4) 20.2% copper in shaft. - primary and secondary copper, infrequent diapiric breccia.

One thousand feet north-east of these workings three costeans in dark green brecciated chloritic siltstone and scapolitised have yielded poorer results up to 0.3% copper.

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V ZINC ANOMALIES NORTH OF O'DONOGHUE'S CASTLE COPPER MINE

Stream sampling indicates that anomalous zinc values north-east of O'Donoghue Castle, have their origin in the Skillogallee Dolomite of Lower Proterozoic age. These beds consist of dark grey siltstones interbedded intermittently with light grey to dark brown dolomite.

Mr. M. Garman's rock chip sampling of six lines across the strike of these beds between O'Donoghue Castle and Arkaroola Homestead, failed to indicate any continuous zinc rich bed of dolomite, but some beds were found to be anomalous.

A series of rock chip sampling in the Skillogallee Dolomite on the stream with the zinc anomaly 380, stream sample 5170 indicated two zinc rich beds and an anomalous zinc area close to a fault zone at the 'back' of O'Donoghue Castle Mine. His samples were taken from a dark brown dolomitic beds outcropping in the creek; F.T.4 near to the fault zone (shown on the Mines Department map), F78A and F78B from beds of thickness two feet and fifteen feet respectively.

A third area of potential zinc interest is in the Grindell Hut area. Here the zinc anomalous streams drain the Wywhyana Formation and the Ulupa siltstones. The source of the zinc anomally I consider is in the diapir where copper veins with anomalous zinc values occur. These veins are irregularly distributed in the matrix and two samples 9910 and 9908 returned 0.26% zinc and 0.39% zinc respectively.

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VI. CONCLUSIONS

On the special Mining Lease 294, there are three and possibly a fourth area of immense interest. The areas are:-

1) The Mount McTaggart Prospect.

2) The Coup Prospect and the Wooltana Volcanics north of Vermiculite Valley.

3) Loch Ness and the associated diapirs.

and possibly:-

4) The find, one and a half miles north east of Grindell Hut.

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VII SAMPLE RESULTS - S.M.L. 294 ..

Rock Chips

Sample Number	Analysis (Cu)	Locality
2918	2.6%	Nick
2917	1.8%	Vermiculite Valley
2916	2.5%	Woolnough Crag
2915	7.4%	Woolnough Crag
2914	4.1%	Arkaroola Creek
2913	12%	Arkaroola Creek
2912	0.02%	Arkaroola Creek
2911	0.8%	Arkaroola Prospect
9905	16%	Arkaroola Prospect
9903	14%	Groan
9904	7.6%	Groan
9902	8%	Groan
2909	0.8%	Groan
2910	2.7%	Coup
2908	4.2%	Coup
2907	1.3%	Barrananna Gorge
2906	0.15%	Barraranna Gorge
53A	9.5%	Barraranna Prospect
56A	1.4%	Picnic Point
55A	1.3%	Wheal Hancock
58A	0.01%	Welcome Mine
61A	8.5%	Great Boulder Mine
9901	25%	Arkaroola Bore
9906	15%	Wywhyana
9907	1.8%	Wywhyana
9909	0.6%	Wywhyana
31A	0.44%	McPhar 111
44A	0.25%	Sprigg's Charity

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Rock Chips Sample Number	Analysis (Cu)	Locality
43A	11.8%	Sprigg's Charity
45A	0.4%	Sprigg's Charity
59A	0.38%	Mt. McTaggart
9911	8.8%	Mt. McTaggart
9913	9%	Wortupa Mine
9912	8%	Crusoe's Prospect
9914	4.5%	Grindell Hut
9910	3.4%Cu 0.26% Zn.	Grindell Hut
66A	8.4%	Loch Ness Mine
9908	17% Cu 0.39% Zn.	Loch Ness Mine

Appendix II

VIII REFERENCES

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26th February, 1971

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MEMORANDUM FROM: I.R. Pontifex
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SUBJECT: GEOLOGY, ARKAROOLA GRID AREA,
WOOLTANA VOLCANICS, S.M.L. 294
(WITH COMMENTS ON SOIL GEOCHEMISTRY)

DATE: 23rd February, 1971

INTRODUCTION

The author mapped the Arkaroola Grid area, S.M.L. 294, at the scale of 400 ft to 1 inch, November, 1971. Mapping was carried out generally along E-W lines spaced at 800 ft. apart, tracing out contacts between these lines in some areas.

Lithologic variations were recorded along the lines and an attempt made to correlate these from one line to the other by a combination of "eye-balling" and interpretation on air photos at the same scale. Since the air photo interpretation carried out in identical rocks in the Woodlamulka Grid area gave such an incomplete picture of geological boundaries and since many of these boundaries are rather speculative, it was not considered warranted to do a similar interpretation on the Arkaroola map. Some features however such as faults, and some mappable units can be confidently photo-interpreted.

These are included on the Arkaroola map, which may be considered essentially as a fact map.

The following comments are provided with the map which relate briefly to:

1. Rock types
2. Structures
3. Correlation with geochemistry
4. Summary
5. Conclusions and recommendations.

1. Rock Types

(a) Volcanics

The Arkaroola Grid covers part of the area mapped by the S.A. Geological Survey (and others) as Wooltana Volcanics. The volcanic rock types were found to be essentially the same as at the Coup Prospect (previously mapped by the author for North Flinders), where rock types were established by petrological investigations. Very little petrological work was done on samples from the Arkaroola Prospect since rock names determined to The Coup area are readily applicable to the rocks in the Arkaroola Grid area.

The comments regarding the field mode of occurrence and specification of volcanic rock types in the Wooltana Volcanics at The Coup, as described in the report on The Coup, refer also to the Arkaroola area.

The volcanic rocks consist of an intimately intercalated sequence of very fine grained basic volcanics of basalt to andesite composition and trachytes of variable composition. These rock types are variably massive-crystalline, vesicular and primarily brecciated. The volcanic breccias most commonly occur in vesicular rock types.

They appear to be restricted to individual flows, and are less widespread and cover smaller areas than at The Coup.

Quality of outcrop is variable but can not in all places be positively related to variations in rock type.

It is difficult to trace lithologic contacts for more than several hundred feet since lateral and horizontal variations of flows of different composition occur rapidly over such short distances.

Generally however it appears that basaltic rock types predominate in the southern part of the grid and trachytic rock types north of the Arkaroola Creek. In several places bands of brecciated vesicular basalt pass up into vesicular, or massive crystalline trachyte, and then into massive fine grained basalt.

The volcanic sequence rarely contains intercalated thin sedimentary rock horizons, seen at about 4800N, base line. These are far less abundant than at Woodlamulka. The massive coarse gritty sandstones interbedded or faulted into the volcanics seen at The Coup are absent from the Arkaroola Prospect.

Epidotisation is commonly locally developed.

(b) Sediments overlying the Volcanics

Sediments very similar to those mapped at The Coup overly the Wooltana Volcanics in the southwest corner of the grid. They consist of coarse quartzo-felspathic sandstones which pass upwards into grit, pebble and conglomerate bands and with intercalated siltstone - commonly leached and bleached. Mineralisation occurs in these sediments (see later).

Veneers of much younger, largely unconsolidated pebble and boulder beds overlie the volcanics on part of the grid. These are mapped by the Mines Department of S.A. as ? Jurassic-Cretaceous sediments. Their superficial, unconsolidated and very thin characteristics suggests that they could be younger than this.

2. Structures

The prominant feature of the Arkaroola Prospect grid is the fault zone extending throughout its north-south length.

Between Arkaroola Creek, south to the overlying sediments this fault zone measures up to a maximum of about 400 ft. wide. Within the zone it is difficult to positively identify rock types but it appears that all volcanic rock types have been transected. These have been brecciated and sheared and cemented mainly with silica, iron and less commonly carbonate.

Within the zone south of Arkaroola Creek several reef or massive vein-like walls of brecciated and mylonitised rock are extensively impregnated, almost completely replaced and cemented by silica, iron and siderite with associated manganese staining and micaceous hematite. No copper mineralisation was found associated with these.

Between about 00N and the overlying sediments the fault zone is complicated by oblique faults, commonly associated with reefs up to 2 ft wide of massive crystalline siderite and quartz. The relationship to the fault to the sediments was not examined.

North of Arkaroola Creek the fault zone is narrower but positively continuous. It is identified by sheared and brecciated volcanic rock and in this area a far greater development of iron enrichment, carbonate veins and reefs. The reef at 7350N 400E measures up to 150 ft. long and 12 ft. wide.

Smaller faults cut the main zone, and occur adjacent to it. Carbonate veins in volcanics adjacent to the main fault are fairly common and far more abundant than at Woodlamulka or The Coup.

The Volcanics, at least on the western side of the fault zone strike roughly north-northwest and dip about 40° to 50° southwest. The overlying sediments are more-or-less conformable to the attitude of the volcanics.

No attitude of the volcanics east of the fault zone was established south of Arkaroola Creek. North of this Creek at about 6400N 700E the rocks dip roughly northeast at about 50°. Any displacement or other relative movement along the fault is not known.

Minor shears, are common in the volcanics and may be marked by carbonate and quartz veining up to 100 ft. long and 3 ft. wide. These may be discontinuously followed over 800 ft.

A local breccia fault zone causes considerable local structural complexity at about 7300N, 1000W.

3. Mineralisation

Mineralisation within the grid area is restricted to secondary copper minerals (malachite and traces of chalcocite, commonly with associated specularite),

occurring both in the volcanics and in overlying sediments.

(a) In the volcanics

Shafts have been sunk on weak veins of secondary copper minerals and specularite occurring along local shears in the volcanics. These veins are discontinuous and of the order of several inches wide only. South of Arkaroola Creek these veins are not necessarily associated with quartz or carbonate veining and they show no special relationship to the main fault zone. The local shears however may have formed in sympathy with this main structure.

The host rocks to this mineralisation are of no specific type, in fact most varieties occur in the vicinity of the main group of shallow shafts south of Arkaroola Creek.

Iron and silica impregnated volcanic breccia is however most common (together with abundant specularite) at the single shaft (about 25 ft. deep) at 2800N 100W. In this shaft copper is associated with a carbonate vein 12 inch. wide.

No mineralisation is found associated with the main fault south of the Creek. Isolated patches of malachite however were found in volcanics, in massive epidotised basalt type at 600N, 700E, 100N, 500E, 2100N, 80E, and in similar rocks on the track at 3200N, 100E. Also in trachyte at 2300N, 1750W, and 3950N, 200W.

In the Volcanics north of Arkaroola Creek a pit some 8 ft. deep has been sunk on secondary copper in a silicified and iron impregnated area in the major fault zone, at the intersection of a minor cross-cutting fault. Massive carbonate occurs in the fault north of

here but no coincident copper mineralisation was seen. Small pits have dug malachite in carbonate on a fault at 6600N, 850W and at 7900N, 700W. Malachite was seen with a small carbonate vein in vesicular trachyte at 6400N, 700W. The grade of grab samples of mineralisation at these various localities within the volcanics is shown on the accompanying map.

The amount of ore mined, or existing reserves in any one digging is extremely small (of the order of 100's of tons) and even in the area about 2400N, 200E the narrow width of the veins and their discontinuity along strike indicates only extremely small potential mineralisation, and is of no economic significance.

(b) In overlying sediments

The mode of occurrence of copper mineralisation in the sediments overlying volcanics in the south western part of the grid is consistent with the mineralisation with identical mode of occurrence at The Coup.

Malachite occurs along the bedding and joints of leached (and bleached) siltstones which are intercalated with coarse sandstone and minor conglomerate. It also occurs, impregnated through the coarse-sand-conglomerate horizons. Both types of occurrence are apparently local and mineralisation shows no evidence of continuing significantly beyond the pits which expose it.

The grade of grab samples of mineralised rock from these workings is shown in the accompanying map.

No disseminated mineralisation was seen within the area.

4. Correlation of Geology and Geochemistry

An early geochemical soil sampling programme was carried out on a reconnaissance basis over this area. Some lines, where located are shown by figures AK8 etc. on the map, however the exact position of these samples in relation to this grid is not known.

Subsequently soil geochemical samples were collected from the grid which controlled the geological mapping. These were analysed for copper.. This had not been contoured at the time of writing and so an accurate correlation of geology and geochemistry could not be made.

From examining the plotted results on an overlay however the following general conclusions are drawn:

(a) the major fault line shows generally no indication that it is anomalous in copper south of the Arkaroola Creek.

(b) North of the creek the fault zone is anomalous at the small working and in areas to the north of here where no mineralisation was seen.

(c) No area within the volcanics including areas of local faulting and carbonate and quartz reef formation are anomalous in copper over any significant area, (although isolated very local showings of malachite are not uncommon).

(d) An area of anomalous copper coincides with the group of shafts and surrounding sediments in the southwest of the area.

NOTE: A chip sample across 12 ft. of intensely brecciated and carbonate impregnated band within the main fault zone at 800N, 100E was submitted for a spectrographic scan for all major metallic elements to determine the possibility of an unexpected elements of value being associated with this fault. The results are not yet to hand.

CONCLUSIONS AND RECOMMENDATIONS

The geological mapping combined with a soil geochemical survey (copper) indicates that chances are very remote that areas of potentially economic copper mineralisation occur within the volcanics, or are associated with structures such as the major fault zone at least south of the Arkaroola Creek.

There is very little basis therefore on which to recommend further geological, geochemical or geophysical work or drilling within the volcanics in the Arkaroola Grid area.

The possible exception is a closer examination of the fault zone north of Arkaroola Creek. The existing patches of mineralisation and anomalous values along this feature should be more specifically deligneated by a more detailed grid of geochemical sampling, followed possibly by costeaning or by several I.P. reconnaissance traverses across the fault. Considering the general mode of occurrence of copper mineralisation within the Volcanics however even this work should be given low priority in the existing general programme of exploration.

Both of these surveys indicate that the most interesting mineralisation exposed, which is coincident with an area of reasonably widespread anomalous copper values occurs within the sediments overlying the volcanics. This is consistent with an identical mode of occurrence of similar mineralisation at The Coup, however the extent of known mineralisation and of anomalous zones is not as extensive as at The Coup. At this stage it is suggested that no further work should be carried out in this local area within the Arkaroola Prospect. Rather, the slightly more attractive targets of this nature should be investigated (by drilling) firstly at The Coup. If encouraging results are obtained there, then similar investigations should proceed on the similar occurrences in the Arkaroola Prospect.

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23rd February, 1971

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MEMORANDUM FROM: Mr. I.R. Pontifex,
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SUBJECT: GEOLOGY, WOODLAMULKA GRID AREA, WOOLTANA VOLCANICS, S.M.L. 294, (WITH COMMENTS ON GEOCHEMISTRY ANOMALIES).

DATE: 23rd February, 1971.

INTRODUCTION

The author mapped the Woodlamulka Grid area in S.M.L. 294, at the scale of 400 ft. to 1 inch during November 1970. Mapping was carried out generally along alternate E-W grid lines spaced at 800 ft. apart, closing up to 400 ft apart in some areas.

Lithologic variations were recorded along these lines and then an attempt made to correlate these from one line to the other by interpretation on airphotos at the same scale.

The following comments are given to accompany the map and these relate to:

1. Rock types.
2. Structures.
3. Mineralisation.
4. Correlation with geochemistry.
5. Summary.
6. Conclusions and recommendations.

1. Rock Types.

(a) Volcanics

The Woodlamulka Grid covers part of the area mapped by the S.A. Geological Survey (and others) as Wooltana Volcanics. The volcanic rock types were found to be essentially the same as at the Coup Prospect (previously mapped by the author for North Flinders), where rock types were established by petrological investigations. Very little petrological work was done on samples from the Woodlamulka Prospect since rock names determined to the Coup area are readily applicable to the rocks in the Woodlamulka Grid area.

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The volcanic rocks consist of an intimately intercalated sequence of very fine grained basic volcanics of basalt to andesite composition and trachytes of variable composition. These rock types are variably massive-crystalline, vesicular and primarily brecciated. The volcanic breccias most commonly occur in vesicular rock types. They appear to be restricted to individual flows, and are less widespread and cover smaller areas than at The Coup.

Quality of outcrop is variable but can not in all places be positively related to variations in rock type.

It is difficult to confidently trace the contact between various volcanic rock units for more than say 200 ft. since lateral and horizontal variations of flows of different composition occur quite rapidly over such distances. The contacts obtained from photo interpretation are poorly defined and have only minimal control by observation, hence the incompletion or discontinuity of such inferred contacts as seen onthe map. They do however indicate to some degree the complexity of the compositional variation throughout the sequence.

The volcanic sequence contains more abundant intercalated sedimentary beds than at The Coup or Arkaroola Prospect area. These are not the massive, coarse gritty sandstones as at The Coup, but rather thin beds (up to 15 ft) of massive fine to medium grained reddish, quartz sandstone. These form prominant outcrops, are commonly ripple marked and may be traced as discrete units for up to 800 ft. A good example of these sandstone interbeds in at 324N - base line, south of the main group of old workings.

(a) Sediments overlying the volcanics

In the northwestern part of the grid, massive bedded sandstone more-or-less conformably overlies the volcanics. It forms a prominant scarp and gives rise to an apron of extensive scree slopes to the east of the scarp.

This unit was not examined in detail but was found to consist of massive, light grey, medium grained to gritty and rarely ripple marked sandstone.

collapsed.

It is mapped elsewhere as Blue Mine Conglomerate but in the several localities examined it is generally not similar to this unit as seen elsewhere by the author. Also it does not resemble the massive, gritty and pebbly, commonly ferruginous sandstone found overlying the volcanic sequence at The Coup.

2. Structures

The volcanic rocks and intercalated sediments have a fairly consistent attitude, striking generally about north-north-east dipping 30^{o} to 50^{o} north-north-west.

Several faults occur in the grid area, the largest of which cuts across the southeast corner of the grid. This can be followed on the air photos and recognised on the ground by shearing, minor brecciation and coincident but local development of carbonate veins.

Other faults in the area are largely inferred from the photos together with minor topographic features and field evidence.

3. Mineralisation

Mineralisation within the area mapped is mainly restricted to secondary copper minerals (malachite and traces of chalcocite) associated with carbonate veins, almost exclusively located in faults or local shears within the volcanics.

The old workings forming the Woodlamulka Mine consist of a series of shafts sunk along a shear or fault zone. Mineralisation occurs predominantly in a carbonate (siderite) and quartz gangue, occuring as a vein several feet wide within chloritised volcanic country rock. The shafts reach a maximum depth of 30 ft most have collapsed.

The pit at 369N, 238E is small and consists of malachite staining in a narrow shear along strike from a quartz vein. Malachite is associated with a small carbonate vein at 350N, 242E.

The grade of mineralisation in the old workings is not known but several randomly chosen lumps of cupriferous carbonate gangue assays . % Cu.

One of the few unworked (but previously recognised) copper occurrences in the area occurs at 332N, 239E where malachite occurs in a quartz-epidote-hematite vein within epidotised basalt-andesite, immediately overlying a quartzite interbed. Grab samples of the most intense mineralisation here assay % Cu. Scree down dip from this locality contains traces of malachite.

This copper occurrence appears to occur in a local shear in volcanics, possibly related to a relatively larger fault to the north. It does not appear to be associated with the adjacent quartzite interbed.

Several other quartz and carbonate reefs occur throughout the grid area, these show no evidence of accompanying copper mineralisation.

No evidence of disseminated mineralisation was seen in situ in the area. However two pebbles of vesicular basalt in a major creek at 237E, 332N contain traces of disseminated chalcocite and gave values of 0.21% and 0.28% Cu. The origin of these was not traced.

4. Correlation of Geology and Geochemistry

(a) Copper

The most prominant (and continuous) copper anomalies occur in the south of the grid, largely centred over the area of old workings and over the outcrop of copper mineralisation noted at 332N, 239E including the debris down-slope derived from this occurrence.

High copper values within this and some other anomalous zones coincide with carbonate veins, but similar veins in the area show no corresponding anomalous values indicating that this is not an exclusive association.

This southern anomaly is "open" along its entire southern margin.

The anomaly centred about 368N, 237E is caused by debris from the existing pit on minor copper mineralisation.

The anomaly centred approximately about 352N, 233E and several other minor anomalies not mentioned specifically above are geologically unexplained with the possible exception, that in very general terms, there appears to be a vague correlation between high copper values and the fine grained, dense basalt rock type. In fact this rock type has world average inherent copper content of about 90 ppm Cu as distinct from an average figure for syenite - or the volcanic equivalent, trachyte, of 5 ppm.

Therefore there exists vague evidence that some of the low order "anomalies" may relate to lithologic variations in the volcanic sequence.

(b) Zinc

Generally the zinc anomalies do not coincide with the copper values, therefore the primary distribution of the zinc is controlled by different agencies to those responsible for the distribution of the copper.

Anomalous zinc values are unrelated to structures. There does however appear to be a general correlation between anomalous zinc areas and the massive-crystalline and vesicular trachyte. (As suggested by P. Donovan in his memo to North Flinders dated 26/11/70.) World figures indicate that rocks of trachytic composition contain an average of 130 ppm Zn, and basaltic rocks 100 ppm and so there is slight evidence that the anomalous zinc zones in the area reflect lithologic variations.

The zinc anomalies almost certainly do not indicate zones of potential economic mineralisation.

(c) General

There is no suggestion of anomalous copper or zinc values associated with the sandstone overlying the volcanics as found at The Coup. Two of the major bands of intercalated quartzite fall within copper anomalies, but these alone do not appear to contribute to the anomalous values.

SUMMARY

The geological mapping of this area, although on a semi-reconnaissance basis, is sufficient to indicate that the Woodlamulka grid area consists of a sequence of volcanic rocks, varying laterally and horizontally, over short distances in composition between basalt and trachyte. The rocks are variably vesicular and primarily brecciated. They contain minor but ubiquitous intercalated thin quartzite bands, and are more-or-less conformably overlain by a sandstone formation.

A moderately prominant fault causing unknown displacement, cuts the southeast of the area; several lesser faults are scattered.

These faults and minor shear zones in the volcanics are locally associated by carbonate and quartz veins. In places, notably in the vicinity of the Woodlamulka workings, these contain minor secondary copper mineralisation. Other such veins in the area are unmineralised.

Copper geochemical (soil) anomalies reflect known mineralisation mainly in the southern part of the area, but the anomalous zone here is open along its southern margin. A poor correlation can be made between copper anomalies and relatively basaltic rock types.

Zinc anomalies are unrelated to copper anomalies, and evidence suggests that they may reflect prominantly trachytic rocks.

These comments on geochemistry essentially correspond with those of P. Donovan in his memo to North Flinders, dated 26th November, 1970.

CONCLUSIONS AND RECOMMENDATIONS

The geological mapping combined with the soil geochemistry indicates that the potential for locating economic mineralisation in this area is remote. Both of these surveys focus attention on the southern end of the grid between 336N and 328N, where a copper anomaly is open along its whole southern margin.

Geochemical anomalies within the grid but outside of this "southern area" can be more-or-less explained geologically and are considered to be economically insignificant.

The work does not provide any specific targets for drilling or follow up geophysical surveys. However in view of the open nature of the southern copper anomaly it is recommended that the grid be extended to at least 320N, and further soil samples taken in an attempt to close this anomaly. Geological mapping should also cover this extension.

When closed, this anomaly should be reassessed in the light of it possibly providing areas worthy of

(a) follow up geochemical sampling
(b) geophysical surveys
(c) drilling

From the mode of occurrence of mineralisation in the Wooltana Volcanics however, the author anticipates that this grid area will be placed low on the list of priorities for further investigation.

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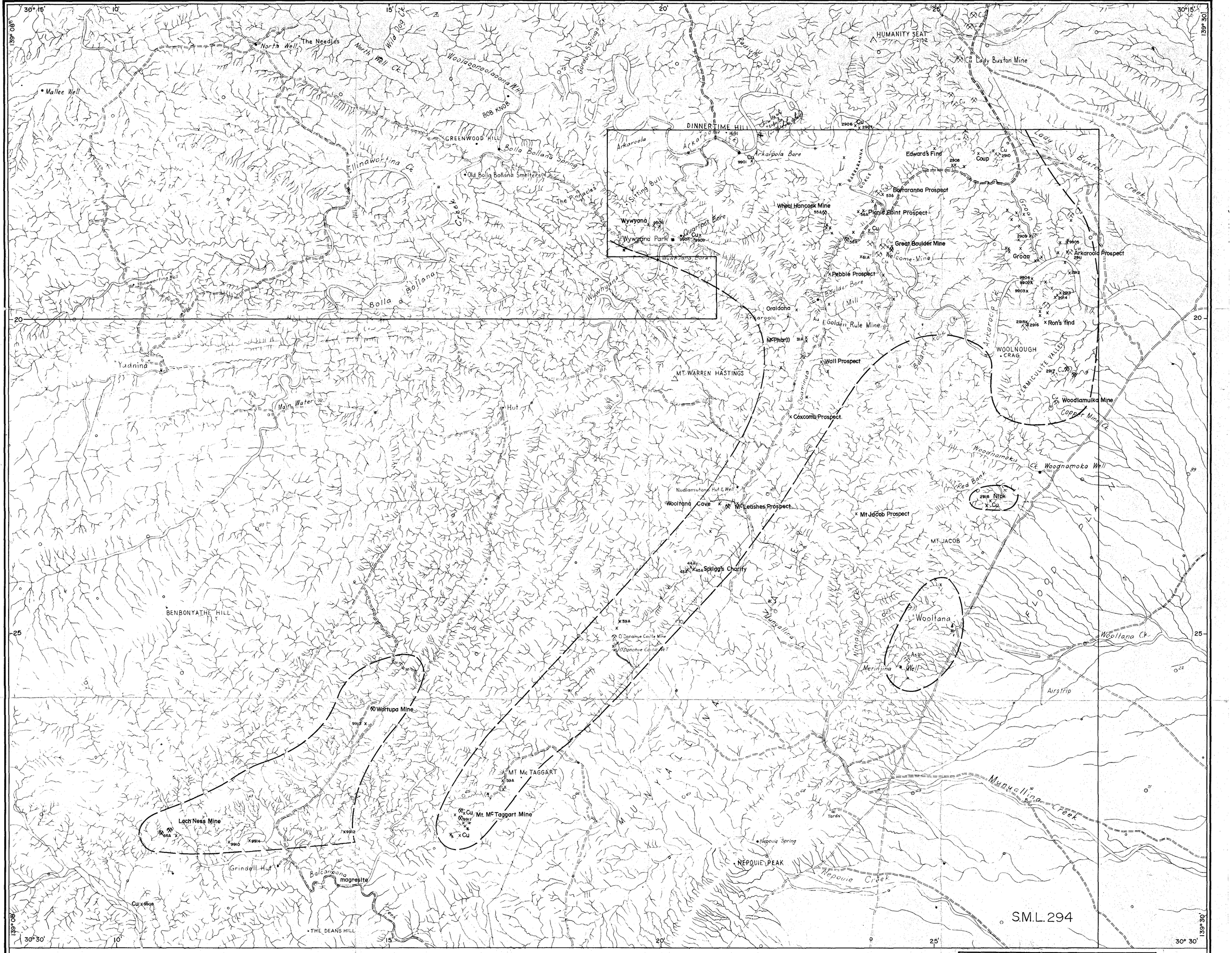
I.R. PONTIFEX
Chief Mineralogist



APPROXIMATE BOUNDARY OF ANOMALOUS COPPER AREA DETERMINED FROM STREAM SEDIMENT SAMPLING BY McPHAR GEOPHYSICS PTY. LTD.

MINE

PROSPECT

9948 SAMPLE LOCATION

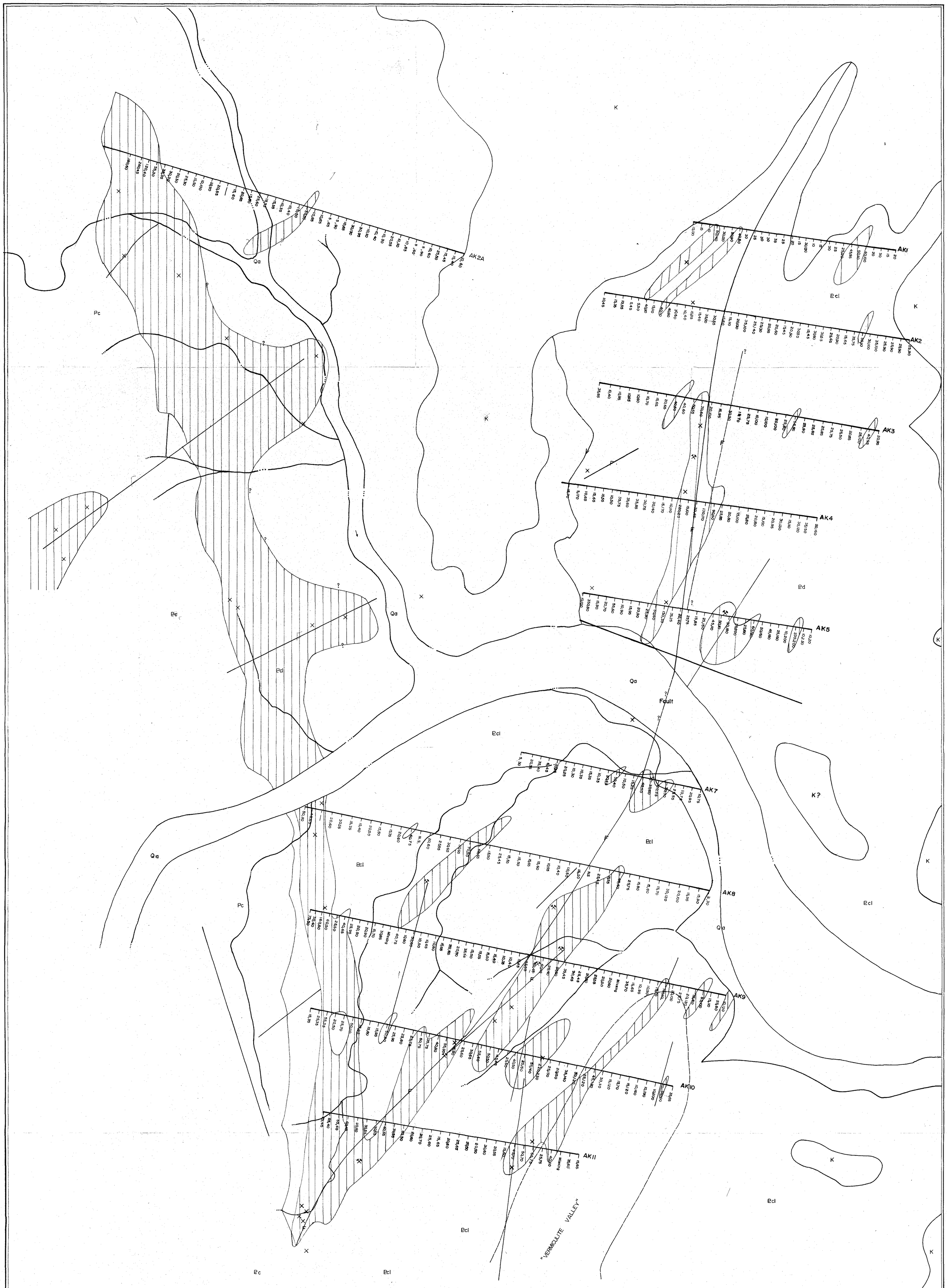
SCALE 60 40 20 0 60 120 180 CHAINS

NFM North Flinders Mines N. L.

PLAN SHOWING LOCATION OF MINES AND PROSPECTS S.M.L. 294

MAPPED BY S J CARTHEW

DRN:- D.K.T.	DATE:- 22-7-70	SCALE:- 1 INCH = 60 CHAINS



Qa Alluvium.

K Cretaceous.

Pc Sediments of Callana Beds and Burra Group.

Pd Woolfana Volcanics.

Old Copper - Workings.

Copper Occurrence (S.Carthew.).

Fault.

Anomalous Areas as defined by S. Carthew.

Regional Soil-Geochem Traverses & possible anomalous areas.

Cu/Zn

RECEIVED
6 MAY 1971
DEPT. OF MINES
SECURITY

North Flinders Mines N. L.

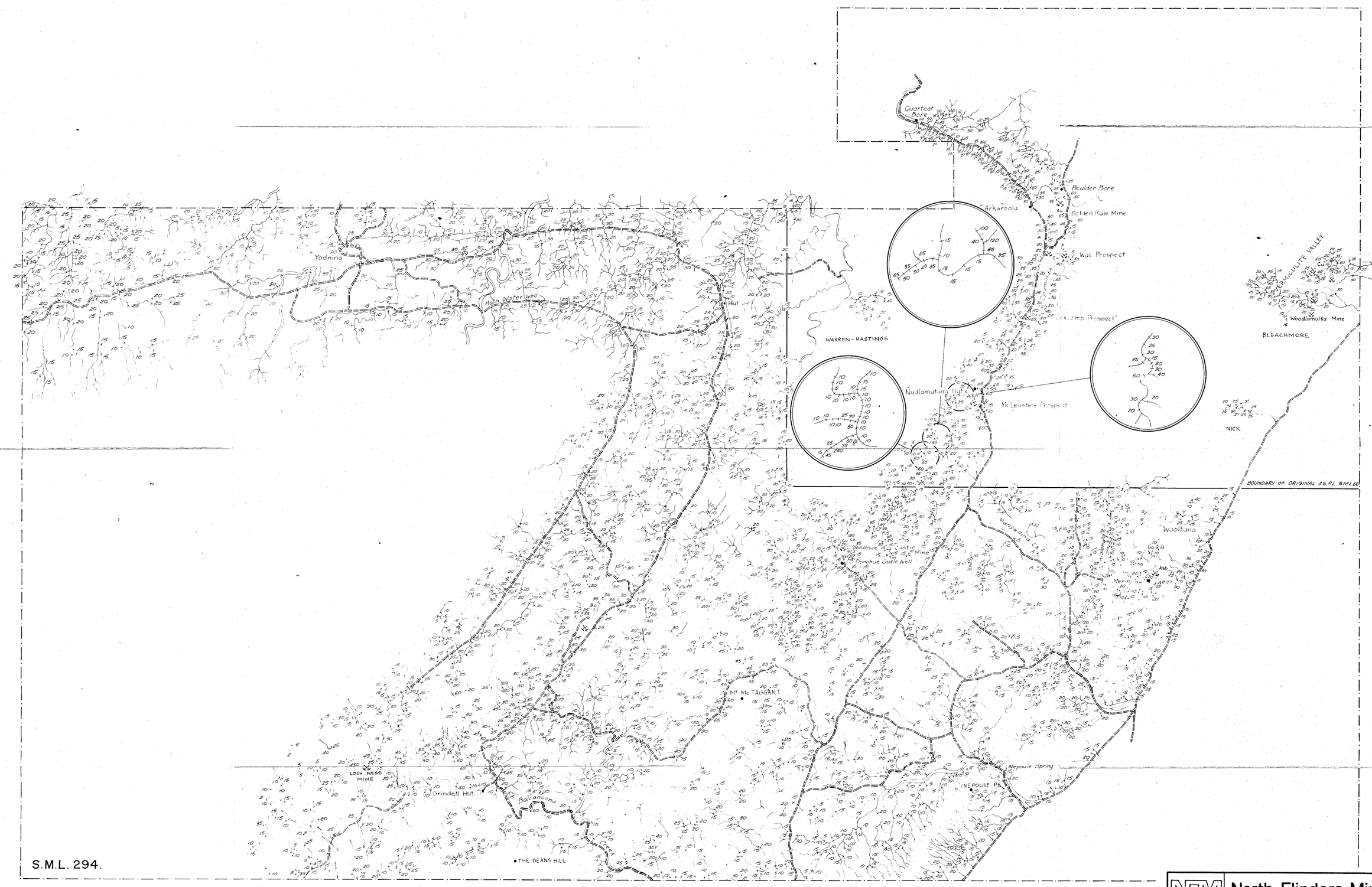
ARKAROOLA PROSPECT
S.M.L. 294
SKETCH MAP SHOWING
WOOLTANA VOLCANICS
with
REGIONAL SOIL- GEOCHEM TRAVERSES
BY
S.J.CARTHEW

DRN:-M.J.T.	DATE:- 8/2/1971	SCALE:-1"reps 500' (approx.)

Dwg. 294-40.

ENV 1226 (X) - 6

McPHAR GEOPHYSICS PTY. LTD.



Cu by AAS following hot 25% HNO3 leach.
for 1 hour on 0.25 gm sample of minus 80 mesh.

ENLARGMENTS NOT DRAWN TO SCALE

North Flinders Mines N.L.

WOOLTANA AREA

S.M.L.–294.

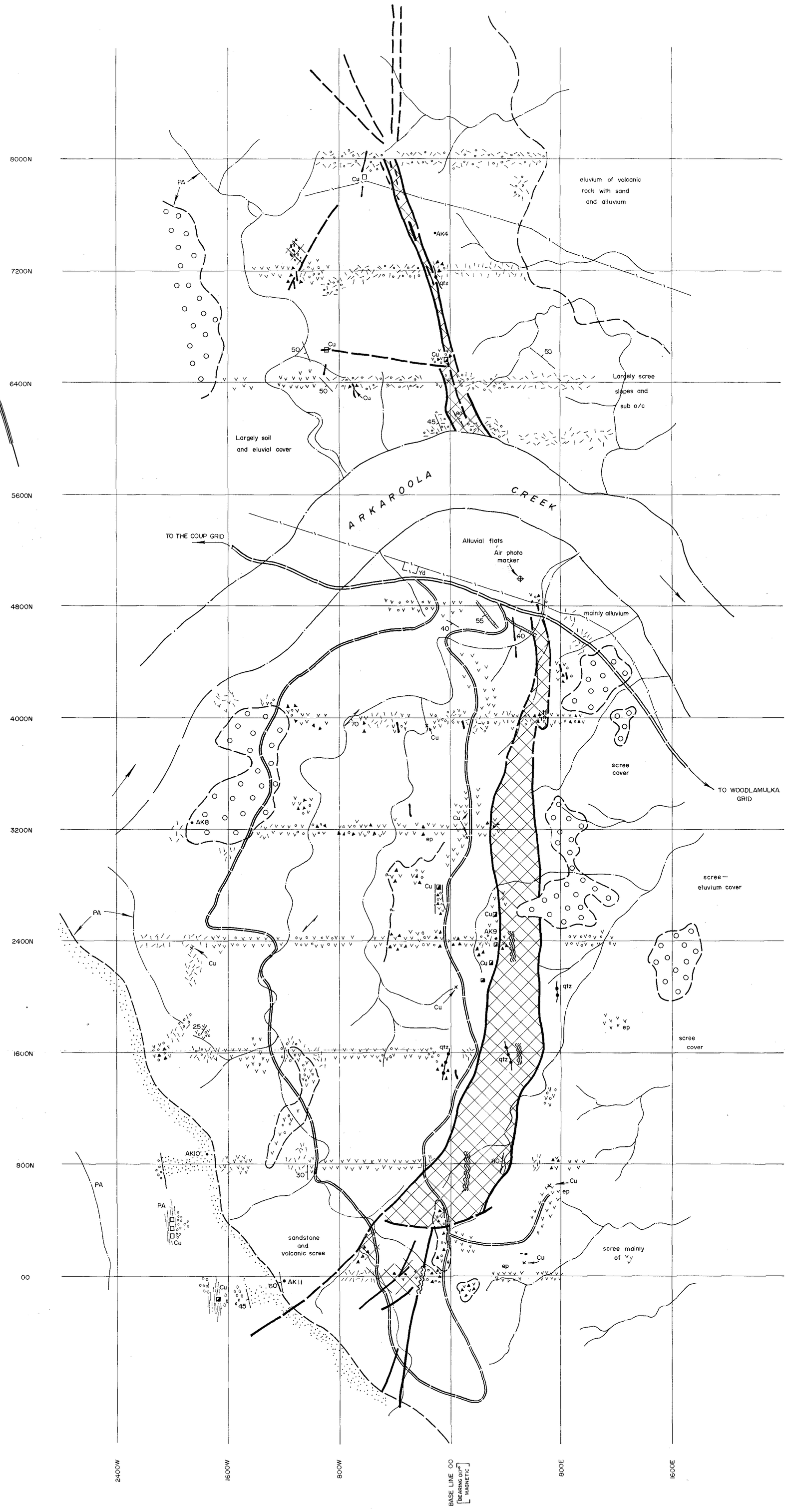
STREAM SEDIMENT RECONNAISSANCE
AND FOLLOW UP SURVEY.

COPPER RESULTS p.p.m.

DRN:- I.S.	DATE:- 25·11·69	SCALE:- 60 chains = 1inch. 1226

Same as 1226(E)-4 ENV 1226(E)-7 D.WG: G.C. 3014–A.

McPHAR GEOPHYSICS PTY. LTD.



REFERENCE

(? Jurassic – Cretaceous) unconsolidated conglomerate, boulder beds, gravels, sands

SEDIMENTS OVERLYING VOLCANICS

- Sandstone
- Siltstone (generally leached and bleached)
- Gritty sandstone with minor conglomerate

WOOLTANA PROSPECTS

- Basalt, massive to blocky, very fine grained, dark grey
- Vesicular basalt
- Trachyte, medium crystalline, massive, grey–green to brown
- Vesicular trachyte
- Volcanic breccia, usually in vesicular volcanic rocks, impregnated and cemented with iron and silica
- Sandstone band in volcanics
- ep — Epidotisation
- Fault zone generally in volcanic rocks, commonly cemented by iron – silica and carbonate
- Carbonate (Lens, vein, reef or pod)
- Massive quartz – iron or carbonate veining associated with brecciation and mylonitisation within fault zone
- Fault observed
- Fault inferred
- Shaft
- Pit
- Cu — Copper occurrence
- Track
- Graded road
- Fence
- PA — Position approximate
- Geological boundary
- Bedding attitude

North Flinders Mines N. L.

GEOLOGICAL MAP
ARKAROOLA PROSPECT, WOOLTANA VOLCANICS
SML.294.

GEOLOGY BASED ON MAPPING GRID LINES
800 FEET APART AND AIR PHOTO INTERPRETATION
BY I.R.PONTIFEX OF McPHAR GEOPHYSICS PTY. LTD. NOV. 1970

DRN:- J.R.G.	DATE:- 14.12.70	SCALE:- 400 FEET TO 1 INCH

ENV 1226(2)-8 DWG: G3140A

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MAGNETIC NORTH

249 E

BASE LINE 237 E
(BEARING 360°)

225 E

368N 364N 360N 356N 352N 348N 344N 340N 336N 332N 328N

Quartz
Scree
Cu
Epidote
FAULT
Malachite stain in carbonate
Ferruginous sandstone
Rubbly
POSSIBLE FAULT
Cu occurrence
Extensive scree slopes mainly of medium quartz ferruginous sandstone, minor volcanics

REFERENCE

SEDIMENTS OVERLYING VOLCANICS

- Sandstone

WOOLTANA VOLCANICS

- Basalt to andesite, massive, fine grained
- Trachyte, massive, medium crystalline
- Basalt to andesite, vesicular
- Trachyte, vesicular
- Volcanic Breccia may be in :—
  1. Vesicular basalt.
  2. Vesicular trachyte
- Sandstone intercalated with volcanics
- Carbonate vein
- Geological boundary interpreted from air photos

RECEIVED
4 MAY 1971
DEPT. OF MINES
SECURITY
1226 (3)

North Flinders Mines N. L.

GEOLOGICAL MAP
WOODLAMULKA PROSPECT, WOOLTANA VOLCANICS
SML.294.

GEOLOGY BASED ON MAPPING GRID LINES
800 FEET APART AND AIR PHOTO INTERPRETATION
BY I R PONTIFEX OF McPHAR GEOPHYSICS PTY LTD NOV 1970

DRN:- R G Z.	DATE:- 14.12.70	SCALE:- 400 FEET TO 1 INCH

ENV1226(3)-9

DWG. G2084A