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SML 422

MOUNT SERLE – ANGEPENA AREA

PROGRESS AND FINAL REPORTS TO LICENCE EXPIRY/RENEWAL FOR THE PERIOD 21/5/1970 TO 20/5/1972

Submitted by
Fox Mining and Exploration Pty Ltd and Australian Aquitaine Petroleum Pty Ltd
1972

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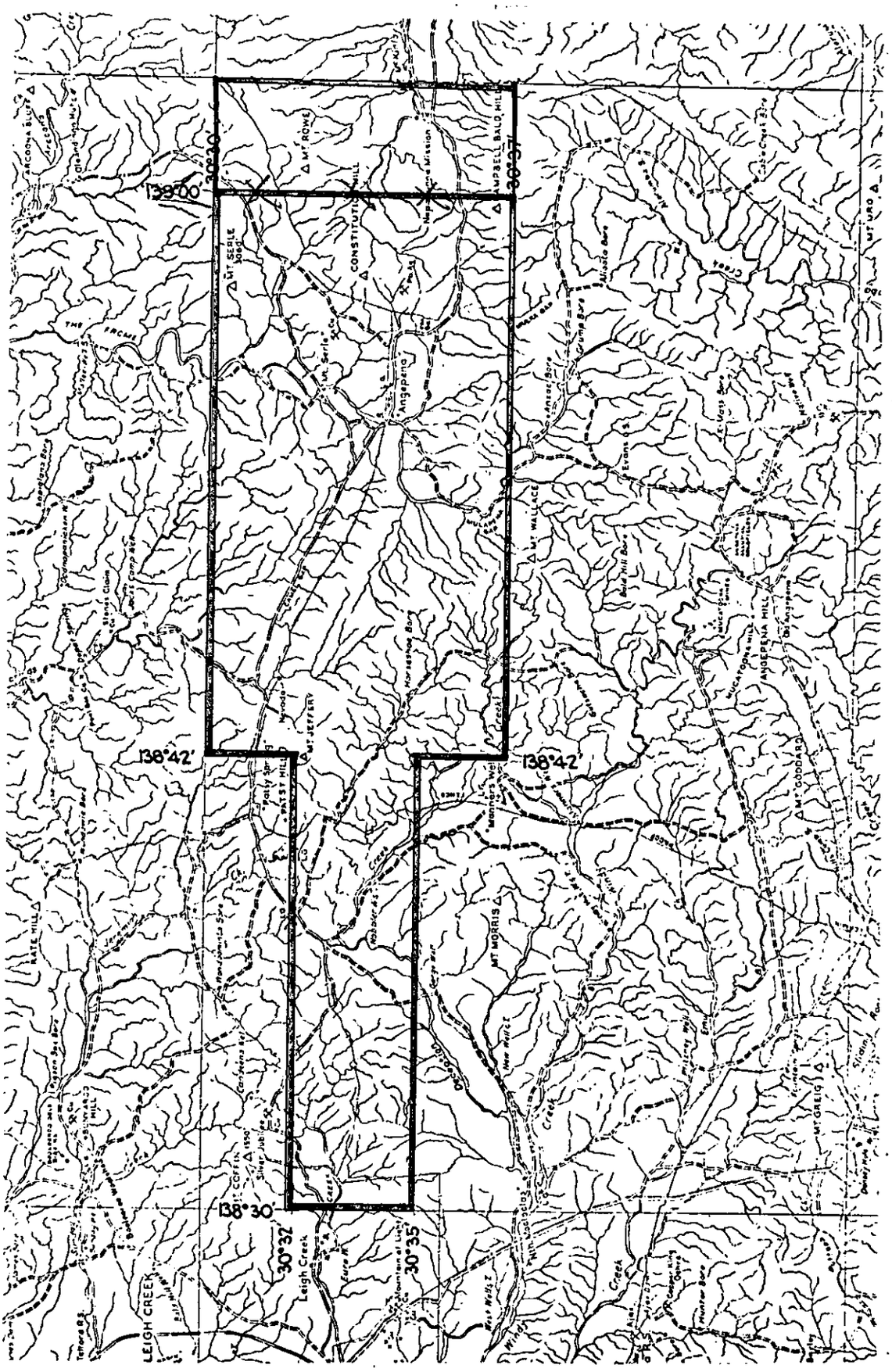
Government of South Australia
Primary Industries and Resources SA



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FOX MINING AND EXPLORATION PTY. LTD.

DOCKET D.M. 403/70 AREA 160 SQ MILES

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LOCALITY

S.M.L. No. 422 EXPIRY DATE 20-5-71

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McPHAR GEOPHYSICS PTY. LTD.

50-52, Mary Street, UNLEY, SOUTH AUSTRALIA

- COPY -

Mr. C. Fox,
Fox Mining & Exploration Pty. Ltd.,
57, Maesbury Street,
KENSINGTON S.A. 5068.

7th December, 1970

Dear Mr. Fox,

The stream sediment sampling programme by your staff on S.M.L. 422 is now complete. We have carried out analysis for Cu, Pb and Zn and the map preparation is almost complete.

I shall write the memorandum for the Mines Department on my return to the office on 21st December after my trip to Fiji.

Yours sincerely,
McPHAR GEOPHYSICS PTY. LTD.

(signed) E. BURNSIDE
for P.R. DONOVAN Ph.D., M.A.E.G.

Mr. C.Fox(1)
c.c. Mr. Fox(1)
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McPHAR GEOPHYSICS PTY. LTD.

50-52 MARY STREET, UNLEY, SOUTH AUSTRALIA
POSTAL ADDRESS: P.O. BOX 42, UNLEY, SOUTH AUSTRALIA 5061

TELEPHONE 72 2133
CABLE "PHARGEO" ADELAIDE
TELEX "PHARGEO" AA82623

1481

MEMORANDUM TO: FOX MINING AND EXPLORATION PTY. LTD.

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

SUBJECT: STREAM SEDIMENT RECONNAISSANCE SURVEY ANGEPENA AREA, S.M.L. 422, SOUTH AUSTRALIA. INTERIM REPORT

DATE: 14TH JANUARY, 1971

INTRODUCTION

This S.M.L. of approximately 160 square miles has previously been partly covered by stream sediment reconnaissance by Electrolytic Zinc Co. of A'Asia Pty. Ltd. who sampled over the Cambrian carbonate sequence. The areas thus covered are indicated on the accompanying maps.

In all the staff of Fox Mining and Exploration Pty. Ltd. collected 877 samples over approximately 130 square miles, yielding a density to date of approximately 6.7 samples per square mile.

The area lies completely within the Angepena one mile sheet and the unpublished Copley 4 mile sheet of the S.A. Mines Department.

ANALYSIS

Samples were sieved to minus 80-mesh and analysed for Cu, Pb and Zn following a hot 25% HNO_3 leach on 0.25 g. sample. However Ag analysis was also requested for samples 422001 - 422281 and therefore an aqua regia leach was used on these samples.

All anomalous values have been checked by reanalysis following a 25% HNO_3 leach unless stated below.

The results are given in McPhar Batches CH 0419 (21/9/70), CH 0826 (20/11/70) and CH 0939 (1/12/70).

.../2

RESULTS

The sample locations and Cu, Pb and Zn values are presented in DWG.'s G.C. 4013A - 4016A inclusive.

The silver values were all below the limit of detection (2 ppm) and were consequently not plotted.

Copper (DWG. G.C. 4014A)

Values ranged from 5 - 100 ppm.

Using a threshold of 35 ppm there were 11 anomalies. These were all possible anomalies (35 - 69 ppm) with the exception of 422036 (100 ppm) which is probably contaminated from the Silver Jubilee Mine approximately one mile north of the S.M.L. Samples 42213 and 422497 remain to be checked by reanalysis.

It should be noted that no Cu anomalies were obtained below the Nevada Mine (due to insufficient minus 80-mesh material for analysis in sample 534) and there are no copper anomalies below the Eveline Mine, possibly due to incorrect sampling, possibly due to transported overburden, and possibly due to incorrect location of the mine on DWG. G.C. 4014A. The copper diggings 3 miles NNE of the Nevada Mine did not give rise to copper anomalies, again possibly due to incorrect sampling technique.

The possible anomalies may be classified as follows:

Marinoan:	213 (45 ppm),	497 (35 ppm),	705 (45 ppm).
Diapir:	442 (35 ppm), 439 (60 ppm).	443 (45 ppm),	444 (50 ppm),
Cambrian:	761 (65 ppm),	758 (40 ppm).	

Lead

Values ranged from <20 to 100 ppm. A threshold of 80 ppm was selected and there were two possible anomalies 422844 (80 ppm) and 422322 (100 ppm) both of which remain to be checked by reanalysis.

It should be noted that the Constitution Hill Ag-Pb Mine does not give rise to a Pb anomaly at this stage. The reason for this is not clear. This should be investigated by a geologist-geochemist in the field.

Zinc

Values ranged from 5 - 130 ppm.

A threshold of 100 ppm was selected and there were four possible anomalies. However, these all remained to be checked by reanalysis.

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RECOMMENDATIONS

The overall density of sampling must be approximately doubled, up to 15 per square mile. The fact that several known occurrences do not give rise to sediment anomalies indicates that the sampling to date has been inadequate.

The data of Electrolytic Zinc Co. of A'Asia Ltd. should be incorporated onto the current maps; the same analytical method was used in this work and the S.M.L. treated as a single unit in the final report.

At the completion of the additional sampling the final report will be written with recommendations for follow-up.

CONCLUSIONS

At present the most encouraging aspect is the group of anomalous copper values around the diapir, some 3 miles north of the Nevada Mine.

Signed:
McPHAR GEOPHYSICS PTY. LTD.

P.R. Donovan Ph.D., M.A.E.G.

c.c. Mr. C. Fox (2)
Files

McPHAR GEOPHYSICS PTY. LTD.

50-52 MARY STREET, UNLEY, SOUTH AUSTRALIA
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TELEPHONE 72 2133

CABLE
"PHARGEO" ADELAIDE
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"PHARGEO" AA82623

MEMORANDUM TO: FOX MINING & EXPLORATION PTY. LTD.

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

SUBJECT: STREAM SEDIMENT RECONNAISSANCE SURVEY, ANGEPENA AREA, S.M.L. 422, SOUTH AUSTRALIA.

DATE: 13TH JULY, 1971

INTRODUCTION

An interim report on the stream sediment reconnaissance of S.M.L. 422 was submitted by the writer on 14th January, 1971.

The recommendations in that report have now been completed and this memorandum is intended as a comprehensive final report of the stream sediment reconnaissance. Firstly the sampling by Fox Mining will be considered and subsequently the Electrolytic Zinc programme.

Since January, 1971, a further 759 sediment samples have been collected by the staff of Fox Mining and Exploration Pty. Ltd., bringing the sampling density over the 130 square miles outside the E.Z. areas to approximately 12.6 samples per square mile.

The E.Z. data has now been incorporated on Dwg's. 4103A - 4106A so that the stream sediment data for the area is now essentially complete.

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The geology of the area is given in the Angepena One-mile Sheet and the unpublished Copley 1:250,000 Sheet of the S.A. Mines Department, which should be used in conjunction with this report. The 60-chain base-map mapping for the Copley Sheet is particularly useful.

ANALYSIS

Samples were sieved to minus 80-mesh and analysed for Cu, Pb and Zn by AAS. It should be noted, however, that the acid leaches used were different for various batches as follows:

Batch		Samples	Hot Acid Leach
CH 0419	(21/9/70)	422001 - 422281	Aqua Regia
CH 0826	(20/11/70)	(422213 & 422145 (422282 - 422461	25% HNO_3
CH 0939	(1/12/70)	422462 - 422880	25% HNO_3
CH 2173	(11/6/71)	(422001 - 422636 (422878 - 422999	Conc. $HClO_4$

E.Z. samples were analysed on a -20 + 80-mesh fraction by AAS following a 25% HNO_3 leach.

In order to avoid confusion due to duplicate sample numbers, Batch CH 2173 has been plotted with an 0 before the last three digits on the sample location map and these samples are referred to similarly in the following text. For example, sample 422145 from Batch CH 0826 is referred to as 145, but sample 422145 from Batch CH 2173 is referred to as 0145.

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FOX MINING DATA

RESULTS:

All Cu anomalies have been checked by analysis following 25% HNO_3 to produce some measure of uniformity in assessing anomalies. Thus on the Cu map a value of 40 ppm with a circled value of 25 ppm means that the original value of 40 ppm was obtained by an acid other than 25% HNO_3 but the repeated 25% HNO_3 result was 25 ppm. In such a case the sample would not be considered to be anomalous.

This approach was not considered necessary in the case of Pb and Zn.

The sample locations and metal values are shown on Dwg's. G.C. 4103A - 4106A.

Copper (Dwg. G.C. 4104A)

Values ranged from 5 - 230 ppm. A threshold of 35 ppm was selected (following a hot 25% HNO_3 leach).

There are several old Cu workings in the area as shown in the following list, which also gives the stratigraphic setting.

(1) Nevada Mine (Marinoan)

(2) Eveline Mine (probably Marinoan, possibly Sturtian)

(3) Unnamed working 1 mile west of Eveline (Sturtian)

(4) White Virgin Mine 2 miles WNW of Constitution Hill (Marinoan)

(5) and (6) Unnamed workings east of diapir.

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There are also the following showings, reported mainly by the geologists of the S.A. Mines Department during their regional mapping.

(7) A Cu-Mn-Ba showing 1/2 mile west of (3). Possibly fault controlled.

(8) 3/4 mile SE of Mt. Serle. Possibly fault controlled.

(9), (10), (11), (12) On a line between the White Virgin and the Constitution Hill Ag-Pb Ochre Mine (all Marinoan).

(13) At the northern tip of the diapir (Marinoan).

(14) 1 mile west of the diapir (Sturtian).

(15) 1/2 mile west of Nevada Mine (Marinoan).

Two significant zones of copper occurrences and anomalies may be recognised - Zone A around the diapir and Zone B around the Eveline Mine.

Zone A contains several copper shows as mentioned above ((5), (6), (13) and (14)). There are also Cu anomalies within the diapir itself (samples 705 - 45 ppm, 0211 - 90 ppm) as well as in the Sturtian and Marinoan on either side. The geology and structure in and around Zone A are probably more complex than hitherto realized.

Zone B contains three old copper shows, including the Eveline Mine, together with several old barite workings. This zone is structurally complex and widespread Tertiary and Quaternary surficial deposits further complicate interpretation and exploration. The latter, however, improve the chances of locating mineralization which the old prospectors may have missed.

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There are anomalies related to the Nevada Copper Mine (0176 - 55 ppm) and also the Elsie Adair and South Adair copper workings (36 - 100 ppm) which lie approximately 1 mile north of the area. Anomaly 0887 (60 ppm) is probably due to backwash from the latter source.

Outside these zones, the anomalies may be listed stratigraphically.

(i) Sturtian

(a) 213 (45 ppm) just east of Deception Creek.
(b) 07 (50 ppm) 1 mile north of Angepena Station.
(c) 0878 (40 ppm) just north of Leigh Creek.

(ii) Marinoan

(a) 0555 (80 ppm) with 497 (35 ppm) downstream, just south of the Copley Road. This appears to be in the same horizon of the Marinoan as the Patsy Springs copper occurrence, 2 miles west of the S.M.L.
(b) 0570 (40 ppm) 2 miles west of the Nevada Mine and in approximately the same stratigraphic setting.

(iii) Lower Cambrian

(a) 0953 (35 ppm) 2 miles SE of the Eveline Mine.

Lead (Dwg. G.C. 4105A)

Values ranged from <20 to 230 ppm. A threshold of 60 ppm was selected and in all there were 9 anomalies as follows:

6 possibly anomalous (60 - 110 ppm)
1 probably anomalous (120 - 170 ppm)
2 definitely anomalous (180 ppm and above)

One of these was also anomalous in Cu, namely 0176 (220 ppm Pb, 55 ppm Cu). This is related to the Nevada Mine. Sample 844 (80 ppm) occurs 1 mile to the ESE in a similar stratigraphic position.

Samples 0591 (60 ppm) and 0593 (60 ppm) occur within the Lower Cambrian 2 miles ENE of Constitution Hill.

Samples 029 (230 ppm) and 032 (160 ppm) appear to be related to the Constitution Hill Ag-Pb workings.

Sample 081 (60 ppm) drains Marinoan sediments east of Deception Creek, and 0261 (60 ppm) drains the same rock types west of Frome River in the southern part of the S.M.L. Sample 0261 is also anomalous in Zn (180 ppm).

Sample 322 (100 ppm) occurs within the Sturtian 2 miles ENE of the Nevada Mine.

Zinc (Dwg. G.C. 4106A)

Values ranged from 5 to 180 ppm. A threshold of 100 ppm was selected and there were 9 possible anomalies in the range 100 - 200 ppm Zn.

Sample 0112 occurs within the Lower Cambrian on the western fringe of the E.Z. Castle Rock anomaly (see below under E.Z.) while 0100 and 0103 occur within the Pound Quartzite just south of the same anomaly.

. . . . /7

Sample 0261 has been mentioned under Pb above.

The remaining five anomalies all drain Sturtian sediments.

Samples 299 (100 ppm) and 347 (100 ppm) have been collected below roads and may be suspect.

Samples 021 and 023 occur just south of Leigh Creek at the western end of the area.

Sample 0925 is also anomalous in Cu and occurs within Zone A 3 miles NNW of the Nevada Mine.

CONCLUSIONS:

A number of significant anomalies have been located by the stream sediment survey. These are principally copper anomalies, but there are also anomalies in Pb and Zn or combinations of these metals.

Apart from follow-up of isolated anomalies, the emphasis in the area should now switch to geological mapping in critical areas.

Recommendations for follow-up of the anomalies follow below.

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RECOMMENDATIONS:

(1) The following Cu anomalies should be followed up by detailed sediment sampling (100' spacings) to the heads of their respective creeks.

213, 07, 0555, 0570, 0878 and 0953.

(2) The following Pb anomalies should be followed up by detailed sediment sampling (100' spacings) to the heads of their respective creeks:

322, 844, 081, 0261*, 0591, 0593

(* should also be analysed for Zn)

(3) The following Zn anomalies should be followed up by detailed sediment sampling (100' spacings) to the heads of their respective creeks:

299, 347, 021, 023, 0925*

(* should also be analysed for Cu)

(4) Large scale aerial photographs should be obtained for Zone A (1,000' = 1 inch) as indicated on Dwg. G.C. 4104A. Geological mapping and prospecting should be carried out.

(5) Large scale aerial photographs should be obtained for Zone B (preferably 500' = 1 inch) and geologic mapping carried out at this scale. In particular the surficial deposits and geomorphological development of this critical area should be given some attention. A geophysical survey may be required in the area eventually.

. . . . /9

(6) The barite occurrences within Zone B should be mapped at a scale of 1" = 100' and sampling carried out so that the economics of these deposits and the possibilities of finding further material under the overburden may be assessed.

E.Z. DATA

INTRODUCTION:

The following maps of E.Z. are pertinent to S.M.L. 422.

D102-2	Stream Sediment Reconnaissance - Cu Results
D102-3	Stream Sediment Reconnaissance - Pb Results
D102-4	Stream Sediment Reconnaissance - Zn Results
B102-20	Castle Rock Syncline - Geology
B102-21	Castle Rock Syncline - South Limb - Geology
CA102-17	Castle Rock Grid Geochemistry - Cu Values
CA102-18	Castle Rock Grid Geochemistry - Pb Values
DA102-22	East Angepena Geological/Geochemical Cross-Section.

Presumably there is another map CA 102-19 showing the Zn values for the Castle Rock Grid, but this is not available.

The reports of E.Z. are not very informative. It appears that the main target of exploration was Zn-Pb mineralization in the Lower Cambrian limestones. Three specific areas were investigated geologically, (1) the Castle Rock Syncline, (2) the Castle Rock Syncline - South Limb, and (3) the East Angepena area. Nothing of significance was found in these areas.

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DISCUSSION AND RECOMMENDATIONS:

Copper

Leaving aside the sediment anomalies at the Castle Rock Syncline, the following anomalies should be followed up by routine detailed sediment sampling at 100' spacings:

912, 917, 1079, 1122, 1123, 1124, 1153 and 1283

It is perhaps significant that the three copper occurrences around Mt. Serle were not detected yet five other anomalies were located.

Lead

The location of the East Angepena area is not certain, except that it occurs in the Mt. Serle area.

The following anomalies in the Mt. Serle area are considered worth following up by routine detailed sediment sampling at 100' spacings:

1157, 1181, 1231 and 1245

. . . . . /11

Zinc

It is assumed that the Castle Rock Syncline and South Limb areas were adequately investigated by E.Z.

The following anomalies in the Mt. Serle area are considered worth following up by routine detailed sediment sampling at 100' spacings:

1129, 1135, 1199, 1262, 1263 and 1575

Signed
McPHAR GEOPHYSICS PTY. LTD.

P.R. Donovan, Ph.D., M.A.E.G.

c.c. Fox Mining (3)
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Rec'd 6-1-72

SPECIAL MINING LEASE 422

QUARTERLY REPORT

FOR PERIOD ENDING 21ST NOVEMBER, 1971.

Work done on SML 422 consisted mainly of revision of all bibliographic information.

This area was prospected by Electro-Zinc by stream sediments, with almost negative results, nevertheless the whole area had not been covered by Electro-Zinc and McPhar on behalf of Fox Mining, carried out a new sampling of SML 422.

A visit in the field with R. FIDIER, geologist of McPhar, was successful enough to find a new Spharelite occurrence in the BALCANOONA formation. A dissemination of sulphides in Balcanoona could have caused the geochemical Zn anomaly.

Consequently we will base our next exploration programme not only on well known AJAX and PARACHILNA formation, but also on BALCANOONA formation by detailed stream sampling and dip sampling of outcrops.

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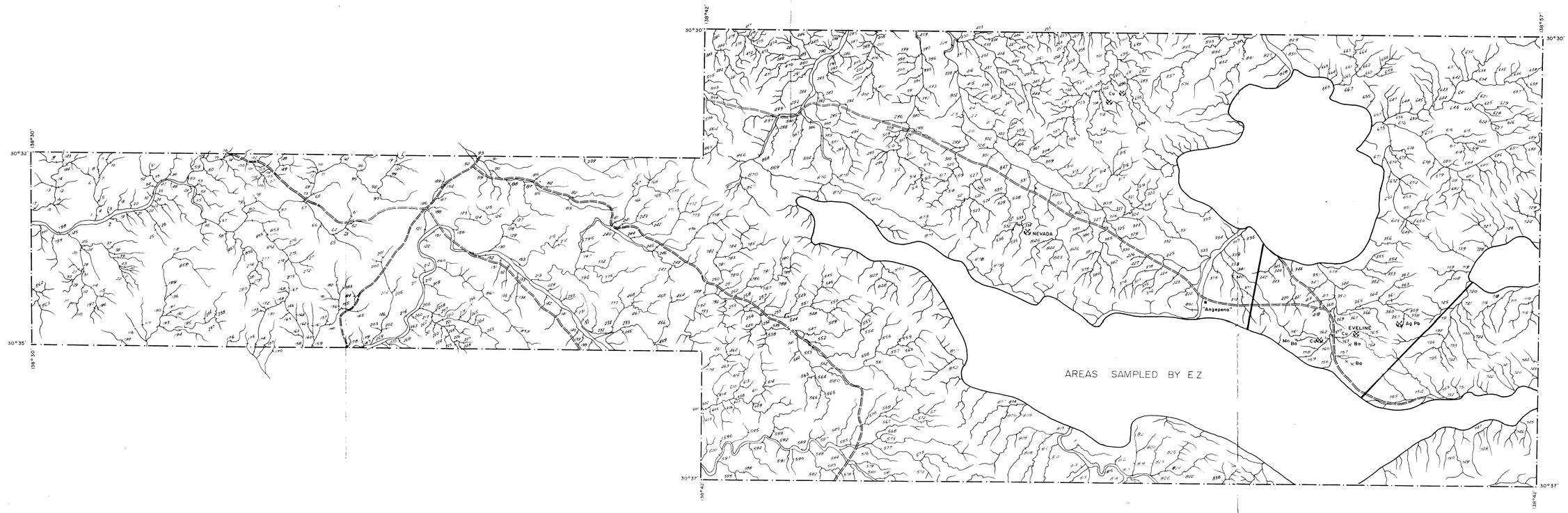

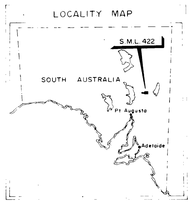

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ANGEPENA AREA S.A.

S.M.L. 422.

STREAM SEDIMENT RECONNAISSANCE SURVEY.

SAMPLE LOCATION MAP.

SCALE: 60 chains to 1 inch

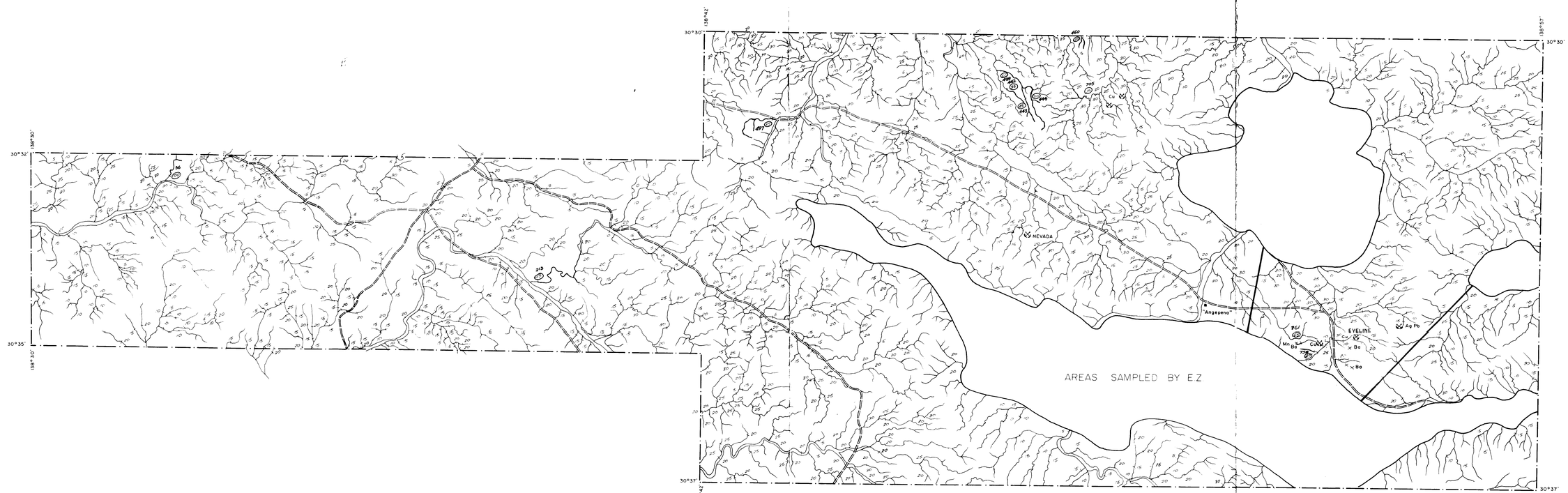
1481

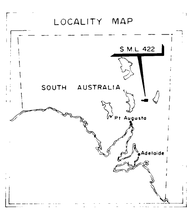
DRAWN: I.S.
DATE: 2-10-70
APPROVED: I.S.

DATE: 12/1/71

ENV 1481(1)-1

DWG: G.C. 4103-A





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ANGEPENA AREA S.A.

S.M.L. 422.

STREAM SEDIMENT RECONNAISSANCE SURVEY.

COPPER RESULTS p.p.m.

SCALE: 60 chains to 1 inch

1481

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

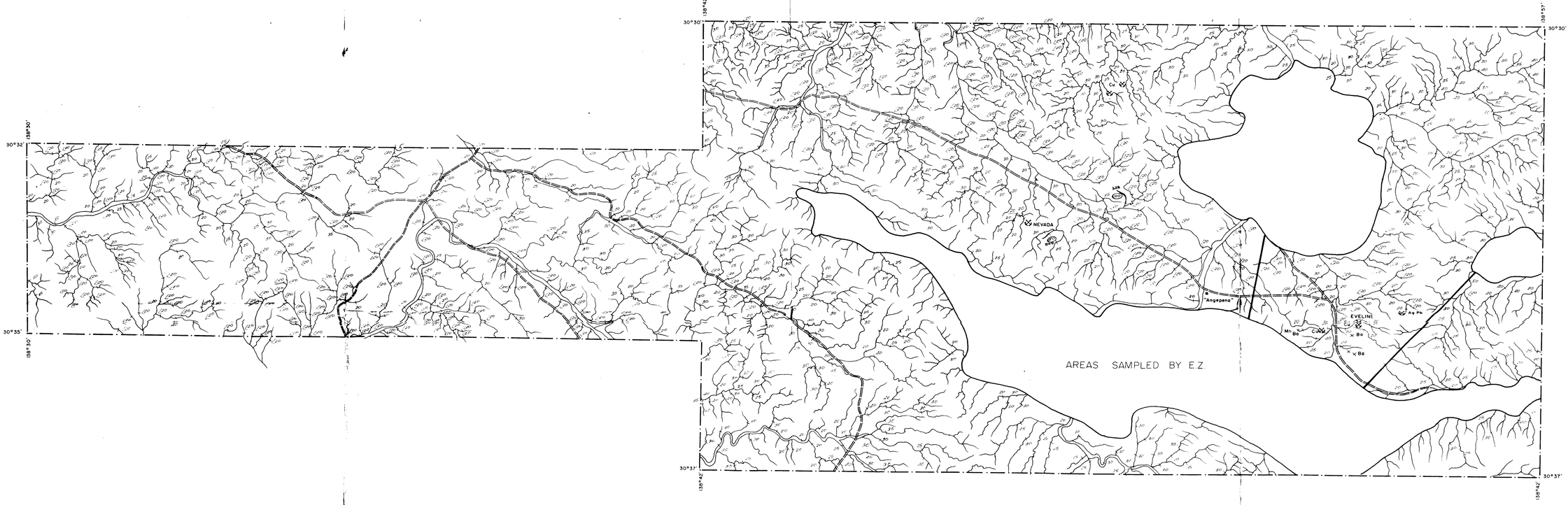
DRAWN: I.S.
DATE: 2.10.70
APPROVED: R.S.

DATE: 12/1/71

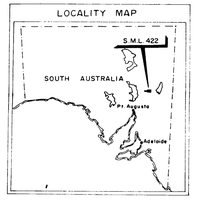
ENV 1481(1)-2

DWG: G.C. 4104 A

McPHAR GEOPHYSICS PTY. LTD.



LOCALITY MAP



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ANGEPENA AREA S.A.

S.M.L. 422.

STREAM SEDIMENT RECONNAISSANCE SURVEY.

LEAD RESULTS p.p.m.

SCALE: 60 chains to 1 inch

1481

Pb by AAS following hot 25% HNO3 leach for 1 hour on 0·25 gm. sample of minus 80 mesh

DRAWN: I S
DATE: 2.10.70
APPROVED:

DATE:

ENV 1481(1)-3

DWG: G.C. 4105A

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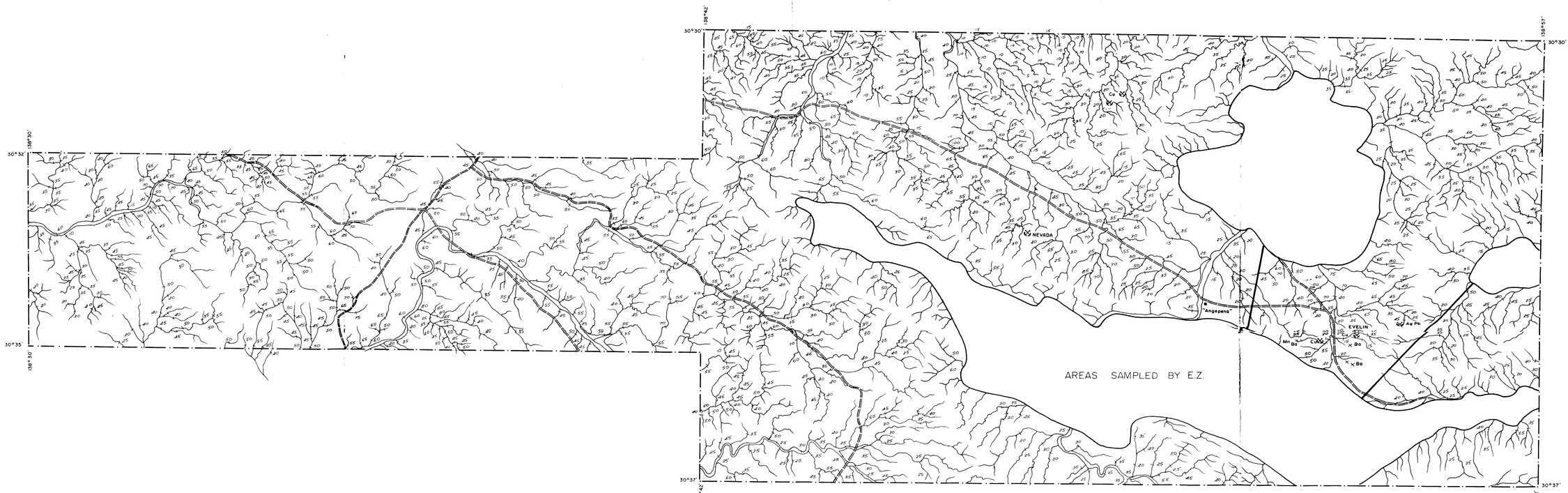
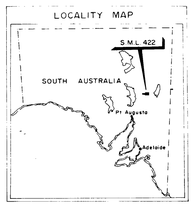
Zn

1481



LOCALITY MAP



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ANGEPENA AREA S.A.

S.M.L. 422.

STREAM SEDIMENT RECONNAISSANCE SURVEY.

ZINC RESULTS p.p.m.

SCALE: 60 chains to 1 inch

Zn by AAS following hot 25% HNO3 leach for 1 hour on 0·25 gm. sample of minus 80 mesh

DRAWN: I.S.
DATE: 2·10·70
APPROVED:

DATE:

ENV 1481(1)-4

DWG: G.C. 4106A

AUSTRALIAN AQUITAINE PETROLEUM PTY. LTD.

INCORPORATED IN A.C.T.

PERRY HOUSE, 131-145 ELIZABETH STREET, BRISBANE 4000.

BOX 142, GPO BRISBANE, 4001 TELEPHONE: 2 2966. CABLES: PETRAKI. TELEX: 40196.

18th April, 1972

A/DE/72/563
BB/mm

The Managing Director,
Fox Mining & Exploration Pty. Ltd.,
57 Maesbury Street,
KENSINGTON. S.A. 5068

Re: Special Mining Lease 422

Dear Sir,

Please find enclosed Quarterly Report for S.M.L. 422 covering the period ended 31st March 1972.

Not much work was done on this permit during this period, but the next report which will include work done in April will show greatly increased expenditure.

Yours faithfully,
AUSTRALIAN AQUITAINE PETROLEUM PTY.LTD.

B. BLANGY.
Chief Geologist
Mineral Department.

Encl. (1)

c.c. S. Ognar

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Australian Aquitaine Petroleum Pty. Ltd.

Distribution:

FOX MINING & EXPLORATIO
PTY.LT

B. BLANGY.....

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Geologist in
Charge: ...S. OGNAR...

ACTIVITY REPORT

MONTH OF: ..MARCH 1972.....

PERMIT: ..SML 422.....

AREA: ..ANGEPENA....S.A.

After a joint venture between Fox Mining & Exploration Pty. Ltd. and Australian Aquitaine petroleum Pty. Ltd., A.A.P. started the field work on the SML 422, on the tenth of March 1972.

This report relates to the investigations made from this date until the 30th March 1972.

Following a stream sediment carried out by McPhar Geophysics Pty. Ltd. during 1971, A.A.P. commenced an additional investigation programme.

To date this programme has involved:

- geological reconnaissance - rock sampling undertaken : 11 samples for assays and spectrography ; 2 samples for petrographical description
- field surveying - 5 chip sampling profiles were made on the ferruginous horizon of Balcanoona Formation. (194 chip sampling rocks & 35 soil samples)
- geochemical stream sampling - 26 Cu Pb Zn anomalies found by McPhar, were checked by detailed routine stream sediment sampling at 100' spacing. (This survey is still in progress).

All samples are still in the laboratory for assay and survey and the results have not yet been returned.

The interpretation of these results will be plotted in the next report.

FINAL REPORT SML 422

NORTH FLINDERS AREA

May 1972

Distribution:

SNPA

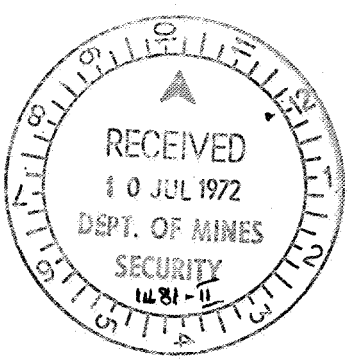
AAP -Manager/Archive

AAP - Mineral Geology

AAP - S.Ognar

Fox Mining

✱ S.A. Dept of Mines



By: S. Ognar
P. Elliott
D. Mutch

MG 170

FINAL REPORT

S.M.L. 422

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LOCATION MAP

AUSTRALIAN AQUITAINE PETROLEUM PTY. LTD.

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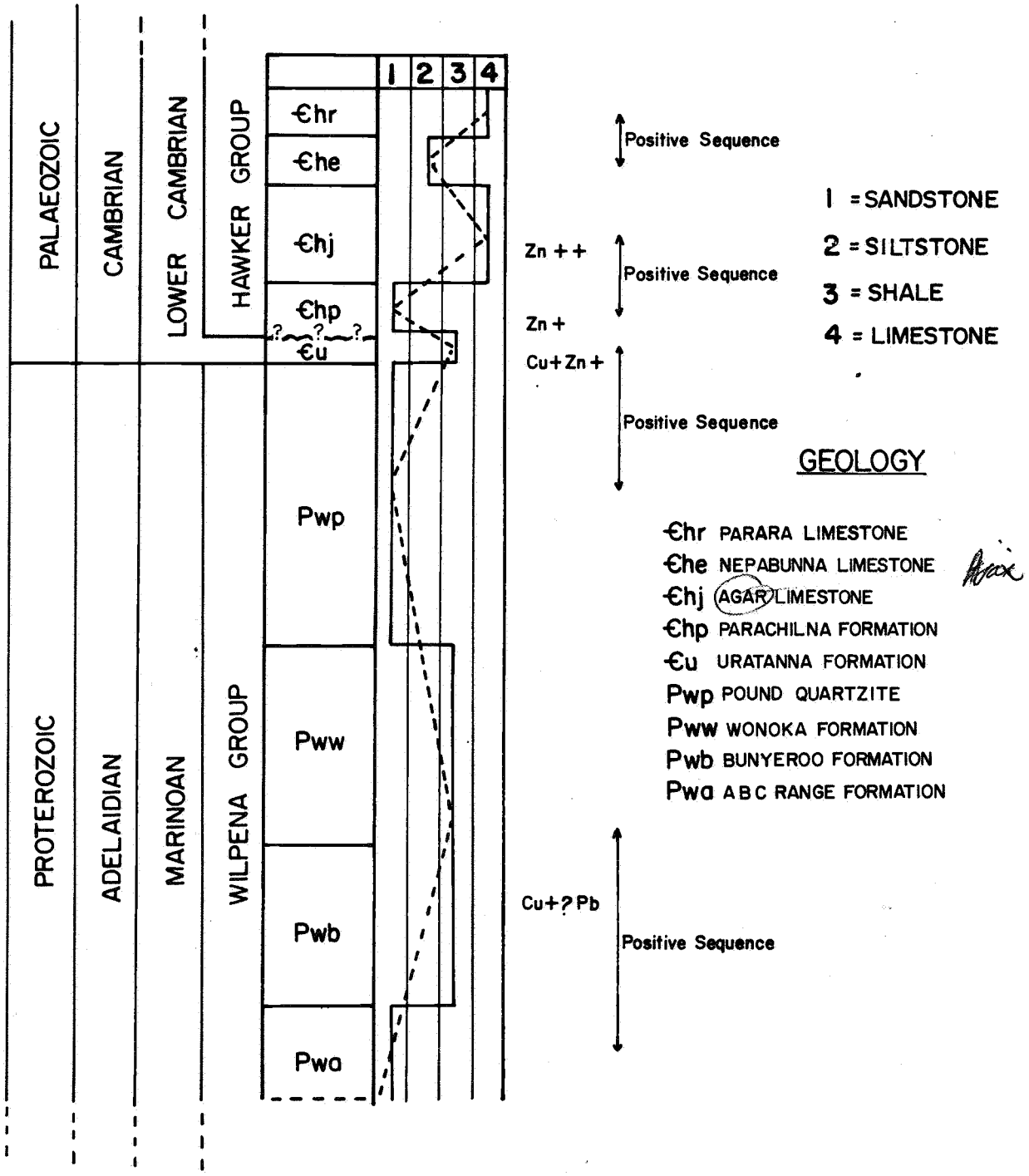
FIG.1

SML 422

FINAL REPORT MAY, 1972

FORECAST DIAGRAM

MIN.GEOL.(S.OGNAR) VERT. SCALE 1"=60 Chains 5·6·1972



1. INTRODUCTION

A.A.P. commenced field work in SML 422 at the end of 1971 with some short geological reconnaissances, and at the end of March 1972 for the exploration work, following the negotiation of a joint venture agreement between Australian Aquitaine Petroleum Pty. Ltd. and Fox Mining and Exploration Pty. Ltd., This report covers the period from the end of 1971 to 20th May 1972. Special Mining Lease 422 is located in the North Flinders Ranges of South Australia. The centre of the Lease is about 20 miles East of Copley. Access is by the Copley - Arkaroola road.

The investigation covered in this report follows a stream sediment sampling made by Electrolitic Zinc and also by McPhar Geophysics for Fox Mining and Exploration (see Plate 1).

To date A.A.P. has carried out the following :

- Geological reconnaissance (6 units for petrography, 19 units for analysis).

- Chip sampling on the Balcanoona Formation (35 units for soil sampling, and 194 units rock samples for analysis).

- Diamond Drill

  After the chip sampling results on the Balcanoona Formation, we decided to drill approximately on the chip sampling profiles BF P1 and BF P2 - with the diamond drill holes BF DD1 300 ft and BF DD2 400 ft respectively.
  Only BF DD2 intersected the equivalent rock which outcrops with some ferruginous material. The assays are negative.

- Stream Sediment sampling = 22 anomalies (Cu, Pb,Zn) found by Electrolitic Zinc and McPhar, were checked by routine stream sediment sampling (320 units of stream sediment

samples for analysis).

After the first results A.A.P. has exercised its option rights with Fox Mining and Exploration Pty. Ltd. as of 1st May, 1972.

2. GEOLOGY

2.1 Regional Potential

The North Flinders Ranges are indicated as a very prospective area in statistical terms. The large number of showings combined with favourable metallotectic factors, particularly the possibility of positive basement structures, are most attractive in the selection of an area for base metal search.

This is the case in the Angepena area. The Torrensian and Cambrian Formations, both potential mineralisation hosts, are present along both flanks of the structure between Mt Painter and Ediacara.

2.2 Local Metallotectic Factors

On the Forecast diagram (Fig. 1) we can see that the horizons above and below the Palaeozoic-Proterozoic contact, give some positive sequences, with a possible potential.

2.2.1 Marinoan

The obvious positive sequence on the Forecast diagram in the Marinoan corresponds to the Buneyroo Formation of the Wilpena Group.

Buneyroo formation is the host rock of known small sedimentary copper deposits.

2.2.2 Lower Cambrian

Locally along the south flank of Mt Painter Ediacara positive structure, the main base metals host rock is AJAX LIMESTONE (Ehj). R.K. Johns (Mineral Resources Review S.A. No 128) said " Significant concentrations of lead and zinc with minor copper and silver, are widely distributed within Lower Cambrian strata in the northern Flinders Ranges (Ajax Ehj) and Willkawillina limestones and Parachilna Formation (Ehp). The results of exploration in this environment were the discovery of zinc deposits : Puttapa (Ajax Limestone) and some occurrence of lead, zinc and copper mineralisation elsewhere (Parachilna Formation)"

3. LOCAL GEOLOGICAL RECONNAISSANCE

We had visited some old mines and diggings existing in the SML, in the Marinoan and Lower Cambrian respectively with copper and lead mineralisation.

3.1 Marinoan

As shown on the Forecast Diagram, Wilpena Group part (Fig 1) Buneyroo formation is in the positive sequence, but all visited occurrences confirm the red-bed characteristics (red, yellow, purple shale, red brown dolomite and sometimes presence of gypsum). One sample BI 655 which came from the Virginia Mine is green and purple shale which contains copper in some small calcite veins and also disseminated in the rock. (AMDEL Report No. MP 2556/72)

3.1.1 Constitution Hill Lead-Silver Mine

Located about 1 1/2 miles south of Constitution Hill this Mine contains two types of deposit.

- Mineralised calcitic veins (galena) transecting

the bedding of the dolomite of the Buneyroo Formation.

- And a few hundred metres south, lead mineralisation is located in a well bedded (in part by crushing) carbonaceous rock - Geologically also in the Buneyroo Formation near the base (?Fault contact) of the Pound quartzite.

3.1.2 Conclusions

The second host rock described can correspond to a pene-concordant lead type deposit in the red-bed units of the Buneyroo Formation and generally speaking we know that these types of deposit are very often without economic potential.

For Constitution Hill lead silver Mine, a small additional programme can be warranted for the next investigations.

3.2 Lower Cambrian

In the Flinders Ranges there exist many old mines and showings in the Parachilna Formation (Lower Cambrian) near the contact with Pound Quartzite (Top of Marinoan), which were considered as red bed type deposits (unpublished AAP's report 1971) and probably without economical potential. This fact was probably true on the Flinders Ranges scale, but on the scale of SML 422, we recognised a positive metallotectic factor which is characterised by the Narina Greywacke (Ehn) and some possible tufaceous components in the Parachilna Formation itself. (See Annex 3, Examination of Narina Greywacke near Angepena Homestead).

Now we have to study these small occurrences with a new point of view.

A small zinc occurrence of medium values was also found in the Parachilna formation in the anticline located 2 1/2 miles South-

East of Constitution Hill.

The host rock (BI 702) is a silicified ?greywacke. It is considered to be a greywacke because of the presence of lithic siltstone fragments but in places the rock appears to have a tuffaceous component with enhedral and partly resorbed relict ? phenocrysts of quartz.

Two other samples were assayed for Cu, Pb, Zn and show the anomalous character of this type of rock.

- BI 699 = Cu 270 ppm - Pb 270 ppm
- BI 703 = (gossanous horizon of BI 702) Cu = 140 ppm
  Zn = 940 ppm

3.2.1 Conclusions

Volcanic manifestations are always considered as positive metallotectic factors for copper, lead and zinc, this fact is sufficiently important for reconsideration of the Parachilna Formation and Pararo Limestone which is shown to be a positive sequence on the Forecast Diagram (Fig. 1).

4. FERRUGINOUS ROCK WITHIN BALCANOONA FORMATION

At first sight the outcrop appears attractive. Indeed these ferruginous masses which form crests of hills, look like gossans (iron cap).

Meanwhile, when we examine these formations in more detail we can find some analogies with the same type of ferruginous rocks known in the Congo by the name of'iron-feet'. (Translation from 'Pieds de fer' in french).

The following characteristics are common for both formations in the Congo and in S.M.L. 422.

- broken dolomite host rock
- massive rock essentially composed of Hematite and Limonite.
- Morphological location of these hills.

In S.M.L. 422 we found after chip sampling some Cu, Pb, Zn and Co anomalies with traces of Hg. But in the Congo the "iron caps" have no expression in depth and also bring together various metals (Cu, Pb, Zn, U) by a per-descensum phenomenon, and sometimes with a notable abundance (few %) of metal. (In the Congo the M'Fowati Mine containe - 500,000 tons of metal). In fact these formations are pedological concentrations of metals, similar to the lateritical process.

In order to verify the type of deposit to which the S.M.L.'s ferruginous rock belongs, we made 5 chip-sampling profiles in the north middle part of the Lease where this formation outcrops sporadically along 7 miles of the outcrop of the Balcanoona Formation. The results of profiles 1 and 2 were sufficiently encouraging (See Chip Sampling on Ferruginous Rock on Balcanoona Formation - Annex 1) for two diamond drill holes (BF DD1 and BF DD2) to be made. The first hole (300') didn't intersect the formation and the second one, (400') intersected the formation from minus 100' to minus 400'

The rock unfortunately has only a few hematitic calcite veins in a very fractured silicified dolomite.

4.1 Conclusions

With negative assays results we can say that these formations are not a gossan type deposit, and come from the same type of deposits known in Congo and are not deep-rooted.

5. ROUTINE STREAM SEDIMENT SAMPLING AND LOCAL GEOLOGICAL INVESTIGATIONS.

After the stream sediment surveys made by Electrolytic Zinc and later by McPhar for Fox Mining and Exploration Pty Ltd, we selected 22 Cu Pb Zn anomalies which were resampled by a routine stream sampling every 100' from the original sample site to the end of each creek or to the next original sample. (See Plate 1 and Annex 2 - D. Mutch Report).

The results confirmed seven anomalies which were surveyed by a local geological control (Annex 2 - P. Elliott Report).

5.1 Conclusions

The results of local geological investigation suggest doing an additional programme, especially for the anomalies 0176, 0953, 0844 and for 0887, 081 and 1157 which were not examined during the last programme.

6. GENERAL CONCLUSIONS

6.1 Marinoan

The results of our investigations in the Marinoan are not really encouraging, nevertheless there are small areas which should be surveyed during the next programme.

- copper Anomaly 0887 south of the Mt Coffin copper field.
- lead and zinc anomaly 0844 and 0176
- Constitution Hill lead silver Mine.

No justified programme can be reasonably proposed on the Balcanoona Formation.

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AUSTRALIAN AQUITAINE PETROLEUM PTY. LTD. PLATE I

FINAL REPORT SML 422

GENERAL LOCATION MAP

After S.A. Department of Mines

ANGEPENA

PRELIMINARY GEOLOGICAL MAP

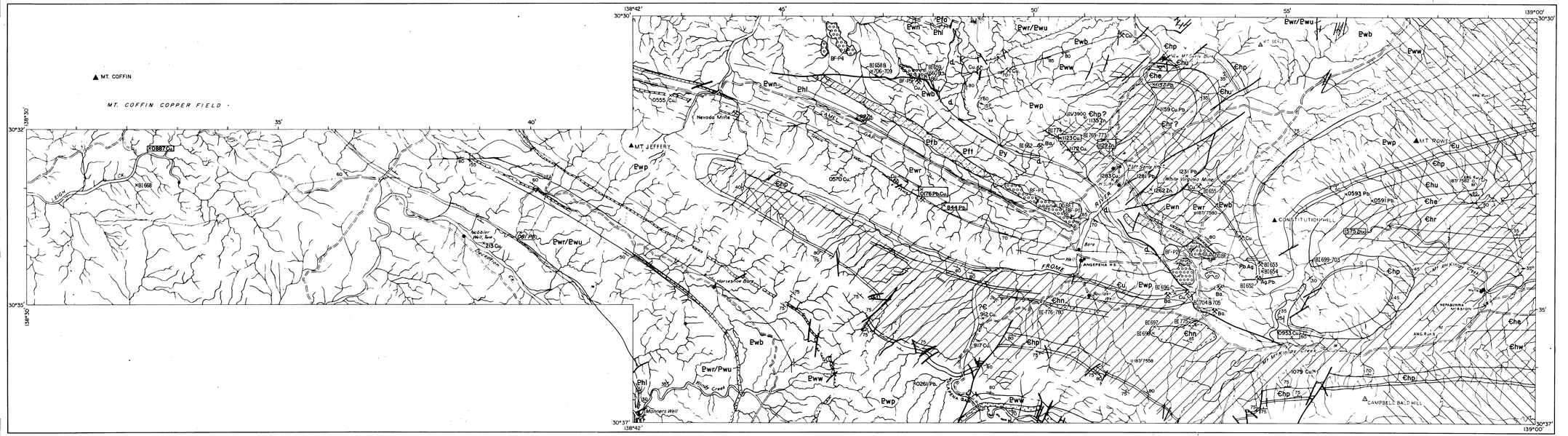
S.OGNAR SCALE 1in. = 60ch. (1:47500) JUNE 1972

GEOLOGY ONLY PLOTTED AROUND WORKED AREAS

LEGEND *(APPLYING TO WORKED AREAS ONLY)*

- Cu URATANNA FORMATION
- Chn NARINA GREYWACKE
- Chp PARACHILNA FORMATION
- Chr PARARA LIMESTONE
- Ewp POUND QUARTZITE
- Ewr BRACHINA FORMATION
- Ewu
- Eww WONOKA FORMATION
- Ewb BUNYAROO FORMATION
- Pfb BALCANOONA FORMATION
- Pfb FERRUGINOUS ROCKS
- Pft TINDELPINA SHALE MEMBER
- d. DIAPIRIC BRECCIA
- ELECTROLITIC ZINC DATA
- AREA WITHOUT STREAM SAMPLING
- × 81770 ROCK SAMPLE
- BF-P5 CHIP SAMPLING PROFILE
- BF-P2 CHIP SAMPLING PROFILE CHECKED BY DIAMOND DRILL
- DD BF2 DIAMOND DRILL
- × 0513 Cu. STREAM SEDIMENT ANOMALY CHECKED BY ROUTINE SAMPLING
- × 1176 Cu. STREAM SEDIMENT ANOMALY TO BE CHECKED IN NEXT PROGRAM
- × 1231 Cu. STREAM SEDIMENT ANOMALY INVESTIGATED BY LOCAL GEO.SURVEY

RECEIVED 10 OCT 1972 DEPT. OF MINES SECURITY



FINAL REPORT SML 422

ANNEX 1

CHIP SAMPLING ON FERRUGINOUS ROCK

INSIDE BALCANOONA FORMATION.

April 1972 — By D. Mutch

May 1972 — S. Ognar

DIAMOND DRILLS ON BF P1 AND BF P2

May 1972 — By P. Elliott

S. Ognar

1. INTRODUCTION

In order to have some information about the type of deposit of these ferruginous formations we made five chip sampling sections crossing these outcrops.

2. RESULTS

2.1 BF P1

Lead results in this profile are nil, but in part "A" the diagrams show a relationship between Copper (800 ppm) and Nickel (350 ppm) and in part "B" the copper values (800 ppm is the average for about 20 metres) have a good relationship with cobalt (1200 ppm and 1000 ppm) and mercury (2 ppm for one sample).

Conclusions

The results are more encouraging for diamond drilling in BF P1 with its copper and cobalt results.

2.2 BF P2

The diagram results show in part "A" a relationship between copper (400 ppm) and mercury (2 ppm).
In part "B" a relationship between copper (800 ppm) and zinc (450 ppm).
In the part "C" a relationship between copper (800 ppm), zinc (350 ppm) nickel (250 ppm) and mercury (0.3 ppm)
In the part "D" all metals(except mercury) showing relatively high values.

Conclusions

The results are relatively low but nevertheless sufficiently encouraging to check the formation in depth by diamond drilling.

.../2

2.3 BF P3

Mercury result shown on part "A" of the diagram results is 3 ppm but only for one sample.
Lead is also nil in this profile.
In the parts "B" and "C" copper is present with 800 ppm in 3 places.
Zinc is anomalous in part "D" (6 and 800 ppm).

Conclusions

If we want to drill the Balcanoona with three holes this profile could be tested.

2.4 BF P4 and BF P5

The diagram results show a very flat curve and no future investigations are warranted on these sites.

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Annex I. Fig. I.

FINAL REPORT SML 422

Chip Sampling in Ferruginous Rock inside

BALCANOONA FORMATION

DIAGRAM RESULTS

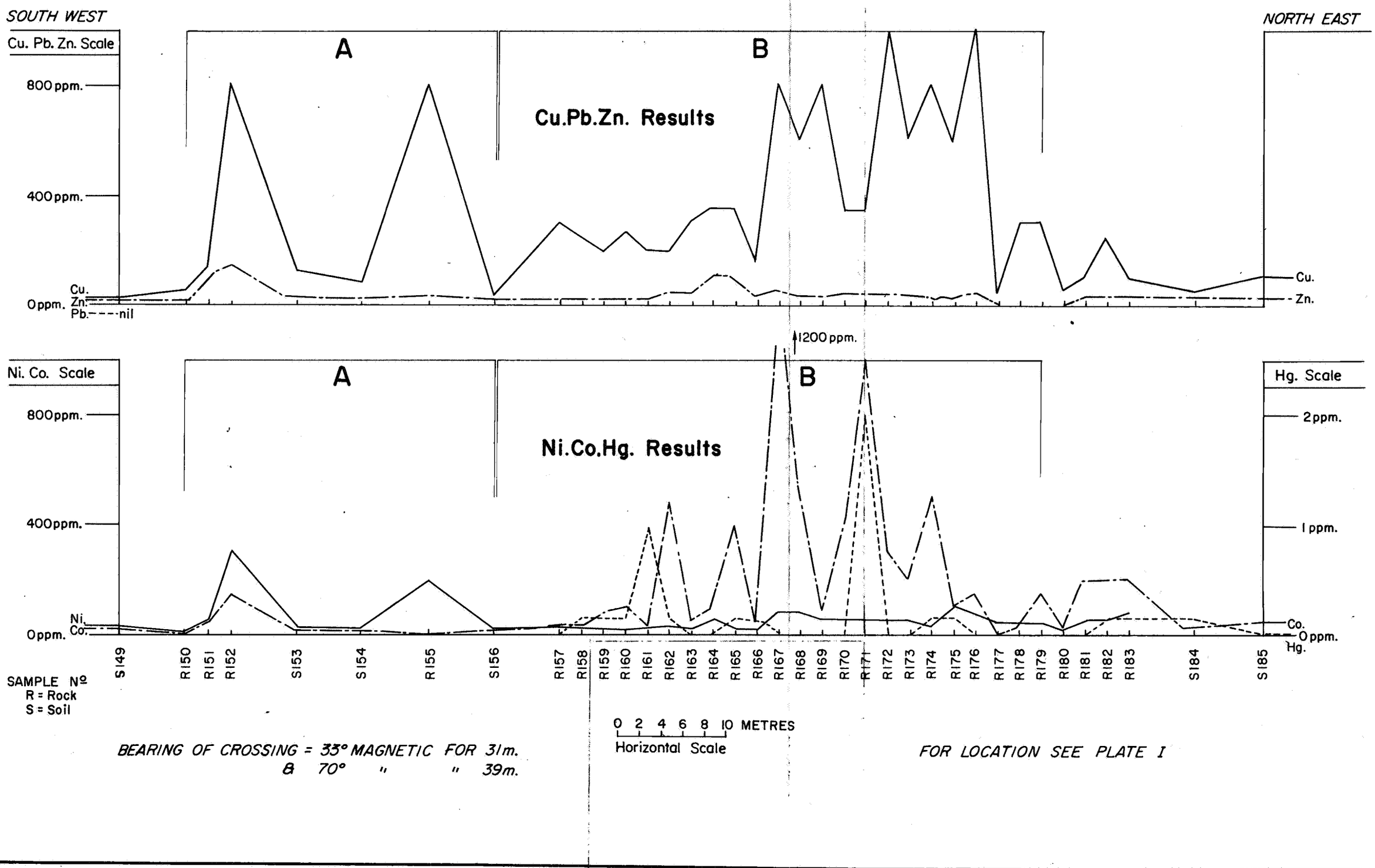
PROFILE Nº I

(BF – P I)

S. OGNAR

SCALE 1in. = 10m. (1:394)

JUNE 1972



BEARING OF CROSSING = 33° MAGNETIC FOR 31m.
& 70° " " 39m.

FOR LOCATION SEE PLATE I

AUSTRALIAN AQUITAINE PETROLEUM PTY. LTD.

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Annex I. Fig. 2

FINAL REPORT SML 422

Chip Sampling in Ferruginous Rock inside

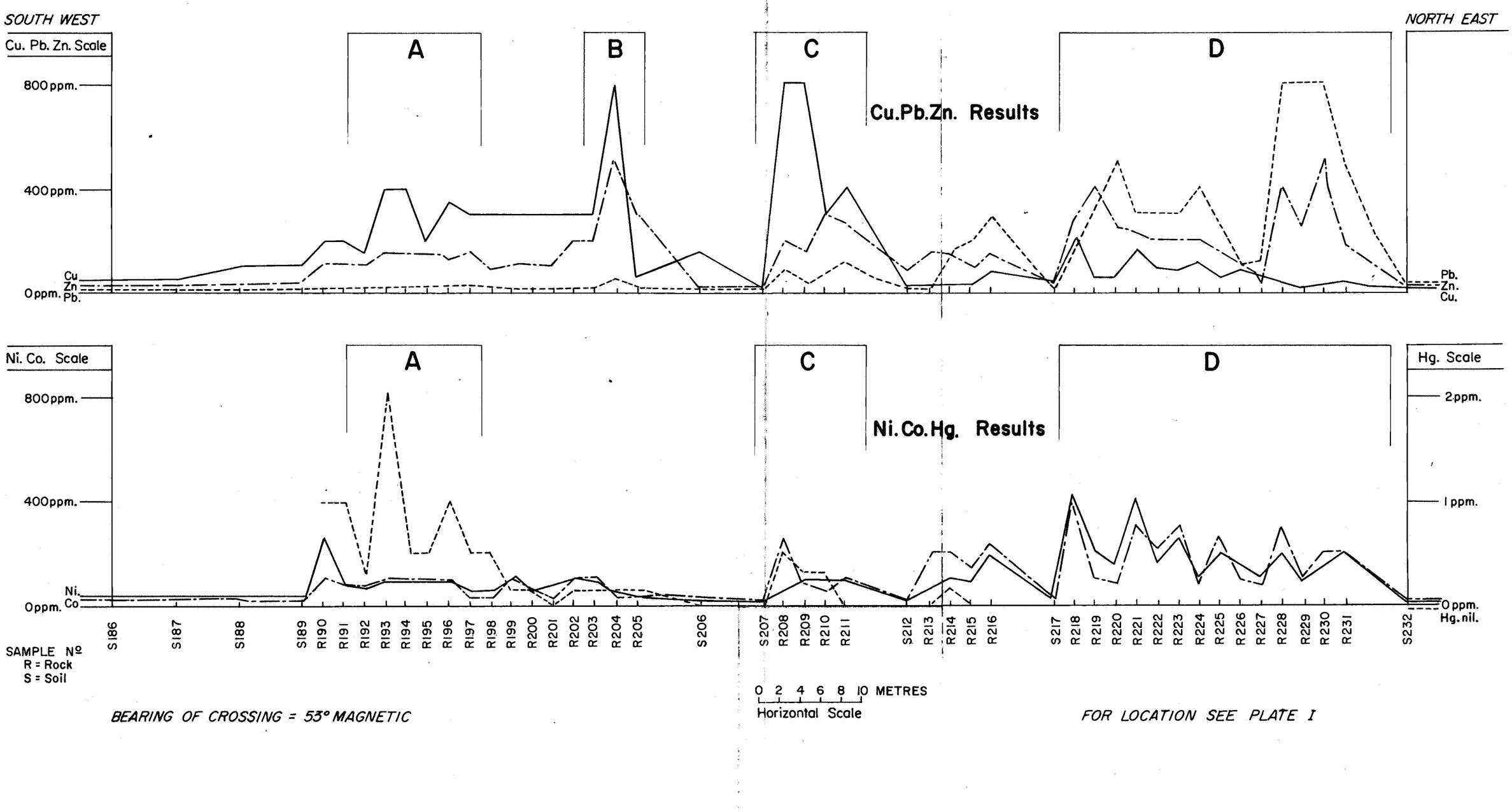
BALCANOONA FORMATION

DIAGRAM RESULTS

PROFILE Nº 2

(BF – P2)

S. OGNAR SCALE 1in. = 10m. (1 : 394) JUNE 1972



BEARING OF CROSSING = 53° MAGNETIC

FOR LOCATION SEE PLATE I

AUSTRALIAN AQUITAINE PETROLEUM PTY. LTD. 038

Annex I. Fig. 4.

FINAL REPORT SML 422

Chip Sampling in Ferruginous Rock inside

BALCANOONA FORMATION

DIAGRAM RESULTS

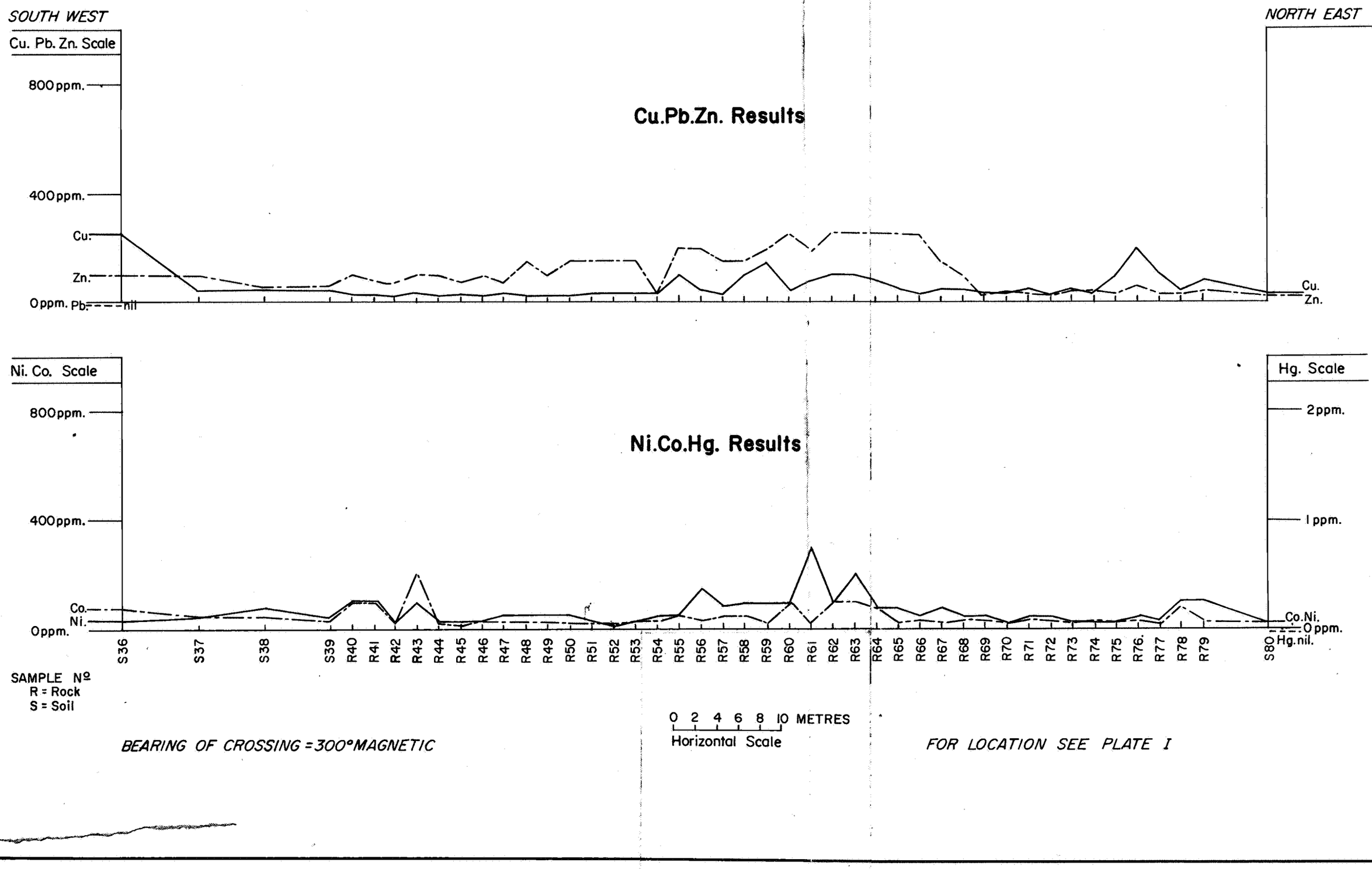
PROFILE Nº 4

(BF – P4)

S. OGNAR

SCALE 1in. = 10m. (1:394)

JUNE 1972



SAMPLE Nº
R = Rock
S = Soil

0 2 4 6 8 10 METRES
Horizontal Scale

BEARING OF CROSSING = 300° MAGNETIC

FOR LOCATION SEE PLATE I

AUSTRALIAN AQUITAINE PETROLEUM PTY. LTD. 039

Annex I. Fig. 5.

FINAL REPORT SML 422

Chip Sampling in Ferruginous Rock inside

BALCANOONA FORMATION

DIAGRAM RESULTS

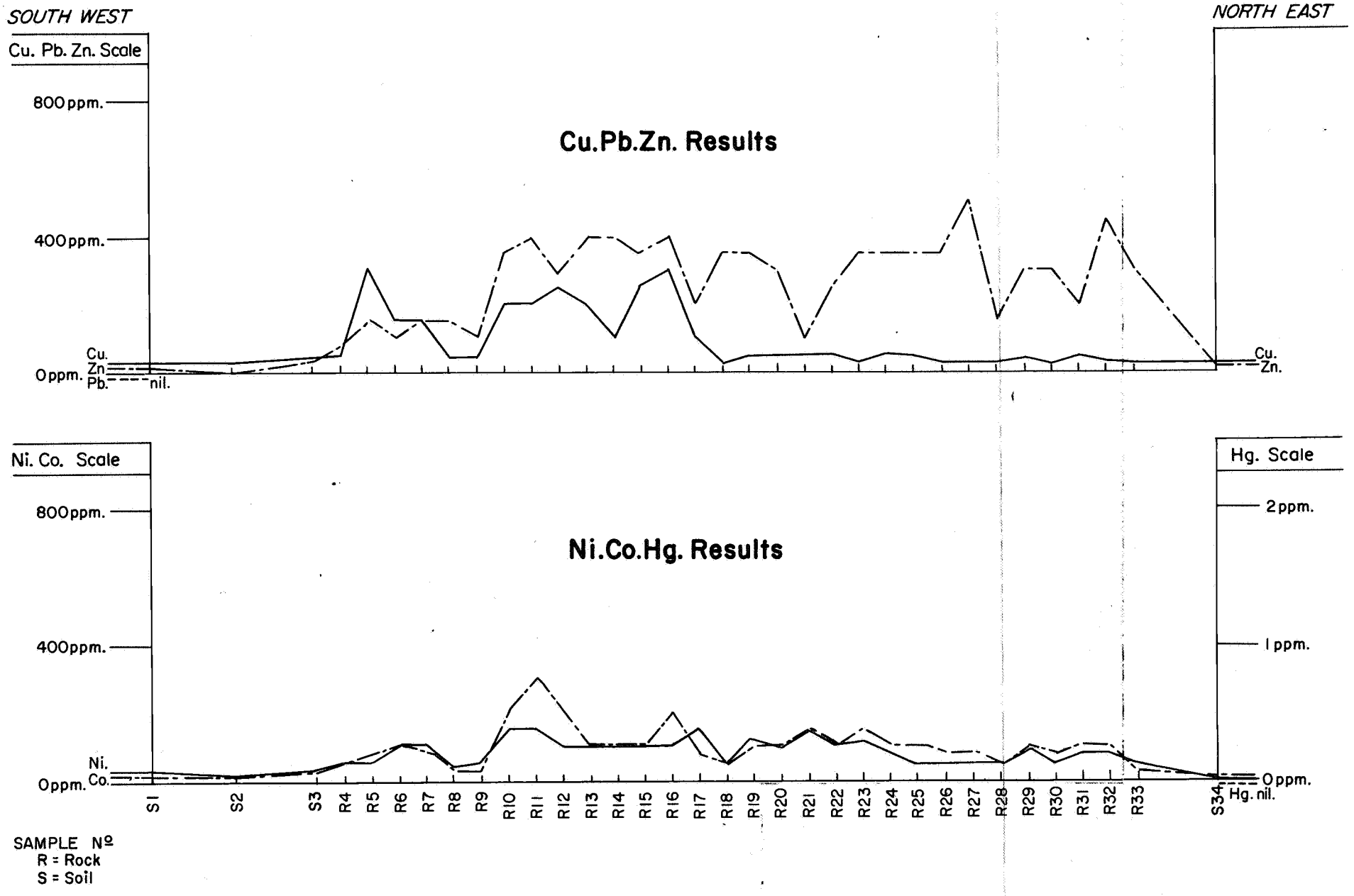
PROFILE Nº 5

(BF – P5)

S.OGNAR

SCALE 1in.= 10m. (1:394)

JUNE 1972



SAMPLE Nº
R = Rock
S = Soil

BEARING OF CROSSING = 38° MAGNETIC

FOR LOCATION SEE PLATE I

0 2 4 6 8 10 METRES
Horizontal Scale

3. DRILLING

Following the positive results gained on a chip sampling profile BF P1 and BF P2, it was decided to drill two diamond drill holes on these sites, DD BF 1 and DD BF 2.

The hole DD BF1 is located near the site of the profile originally known as BF P2, now BF P1. This change in annotation was done to avoid confusion. Thus the profile BF P1 and the drill hole DD BF1 correspond and are located just south of Mt Serle Homestead, BF P2 and DD BF 2 are located a few miles to the east of the first site.

DD BF 1 was spudded in on May 9th and reached 300' on 15/5/72 without intersecting dolomite. It was abandoned at this depth and the rig moved to the second site. Throughout its depth DD BF 1 was in a fairly uniform, fissile, weathered shale, with no indication of mineralisation.

DD BF 2

The hole was spudded in on May 16th and struck thinly bedded dolomite at 102'. The hole continued in unmineralised dolomite down to 397', at which point it was abandoned. Analysis results are negative. Cu-Pb-Zn-Co-Ni were assayed. The best values are:

Cu	-	220 ppm at 174'-175'
Pb	-	160 ppm at 174'-175'
Zn	-	85 ppm at 179'-180'
Co	-	20 ppm at 124'-130'
Ni	-	65 ppm at 194'-195'

.../2

CONCLUSIONS

Although neither hole intersected any mineralisation, the results are sufficient to enable the iron deposits on the Balcanoona Formation to be classified as the 'iron-foot' type of deposit as known in the Congo. Because of their small size it is considered that they have no economic potential.

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ANNEX 2

ROUTINE STREAM SEDIMENTS SAMPLING

April/March 1972

By D. Mutch
S. Ognar

LOCAL GEOLOGICAL INVESTIGATION AFTER ROUTINE STREAM SEDIMENTS SAMPLING RESULTS

May 1972

By P. Elliott
S. Ognar

- ROUTINE STREAM SEDIMENTS SAMPLING -

ANNEX 2

C O N T E N T S

1. INTRODUCTION

2. PROGRAMME

3. RESAMPLED ANOMALIES

3.1 In Marinoan

3.2 In Lower Cambrian

4. NEXT PROGRAMME

5. CONFIRMED ANOMALIES RESULTS

5.1 Marinoan

5.2 Lower Cambrian

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AUSTRALIAN AQUITAINE PETROLEUM PTY. LTD.

Annex 2.

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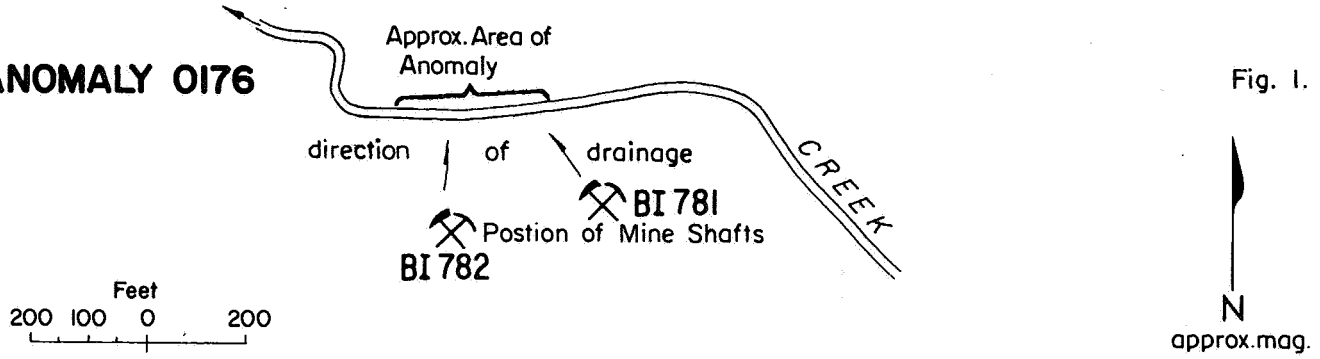
ANOMALY SKETCHES

S. OGNAR JUNE 1972

ANOMALY 0176

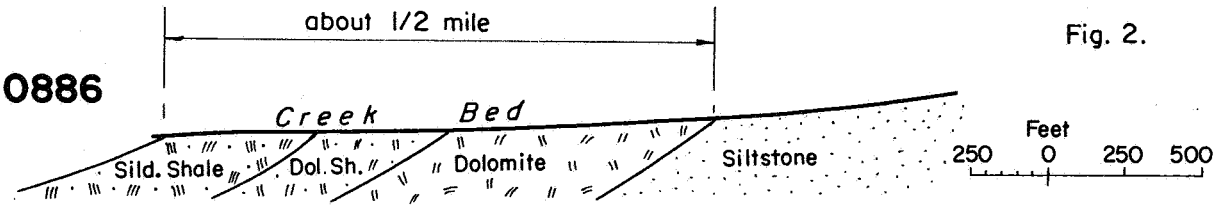
Fig. 1.



APPROX SCALE 1in.= 330ft.(100m.) 1:3950±

ANOMALY 0886

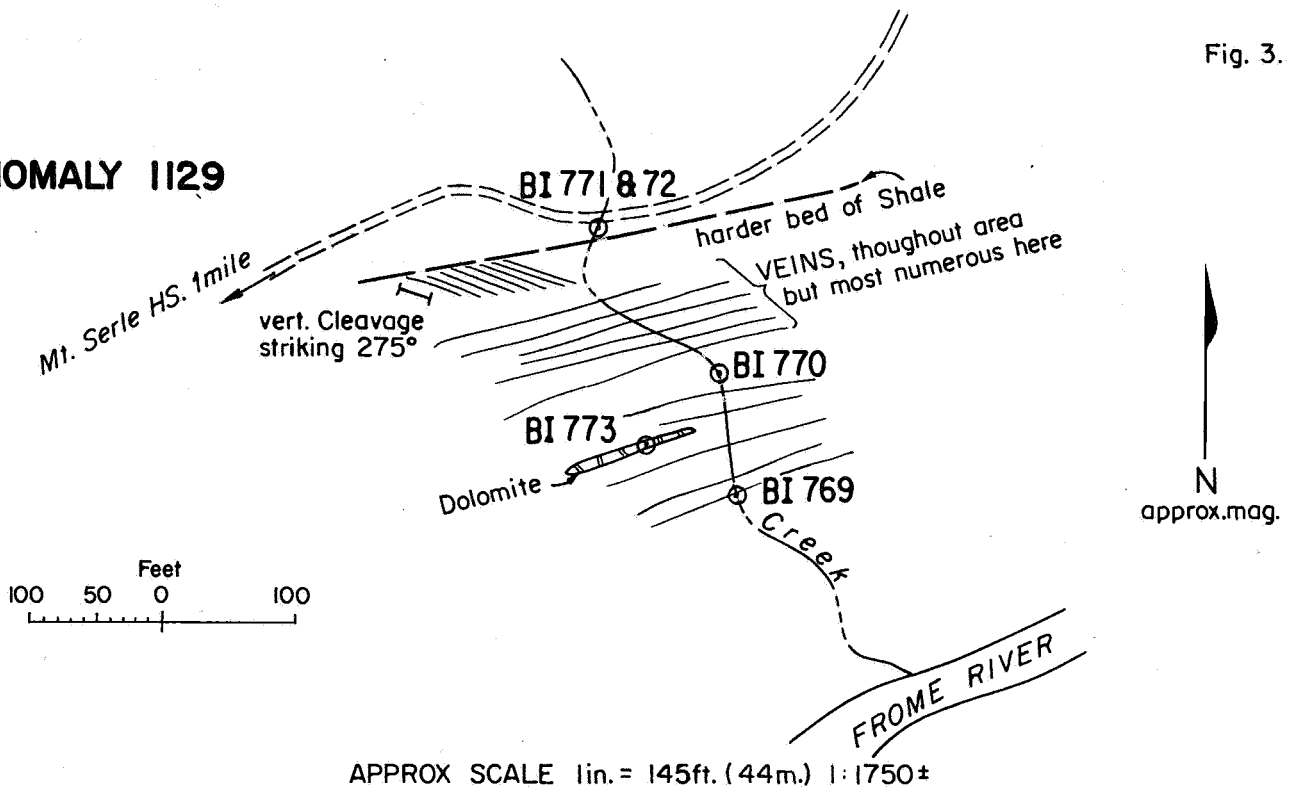
Fig. 2.



APPROX SCALE 1in.= 625ft.(190m.) 1:7500±

ANOMALY 1129

Fig. 3.



APPROX SCALE 1in.= 145ft.(44m.) 1:1750±

ROUTINE STREAM SEDIMENTS SAMPLING

By D. Mutch
S. Ognar

1. INTRODUCTION

After the results of Electrolytic Zinc and McPhar Geophysics stream sampling surveys some Cu Pb Zn anomalies were found. We selected 24 of them for an investigation by routine stream sediment sampling.

2. PROGRAMME

It was decided to take a sample every one hundred feet above each anomaly selected, the head of each creek or to the next low grade sample.

The sediments were sieved and the +80 - 20 mesh material assayed systematically for Cu, Pb, Zn.

3. RESAMPLED ANOMALIES

3.1 In Marinoan

After Electrolytic Zinc data : 1157 1159 1231
After McPhar data : 081-213-299-844-1076-1555-0570

3.2 In Lower Cambrian

After Electrolytic Zinc data : 912-917-1079-1122-1123-1129-1262-1283

.../2

After McPhar data : 0261 - 0591 - 0593 - 0953

4. NEXT PROGRAMME

The following anomalies were confirmed : 081 - 0176 - 0953 - 844 - 1123 - 1129 - 1157, and could be surveyed by a local geological investigation.

5. CONFIRMED ANOMALIES RESULTS (*)

5.1 Marinoan

5.1.1 Anomaly No 1157 (Pb) after Electrolytic Zinc data : Photo No 3901 Survey 134.

Start Point - Western part of creek on Location 1157 (McPhar Location map).

Sampling done up creek to east.

Ticket No.	Footage	Results			Ticket No.	Footage	Results		
		Cu	Pb	Zn			Cu	Pb	Zn
1157/1	0' (start)	25	35	75	1757/8	700'	30	55	85
1157/2	100'	25	40	70	1757/9	800'	25	50	90
1157/3	200'	30	75	90	1757/10	900'	30	50	90
1157/4	300'	25	40	75	1757/11	1000'	30	60	95
1157/5	400'	25	40	75	1757/12	1100'	30	50	90
1157/6	500'	15	30	65	1757/13	1200'	30	35	90
1157/7	600'	30	60	100					

(*) From AMDEL Reports AN 4652/72, AN 4822/72.

5.1.2 Anomaly No 081 (Pb) after McPhar data : Photo 7574 - Survey 187

Ticket No.	Footage	Results			Ticket No.	Footage	Results		
		Cu	Pb	Zn			Cu	Pb	Zn
081/1	0' (start)	45	40	100	081/080/1	100'	80	20	75
081/2	100'	45	45	100	081/080/2	200'	25	20	75
081/3	200'	45	45	110		Up Creek towards #080			
081/4	300'	45	55	100	081/079/1	100'	40	40	95
081/5	400'	35	55	100	081/079/2	200'	30	35	95
081/6	500'	35	35	100		Up Creek towards #079			
081/7	600'	35	60	100					
081/8	700'	35	30	100					
	Creek Junction								

5.1.3 Anomaly No. 0176 (Cu,Pb,Zn) After McPhar data : Photo 7578 Survey 187.

Note: There are 3 old mine shafts in this area, probably the anomaly has come from washing from the mining spoil or dump.

Ticket No.	Anomaly No.	Footage	Assay		
			Cu	Pb	Zn
127	0176/1	0'(start)	100	1200	200
128	0176/2	100'	60	140	90
129	0176/3	200'	75	440	140
130	0176/4	300'	40	40	45
131	0176/5	400'	45	20	30
132	0176/6	500'	45	10	40
133	0176/7	600'	50	20	40
134	0176/8	700'	45	10	40

5.1.4 Anomaly No. 844 (Pb) After McPhar data, Photo 7578 - Survey 187

Ticket No.	Anomaly No.	Footage	Assay		
			Cu	Pb	Zn
135	844/1	0'(Start)	30	25	75
136	844/2	100'	25	25	75
137	844/3	200'	30	25	80
138	844/4	300'	30	20	75
139	844/5	400'	30	10	75
140	844/6	500'	40	10	80
141	844/7	600'	30	10	75
142	844/8	700'	25	10	75
143	844/9	800'	30	10	65

5.2 Lower Cambrian

5.2.1 Anomaly No. 1123 (Cu) After Electrolytic Zinc data: Photo 7579 Survey 187.

Ticket No.	Footage	Assay			Ticket No.	Footage	Assay		
		Cu	Pb	Zn			Cu	Pb	Zn
1123/1	0' (start)	40	< 5	10	1123/5	400'	40	< 5	10
1123/2	100'	45	< 5	10	1123/6	500'	40	< 5	20
1123/3	200'	45	< 5	20	1123/7	600'	45	< 5	20
1123/4	300'	50	< 5	20	1123/8 END	700'	50	< 5	20

5.2.2 Anomaly No. 1129 (Zn) After Electrolytic Zinc data : Photo 7579 Survey 187.

Note: Nine samples were taken only; the creek continues but is only a very shallow run-off having little or no true

.../5

sediments. The last station is just west of the Kaeli .

Ticket No.	Footage	Assay			Ticket	Footage	Assay		
		Cu	Pb	Zn			Cu	Pb	Zn
1129/1	0' (start)	20	45	120	1129/6	500'	25	55	120
1129/2	100'	25	35	120	1129/7	600'	25	35	135
1129/3	200'	25	35	130	1129/8	700'	25	35	100
1129/4	300'	25	40	130	1129/9	800'	25	35	100
1129/5	400'	25	45	130	END				

5.2.3 Anomaly No. 0953 (Cu) After McPhar data:
Photo 7556 Survey 187

Ticket No.	Footage	Comment	Assay		
			Cu	Pb	Zn
0953/1 = (94)	0'(start)		80	15	55
0953/2 = (95)	100'		80	20	50
0953/3 = (96)	200'		70	20	40
0953/4 = (97)	300'		95	20	50
0953/5 = (98)	400'		70	15	50
0953/6 = (99)	500'		65	15	40
0953/7 = (100)	600'	Fork in Creek	80	15	50
0953/8 = (101)	700'	Fork in Creek	180	15	50
0953/9 = (102)	800'	END SAMPLING	160	10	50

Conclusions

All of these results except for 0176 and 1953 are of a low grade but it is necessary to make an additional local geological investigation and try to find the origin of the metals in the stream samples.

ANNEX 2

LOCAL GEOLOGICAL INVESTIGATION AFTER ROUTINE STREAM SEDIMENTS SAMPLING RESULTS.

By P. Elliott
S. Ognar

May 1972

- LOCAL GEOLOGICAL INVESTIGATION AFTER ROUTINE STREAM SEDIMENTS SAMPLING RESULTS. -

C O N T E N T S

1. INTRODUCTION

2. MARINOAN

3. LOWER CAMBRIAN

4. ANOMALY 0176
   - 4.1 Description
   - 4.2 Results
   - 4.3 Conclusions

5. ANOMALY 844
   - 5.1 Description
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   - 8.3 Conclusions

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   - 9.1 Description
   - 9.1 Samples
   - 9.3 Results
   - 9.4 Conclusions

10. GENERAL CONCLUSIONS

1. INTRODUCTION

A number of areas centered around stream sediment anomalies from two surveys done by Electrolytic Zinc and for Fox Mining and Exploration Pty. Ltd. by McPhar Geophysics, were examined with a view to determining the origin of the anomalous elements. The profile numbers are set out below along with the anomalous element.

2. MARINOAN

0176	Pb Zn	
0844	Pb Zn	
0887	Cu	(Which was not checked by a routine stream sampling).

3. LOWER CAMBRIAN

0953	Cu
1123	Cu
1129	Zn

The results * of this investigation indicate that some profiles warrant further investigation. In addition some profiles were not fully investigated, due to the urgency of other field work, and should be included, for more thorough examination, in the next exploration programme.

* From AMDEL Report AN 5486/72.

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4. ANOMALY 0176 (Pb - Zn)

4.1 Description

Marinoan (? Pww or Pwb)

The area surrounding the anomaly was dominated by shale outcrop of a monotonous lithology. Upslope from the first half of the profile were two large shafts, one small one and several pits belonging to old mine workings. The workings were centered on a quartz-calcite-vein. In the smaller of the two large shafts chalcopyrite and possibly bornite was observed in the vein material and a sample (BI 781) was taken for a petrographic description.

In the second large shaft, which contained water, there were (in the dump from the mine) fragments of a gossanous formation, associated with the quartz-calcite vein, in which galena was found (sample BI 782).

No occurrences of zinc, using the reagent and by visual examination were recorded however, and so it is proposed to have a Cu-Pb-Zn analysis done on BI 782 to determine the zinc content, if present.

The position of the anomaly in the creek appears to correspond to the water drainage from the mine shafts. (Fig 1).

4.2 Results

Analysis of sample BI 782 showed 10,000 ppm of copper, $\geq$ 10,000 ppm of lead and 1.4% of zinc.

4.3 Conclusions

It can be stated fairly conclusively that the origin of the anomalous lead and zinc valves in the creek was the quartz-calcite vein occurring where the mines are at present.

.../9

Future investigation is warranted for this anomaly at the same time as the next investigations of 844.

5. ANOMALY 844 (Pb-Zn)

5.1 Description

Marinoan (? Pww or Pwb)

No lead or zinc occurrences were observed in an examination of this anomaly. The predominant lithology was shale, with a prominent dolomitic limestone bed of approx. 0.5m passing through the beginning of the profile ; its dip was 90° and dip direction 020°N. There were also thin beds of dolomitic shale. The shale was generally calcareous. Only one fragment of vein calcite was observed on the whole of the watershed area for this profile, and it appeared unmineralised upon visual and chemical examination. One piece of arkosic sandstone (very weathered) was seen to be interbedded in the shale. It was unmineralised and its origin and relationship to the shale was not obvious but it may have been a channel deposit. It was not calcareous, and was approx. 30 x 30 x 6 cm and appeared to have faint current bedding in it distinct from the weathering rings.

There was nothing to suggest any local origin for the lead and zinc anomalies, although the calcite fragment and the sandstone were both found just upslope from the end of the lead anomaly.

No samples were taken from this profile due to the valley fill deposits that the stream generally ran through. An intensive chip sampling survey would be required to determine the source of the lead and zinc anomalies.

5.2 Conclusions

The anomalous lead and zinc values were most probably due to a high background level in the shale, which must be investigated in a future programme.

.../10

6. ANOMALY 0887 (Cu)

6.1 Description

Marinoan

The section along the creek was briefly examined and consisted of silicified shale, dolomitic shale, dolomite (some sed. breccia) and siltstone (Fig 2).

Small fragments of cupriferous siltstone were found and their continued occurrence was followed up the creek to the siltstone. The copper occurrence was not found, as a complete examination could not be made. A sample, BI 788, was taken of a ferruginous, silicified capping on a part of the shale, to be analysed for Cu-Pb-Zn. Sample BI 787 consists of the siltstone fragments found in the creek.

6.2 Results

The assay of sample BI 788 showed no significant copper content although zinc was reasonably high at 310 ppm.

6.3 Conclusion

As the copper bearing outcrop could not be found, it is not possible on the evidence shown by this investigation to assign an origin to the cupriferous shale fragments found in the creek. It has been proposed by a geologist from McPhar Geophysics that the fragments are derived from the tailings of a copper mine to the north, but this must be checked in a future programme.

7. ANOMALY 0953 (Cu)

7.1 Description

.../11

Lower Cambrian

Using the information supplied it was not possible to accurately locate the creek section sampled, and higher up the creek it was impossible to tell which fork was taken. As it was above the first fork that the anomalies were recorded, it was at this stage proposed that this section be left until the end of the survey.

7.2 Conclusion

Due to the urgency of other field work it was not possible to further investigate this anomaly, which must be investigated in a future programme.

8. ANOMALY 1123 (Cu)

8.1 Description

Lower Cambrian (?€hp)

The consistent values of 40 - 50 ppm for the copper concentration inferred that the source of the anomalous values lay upstream from the section sampled. On this basis a thorough investigation of the slope above the stream was made.

The predominant lithology was sandstone and siltstone which was weathered and barren. One outcrop approximately 5' x 12' of shale had azurite veins deposited along cleavage planes and it is proposed that this occurrence would account for the anomalous Cu values found in the creek.

No bedding was evident in the shale outcrop but a cleavage (dip 60°S strike 105°) was measured, which is probably the fan cleavage associated with the synclinal fold evident in the photograph. The local bedding orientation is approximately dip 75° dip direction 65°N.

Sample BI 774 was taken of the copper-bearing shale, of which the petrographical description is set below:

8.2 Sample BI 774: TS 29150 *

Rock Name: Siltstone which was originally pyritic. Part of it is stained by azurite.

Hand Specimen: A very fine-grained and finely laminated rock in which the parallel layers vary in colour. Some are pale grey, others pink to yellowish-brown. A blue colouration spreads out from small joints.

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

	%
Quartz	30 - 40
Detrital mica	10 - 15
Tourmaline	Trace
Leucoxene	Trace
Zircon	Trace
Opaque grains	Trace
Sericite	50 - 60
Secondary iron oxide	2 - 3
Azurite	1 - 3 (in places only)

This is a fine-grained sedimentary rock containing detrital quartz grains less than 0.05 mm in size and detrital mica flakes 0.05 - 0.1 mm long in a matrix now largely composed of sericite which was probably derived from clay.

There are very numerous grains of secondary iron oxide, most of them only a few microns in size. Many of these are spherical and in general appearance are typical of micro-spherular or framboidal pyrite. The concentration of these grains varies slightly in the different layers and it can be reasonably assumed that they were originally derived from iron sulphide. The iron sulphide has been replaced by iron oxide during weathering.

* From AMDEL Report MP 5487/72

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Two small joints almost parallel to the bedding contain azurite, and in a zone 0.5 - 1mm wide on each side of these joints, azurite has penetrated along cleavage planes in mica and along some grain boundaries and has also replaced a few small grains of an unidentified mineral.

Except for crystallization of sericite there is no evidence of metamorphism.

8.3 Conclusions

As no other cupriferous outcrops were explored on the slope draining into the stream sampled, it is most probable that this occurrence has caused the anomalous copper values in the creek sediments.

The mineralised outcrop is very small and as azurite is deposited on cleavage surfaces, the occurrence is fissural and so does not warrant further investigation.

9. ANOMALY 1129 (Zn)

9.1 Description

Lower Cambrian

Nine samples were taken previously by D.H. Mutch in the course of a stream sediment survey during March-April, in this stream. The analysis results showed anomalous Zn values ranging from 100 to 135 ppm.

The course of the stream lies across a thick shale horizon dipping steeply to the North (about 80°) striking 240°N. The predominant cleavage is almost vertical and strikes 275°. The shale (lower cambrian ?Ghp) is cut by many calcite and calcite-quartz veins which all have the same orientation as

.../14

the bedding. The width of the veins varies from about 10cm up to 1.5m.

Both the shale and the vein material were extensively examined using the Zn reagent but only one possible confirmatory results was observed, being in silicified nodules in the shale. A sample, BI 770 was taken of the particular nodule for analysis. This sample also showed small grains of an unknown mineral which may have been sphalerite.

A thin bed of dolomite was also sampled.

9.2 Samples

BI 769 - calcite-siderite vein.
BI 770 - silicified nodule in shale
BI 771 - foreign quartz vein material
BI 772 - " " " "
BI 773 - dolomite

were taken and submitted for analysis.

9.3 Results

The assay results of the five samples analysed are set out below:

	Cu	Pb	Zn
BI 769	5	<5	10
BI 770	45	1300	80
BI 771	70	180	45
BI 772	120	1900	180
BI 773	10	190	100

9.4 Conclusions

The zinc anomaly is probably due to the presence of the foreign quartz vein material found in the creek at the side of the track and sampled (BI 771 and 772). The origin of this material is unknown, but it is not local. There were

no quartz veins nearby and it is highly unlikely that it was transported by the creek, as the creek at this point is very small.

No future investigation is warranted for this anomaly.

10. GENERAL CONCLUSIONS

The results and the importance of the anomalies Nos. 0953, 0176, and 844 will be fully investigated during the next programme.

Some additional geological investigation will also be carried out for 887, 081 and 1157 which were not surveyed fully due to the urgency of other field work.

FINAL REPORT SML 422

ANNEX 3

EXAMINATION OF NARINA GREYWACKE (€hn)

NEAR ANGEPENA HOMESTEAD.

May 1972 By P. Elliott
March 1972 S. Ognar

C O N T E N T S

1. LOCATION AND GEOLOGICAL OBSERVATIONS

2. ASSOCIATED MINERALISATIONS

3. PETROGRAPHICAL DESCRIPTION

3.1 Sample BI 698

3.2 Sample BI 702

3.3 Sample BI 705

3.4 Sample BI 775

3.5 Sample BI 776

3.6 Sample BI 777

3.7 Sample BI 778

3.8 Sample BI 779

3.9 Sample BI 780

4. CONCLUSIONS

AUSTRALIAN AQUITAINE PETROLEUM PTY. LTD.

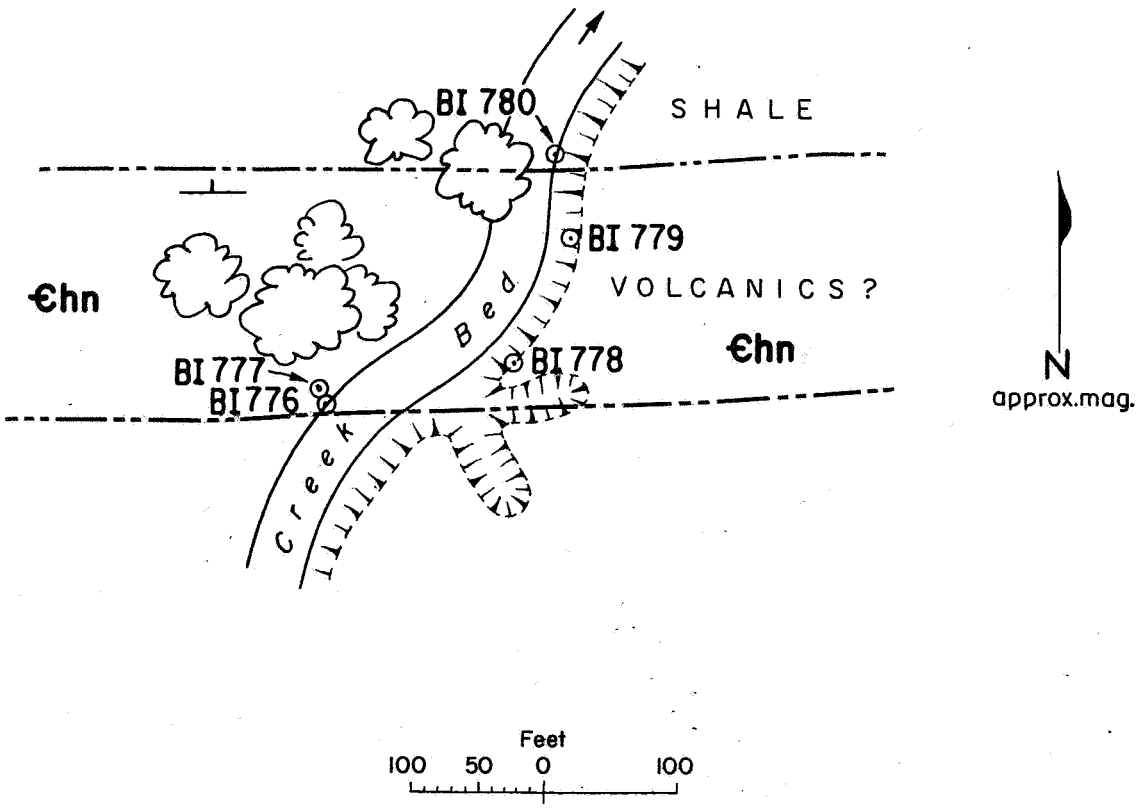
Annex 3. Fig. 1

FINAL REPORT SML 422

EXAMINATION OF NARINA GREYWACKE €hn

Near Angepena Homestead

S. OGNAR APPROX SCALE 1in. = 145ft (44m.) 1:1750± JUNE 1972



1. LOCATION AND GEOLOGICAL OBSERVATIONS

The horizon was examined in two localities, the first about 2.7 miles N 120° from the homestead and the second about 1.4 miles N 225° from the homestead.

Three samples were taken at the first locality BI698 - 702 - 775 (Plate 1).

The rock was very fissile in most parts, green on a fresh surface and often brown (iron-staining) on cleavage faces. The outcrop was weathered to a darker green than the fresh rock. It was not possible to identify any constituents of the rock due to the fine texture.

In the second locality the same lithology was present but there was a dark silicified shale overlying the unit. The fissility was more varied than in the first locality and at the base there was a part of the outcrop with an appearance very similar to slump structures in shales and parts of it may have been a sedimentary breccia. (BI 777)

Five samples were taken and plotted-Fig 1.

2. ASSOCIATED MINERALISATIONS

An other facies BI 705 came from Eveline Mine (see Plate 1) and the hand specimen was submitted as a tufaceous rock, with disseminated copper mineralisation. (1.4% Cu). BI 702, a similar sample gave 270 ppm Cu and 270 ppm Pb (BI 699) and 140 ppm Cu amd 940 ppm Zn (BI 703).

.../2

3. PETROGRAPHICAL DESCRIPTION (*)

3.1 Sample: BI 698 : TS 28715

Rock Name: Greywacke

Hand Specimen: A massive, compact grey rock. The grain size is too small for crystals to be seen with the naked eye.

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

	%
Quartz	70
Plagioclase	1 - 2
Lithic fragments	5 - 10
(?K-) feldspar	1 - 2
Calcite	3
Dolomite	10
Clay	5
Rutile	Rare
Zircon	Rare
Opaques	Trace
Tourmaline	Trace

The sample was submitted for examination as a 'volcanic rock' but it is in fact, a greywacke, an immature, arenaceous sediment.

The framework fraction ranges in size from about 0.1 to 0.4mm but, since part of the framework has been replaced by matrix, source grains may have been larger initially, although the close packing precludes any great decrease in size. Single quartz grains are the predominant type of grain - most show plain or only slightly undulose extinction. As implied above, grain shapes have been modified by replacement but, although grain boundaries are generally ragged in detail, most grains have moderate to high sphericity and roundness. Feldspars show either simple albite-law twinning or none at all; grains of the latter may be of potassium feldspar.

* From AMDEL Reports Nos MP 4404/72 and MP 5487/72.

Lithic fragments appear to have been extensively modified during diagenesis and many are rather obscure. Volcanic rock fragments with trachytic textures are common. Several indefinite, fine-grained fragments are also probably volcanic. Other fragments are composite quartz grains.

The matrix consists mostly of dolomite, calcite, clay (?illite) and fine-grained quartz. Much of the carbonate has an irregular shape and may be remnant from originally detrital material.

This is a fairly typical greywacke, with a somewhat calcic composition and a considerable proportion of lithic fragments and feldspars, and carbonate matrix.

3.2 Sample: BI-702 : TS 28716

Rock Name: Silicified ?greywacke

Hand Specimen: A pale, grey rock, slightly friable in the hand. One surface contains euhedral quartz crystals.

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

	%
Quartz	10
Chalcedony	55
Rock fragments	35
Ferruginous staining	<1

The rock now consists of lithic rock fragments and ?detrital quartz grains set in an abundant chalcedonic cement. Since the rock contains a variety of fine-grained fragments as well as quartz, it is probably that it was an immature, sandy sediment and that all the original matrix and some of the fragments have been replaced by chalcedony.

Quartz fragments range in size from about 0.4 mm to almost totally replaced remnants much smaller than this. Most grains have indented edges and irregular shapes defined principally by the surrounding chalcedony and some grains are composites of a few crystals. The latter are probably of metamorphic origin.

.../4

The rock fragments are generally turbid brown grains, typically about 0.4 mm across. Many are fine-grained clay-mica-quartz-goethite rocks, in a few cases showing a crude foliation, (?thachytic). Some quartz grains in the lithic fragments are probably of secondary origin.

The matrix is an homogenous mass of granular chalcedony. In several places more fibrous material has filled cavities among the detrital grains and has a radial arrangement with coarse chalcedony rimmed by finer material. Commonly, however, the chalcedony simply forms a randomly-oriented mass of equant crystals less than 0.03 mm across.

Rare cavities in the thin section have distinctive rhombohedral shapes indicative of an idiomorphic carbonate mineral (?dolomite

Brown-stained areas of the rock usually consist of somewhat altered lithic material.

No evidence of zinc mineralisation can be seen in this rock.

The origins of the rock are not certain. It is considered to be a greywacke because of the presence of lithic siltstone fragments but in places the rock appears to have a tuffaceous component with euhedral and partly resorbed relic ?phenocrysts of quartz.

3.3 Sample: BI 705 : TS 28717

Rock Name: Sandstone

Hand Specimen: A massive but friable white rock containing specks of an earthy black mineral and a circular patch (1 cm across) of apple-green copper minerals.

The rock has an extremely irregular texture and mineral proportions would probably not be representative of the whole rock.

The sample is a sedimentary rock, predominantly a sandstone but also containing 'balls' of compacted sediments and large single crystals of quartz.

Much of the detrital material consists of single quartz grains about 0.02 - 0.08 mm across; these are xenomorphic, weakly undulose crystals with corroded boundaries resulting from partial replacement by the argillaceous matrix material. Strained, metamorphic quartz crystals are as large as 0.6 mm in diameter. Apart from the heterogeneous character of the quartz detritus the rock also contains partly resorbed lithic fragments which give the impression of considerable variation within the matrix also. As in sample BI 702 these lithic fragments are most commonly fine-grained argillaceous rocks stained brown in colour. Some are medium-grained and possible schistose. The true matrix is wholly a pale brown clayey material with a minor amount of secondary quartz. It is probably slightly recrystallised argillaceous mud.

A large fragment (>1 cm) in the sandstone is a fine-grained sandstone with a distinctive matrix of ?illite, now coarsened during authigenic recrystallisation - some flakes are 0.015 mm across. In one part of the thin section there is a rapid transition out from this clear recrystallised clay into a sandstone cemented by deep yellow-brown clay.

Large fragments of coarsely granular chalcedonic quartz are present also.

Interstitial dark brown semi-opaque material is present but constitutes less than 2% of the rock. Tourmaline and rutile are rare accessory minerals.

No evidence of copper mineralisation can be seen in the thin section.

Though this rock is largely composed of lithic sedimentary fragments, a tuffaceous component is possible.

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3.4 Sample : BI 775: TS 29151

Rock Name: Indurated, calcareous mudstone or argillite.

Hand Specimen: A very fine-grained, olive grey rock which does not show definite layering. It effervesces with cold, dilute hydrochloric acid.

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

	%
Detrital quartz	10 - 15
Feldspar	Trace
Sericite and mica	60 - 70
Opaque grains	Trace
Leucoxene	1 - 2
Calcite	15 - 20
Zircon	Trace
Tourmaline	Trace
Iron Oxide staining	

Angular grains of quartz, less than 0.05 mm in size, a few larger subrounded grains and some flakes of muscovite and rare biotite are scattered through a matrix composed of brown, iron-oxide-stained sericite and scattered grains of a carbonate mineral.

This differs from specimen BI 774 in that in general, it is finer grained, does not show evidence of layering nor any parallel orientation of elongate mineral grains.

There are very few, microspherular goethite grains and also very few pseudomorphs of goethite replacing minute cubic crystals - probably of pyrite.

The section is cloudy due to iron oxide staining and textures are indistinct, but it is possible that the sediment also contained some rounded, lithic grains now weathered.

Except for the crystallization of sericite from clay there is no evidence of metamorphism.

3.5 Sample: BI 776: TS 29152

Rock Name: Fine-grained greywacke

Hand Specimen: A fine-grained, olive grey rock darker in colour than BI 775. It contains part of a paler grey pebble which effervesces strongly in cold, dilute hydrochloric acid. There is no evidence of layering.

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

	%	
Quartz	30 - 40	
Detrital mica	5 - 10	
Feldspar	2 - 3	
Leucoxene	1 - 2	
Tourmaline	Trace	
Zircon	Trace	
Sericite (stained)	50 - 60	
Calcite	2 - 3	(50-60 in pebble)

Poorly sorted quartz and feldspar grains up to 0.2 mm in size, mica flakes and probably some weathered lithic grains are surrounded by a cloudy, iron oxide-stained matrix now composed predominantly of sericite and minor carbonate.

There is no evidence of layering and elongate grains and mica flakes show apparently random orientation.

It is not possible to distinguish lithic grains which have merged with the matrix but there are a few composed of biotite or chlorite. Some scattered grains of calcite may also represent replaced lithic grains.

The paler coloured pebble is composed of intergrown, fine-grained feldspar (albite?), very fine-grained calcite and minor quartz. It also contains a trace of very fine-grained mica, rare tourmaline grains and scattered rhombohedral grains replaced by brown iron oxide.

.../8

Along most of its boundary it is separated from the host rock by a vein of coarser grained plagioclase and calcite.

This paler grey rock is definitely a pebble - not a concretion

The hand specimen shows a few goethite pseudomorphs after pyrite crystals.

3.6 Sample: BI 777: TS 29153

Rock Name: Fine-grained greywacke with pebbly layer.

Hand Specimen: A fine-grained, olive grey rock with a coarser grained, pebbly layer 1 cm thick. Another part of the sample contains an elongate (possibly stretched ?) pebble 3 cm long.

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

	%
Quartz	30 - 40
Feldspar	5 - 10
Detrital Mica	15 - 20
Leucoxene	1 - 2
Zircon	Trace
Tourmaline	Trace
Opaque grains	Trace
Sericite and chlorite	30 - 40
Iron Oxide staining	

Lithic grains are present in the pebbly layer.

This is very similar to specimen BI 776, and it differs mainly in the presence of more abundant pebbles and lithic grains.

Most of the pebbles are composed of finely intergrown feldspar and quartz similar to the pebble in specimen BI 776 but with only a trace of calcite. Some do not show sharply defined boundaries against the host rock.

3.7 Sample: BI 778: TS 29154

Rock Name: Greywacke similar to other specimens.

Hand Specimen: A fine-grained, olive grey rock very similar to specimen BI 776.

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

	%
Quartz	30 - 40
Detrital mica	10 - 15
Feldspar	1 - 2
Leucoxene	1 - 2
Tourmaline	Trace
Detrital chlorite	Trace
Zircon	Trace
Sericite and chlorite	40 - 50
Calcite	3 - 5
Goethite (some replacing pyrite)	1 - 2

This is a poorly sorted sediment very similar to specimens BI 776 and 777. It does not show any evidence of layering but a few of the elongate grains and mica flakes show subparallel orientation. Most have apparently random orientation. Small grains of calcite are dispersed throughout the rock.

There are very few microspherular goethite grains scattered through the rock, and it is possible that these have replaced pyrite. A few elongate aggregates of similar goethite contain a few minute cubes which also suggests a little former pyrite.

Pebbles were not found in this section.

3.8 Sample BI 779: TS 29155

Rock Name: Greywacke - slightly finer grained than BI 778

Hand Specimen: A fine-grained, olive grey rock similar to the previous specimens. It shows a gradual colour change towards one surface, possible due to bleaching.

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

	%	
Quartz	30 - 40	
Detrital mica	15 - 20	
Feldspar	2 - 3	
Leucoxene	1 - 2	
Tourmaline	Trace	
Zircon	Trace	
Sericite and chlorite	30 - 40	
Calcite	2 - 3	(locally only)

A fine-grained greywacke very similar to specimens BI 776 - 778, but with a maximum grain size of 0.1 mm. Larger grains and pebbles were not found.

Opaque iron (and manganese?) oxide has accumulated along a few small joints and spread out along a few grain boundarie and cleavage planes in micaceous minerals.

3.9 Sample BI 780 : TS 29146

Rock Name: Fine-grained, calcareous and slightly carbonaceous greywacke.

Hand Specimen: A massive, fine-grained, dark grey rock. It effervesces with cold, dilute hydrochloric acid.

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

	%
Quartz	30 - 40
Mica	10 - 15
Chlorite (detrital)	Trace

	%
Feldspar	1 - 2
Leucoxene	1 - 2
Tourmaline	Trace
Rutile	Trace
Zircon	Trace
Opaque carbonaceous material	2 - 3
Calcite	10 - 15
Sericite etc	30 - 40
Goethite	Trace

This is very similar to the other specimens of greywacke and is composed of poorly sorted, angular to subrounded quartz, feldspar and mica in a matrix now mainly sericite and chlorite. The detrital grains very in size up to 0.1 mm.

This differs slightly from other specimens in that a greater proportion of mica flakes and elongate grains show subparallel orientation but there is no evidence of layering on the scale of the section.

The rock is not as weathered and stained as other specimens and contains more calcite. It also contains fine shreds of black opaque material which are probably carbonaceous, and small microspherular grains, now of goethite are loosely associated with some of this black material. This suggests that the rock was both carbonaceous and pyritic.

4. CONCLUSIONS

It is interesting to compare the descriptions of the mineralised rock BI 702 and BI 705 with the other samples which are associated with volcanic manifestations. This fact confirms the positive metallotectic factor which exists in the Lower Cambrian.

AUSTRALIAN AQUITAINE PETROLEUM PTY. LTD.

Annex I. Fig. 3

FINAL REPORT SML 422

Chip Sampling in Ferruginous Rock inside

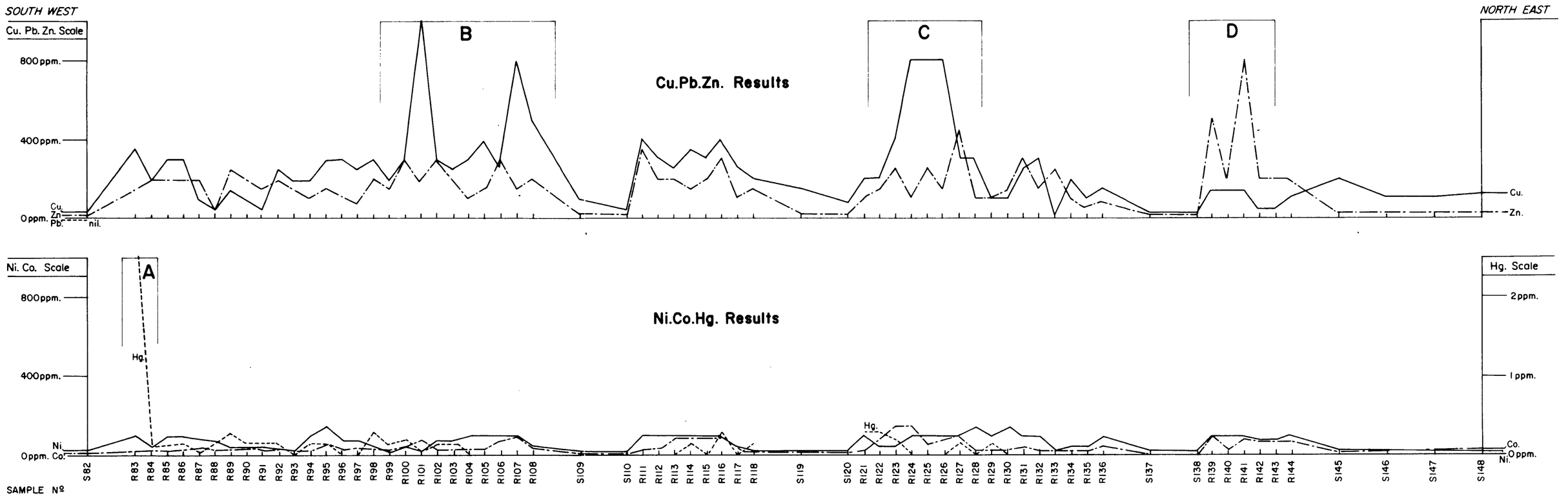
BALCANOONA FORMATION

DIAGRAM RESULTS

PROFILE Nº 3

(BF – P3)

S. OGNAR SCALE 1in.= 10m. (1:394) JUNE 1972



SAMPLE Nº
R = Rock
S = Soil

0 2 4 6 8 10 METRES
Horizontal Scale

BEARING OF CROSSING = 55° MAGNETIC

FOR LOCATION SEE PLATE I

1481-S

Drg. Nº. 8763 MG 170

AUSTRALIAN AQUITAINE PETROLEUM PTY. LTD.

MASTER LOG

1481 - II

MINERAL GEOLOGY

DATE: 29-6-72

WELL		LITHOLOGY	HOLE PARAMETERS
BF2	Location X=138°53'24" Y=30°34'3"		Azimuth
	Ground elevation:		Depression: Vertical
	Origin of depths: Collar		Diameter BQ
	Date spudded: May 16 th. 1972		Outcrop strike
	Date completed: May 20th. 1972		Outcrop dip
			Water level

PERMIT	STATE
SML 422	SOUTH AUST.

SCALE	LOG COMPILED BY
1" = 25'	Name: P. Elliott Date:

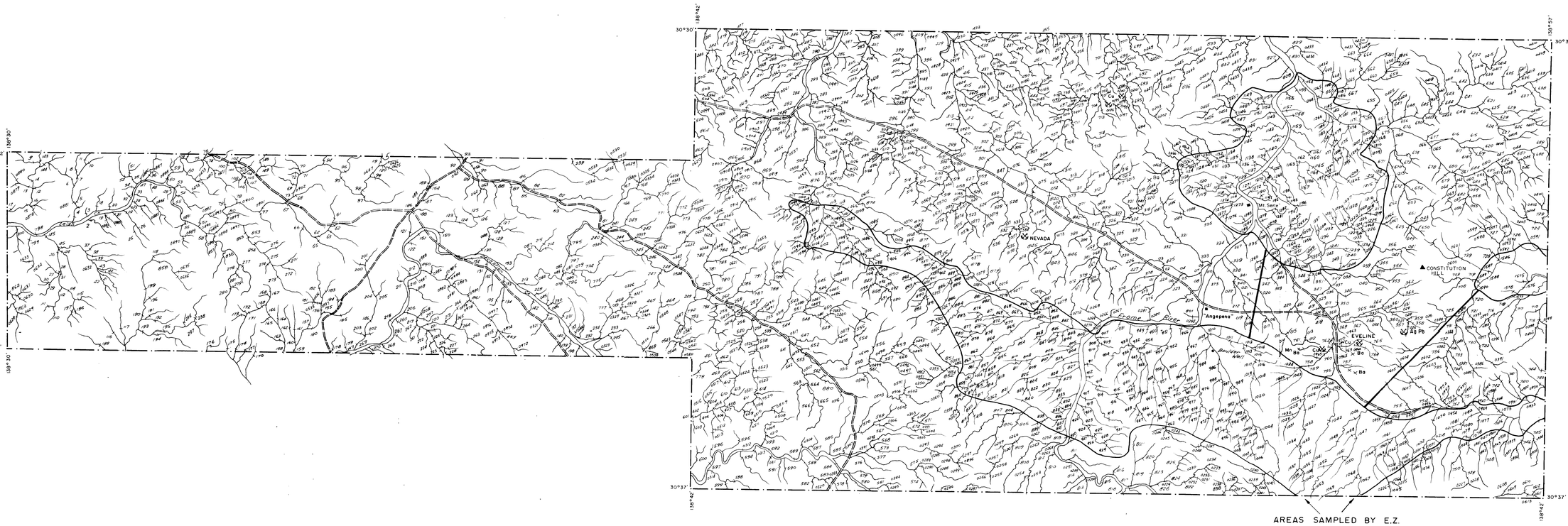
AAP. REPRESENTATIVE	DRILLING CONTRACTOR
P. Elliott	Long Year

DATE	DRILLING BIT	DRILLING PARAMETERS CASING	CUTTINGS LOG	DEPTHS	DRILLING RATE	INTERPRETED LOG	DESCRIPTION	LABORATORY ASSAYS (%)
16-5-72		NW CASING FROM COLLAR TO 70 ft		0–50			Siltstone, yellow or buff colour. Quartz hematite veins at 12 and 30 feet. Nepabunna Slst	Cu/Pb/Zn/Co/Ni were assayed. Results are all negative
17-5-72		BW CASING DOWN TO 300 ft		75–125			Siltstone and Dolomite interbedded. Many cavities and fractures in the dolomite	
				175			Weathered dolomite, fractured with cavities	Cu 220 ppm.
18-5-72				200–225			Recrystallized dolomite. Wilkawillina Lmst?	
19-5-72				275–300			Agate in cavities	
20-5-72				350–375			Fractured cores of dolomite	
				400		397 ft. end of hole		

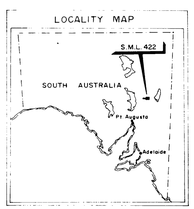
Depths: 0, 25, 50, 75, 100, 125, 150, 175, 200, 225, 250, 275, 300, 325, 350, 375, 400, 425, 450, 475, 500, 525

1481-6

McPHAR GEOPHYSICS PTY. LTD.



LOCALITY MAP



FOX MINING & EXPLORATION PTY. LTD.

ANGEPENA AREA S.A.

S.M.L. 422.

STREAM SEDIMENT RECONNAISSANCE SURVEY.

SAMPLE LOCATION MAP.

SCALE: 60 chains to 1 inch

0624 = sample 422624 from batch CH 2173

624 = sample 422624 from batch CH 0939

Samples from within E.Z. areas have E.Z. sample numbers.

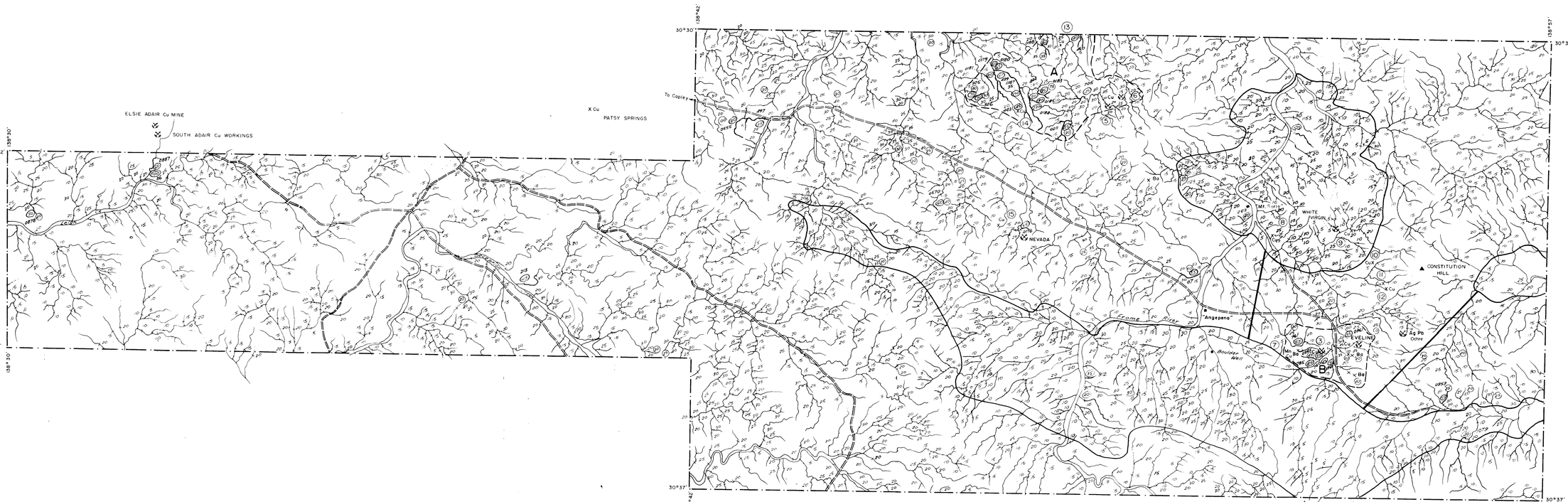
DRAWN: I.S.
DATE: 2-10-70
APPROVED: [illegible]

DATE: 12/1/71

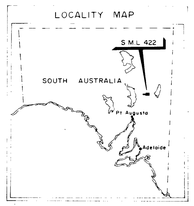
1481-7

1481-1

DWG: G.C. 4103A



LOCALITY MAP



AREAS SAMPLED BY E.Z.

Analysis by AAS, on -20 + 80 mesh following hot 25% HNO_3 leach

FOX MINING & EXPLORATION PTY. LTD.

ANGEPENA AREA S.A.

S.M.L. 422.

STREAM SEDIMENT RECONNAISSANCE SURVEY.

COPPER RESULTS p.p.m.

SCALE: 60 chains to 1 inch

(P) Cu, ppm following 25% HNO_3 leach
Cu, by AAS following miscellaneous hot acid leaches for 1 hour on 0.25 gm. sample of minus 80 mesh material

DRAWN: I.S.
DATE: 2-10-70
APPROVED: [illegible]
DATE: 12/11/71

1481-8

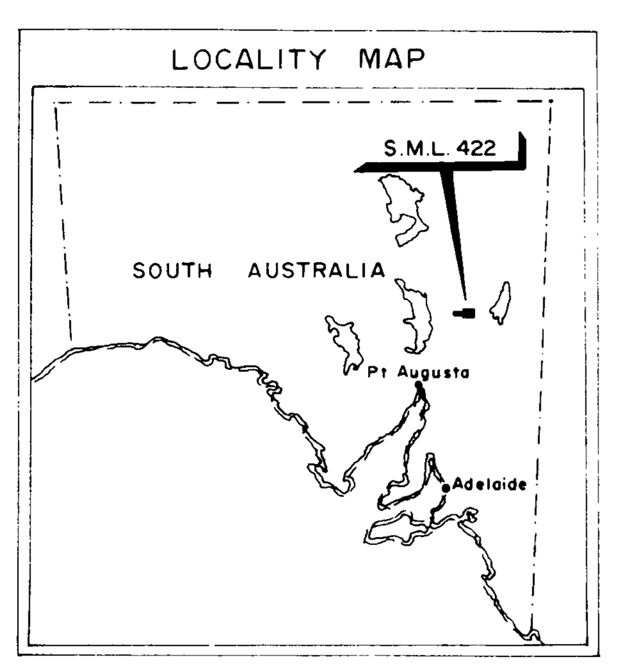
1481-2

DWG: G.C. 4104 A

McPHAR GEOPHYSICS PTY. LTD.

AREAS SAMPLED BY E.Z.

Analysis : AAS, on -20 + 80 mesh following 25% HNO_3 leach



Pb by AAS following miscellaneous hot acid leaches for 1 hour on 0·25 gm. sample of minus 80 mesh material

FOX MINING & EXPLORATION PTY. LTD.

ANGEPENA AREA S.A.

S.M.L. 422.

STREAM SEDIMENT RECONNAISSANCE SURVEY.

LEAD RESULTS p.p.m.

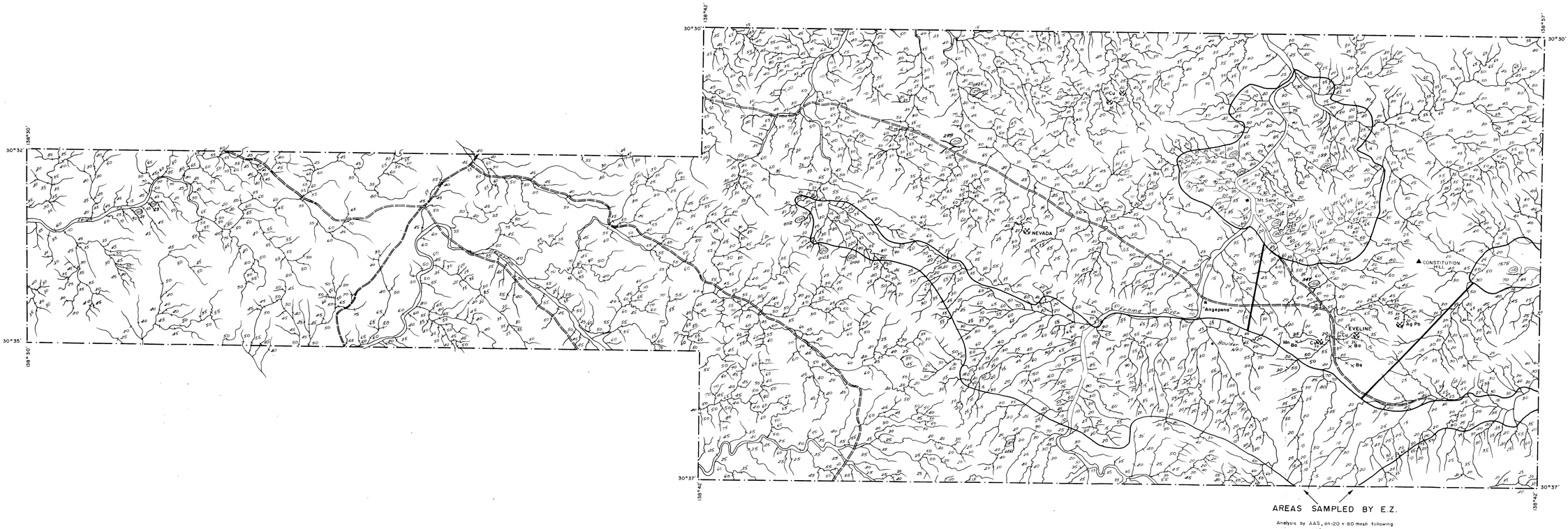
SCALE: 60 chains to 1 inch

1481-9

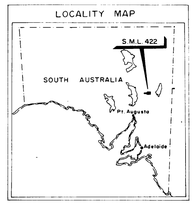
DRAWN: I S
DATE: 2·10·70
APPROVED:

DATE: 12/1/71

DWG: G.C. 4105A



LOCALITY MAP



FOX MINING & EXPLORATION PTY. LTD.

ANGEPENA AREA S.A.

S.M.L. 422.

STREAM SEDIMENT RECONNAISSANCE SURVEY.

ZINC RESULTS p.p.m.

SCALE: 60 chains to 1 inch

Zn by AAS following miscellaneous hot acid leaches for 1 hour on 0·25 gm. sample of minus 80 mesh material.

DRAWN: I.S.
DATE: 2·10·70
APPROVED:

DATE: 12/7/71

1481-10

DWG: G.C. 4106A

AGREEMENT:

AUSTRALIAN AQUITAINE PETROLEUM PTY. LTD.

and

FOX MINING AND EXPLORATION PTY. LTD.

SML. 422.

THIS AGREEMENT is made the seventh day of February 1972

(hereinafter called "this Agreement")

BETWEEN:

AUSTRALIAN AQUITAINE PETROLEUM PTY. LIMITED the principal office of which is at Perry House, 131-145 Elizabeth Street, Brisbane and the registered office of which in South Australia is at 41 Currie Street, Adelaide 5001.

(hereinafter called "Aquitaine")

of the one part

AND

FOX MINING AND EXPLORATION PTY. LTD. the principal office of which is at 57 Maesbury Street, Kensington, South Australia, 5068 and the registered office of which in South Australia is at 23 Leigh Street, Adelaide, 5000.

(hereinafter called "Fox")

of the other part

WHEREAS:

A. Fox is the holder of Special Mining Lease No. 422 issued by the Department of Mines of the State of South Australia (a copy of which is contained in the Schedule hereto) pursuant to which Fox has the right to explore for minerals within the area specified in the said Special Mining Lease.

B. Fox has agreed to grant to Aquitaine an interest in the said Special Mining Lease upon and subject to the terms and conditions hereinafter appearing.

NOW THIS AGREEMENT WITNESSETH that in consideration of the mutual covenants and agreements hereinafter set forth, the Parties hereto hereby agree as follows :-

1. In this Agreement unless the context otherwise requires -

"Area" means the area from time to time comprised in the Mining Tenement (as hereinafter defined);

"Effective Date" means the 1st day of November, 1971;

"Mining Tenement" means Special Mining Lease No. 422 issued by the Department of Mines of the State of South Australia and any renewals, extensions, consolidations and amendment thereof and any mining leases or other mining rights arising thereout and/or granted wholly or partly in substitution therefor;

"Participating Interest" means with respect to either Party at any time the undivided interest of such Party at that time in the Mining Tenement and the benefits and obligations of this Agreement;

"Party" means a party to this Agreement and its permitted assigns and "Parties" has a corresponding meaning.

2. The purpose of this Agreement is to provide upon the terms and conditions hereinafter appearing for the carrying out by the Parties of exploration in the Area for any minerals potentially capable of economic production.

3. Aquitaine hereby covenants with Fox to expend, before the 1st day of May , 1972 an amount of $14,000 on exploration work in the Area. It is agreed by the Parties that in calculating Aquitaine's expenditures for the purposes of this Clause all expenditures made by Aquitaine on exploration work in the Area on and after the Effective Date shall be taken into account notwithstanding that they or some of them may have been made prior to the date of this Agreement.

4. Upon the fulfilment by Aquitaine of the expenditure obligation undertaken by it pursuant to Clause 3 hereof, Aquitaine shall have the right to elect whether or not to carry out further exploration in the Area. Such right of election shall be exercised by Aquitaine giving to Fox written notice of election served on Fox in the manner specified in Clause 17 hereof not later than the 1st day of May , 1972.

5. If Aquitaine elects not to carry out further exploration in the Area or fails to make the election conferred upon it by Clause 4 hereof, this Agreement shall forthwith terminate.

6. If Aquitaine elects pursuant to Clause 4 hereof to carry out further exploration in the Area -

(1) the Participating Interests of the Parties shall subject to sub-clause (2) of this Clause thereupon be :

Aquitaine	33 1/3%
Fox	66 2/3%

and Aquitaine shall have the right to elect by written notice of election served on Fox in the manner specified in Clause 17 hereof not later than the 21st day of May , 1972 (hereinafter called "the First Election") to acquire a Participating Interest greater than 33 1/3% in accordance with sub-clause (2) of this Clause 6;

(2) If Aquitaine makes the election conferred upon it by sub-clause (1) of this Clause 6 it may elect to meet the expenditures on exploration set out in Column 1 below within the period set out in Column 2 below and thereby acquire from Fox the additional Participating Interest specified in Column 3 below :-

Column 1	Column 2	Column 3
$5,000	The period of 6 calendar months commencing on the date of the First Election (herein-after called the "First Period")	6 2/3% (making with the Participating Interest previously acquired 40%)

Column 1	Column 2	Column 3
$5,000	The period (hereinafter called the "Second Period") of 6 calendar months commencing on the date of the acquisition by Aquitaine of a further 6 2/3% Participating Interest within the First Period	6 2/3% (making with the Participating Interest previously acquired 46 2/3%)
$5,000	The period (hereinafter called the "Third Period") of 6 calendar months commencing on the date of the acquisition by Aquitaine of a further 6 2/3% Participating Interest within the Second Period	6 2/3% (making with the Participating Interest previously acquired 53 1/3%)
$5,000	The period (hereinafter called the "Fourth Period") of 6 calendar months commencing on the date of the acquisition by Aquitaine of a further 6 2/3% Participating Interest within the Third Period	6 2/3% (making with the Participating Interest previously acquired 60%)

Each of the elections referred to above shall be made by Aquitaine by notice in writing served on Fox in the manner specified in Clause 17 hereof not later than the date of commencement of the period specified in Column 2 above to which the election relates.

Each election under this sub-clause (2) may be made by Aquitaine only if at the date thereof Aquitaine has complied with all its previous obligations under the provisions of this Agreement and in particular under this sub-clause (2).

For the purpose of this sub-clause (2) Aquitaine shall be deemed to have acquired a further Participating Interest within the First Period, the Second Period, the Third Period or the Fourth Period (as the case may be) on the date upon which within the relevant period it completes the expenditure on exploration of the amount required by this sub-clause (2) to be expended during that period.

7. If Aquitaine fails to make any of the elections conferred upon it by sub-clause (2) of Clause 6 hereof it shall remain (but subject to the provisions of this Agreement) the holder of such Participating Interest as it has acquired under the said sub-clause (2) at the time of such failure.

8. If Aquitaine fails to make an election conferred upon it by sub-clause (2) of Clause 6 hereof and its Participating Interest is, as a consequence, determined under Clause 7 hereof or if Aquitaine acquires a total Participating Interest of 60% hereunder (whichever first occurs) Fox shall forthwith use its best endeavours to have the Mining Tenement vested in Aquitaine and Fox as tenants in common for their then respective Participating Interests therein.

9. Forthwith upon Aquitaine having acquired from Fox its final Participating Interest hereunder pursuant to Clauses 6 and 7 hereof, the Parties shall contribute to the costs of approved programmes and budgets in proportion to their respective Participating Interests.

10. (a) Within thirty days after the date hereof an Operating Committee shall be established. Each Party shall appoint to the Operating Committee one representative and one alternate by giving written notice thereof to the other Party and may revoke such appointment and substitute another representative and another alternate by similar notice. Each representative and alternate so appointed until his appointment is revoked may exercise all such powers and do all such acts and things on behalf of his appointor as his appointor is hereby empowered to exercise and do and his appointor shall be bound accordingly.

(b) The Operating Committee will meet every six months or at any time and in such places as may be agreed (or failing agreement, in Brisbane) and the agenda for such meetings will include the exploration programme, the budgets therefor and reports from the Operator on the results of the various exploration activities. A Party shall have the right to convene a meeting of the Operating Committee on not less than fourteen days' notice.

(c) Each Party shall have one vote at meetings of the Operating Committee, such vote being independent of the voting Party's Participating Interest (if any). No question arising at any meeting of the Operating Committee shall be decided except by unanimous vote.

11. Aquitaine shall be the Operator and as operator shall have the sole entitlement to and responsibility for the management and the sole power and authority to direct the conduct of all exploration carried out in the Area under this Agreement.

12. Aquitaine shall furnish Fox with a monthly progress report relating to operations hereunder. Except as otherwise unanimously agreed between the Parties all information relating to operations hereunder shall be kept confidential by the Parties.

13. Until the Mining Tenement is vested in Aquitaine and Fox for their respective Participating Interests therein pursuant to Clause 8 hereof, Fox shall be responsible for compliance with all relevant provisions of the Mining Act 1930 (as amended) of the State of South Australia and the Mining Regulations thereunder. At all times during the currency of this Agreement Fox shall use its best endeavours to keep the Mining Tenement in good standing.

14. Neither of the Parties shall have the right to transfer the whole or any part of its Participating Interest hereunder without first obtaining the approval of the other Party.

15. Each of the Parties shall have the right to withdraw from this Agreement at any time by ninety (90) days prior notice to the other Party. In the event of such withdrawal or of the termination of this Agreement under the provisions of Clause 5 hereof :-

(1) the withdrawing or terminating Party shall be relieved of all its obligations hereunder except those which have then accrued and remain unpaid or unperformed at the time of withdrawal or termination; and

(2) all rights and interests of the withdrawing or terminating Party in the Mining Tenement and in the Area shall be vested in the other Party and the withdrawing or terminating Party shall execute all such documents and do all such things as shall be necessary in order to vest such interest in the other Party.

The giving of a notice of withdrawal by Aquitaine pursuant to this Clause 15 shall not operate to absolve Aquitaine from the obligation of completing the expenditure on exploration within the Area of the sum of $14,000 covenanted to be expended by it under Clause 3 hereof or of any sum it has elected to expend pursuant to Clause 6 hereof.

16. All rights and interests in any mineral discovery made in the Area shall be owned by the Parties in proportion to their respective Participating Interests.

17. All notices and other communications provided for in this Agreement shall be deemed to have been properly served upon a Party when delivered in person to a Director or to the Secretary of Fox or to a Director or to the Secretary of Aquitaine or when sent by airmail to that Party at its address as hereinafter specified :

Fox Mining and Exploration Pty. Ltd.,
Owen Dixon Chambers,
205 William Street,
Melbourne 3000.

Australian Aquitaine Petroleum Pty. Ltd.,
Perry House,
131-145 Elizabeth Street,
Brisbane 4000.
GPO : Box 142, Brisbane 4001.

If notice is given by airmail as provided herein such notice shall be deemed to have been served on the second day after that on which it was posted. Either Party may at any time and from time to time change its address by written notice of change to the other Party.

18. This Agreement is subject to the approval of the Minister of Mines of the State of South Australia being obtained not later than the 1st day of March, 1972 or such later date as may be mutually agreed between the Parties.

19. This Agreement shall be interpreted in accordance with the laws of the State of South Australia.

20. It is not the intention of the Parties to create nor shall this Agreement be construed as creating a Partnership.

21. If any Party shall be prevented or delayed in performing any of its obligations or the conditions on its part to be performed hereunder by reason of acts of nature, acts of God, acts of enemies, strikes, labour disputes, walkouts, fires, floods, severe weather conditions, war insurrections, requirements or regulations of government, or by any cause not within the control of the Party affected which by exercise of one's diligence such Party shall not have been able to avoid or overcome then in such event such failure to perform shall not be deemed to be a breach of this Agreement but performance shall be deemed suspended for a time equal to the period of disability.

IN WITNESS WHEREOF the parties hereto have executed this Agreement the day and year first hereinbefore written.

THE COMMON SEAL OF FOX MINING AND)
EXPLORATION PTY LTD. was hereunto)
affixed by authority of the)
Directors and in the presence of :)

FOX MINING AND EXPLORATION PROPRIETARY LIMITED
COMMON SEAL

Director. Joan Fox

Secretary. Colin Fox

THE COMMON SEAL of AUSTRALIAN)
AQUITAINE PETROLEUM PTY LIMITED.)
was hereunto affixed by authority)
of the Directors and in the presence)
of :)

Director. MANAGING DIRECTOR.

Secretary.

I consent,

W. A. Wentworth.
Minister of Development & Mines.

088

SOUTH AUSTRALIA

DEPARTMENT OF MINES

TELEPHONE: 23 0451

TELEGRAPHIC ADDRESS:
"DOMEX" ADELAIDE

OUR REF.: DM76/70
(Quote in reply)

YOUR REF.: _____

GOVERNMENT OFFICES
169 RUNDLE STREET, ADELAIDE
SOUTH AUSTRALIA 5000

CORRESPONDENCE ADDRESS:
BOX 33, RUNDLE ST. P.O.
ADELAIDE, SOUTH AUSTRALIA 5001

12th March, 19 71

Mr. Colin Fox,
Director,
Fox Mining and Exploration Pty. Ltd.,
57 Maesbury Street,
KENSINGTON, S.A. 5068.

Dear Sir,

I am directed by the Honourable the Minister of Development and Mines to advise you that His Excellency the Governor has extended the term of Special Mining Lease 394 in the Umberatana area for a further twelve months from 19th March, 1971, on the attached terms and conditions.

The amount of $100 for one year's rental is now payable.

Yours faithfully,

DIRECTOR OF MINES.

DEPARTMENT OF MINES 089
SOUTH AUSTRALIA

TERMS AND CONDITIONS OF SPECIAL MINING LEASE
IN THE UMBERATANA AREA

1. The area to be approximately 138 square miles, as outlined in the attached plan and described as follows:-

Commencing at a point being the intersection of latitude 30°02'S, and longitude 139°10'E., thence east to longitude 139°16'E., south to latitude 30°15'S., east to longitude 139°18'E., south to latitude 30°20'S, west to longitude 139°10'E., north to the point of commencement

19th March, 1971

2. The term to be one year commencing on [illegible]

3. The rental to be $100 p.a. payable in advance.

4. The lessee as far as practicable to undertake continuous exploration of the area such that a minimum of $25,000 is expended [illegible] mainly on drilling out and evaluating targets outlined in the first year of exploration.

5. The lessee shall report immediately the discovery of any minerals potentially capable of economic production.

6. The lessee shall submit full technical reports at the conclusion of each three months showing results of all work undertaken, and including a statement of actual expenditure on field operations. Such reports to be confidential during the currency of the lease or any mining title granted pursuant to the lease. All plans must be submitted in the form of a transparency accompanied by a print.

7. At the expiration of the lease, or of any mining title granted pursuant to the lease, any reports received will be available for distribution or publication.

8. The lease to exclude mining claims and leases held by other parties at the date of commencement.

9. The lease not to be available for transfer, or made the subject of any dealing without the consent of the Honourable the Minister of Development and Mines after a full disclosure of all considerations concerned.

10. The lessee will notify, in writing, the occupiers of the lands comprising the lease of his intention:-

a. To carry out surveys etc.

b. To construct roadways or otherwise to disturb the surface of the land, and will so arrange such work as to minimise damage, and

c. To carry out low-level aerial surveys which might disturb stock.

Unless mutually agreed otherwise with any occupier, such notice is to be given at least fourteen days prior to the commencement of such work.

11. The lessee shall progressively make good any damage to the land arising from his exploration activities and shall finally restore it to a condition satisfactory to the Minister.

12. The lessee will ensure that his exploration activities are carried out in such a manner as to prevent pollution or deterioration of surface or underground waters.

13. The lessee will observe such other conditions as may be specifically imposed in respect of National Parks, Aboriginal Reserves, Historic Monuments, Navigation, Harbours or Fishing etc.

14. In the event that significant underground water is encountered in drilling operations, the lessee will notify the Department of Mines, will collect samples, if practicable, and forward them to the Department of Mines, Dalgleish Street, West Thebarton, and will carry out such abandonment procedures as the Department may require to protect the aquifers.

15. The lease to be subject to cancellation for non-compliance with any of the above terms and conditions.