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EL 633 AND EL 1021

PARAGON BORE

PROGRESS AND FINAL REPORTS FOR THE PERIOD 27/5/80 TO 3/2/84

Submitted by
Amoco Minerals Australia Co. and BHP Minerals Ltd
1984

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PRIMARY INDUSTRIES AND RESOURCES SA

CONTENTS ENVELOPE 3881

TENEMENT: E.L. No. 633 - Paragon Bore - N.W. Of Coober Pedy.

TENEMENT HOLDER: AMOCO Minerals Australia Co.

AMOCO MINERALS AUSTRALIA COMPANY

EXPLORATION LICENCE 633

PARAGON BORE, SOUTH AUSTRALIA

REPORT FOR FIRST QUARTER, ENDING AUGUST 26, 1980

South Australia
September 1980

AMOCO MINERALS AUSTRALIA COMPANY

EXPLORATION LICENCE 633

PARAGON BORE, SOUTH AUSTRALIA

REPORT FOR FIRST QUARTER, ENDING AUGUST 26, 1980

1. INTRODUCTION

Exploration Licence 633 covers 664 square kilometers in the Paragon Bore area, 80 kilometers west of Coober Pedy in the far north of South Australia. The expenditure commitment for twelve months is $25,000.

Amoco acquired the Licence primarily to investigate the base and precious metal potential of inferred Proterozoic rocks beneath younger sedimentary cover. A number of aeromagnetic anomalies were initial exploration targets.

2. EXPLORATION COMPLETED

2.1 Acquisition of black and white Lands Department aerial photography and all relevant topographic, geological and geophysical plans; study of previous explorers' data.

2.2 A geophysical interpretation using published regional aeromagnetic data.

2.3 A 964 line kilometer low level airborne magnetic and radiometric survey (90 meter sensor height; north-south flight lines 400 meters apart) carried out by Geoex Pty. Ltd. of Adelaide.

2.4 A surface geological examination.

2.5 Gridding, levelling and gravity/magnetometer surveying of seven discrete aeromagnetic anomalies; simultaneous collection of soil samples for mercury analysis.

2.6 Modelling (incomplete) of all geophysical data collected.

.... 2.

3. APPROXIMATE EXPENDITURE FOR QUARTER

Salaries (research, field examination, planning and monitoring of geophysical surveys, modelling of geophysical data)	$2,200
Plans and Photographs	60
Field Costs (vehicle costs, fuel, cookery)	1,150
Airborne Geophysics	8,520
Gridding, Levelling and Ground Geophysics	9,518
Annual Rental in Advance	498
Administration/Overheads	1,090
Total	$23,036

4. WORK PLANNED FOR SECOND QUARTER

4.1 Completion of geophysical modelling

4.2 Further ground geophysics

4.3 Possible percussion drilling

Graham Miller

G.C. MILLER
Project Geologist

South Australia
September 23, 1980

AMOCO MINERALS AUSTRALIA COMPANY

0006

EXPLORATION LICENCE 633

PARAGON BORE, SOUTH AUSTRALIA

REPORT FOR SECOND QUARTER ENDING NOVEMBER 26, 1980

1. EXPLORATION COMPLETED

1.1 Geochemical analysis (for mercury) of soil samples collected by Solo Geophysics and Co. during their ground geophysical survey of the first quarter.

1.2 Gridding, levelling and gravity surveying as follows:-

1.2.1 Approximately 160 stations, at 100 or 200 meter spacings over the aeromagnetic anomalies examined during the first quarter; this work comprised additions to the initial grid lines plus two infil lines over the main magnetic anomaly (at Latitude 28°48'33", Longitude 133°55'00) in the north eastern corner of the Exploration Licence.

1.2.2 Approximately 70 stations, at 200 meter spacings, to investigate a Bureau of Mineral Resources positive Bouguer gravity anomaly (at Latitude 29°00'45", Longitude 133°47'40") in the south western corner of the Exploration Licence.

1.2.3 Approximately 225 stations, at 200, 500 or 1000 meter spacings, mainly along fencelines and tracks, to investigate a large positive Bureau of Mineral Resources Bouguer gravity anomaly in the centre of the Exploration Licence and to link up the various areas of detailed examination.

All gravity stations involved in this programme were optically levelled; distances were measured by topolite or vehicle odometer.

1.3 Reduction plotting and drafting of all geophysical data collected and tying in the earlier Solo data (Solo used arbitrary height datums for each of their survey areas). This work was incomplete at the end of the quarter.

1.4 An evaluation of all available data by senior company personel plus geophysical consultant G.O. Dickson, with the particular aim of examining the advisability of pursuing a projected joint venture deal with Dampier Mining Company Limited.

2. APPROXIMATE EXPENDITURE DURING QUARTER

2.1 Salaries (geophysical crew, programme design and monitoring, data reduction, drafting, assessment of results) $8250

.../2

2. APPROXIMATE EXPENDITURE (Contd.)

2.2	Field costs (vehicle costs - including rental, two-way radio rental, rental of survey gear, fuel, grid and level pegs, travel and cookery)	$3600
2.3	Depreciation on company owned gravity meter and magnetometer	$250
2.4	Computer costs (for partial data reduction)	$250
2.5	Geochemical analysis	$225
2.6	Office costs (drafting materials etc.)	$50
2.7	Overheads/administration	$630
	TOTAL	$13255

The cumulative expenditure costs for the first and second quarter amount to $36291.

3. WORK PLANNED FOR THIRD QUARTER

Completion of geophysical data reduction, plotting of all results and complete assessment and geophysical modelling.

Graham Miller

GRAHAM MILLER
Project Geologist - South Australia

12th February 1981

AMOCO MINERALS AUSTRALIA COMPANY

EXPLORATION LICENCE 633

PARAGON BORE, SOUTH AUSTRALIA

REPORT FOR THIRD QUARTER, ENDING FEBRUARY 26th, 1981.

1. WORK IN QUARTER.

This comprised the completion of geophysical (magnetic and gravity) data reduction, plotting of all results, tying in of the earlier solo data and drafting.

2, APPROXIMATE EXPENDITURE FOR QUARTER.

2.1.	Salaries (drafting staff, geophysicist Project Geologist).	$ 1725
2.2.	Drafting materials.	200
2.3.	Geophysical consultant (from second quarter)	520
2.3.	Overheads/Administration.	245
	Total	$ 2690

Cumulative expenditure on Exploration Licence 633 is $38,981.

3. FUTURE WORK.

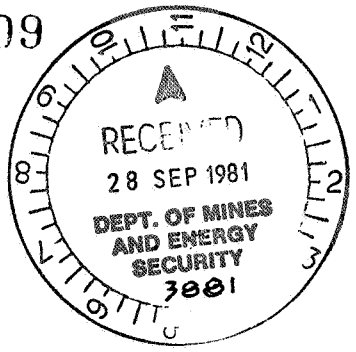
Detailing of gravity/magnetic anomalies and diamond drilling comprising three or four 500 meter holes.

4. JOINT VENTURE.

Future work on Exploration Licence 633, and work adjacent Exploration Licence application area DM/565/80 will be carried out in partnership with Dampier Mining Company Limited; Dampier is the manager. When finalized, a copy of the joint venture agreement will be lodged with S.A.D.M.E.

Graham Miller
Project Geologist - South Australia

0009



AMOCO MINERALS AUSTRALIA COMPANY

EXPLORATION LICENCE 633

PARAGON BORE, SOUTH AUSTRALIA

REPORT FOR FOURTH QUARTER ENDING MAY 26th, 1981

INTRODUCTION.

Dampier Mining Company Limited carried out surface geophysical work on Exploration Licence 633 during the quarter under a joint venture agreement with Amoco. A copy of the finalized agreement is not expected to be available before the end of October.

It was anticipated that all geophysical data would be presented with this report. As, however, data was still being collected at the end of the quarter, presentation of most plans will be held over until the fifth quarterly report. A base map (plan 2092) and aeromagnetic contour map (plan 2372) accompany this report; because of total surficial and Cretaceous cover, no geological map has been compiled.

EXPLORATION.

Dampier carried out approximately 18 kilometers of gridding levelling and gravity measurements of 100 meter stations, plus magnetometer readings at 25 meter spacings. This work was over magnetic anomalies at metric grid references (6)812900N 385500E and 81200N 384700E.

Previous Amoco grid work has been over these anomalies plus those at 813800N 393200E, 811700N 389800, (north aeromagnetic survey block) 792300N 384800E, 794100N 391100E, 78800N 391000E and 792000N 394800E (south aeromagnetic survey block); reconnaissance traversing has also been carried out along fences and tracks.

Gravity anomalies, up to 5 milligals, are coincident or semi-coincident with most of the aeromagnetic anomalies. The reconnaissance work confirmed the existance of a regional Bouguer gravity high in the centre of the Licence but showed no discrete strong anomalies.

EXPENDITURE.

Approximate expenditure during the quarter has been:

Salaries	(gridding, surveying, geophysics, supervision camp establishments)	$ 7340
Cookery		3130
Field costs	(vehicle costs, transport)	1050
Map, photos		360
Overhead		1190
	Total	$13,070.00

Cummulative expenditure on the Licence is now $52,051.00

FUTURE WORK.

Completion of ground geophysical data and diamond drilling.

G.C. Miller
Senior Geologist - South Australia

September 25th, 1981.

Attachments:	Plan 2092:	Base plan	(1:50,000 scale)
	Plan 2372:	Aeromagnetic contour plan	(1:50,000 scale)

133°47'00" 29°02'37

134°00'

28°45'00"

28°50'00"

28°55'00"

29°00'00"

29°02'00"

EL 633

805A12

805A?2

MAGNETIC CONTOURS (gammas)

- > 11000
- 9000 - 11000
- 7000 - 9000
- 5000 - 7000
- 3000 - 5000
- 1000 - 3000
- -1000 - 1000
- < - 1000

The data presented is the residual magnetic intensity, after subtracting the International Geomagnetic Reference Field from the observed Total Magnetic Intensity. The data was corrected for diurnal drift using a base station monitor at COOBER PEDY Airfield. Latitude 29.0335 Longitude 134.717 E Altitude 229 Metres

The sensor height was 3 metres. The adopted value for this location was 57369 nT. Final detailed levelling of the data was performed using tie-line crossover analysis. A simple 3 point filter was applied to the data, which was then gridded and contoured using a 100m by 100m mesh cell.

SURVEY BOUNDARY — CONTOUR INTERVAL 10nT

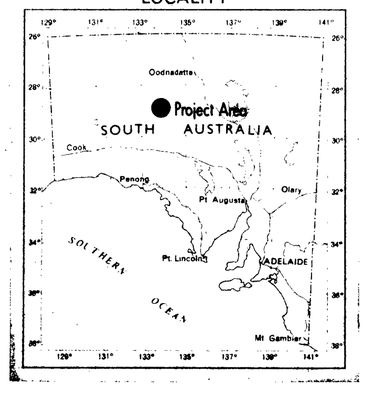
PROJECT NUMBER 80349 — SURVEYED MARCH 1980

EQUIPMENT SPECIFICATIONS
Cessna A185E Aircraft
Geometrics, G803 Magnetometer
Mc Phar SPECTRA 2, Spectrometer
Mc Phar 1024 Channel Analyser
24 Litre NaI (Tl) Detector
Bonzer, Mark 10 Radar Altimeter
16mm Ground Tracking Camera
Digital Recording on 9 track 800 bpi Industry Standard Magnetic Tape
Analogue Recording on Century 444 6 channel Recorder

The nominal flight line separation was 400 metres, and the nominal tie-line bearing was 90° degrees. The observed mean sample interval in the flight direction was 4 metres, achieved with a nominal aircraft speed of 100 Knots, and a reading interval of 0.8 seconds. The mean sensor height was 90 metres, using a towed bird configuration. The magnetometer accuracy is 1.0 nT, and the resolution 1.0 nT.

Airborne geophysical survey and compilation by Geoex Pty Ltd.

LOCALITY



N

0 1 2 3 4 5
KILOMETRES

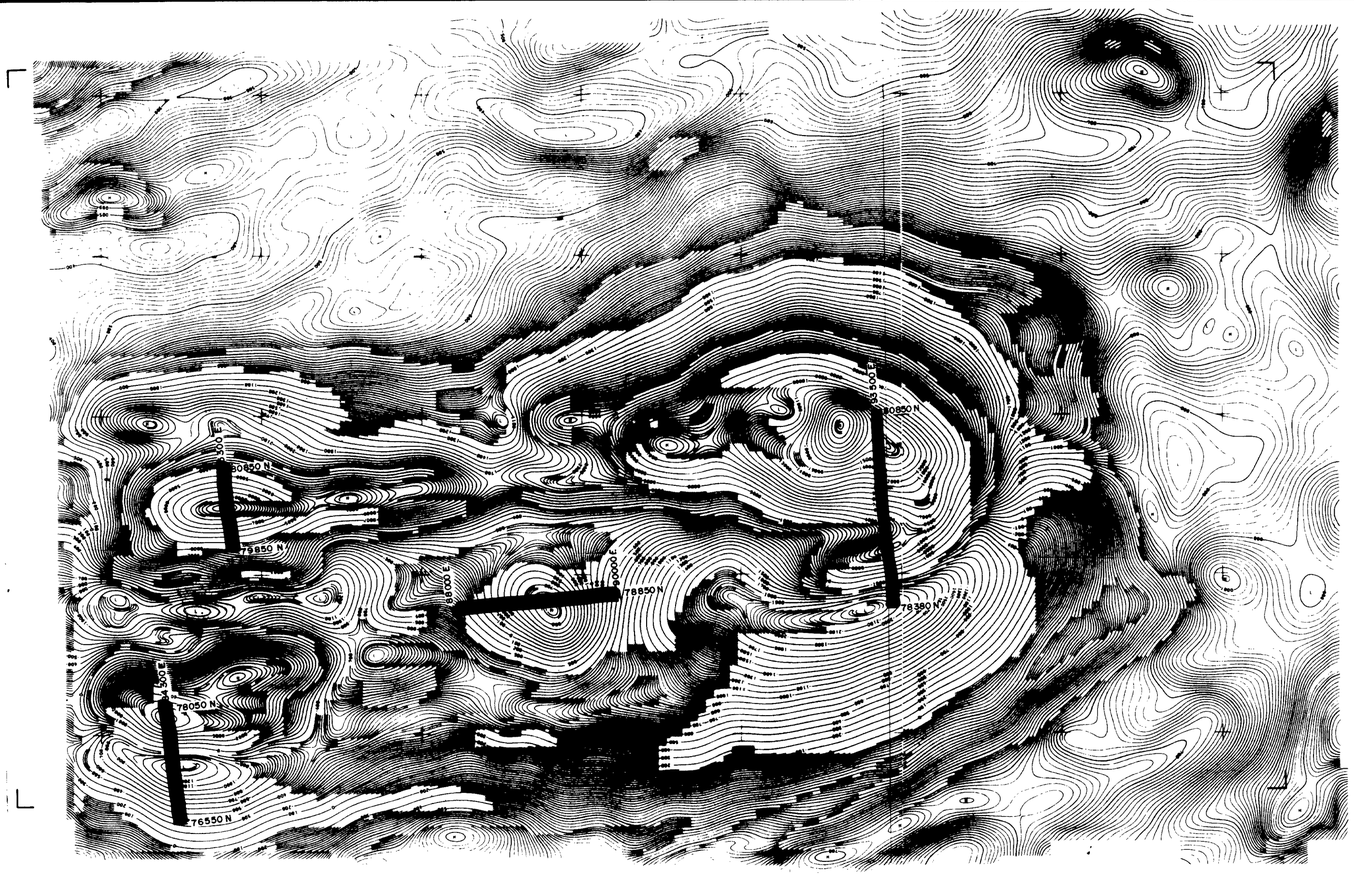
3881-1

Amoco Minerals Australia Company

Project BURRA			**Nº** A-79-63
Project Partner			
PARAGON BORE AEROMAGNETICS			
Map Ref. ANG SH53-2&6	**Latitude** 28°45'00"		**Longitude** 133°47'00"
Surveyed G.C.M.	**Date** 1·12·80	**Scale** 1:50 000	
Drawn	**Date** 1·9·81	**Drawing Nº** W1921	

Report

Enclosure



28° 45'00"

28° 50'00"

28° 55'00"

29° 00'00"

29° 02'00"

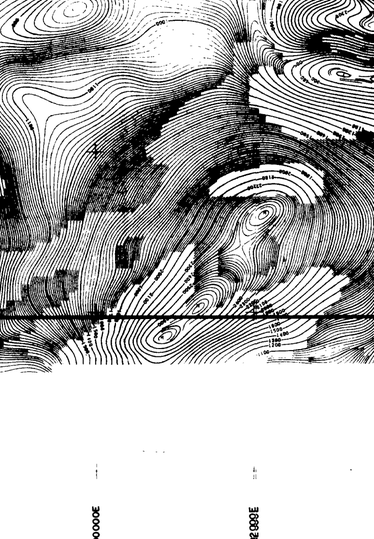
133° 47'00"

EL 633

MAGNETIC CONTOURS (gammas)

- > 11000
- 9000 - 11000
- 7000 - 9000
- 5000 - 7000
- 3000 - 5000
- 1000 - 3000
- -1000 - 1000
- < - 1000

LOCALITY



0 1 2 3 4 5

KILOMETRES

N

The data presented is the residual magnetic intensity,after subtracting the international Geomagnetic Reference Field from the observed Total Magnetic Intensity The data was corrected for diurnal drift using a base station monitor at COOBER PEDY Airfield. Latitude 29.033S Longitude 134.717E Altitude 229 Metres

The sensor height was 3 metres. The adopted value for this location was 57,369 nT

Final detailed levelling of the data was performed using tie-line crossover analysis A simple 3 point filter was applied to the data, which was then gridded and contoured using a 100m by 100m mesh cell

SURVEY BOUNDARY CONTOUR INTERVAL 10nT

PROJECT NUMBER 80349 SURVEYED MARCH 1980.

EQUIPMENT SPECIFICATIONS
Cessna A185E Aircraft
Geometrics G803 Magnetometer
Mc Phar SPECTRA 2 Spectrometer
Mc Phar 1024 Channel Analyser
24 Litre Na I (Tl) Detector
Bonzer Mark 10 Radar Altimeter
16mm Ground Tracking Camera
Digital Recording on 9 track 1600 bpi Industry Standard Magnetic Tape
Analogue Recording on Century 444 6 channel Recorder

The nominal flight line separation was 400 metres,and the nominal tie-line bearing was -90° degrees. The observed mean sample interval in the flight direction was 41 metres. achieved with a nominal aircraft speed of 120 knots,and a reading interval of 1.28 seconds. The mean sensor height was 90 metres,using a towed bird configuration. The magnetometer accuracy is 1.0 nT, and the resolution 1.0 nT.

Airborne geophysical survey and compilation by Geoex Pty Ltd.
Grid lines put in, marked and sampled by Solo Geophysics Pty. Ltd., 1980

SOIL GEOCHEMICAL TRAVERSE

3881-2

Amoco Minerals Australia Company

Project BURRA			**Nº** A-79-63
Project Partner			
PARAGON BORE SOIL GEOCHEMISTRY			
Map Ref. ANG SH53-2&6	**Latitude** 28°45'00"		**Longitude** 133°47'00"
Surveyed G.C.M.	**Date** 1·12·80	**Scale** 1:50 000	
Drawn	**Date** 1·9·81	**Drawing Nº** W1921	

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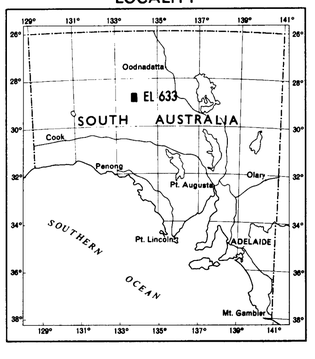
38 0000 mE
39 0000 mE
40 0000 mE
134° 00'E
82 0000 mN
81 0000 mN
80 0000 mN
79 0000 mN
28°45'S
29°00'S
29°02'S
133° 47'E
134° 00'E
DOG FENCE
DOG FENCE
DOG FENCE

E.L. 633

Hardrock Bore
Bore or Well
Bore
Yd
Paragon Bore
Bore (P.D)
Turkeys Nest Bore
HAWKS NEST
K660
Hawks Nest Bore
Watchercallem Bore
K659
Gordons Corner Bore
BM 3017
BM 3016
Box Swamp Bore
Corkscrew Bore
Bell Bird Bore, Mill & Tank

YARLIE 1:100 000
MABEL CREEK 1:100 000
YERADA 1:100 000
PHILLIPSON 1:100 000
TI-5739
202-7

LOCALITY



1 : 50000

0 5

Kilometres

Amoco Minerals Australia Company

Project	BURRA			Nº	A-79-63
Project Partner					
PARAGON BORE E.L. 633					
Map Ref. ANG	SH53-2&6	Latitude	29°00'S	Longitude	134°00'E
Surveyed	G.C.M.	Date	1·11·80	Scale	1:50 000
Drawn	B.J.Z.	Date	20·11·80	Drawing Nº	W2092

Report

3881-3

Enclosure

EXPLORATION LICENCE 633

PARAGON BORE, SOUTH AUSTRALIA

REPORT FOR THE QUARTER ENDED 26th AUGUST, 1981

CONTENTS

FIGURES

EXPLORATION LICENCE 633

PARAGON BORE, SOUTH AUSTRALIA

REPORT FOR THE QUARTER ENDED 26th AUGUST, 1981

1. GENERAL

Exploration Licence 633 of 664 square kilometres in the Murloocoppie and Coober Pedy 1:250,000 sheet areas, was granted to Amoco Minerals on 26th May, 1980 for one year. Subsequently the area has been renewed for a further year under a joint venture agreement between Amoco and BHP Minerals Limited.

BHP Minerals carried out surface geophysical gridding on Exploratrion Licence 633 during the quarter. Drill hole PB1 was completed to 357 metres shortly after the end of the quarter.

2. FIELD INVESTIGATIONS

2.1 Ground Geophysics

Areas previously defined from the aeromagnetic survey flown in EL 633 by Amoco Minerals were gridded and gravity and magnetics surveys run over them.

A total of 43.1 kilometres of gridding, levelling and gravity measurements at 100 metre stations, plus magnetometer readings at 25 metre spacings were done. This work was done over anomalies 3 and 4, as shown in Figure 1.

Coincident magnetic and gravity anomalies were found on each of the gridded targets (Figures 2a and 2b).

2.2 Drilling

Diamond drill hole PB1 totalling 357 metres was terminated on 5th September, 1981 after passing through Precambrian lithologies below 152 metres. Precambrian lithologies included banded iron formation from 152m to 317m and a sequence of skarns and carbonates, culminating in feldspathic and garnetiferous granulites and gneisses by the end of the hole. Anomalous base metal mineralisation was not apparent.

Geological drill logs are in Appendix 1, and graphic and geophysical logs are on Figure 3.

3. FUTURE WORK

Two or three further drill targets were defined in EL 633 from ground geophysics and these are to be drilled in the next quarter.

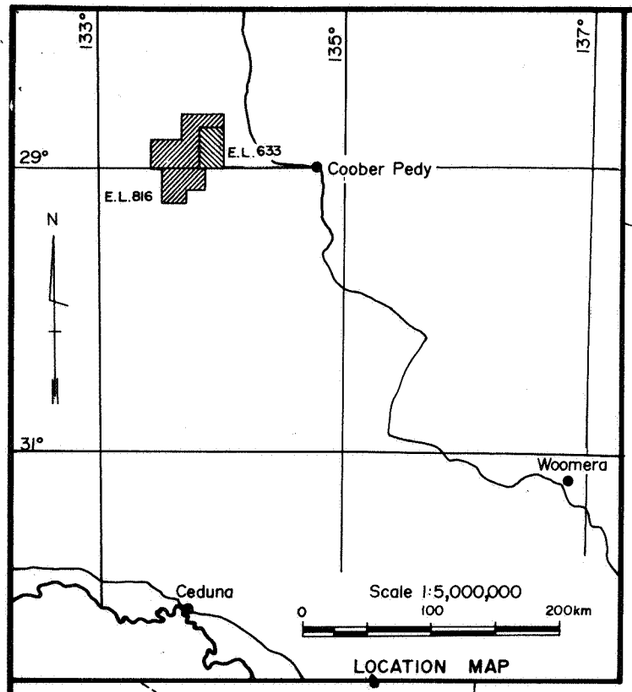
cont./..

4. EXPENDITURE

Expenditure debited to EL 633 by BHP to 31st August, 1981, was:

Wages and Salaries	$24,017
Messing and Accommodation	8,048
Fares and Mobilisation	1,928
Drilling	538
Transport	3,988
Radio Communications	45
Surveying/Aerial Photographs	674
Plant Services	1,895
Sample Analysis	208
Geophysics/Geochemistry	552
Occupancy/Location Expenses	368
Capital Items	1,204
Administration/Overheads	2,173
	$45,638

FIG. 1



133° 30'

E.L. 816

Paragon Bore
Freshwater Bore
Black Oak Bore
Wild Dog Bore
PBI
Turkeys Nest Bore
Jindivick Bore
Gordons Corner Bore
Hawks Nest Bore
Bindabu Bore
Corkscrew Bore
Bellbird Bore
Tallaringa Well

383000E
383500E
384000E
384500E
385000E
394000E
394500E
395000E
395500E

29°00'

E.L.633

133° 30'

N

LEGEND

- E.L. Boundary
- Track
- Fence
- Bore
- Geophysical Traverse
- ⊙PBI Diamond drill hole

Scale 1:250,000

0 5 10 15 20kilometres

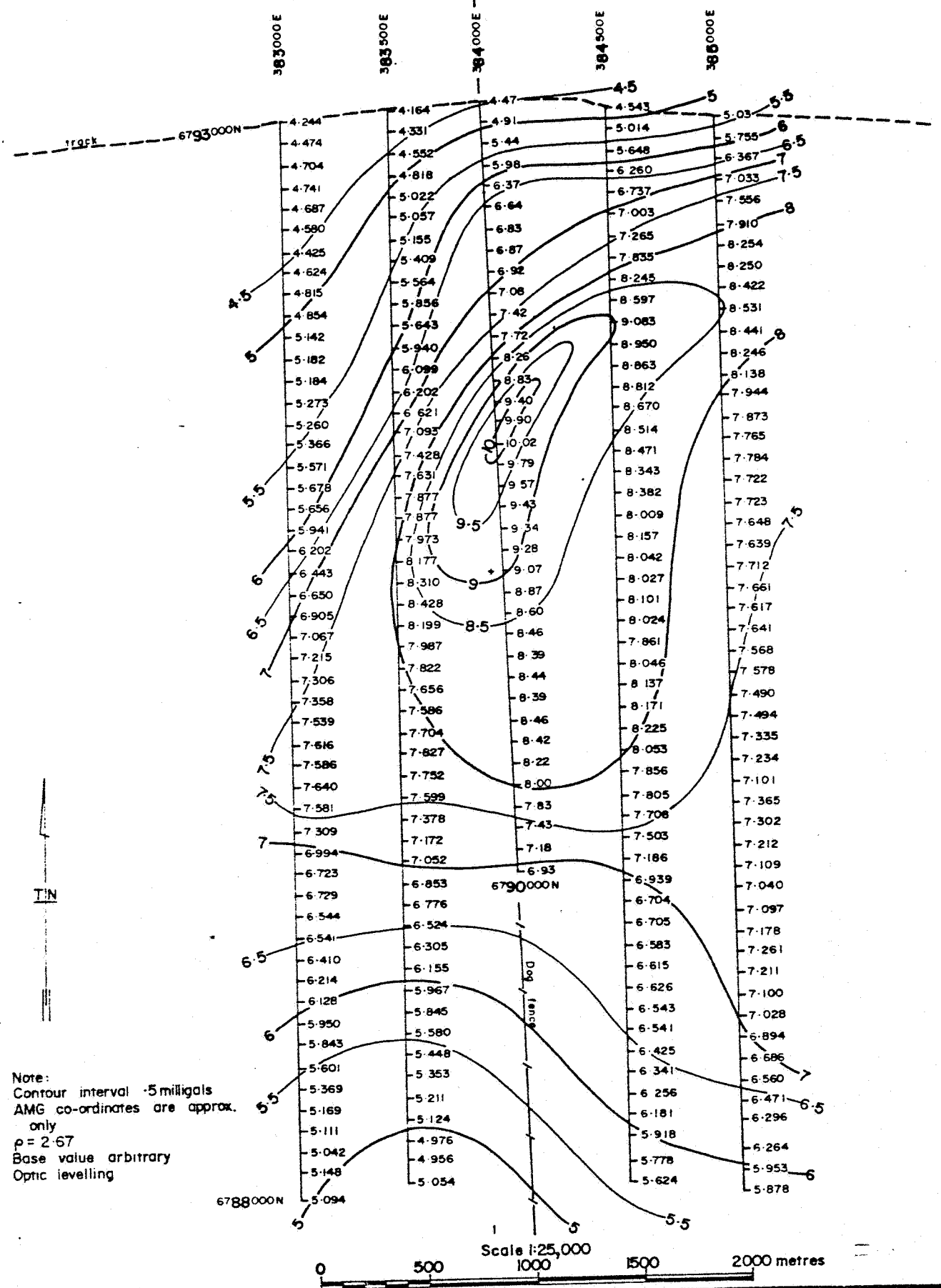
THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

E.L.633 PARAGON BORE, S.A.
LOCATION OF GEOPHYSICAL TRAVERSES, AND DRILL HOLE PBI

0015

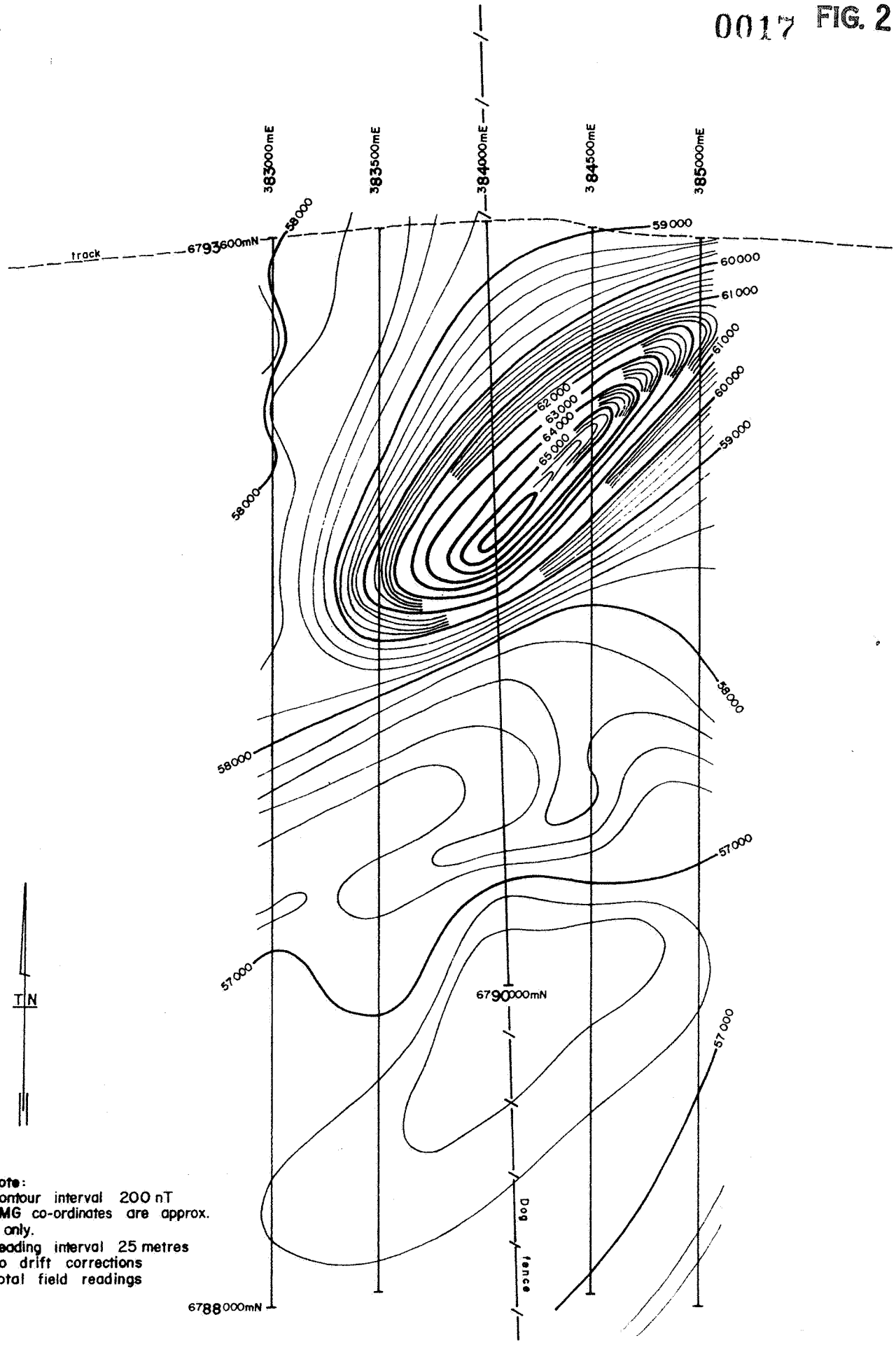
Revisions:

Prepared by : MUP		Centre : ADELAIDE	
Date : 25-6-81		Project No. 6-B660/670-1	Drawing No. A3-79
Drawn : i.ley			



Centre Adelaide	THE BROKEN HILL PROPRIETARY CO. LTD. E.L. 633 PARAGON BORE, S.A. SW ANOMALY GRAVITY CONTOURS	Project No. 6-8670-3
Date 29-7-81		Drawing No. A4-137

0017 FIG. 2 b.



Note:
Contour interval 200 nT
AMG co-ordinates are approx. only.
Reading interval 25 metres
No drift corrections
Total field readings

For location, see map A3-79

Scale 1:25,000
0 500 1000 1500 2000 metres

Centre Adelaide	THE BROKEN HILL PROPRIETARY CO. LTD. E.L. 633 PARAGON BORE, S.A. SW ANOMALY GROUND MAGNETIC CONTOURS	Project No. 6-B670-5
Date 6-8-81		Drawing No. A4-141

DRILL HOLE : PB 1	
LOCATION : 68 12 950 m N 393 850 m E	
DRILL TYPE : Diamond	
CASING TYPE : 152 m of Steel	
INCLINATION : Vertical	
DEPTH DRILLED : 356·2 m	
DEPTH LOGGED : Varies	
LOGGING UNIT : SIE T450E	
DATE : 8-9-81	

Geological Log

Gamma
Winding Speed 4 m/min.

Resistivity
Winding Speed m./min.

Self Potential
Winding Speed m./min.

Logging unit failed at approx. 69 m

Qs

Kmb

Klc

Pls

T.D. 356·2m

307·7m

Magnetic Susceptibility readings taken at 1 metre intervals, histogram shows average for 10m

Specific Gravity readings taken at approximately 10 metre intervals.

Magnetic susceptibilities and specific gravity values were determined on the core.

GEOLOGY

RECENT
- Qs — SOIL and RUBBLE

CRETACEOUS
- Kmb — SHALE and SILTSTONE (Bulldog Shale)
- Klc — SANDSTONE (Cadna-owie Formation)

PERMIAN
- Pls — SHALE and SHALY SILTSTONE (Stuart Range Formation)

- BANDED IRON FORMATION
- SKARN
- GARNET GNEISS

0 — c.p.s. T.C. = 5 secs. — 100

100 ohm.m. Full scale

250 millivolts Full scale

0 — Magnetic Susceptibility x 10^{-6} S.I. units — 200,000

2.0 — Specific Gravity — 4.0

Note: These electric logs are unreliable. Approximately 260 litres of graphite grease were pumped down the drill-hole during drilling.

FIG. 3

3881-4

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

E.L. 633 PARAGON BORE, S.A.

GEOPHYSICAL DOWN HOLE LOGS
PB 1

Drawn: D.& P.
Traced: A.R.V.
Checked:
Date: 13-10-81
Project No.: 6-8670-17
Drawing No.: AI-376

APPENDIX 1

Detailed Drill Log

DETAILED GEOLOGICAL HOLE LOG

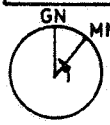
0019

THE BROKEN HILL PTY CO LTD. · PROJECT E.L. 633 PARAGON BORE DRILL HOLE PB1

Location or local co-ordinates 79750N 93500E (NE Anomaly) R.L. Collar (Datum) 216metres

Map Reference Murloocoppie SH53-2 Co-ordinates (Grid) 812950N 393850E

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar	Aust. Diamond	I. Pringle	Foxmobile	Rock Roller		152.5m	6/8-9/8/81
Main Hole	Drilling P/L	"	"	Diamond		356.2m	10/8-5/9/81



Depth	Decl'n	Brg (Mag)	Hole dia.	From	To
	Vertical		HQ	0	152.5m
			NQ	152.5	356.2
			BQ	273.0	274.6

Casing HQ casing cut twice; 81 metres could not be removed

Static water level 87m Date

Logged by M. Page Date 4.9.81

Remarks

From	To	Interval	Recovery	%Rec.	GEOLOGICAL DESCRIPTION	Remarks
0	5	5m	chips		Red-brown gravel and sand; clayey in part	RECENT
5	24	19	"		White & yellow alunitic clay with abundant quartz grit & angular limonitic clasts.	
24	30	6	"		Very fine, pink brown & lilac clay with some grit; very soft to touch and when squeezed gives off lots of water	CRETACEOUS (Bulldog Shale)
30	40	10	"		White & yellow plastic clay with minor grit which forms small clay balls.	
40	50	10	"		More plastic clay which forms large sticky lumps that clog up the rock roller bit. Yellow & grey in colour.	
50	58	8	"		Plastic clay is now becoming quite black with increasing grit content; grit is fine to medium sand.	
58	70	12	"		Fine grey-yellow-brown silt & sand grains; loosely-packed.	
70	84	14	"		Coarser, more competent sand to fine grave; grains up to 2mm across.	CRETACEOUS (Cadna-owie FM)
84	90	6	"		Finer grey sandstone, as seen from 58-70m	
90	104	14	"		Coarse, loose sand with minor white clay flakes; grains sub-rounded to angular & dominantly from 0.5 to 3mm.	

SYMBOLS AND ABBREVIATIONS

DETAILED GEOLOGICAL HOLE LOG

0020

THE BROKEN HILL PTY CO LTD. PROJECT E.L. 633 PARAGON BORE DRILL HOLE PB1

Location or local co-ordinates _____ R.L. Collar (Datum) _____

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							

GN MN Magnetic Declination

Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks 100% unless stated otherwise

From	To	Interval	Recovery	%Rec.	GEOLOGICAL DESCRIPTION	Remarks
104	110	6	chips		Sand now very fine grained to silty and has a black clayey matrix.	PERMIAN (Stuart Range Formation)
110	122	12	"		Fine sand with increasing amount of sticky grey and soft yellow clay.	
122	152	30	"		Dominantly sticky grey clay & soft yellow clay with minor amounts of fine grit.	
152	176.9	24.4	24.4	100%	10-15% magnetite in a banded to poorly-banded BIF with abundant coarse patches of magnetite	Precambrian
176.9	179.3	2.4	2.4		White welded translucent quartzite with very little bedded magnetitie, but coarse patches of same at 177.6 and 178.65m.	
179.3	187.1	7.8	7.8		BIF with many soft-sediment movement textures present, especially between 179.25-180.55m and 186.20-187.15m. Here have 40% magnetite as very fine grains (much finer than anywhere else in the core) with well-developed slump structures (185.40m, 185.85m) and possible sand dykes (179.97m).	Pyrite in slumped material at 185.55m
187.10	203.8	16.7	16.7		BIF with from 15-30% magnetite; well-banded.	Very minor fracturing
203.8	217.0	13.2	13.2		Welded white quartzite with 5-10% magnetite in bands with some associated with chlorite (may be coarser remobilised magnetite along	

SYMBOLS AND ABBREVIATIONS

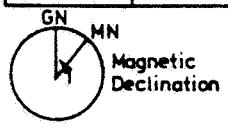
DETAILED GEOLOGICAL HOLE LOG

THE BROKEN HILL PTY CO LTD. · PROJECT E.L. 633 PARAGON BORE DRILL HOLE PB1

Location or local co-ordinates _____ R.L. Collar (Datum) _____

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							



Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks _____

From	To	Interval	Recovery	%Rec.		GEOLOGICAL DESCRIPTION		Remarks
						chloritised fractures). Most of the bedding		
						has vanished due to metamorphism; bedding		
						only seen where magnetite present.		
217.0	222.5	5.50	5.50			Unit transitional between above and below		
						units; mainly a grey-white magnetitic		
						quartzite.		
222.5	245.9	23.4	23.4			Well-banded BIF starting at about 20%		
						magnetite content, but up to 30-40%		
						magnetite around 236.00m and back to 20%		
						magnetitie by 245.90m. The more magnetite		
						unit has quite discrete magnetite and		
						quartzite bands.		
245.90	248.10	2.20	2.20			Mostly white-grey quartzite with up to 10%		
						bands of magnetite, plus irregular coarse-		
						grained patches of magnetite (especially at		
						245.40m).		
248.10	249.48	1.38	1.38			Green chloritic rock with up to 50% mag-		
						netite and coarse patches of hematite (eg		
						249.34m). Carbonate veins common where		
						hematite abundant.		
249.48	257.75	7.27	7.27			Well-banded BIF, with quartzite as discrete		
						bands between the magnetite layers which		
						occupy 30-40% of the rock. Quartzite bands		
						slumped in part and possible cross-bedding		
						at 251.60m.		

SYMBOLS AND ABBREVIATIONS

DETAILED GEOLOGICAL HOLE LOG

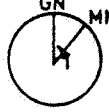
0022

THE BROKEN HILL PTY CO LTD. · PROJECT E.L. 633 PARAGON BORE DRILL HOLE PB1

Location or local co-ordinates _____ R.L. Collar (Datum) _____

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							



Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks _____

From	To	Interval	Recovery	%Rec.	GEOLOGICAL DESCRIPTION	Remarks
257.75	263.75	6.0	6.0		BIF but not as well-banded as above unit. Magnetite content is 25-30%; coarsely crystalline patch at 261.90m.	
263.75	281.05	17.3	16.9	95%	Grey BIF with 30-40% magnetite. The bands generally 1cm with distinct quartzite layers separating the magnetite bands. Bedded magnetite is medium to coarse grained. The quartzite bands are regular to lensoidal. Coarse recrystallised magnetite patches at 264.70m and 278.70m.	Tectonically brecciated & reconstituted BIF at 280.60m with green chlorite groundmass.
281.05	295.70	14.65	14.10	95%	White-grey BIF with magnetite content of 15-20% as mainly fine grains.	
295.70	299.65	3.95	3.75	95%	Transitional change from BIF to quartzite. Some fracturing, which has been rewelded, has displaced beds up to 2cm from original position.	
299.65	302.00	2.35	2.10	95%	White, welded, translucent quartzite with few traces of original bedding.	Minor fracturing.
302.00	310.00	8.00	8.00		White-grey magnetitic quartzite with the magnetite content of the BIF from 10-20%. Generally well-banded, however, has white welded quartzite bands with irregular coarse-grained magnetite patches (e.g. 305.10-305.42, 303.70-304.00m).	Minor sheared schistose material with chlorite & fine grey mica. (eg 306.46m, 303.20m).

SYMBOLS AND ABBREVIATIONS

DETAILED GEOLOGICAL HOLE LOG

0023

THE BROKEN HILL PTY CO LTD. · PROJECT E.L. 633 PARAGON BORE DRILL HOLE PB1

Location or local co-ordinates _____ R.L. Collar (Datum) _____

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							

GN MN Magnetic Declination

Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks _____

From	To	Interval	Recovery	%Rec.		GEOLOGICAL DESCRIPTION		Remarks
310.0	314.35	4.35	4.35			Massive, white, welded quartzite, with many small pits with a carbonate lining. Pyrite is common in this unit with a band of 80% pyrite from 311.67-311.97m and also at 312.35-312.36m. Less regular patches at 311.39m, 312.80m, 312.92m, 313.00m and 313.23m. (these are mainly vein-fill). With the pyrite from 311.67-311.97m find a soft, black mineral and also at 313.88-313.96m.		
314.35	317.35	3.00	3.00			BIF with up to 70% magnetite over a 10cm section but averagin about 20%. This decreases to 5% by 317.35m. Bladed crystals of amphibole in the magnetite-rich bands.		
317.35	318.15	0.80	0.75	95%		Mainly quartzite, with blebs of black to green subspherical to elongate amphibole and chlorite in fractures. Minor irregular patches of pyrite filling inter-grain spaces.		Very fractured at 317.45m.
318.15	320.50	2.35	2.15	95%		Carbonate consisting of white, calcite-rich, coarse, bladed, massive to poorly-bedded rock, with abundant black spheroids of magnetic black mineral. These spheroids become more abundant and by 320.10m is a black magnetite-rich carbonate in a black green dolomite. Pyrite in fractures and open pore space.		Stylolites & minor fracturing.
320.5	324.80	4.30	4.00	95%		Transition from above carbonate unit into soft pyrrhotitic & in part quartzitic unit.		10% pyrrhotite from

SYMBOLS AND ABBREVIATIONS

DETAILED GEOLOGICAL HOLE LOG

THE BROKEN HILL PTY CO LTD. · PROJECT E.L. 633 PARAGON BORE DRILL HOLE PB1

Location or local co-ordinates _____ R.L. Collar (Datum) _____

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							

GN MN Magnetic Declination

Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks _____

From	To	Interval	Recovery	%Rec.	GEOLOGICAL DESCRIPTION	Remarks
					Has abundant green-brown-black bladed crystals (possibly silicified carbonate) and where this is abundant have pyrrhotite to 10%. Also garnetiferous.	323.77-324.77m.
324.80	325.15	0.35	0.32	95%	Carbonate unit with abundant black magnetic spheroids.	
325.15	326.85	1.70	1.60	95%	Massively to poorly-bedded white-grey quartzite with intergrowths of pink garnet.	Talc along fractures.
326.85	328.46	1.61	1.45	90%	Carbonate unit with abundant black magnetic spheroids.	Has fine veinlets of ~~silvery mag-~~ netic mineral esp. from 327.89-328.06
328.46	345.66	17.20	16.50	95%	Garnet gneiss, with the garnet in places totally silicified. Has interbands of black soft, micaceous, very fine-grained material with small (1mm) grains of either feldspar or garnet (especially at 335.15m). Also have red-orange hematitic-looking mineral along fractures. Pyrite also along fractures.	
345.66	347.10	0.44	0.40	95%	Highly chloritic rock which is quartzitic where fractured. Minor pyrite in fractures.	becoming fractures by 347.10m.
347.10	347.84	0.74	0.74		Very hard siliceous rock with veins of red-orange hematite cross-cutting red-green garnet gneiss. This is calcite-veined in	

SYMBOLS AND ABBREVIATIONS

DETAILED GEOLOGICAL HOLE LOG

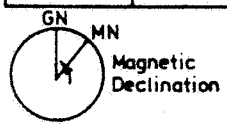
0025

THE BROKEN HILL PTY CO LTD. · PROJECT E.L. 633 PARAGON BORE DRILL HOLE PB1

Location or local co-ordinates _____ R.L. Collar (Datum) _____

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							



Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks _____

From	To	Interval	Recovery	%Rec.	GEOLOGICAL DESCRIPTION	Remarks
					places.	
347.84	348.45	0.61	0.61		Carbonate with black magnetic spheroids.	
348.45	356.2	7.75	7.75		White-grey garnet gneiss with garnet as spheroids up to 1cm across. Chloritic patches occur from 352.80-352.95m, 353.10-353.38m and 355.83-356.00m and also as scattered grains throughout the quartzite.	

SYMBOLS AND ABBREVIATIONS

BHP MINERALS LIMITED

EXPLORATION LICENCE 633

PARAGON BORE, SOUTH AUSTRALIA

REPORT FOR THE SECOND QUARTER ENDED 26th NOVEMBER, 1981

CONTENTS

FIGURES

BHP MINERALS LIMITED

EXPLORATION LICENCE 633

0028

PARAGON BORE, SOUTH AUSTRALIA

REPORT FOR THE SECOND QUARTER ENDED 26th NOVEMBER, 1981

1. GENERAL STATEMENT

Exploration Licence 633 of 664 square kilometres lies in the Coober Pedy and Murloocoppie 1:250,000 sheet areas. The area was granted to Amoco Minerals on 26th May, 1980 for one year. Subsequently the E.L. was renewed for a further year under a joint venture agreement between Amoco and BHP Minerals.

Exploration for this quarter included precollar drilling of 543 metres and completion of diamond drill hole PB3 at 287 metres. One 14.5 kilometre gridded line of gravity and magnetics was completed.

2. FIELD INVESTIGATIONS

2.1 Precollar Drilling

Precollars for drill holes PB2, PB3 and PB4 were completed by Whiteland Drilling, the 3 holes totalling 543 metres of drilling (this includes an extra 93 metres of precollar drilling by the original contractors, Australia Diamond Drilling on hole PB2, who pulled out of the area before finishing this hole due to logistic problems; this hole could not be reused so a new precollar to basement had to be drilled). Pictorial logs for the holes are on Figure 2.

2.2 Diamond Drilling

Diamond drill hole PB3, sited to test a broad gravity high in the middle of E.L. 633, hit basement at 187.25 metres and was terminated at 287 metres after passing through a highly folded sequence of feldspathic and garnetiferous granulites and gneisses, with minor amphibolite bands. No sulphide mineralisation was intersected.

2.3 Geophysics

One line totalling 14.5 kilometres of gridding, levelling and gravity measurements at 100m stations, plus magnetometer readings at 25 metre spacings, was done, (see Figure 1). This line found near-coincident gravity (7 milligal) and magnetic peaks (2,500 gammas), as depicted in Figure 3. These highs occur directly between the gravity/magnetics highs tested in drill holes PB1 and PB2.

cont./..

3. FUTURE WORK

During the next quarter, drill holes PB2 and PB4 should be completed which will conclude the present drilling programme in E.L. 633 Paragon Bore.

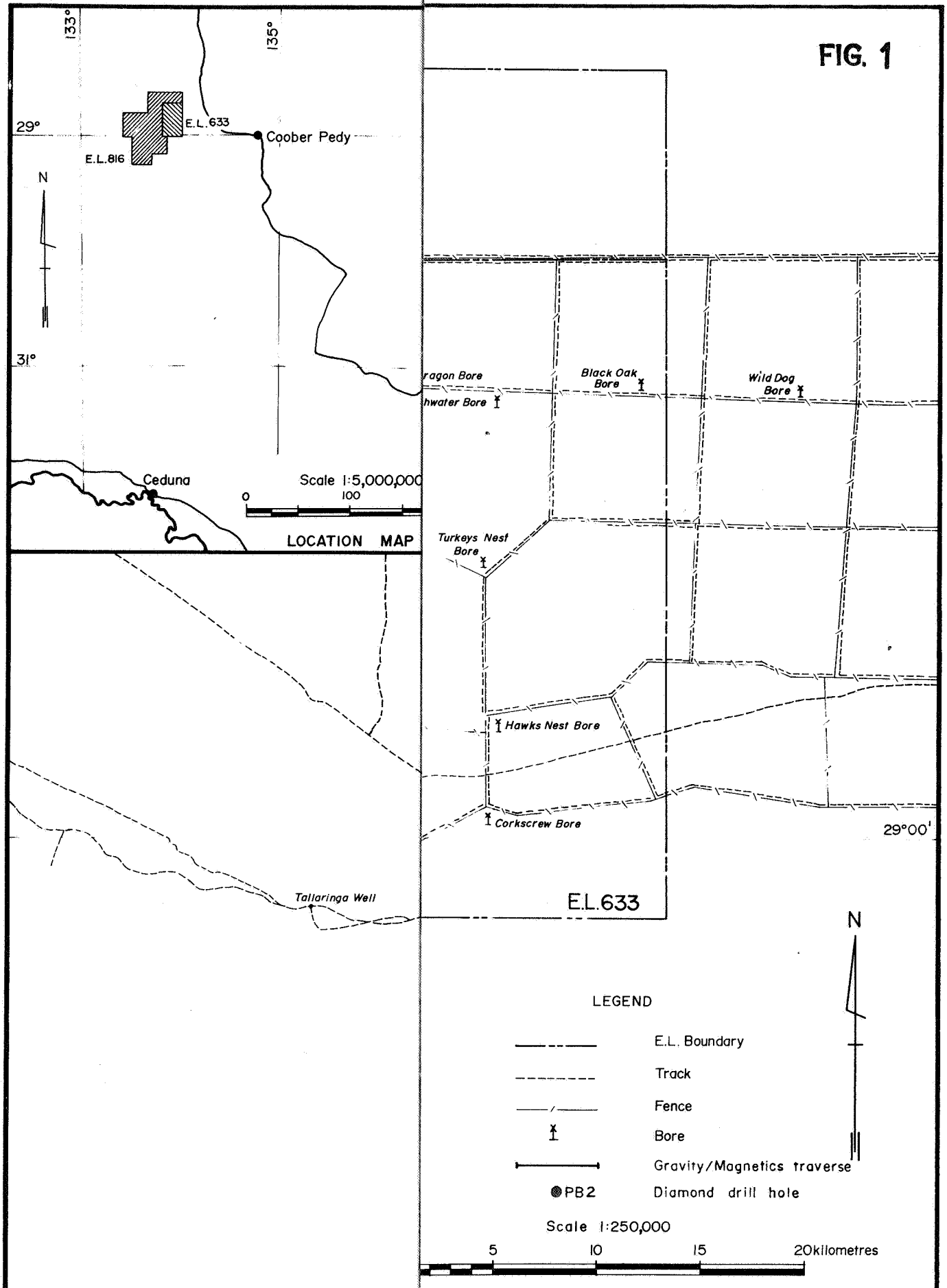
4. EXPENDITURE

Expenditure debited to E.L. 633 during September, October and November, 1981, was:

Wages and Salaries	$10,564
Messing and Accommodation	1,692
Fares and Mobilisation	810
Drilling	45,462
Transport	1,470
Surveying/Aerial Photographs	306
Sample Analysis	2,823
Geophysics	878
Occupancy/Location Expenses	192
Administration/Overheads	3,212
Other Items	45
	$67,454

Total expenditure by BHP Minerals to 30th November: $113,092

FIG. 1



THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

E.L.633 PARAGON BORE LOCATION OF GEOPHYSICAL TRAVERSE AND DRILL HOLES

0030

Prepared by :	MuP	**Centre :** ADELAIDE	
Date :	25-6-81	**Project No.**	**Drawing No.**
Drawn :	i.ley	6-B660/670-1	A3-79C

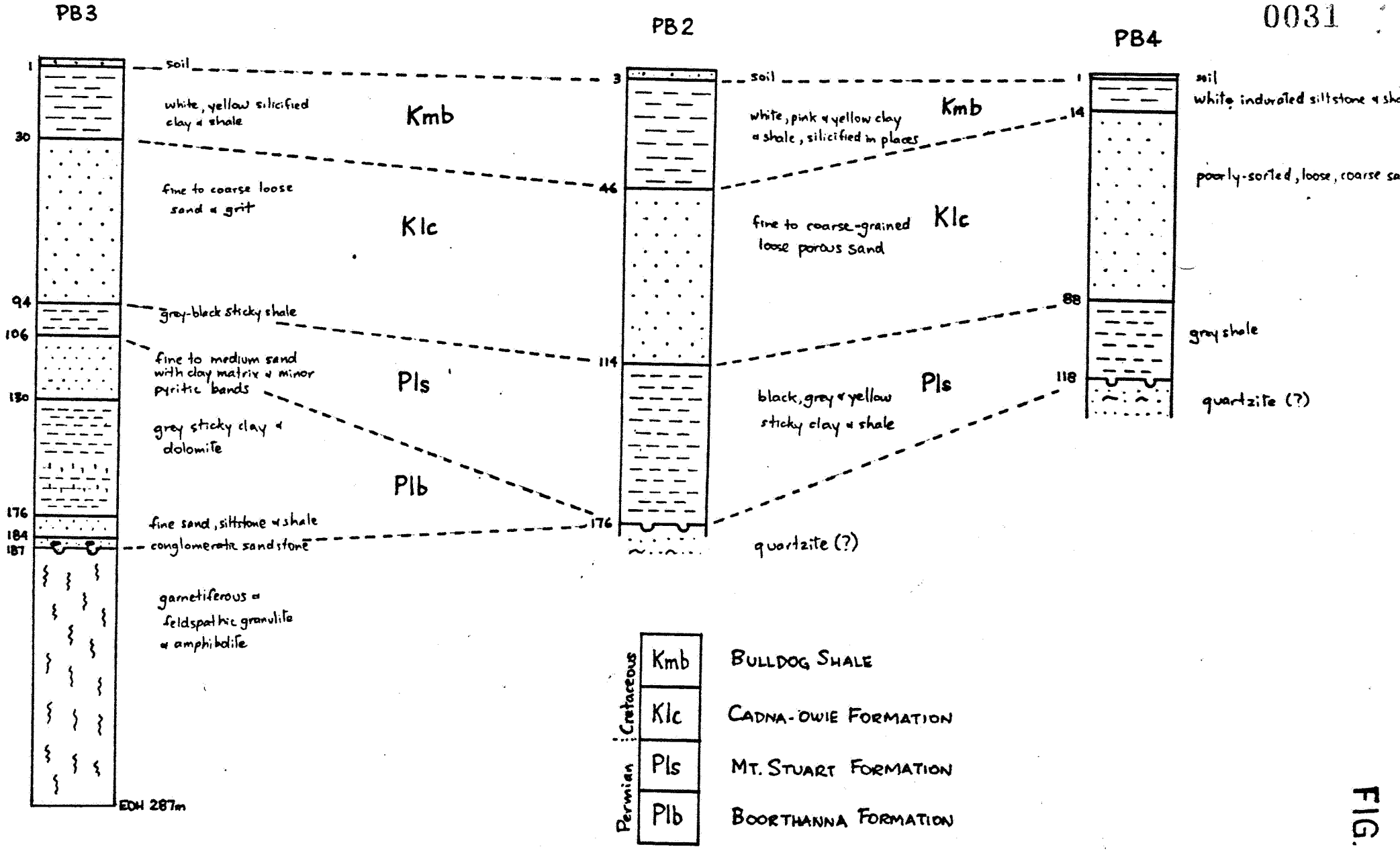
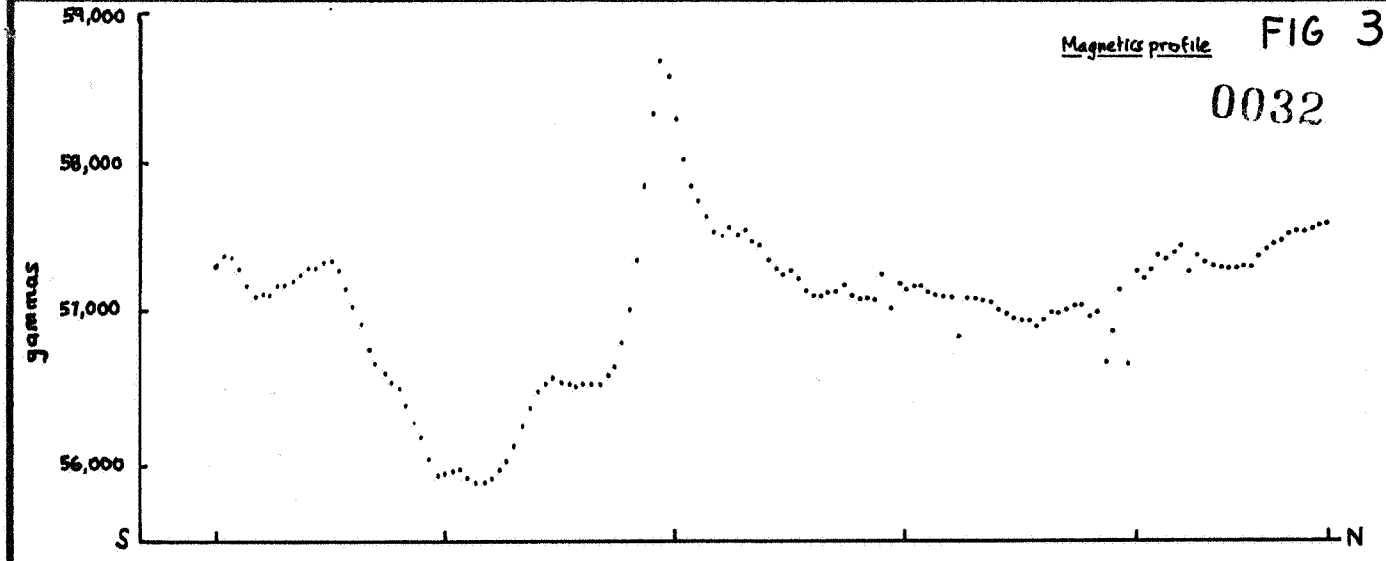

PB3
PB2
PB4
1
soil
white, yellow silicified clay ± shale
Kmb
30
fine to coarse loose sand ± grit
Klc
94
grey-black sticky shale
106
fine to medium sand with clay matrix ± minor pyritic bands
Pls
130
grey sticky clay ± dolomite
Plb
176
fine sand, siltstone ± shale
184
187
conglomeratic sandstone
garnetiferous ± feldspathic granulite ± amphibolite
EOH 287m
3
soil
white, pink ± yellow clay ± shale, silicified in places
Kmb
46
fine to coarse-grained loose porous sand
Klc
114
black, grey ± yellow sticky clay ± shale
Pls
176
quartzite (?)
1
soil
white indurated siltstone ± sha
14
poorly-sorted, loose, coarse sa
Klc
88
grey shale
118
quartzite (?)
Cretaceous
Permian
Kmb
BULLDOG SHALE
Klc
CADNA-OWIE FORMATION
Pls
MT. STUART FORMATION
Plb
BOORTHANNA FORMATION

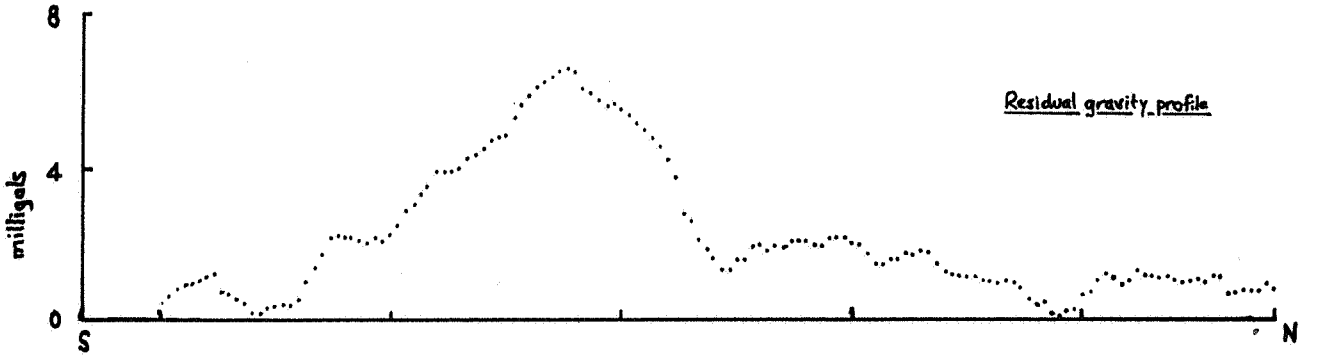
FIG. 2

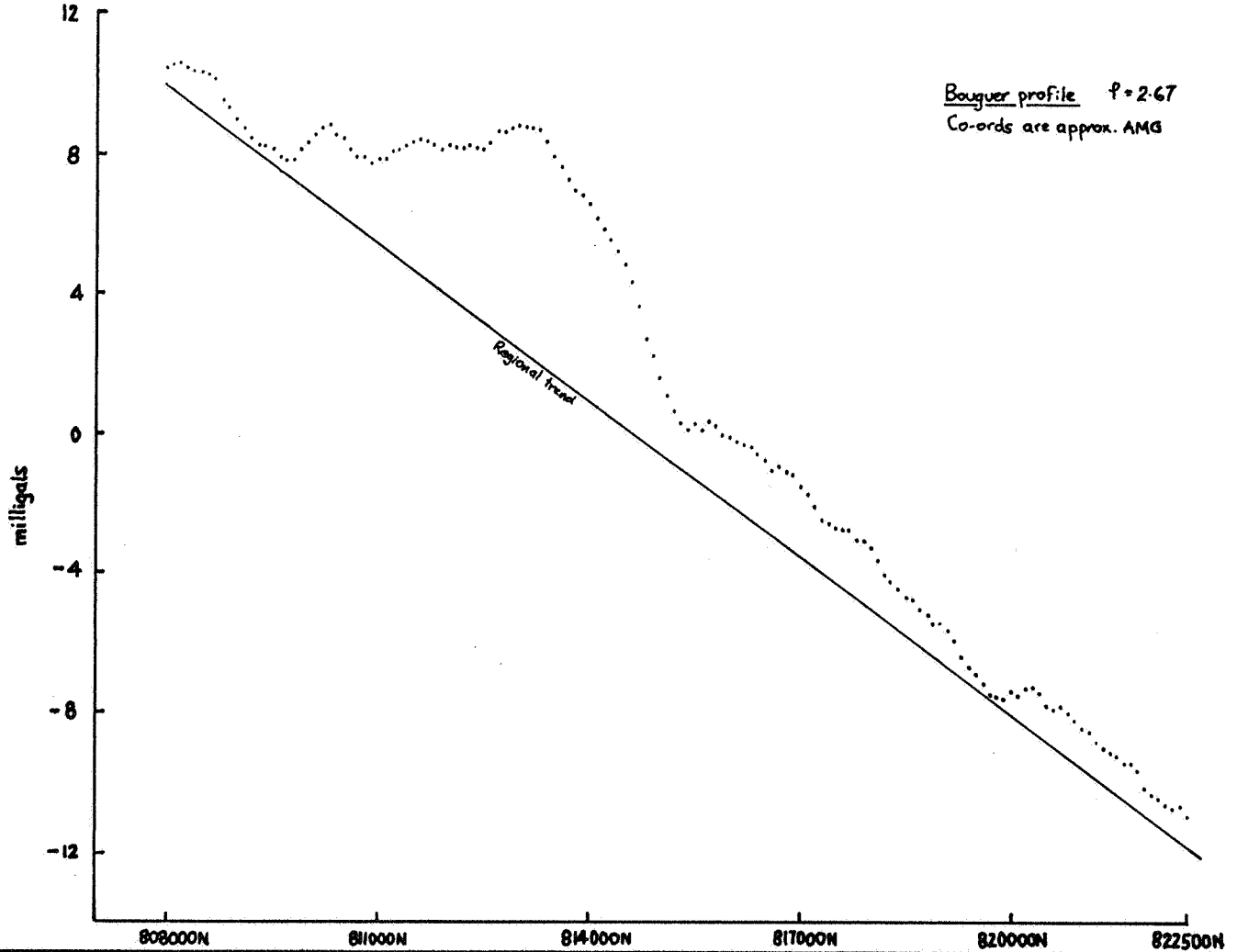
FIG. 2.

FIG 3

0032







Centre	THE BROKEN HILL PROPRIETARY CO. LTD.	Project No.
Date 7-1-82	MAGNETICS & GRAVITY PROFILES, LINE 388800E, E.L. 633 PARAGON BORE	Drawing No.

EXPLORATION LICENCE 633

PARAGON BORE, SOUTH AUSTRALIA

REPORT FOR THE QUARTER ENDED 26th FEBRUARY, 1982

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APPENDICES

FIGURE

EXPLORATION LICENCE 633

PARAGON BORE, SOUTH AUSTRALIA

REPORT FOR THE QUARTER ENDED 26th FEBRUARY, 1982

1. GENERAL STATEMENT

Exploration Licence 633 of 664 square kilometres lies in the Coober Pedy and Murloocoppie 1:250,000 sheet areas. The area was granted to Amoco Minerals on 26th May, 1980, for one year, and was subsequently renewed for a further year under a Joint Venture agreement between Amoco and BHP Minerals.

Exploration during this quarter consisted of completion of drill hole PB2 by diamond drilling from 176 to 437 metres.

2. FIELD INVESTIGATIONS

2.1 Diamond Drilling

Drill hole PB2 was sited to test a gravity high occurring between two magnetic highs located in the NW corner of EL 633 (see Figure 1). A precollar had previously been completed to basement and the programme for this quarter was to test the basement sequence with diamond drilling.

PB2 intersected a sequence of banded iron formation similar to that found in PB1. A greater sequence of the BIF was intersected in this hole than in PB1 (176m to 334.5m, bedding angle of 30^{o}, giving a minimum true thickness of BIF of approximately 140 metres) and the uppermost units of BIF are mineralogically different from the upper units of PB1. In PB2, the upper BIF has abundant talc, pseudomorphing after anthophyllite, plus unaltered anthophyllite. By about 200m, the BIF is quite comparable with that in PB1 and consists dominantly of quartz and magnetite with lesser amounts of hematite. Total iron oxide content appears to be of the order of 25-30%. Varying amounts of banding and content of SiO_2/FeO allow the BIF to be subdivided into subunits.

From 334.50 to 349.40m, a transitional zone with decreasing amounts of banded iron and increasing amounts of orthopyroxene (hypersthene), minor clinopyroxene, anthophyllite, actinolite and garnet was found. Graphite is also a common accessory mineral. This unit is again somewhat similar to the transitional unit below the BIF in PB1 (except PB1 has several coarse-grained carbonate bands). The anthophyllite is the major mineral (after quartz) from 334.5 to 339 metres, but it is then replaced in prominence by khaki-coloured hypersthene and red-pink garnet.

cont./..

From 349.50 to 364.60 metres, a reasonably consistent unit of fine to medium-grained garnetiferous granulite was found. Some coarser (to 1cm) grains of subhedral garnet are present, usually where coarser white-grey quartzite occurs. Minor sulphide is found disseminated throughout this unit, being dominantly pyrite and pyrrhotite.

Below 364.60 metres, a grey quartzite unit occurs, generally rich in garnet and lesser mica, sillimanite, plagioclase and orthoclose. The presence of mica (usually biotite) gives the rock a schistose nature. A subunit between 364.60 and 395.0 metres may be defined, as within this unit are several sulphide-rich bands. The sulphides consist of coarse late-stage euhedral pyrite, crosscutting banded medium to fine-grained pyrrhotite. Chlorite is abundant adjacent to the sulphide bands, replacing biotite and sillimanite. Pyrite is slightly more abundant than pyrrhotite. Trace chalcopyrite is accessory to the pyrrhotite.

From 395 metres until the end of the hole at 437 metres, garnetiferous feldspathic granulite and schist is found with trace very fine pyrite disseminated throughout.

Table 1 is a pictorial log of PB2. A detailed drill log is in Appendix 1. Descriptions by Pontifex and Associates of selected pieces of core are in Appendix 2.

2.2 Geochronology

Two pieces of drill core from diamond drill hole PB1 were submitted to The Australian Mineral Development Laboratories, Adelaide, for age dating by the Rb-Sr method.

Only one sample was found to be suitable for Rb-Sr dating and this gave an age range of 2.65 - 3.31 x 10^9 years (i.e. Archaean). The report of this work is in Appendix 3.

3. FUTURE WORK

During the next quarter, geochemical sampling and geophysical testing of core from drill holes PB1, PB2 and PB3 should be finished and a full assessment of the future potential for exploration in this E.L. completed.

4. EXPENDITURE

Expenditure debited to EL 633 during December, 1981 and January, 1982 was as follows. Expenditure for February has not yet been consolidated.

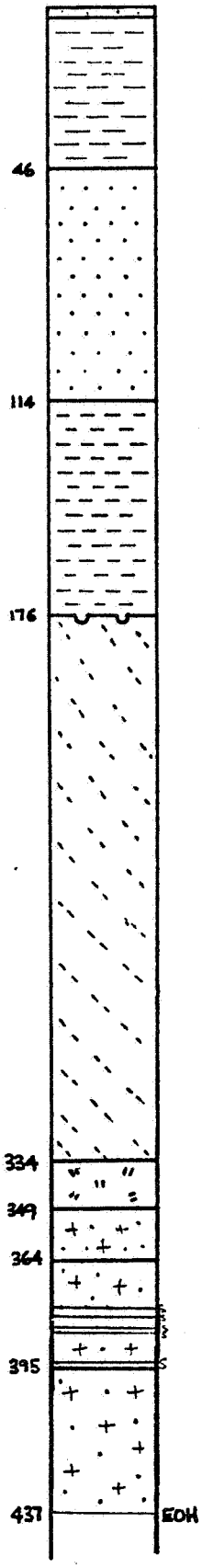
cont./..

Wages and Salaries	$ 6,902
Messing and Accommodation	1,619
Fares and Mobilisation	39
Drilling	62,703
Transport	565
Mobilisation of Equipment	90
Occupancy/Location Expenses	48
Geophysics	777
Administration/Overheads	3,637
	$76,380

Total expenditure by BHP Minerals to 31st January, 1982 is $189,472

PB2

0038



white, pink & yellow clay & shale, in places silicified — BULLDOG SHALE

fine to coarse-grained loose porous sand — CADNA-OWIE FORMATION

black, grey & yellow sticky clay & shale — MT STUART FORMATION

banded iron formation, with about 25-30% iron oxides (mt & minor hm)

amphibolite, sillimanitic & for garnetiferous granulite

garnet granulite

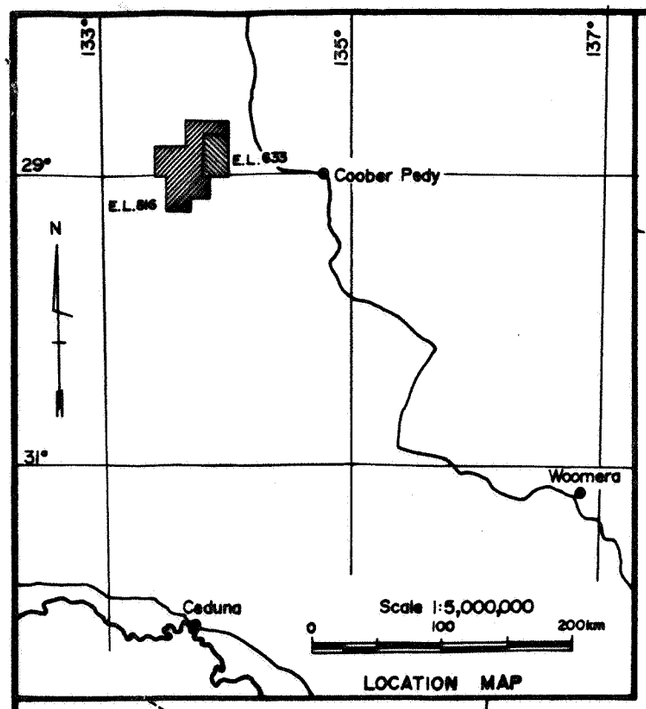
pyritic & pyrrhotitic quartzite & garnet granulite

garnet granulite

Pictorial Drill Log, PB2

FIG. 1

0039



E.L. 816

133° 30'

134° E.

388 800 E

Paragon Bore

Black Oak Bore

Wild Dog Bore

Freshwater Bore

PB 2

PB 1

PB 3

Turkeys Nest Bore

Jindivick Bore

Gordons Corner Bore

Hawks Nest Bore

Bindabu Bore

PB 4

Corkscrew Bore

29°00

Bellbird Bore

Tallaringa Well

E.L. 633

N

LEGEND

E.L. Boundary

Track

Fence

Bore

Gravity/magnetics traverse

PB 3 Diamond drill hole

Scale 1:250,000

0 5 10 15 20kilometres

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

E.L. 816 TALLARINGA WELL, E.L.633 PARAGON BORE S.A. LOCATION OF DRILL HOLES

Revisions:	Prepared by : MGP	Centre : ADELAIDE	
	Date : 11·3·8225-6-81	Project No. 6-B660/670-1	Drawing No. A3-79
	Drawn : j.ley		

APPENDIX 1

Detailed Drill Log, PB2

DETAILED GEOLOGICAL HOLE LOG

0041

THE BROKEN HILL PTY CO LTD. PROJECT E.L. 633 PARAGON BORE DRILL HOLE PB2

Location or local co-ordinates 78850N 85300E (Anomaly 2) R.L. Collar (Datum) 203.304m

Map Reference Murloocoppie SH 53-2 Co-ordinates (Grid) 6811500N 385300E (AMG)

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar	Whitelands	L. Mellet	Mayhew 1000	Blades		176m	5-10/10/81
Main Hole	Action Core	V. Vietneks	Longyear 44	Diamond		437m	6/12-16/1/82

GN MN Magnetic Declination

Depth	Decl'n	Brg (Mag)	Hole dia.	From	To
433m	3° from vert.				

Casing 4" flush couple water bore casing to 150m; HQ casing to 177m

111m HQ removed

Static water level 85m Date

Logged by M. Page Date 28.1.82

Remarks

From	To	Interval	Recovery	%Rec.	GEOLOGICAL DESCRIPTION	Remarks
0	3	3m	chips		Red-brown clay and minor gravel.	
3	21	18	"		Indurated white alunitic clay, pink clay and white calcrete.	
21	24	3	"		Soft pink-brown water-bearing clay which gives off abundant water when squeezed.	
24	46	22	"		White, yellow and pink-brown plastic sticky clay with some gritty bands.	
46	70	24	"		Gritty loose sand with a yellow-white clay matrix. The clay matrix steadily decreases downwards.	
70	114	44	"		Coarse loose quartz sand with very little clay matrix. At 72m lost circulation in the local aquifer and circulation stayed lost until 84m, where hit finer sand. Below 84m sand was still coarse but had more clay matrix.	
114	176	62	"		Mainly grey-black, but occasionally yellow and red sticky clay. A slightly gritty transitional unit is found from 114-126m. The unit becomes darker in colour until 134m and thereafter becomes paler until the end of this unit. Just above 176m were	

SYMBOLS AND ABBREVIATIONS

DETAILED GEOLOGICAL HOLE LOG

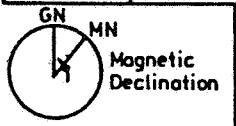
0042

THE BROKEN HILL PTY CO LTD. PROJECT _____ DRILL HOLE PB2

Location or local co-ordinates _____ R.L. Collar (Datum) _____

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							



Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks _____

From	To	Interval	Recovery	%Rec.	GEOLOGICAL DESCRIPTION	Remarks
					gritty sands with minor conglomerate.	
176	225.5	49.5	NQcore	100%	Banded iron formation with black-grey serpentine-like mineral commonly present, especially from 177.60 to 181.20m. With the serpentine, find green chlorite and white needles of anthophyllite (eg 186.7 to 187.7m). The magnetite, which is the dominant iron oxide, is fine to medium-grained and forms in bands that are fine (<1mm) to moderate (1cm) and is occasionally massive where little banding is present due to lack of differentiation into discrete quartz and iron oxide bands. Total iron oxides is about 20-25%.	LCA(180m)=50 LCA(200m)=30 LCA(220m)=75
225.5	239	13.5	NQcore	100%	Banded iron formation, distinguished from adjacent units by its greater total iron oxide content (25-30%) and overall poorer banding which gives the unit a darker grey appearance. Hematite is minor to absent. Iron oxide present as fine equidimensional grains. Minor calcite veining. In this unit find cross-cutting bands of garnet and amphibole which may represent metamorphosed basic intrusives/extrusives (e.g. 226.6 to 227.0m).	LCA(230m)=75

SYMBOLS AND ABBREVIATIONS

DETAILED GEOLOGICAL HOLE LOG

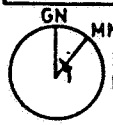
0043

THE BROKEN HILL PTY CO LTD. PROJECT _____ DRILL HOLE PB2

Location or local co-ordinates _____ R.L. Collar (Datum) _____

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							



Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks _____

From	To	Interval	Recovery	%Rec.		GEOLOGICAL DESCRIPTION	Remarks
239	245.8	6.8	NQcore	100%		Transitional unit between less-banded, more iron-rich above and the better-banded, more siliceous unit below. Hematite content is about 10% of total iron oxides, which total 20-25% of the rock. Banding is fine to moderate (<1mm to 1cm). Minor veins of amphibole and some of calcite.	LCA(240m)=70°
245.8	323.25	77.45	NQcore	100%		A broad unit containing well-banded jaspilite with 20-25% total iron oxides. Banding is mainly of wider iron oxides (dominantly magnetite) and thinner quartz bands. Several characteristic subunits are included in this unit:-	LCA(260m)=50°
						267.00-269.30m: banded jaspilite with veins of garnet and amphibole common.	LCA(280m)=45°
						279.10-280.10m: coarse blebby magnetite in grey quartzite, with minor chlorite.	
						291.20-293.00m: coarse quartz hematite unit with blebby to angular grains of hematite in a white granular quartz matrix. Orthoclase occupies 10% of the rock. Minor green amphibole.	LCA(300m)=70°
323.25	332.0	8.75	NQcore	100%		Coarse, blebby magnetite grains and some hematite blades in a fine to medium-grained grey quartzite. Total iron oxides is about 5-10%. Very	LCA(320m)=60°

SYMBOLS AND ABBREVIATIONS

DETAILED GEOLOGICAL HOLE LOG

0044

THE BROKEN HILL PTY CO LTD. PROJECT _____ DRILL HOLE PB2

Location or local co-ordinates _____ R.L. Collar (Datum) _____

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							

Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks _____

From	To	Interval	Recovery	%Rec.	GEOLOGICAL DESCRIPTION	Remarks
					coarse iron oxides from 326.6 to 326.9m.	
332.0	334.5	2.5	NQcore	100%	Grey quartzite with discrete bands of magnetite from 0.2 to 3mm giving the core a striped nature. anthophyllite band from 333.0-333.45m. Total iron oxides is 5-10%.	
334.5	349.4	14.9	NQcore	100%	Zone below the banded iron formation with abundant white fibrous anthophyllite (especially from 334.5-339m). This is replaced in prominence by pale khaki-green orthopyroxene below 339m. From 341.85-341.95m and 346.20-348.46m medium to coarse red-pink garnet bands are found. Amphibolite is present from 348.46 to 349.40m. Sulphide is rare to absent (pyrite only).	LCA(340m)=70
349.4	364.6	15.2	NQcore	100%	Generally a fine to medium-grained garnetiferous granulite with bands of coarser (to 1cm) pink garnet and accompanying coarse welded white-grey quartzite. Minor fine-grained brassy mica gives the core a pitted nature on its surface.	LCA(360m)=75
364.6	395.0	30.4	NQcore	100%	Garnetiferous granulite as in above unit, but this unit is rich in	

SYMBOLS AND ABBREVIATIONS

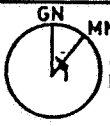
DETAILED GEOLOGICAL HOLE LOG

THE BROKEN HILL PTY CO LTD. PROJECT _____ DRILL HOLE 8245

Location or local co-ordinates _____ R.L. Collar (Datum) _____

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							



Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks _____

From	To	Interval	Recovery	%Rec.	GEOLOGICAL DESCRIPTION	Remarks
					sulphide with major bands of coarse	
					pyrite and banded pyrrhotite as follows:	LCA(380m)=5
					377.53-377.71m, 379.77-380.26m,	
					382.65-383.00m, 383.79-384.11m.	
					These all contain up to 80% sulphides	
					and minor chalcopyrite may be present	
					at 377.65m. All sulphides band	
					contain graphite and possibly	
					serpentine. Pyrite is late stage	
					and cross-cuts the pyrrhotite and	
					bedding. From 394.64-394.78m, well-	
					banded pyrite and pyrrhotite in fine	
					garnetiferous granulite is found.	
					Smaller pyrite bands are found from	
					389.00-389.01m and 390.40-390.42m.	
					From 381.40-384.11m garnetiferous	
					down to 5% but here find fine bands	
					and blebs of pyrrhotite common	
					(5-10%).	
395.0	437.0	42.0	NQcore	100%	Garnetiferous granulite which is	LCA(400m)=80
					slightly coarser grained than above	
					garnet units, and in which the	
					garnets are equidimensional. An	
					abundance of brassy mica can be	
					mistaken for pyrite, although pyrite	LCA(420m)=65
					content as fine disseminated grains	
					is up to 5%. A coarse feldspathic	
					unit is found from 426.5-426.8m.	
					At 400.7m find a 10cm unit of coarse	
					subhedral garnet and books of brown-	

SYMBOLS AND ABBREVIATIONS

black mica.

APPENDIX 2

Petrological Descriptions, PB2

Pontifex & Associates Pty. Ltd.

0047

TEL. 332 6744
A.H. 31 3816

26 KENSINGTON ROAD, ROSE PARK
SOUTH AUSTRALIA

P.O. BOX 91, NORWOOD
SOUTH AUSTRALIA 5067

MINERALOGICAL REPORT NO. 3610

by A.C. Purvis, PhD

23rd February, 1982

TO:	Mr. M. Page, B.H.P. Exploration Co., G.P.O. Box 1818, ADELAIDE, S.A. 5001
YOUR REFERENCE:	Project B670, Despatch Sheet 004784
MATERIAL:	Drill Core samples
IDENTIFICATION:	ADL 36301 to ADL 36314
WORK REQUESTED:	Thin section and petrological description
SAMPLES & SECTIONS:	Returned to you with this report

PONTIFEX & ASSOCIATES PTY. LTD.

COMMENTS

These samples represent a sequence gradational from chemical sediments, largely banded iron formation; through a garnet quartzite unit into pelitic and quartzofelspathic metasediments. Sulphides are concentrated at or near the garnet-quartzite-pelitic schist boundary, and include pyrite, pyrrhotite and very minor chalcopyrite.

The silicate parts of the banded iron formations locally contain amphibole (anthophyllite, actinolite) and locally contain pyroxenes, usually only orthopyroxene, but with orthopyroxene dominant over clinopyroxene, in sample ADL36306, at the base of the banded iron formation.

The orthopyroxenes appear, on the basis of optical properties, to be iron-rich. This, together with the presence of amphiboles suggests conditions transitional between the upper amphibolite and lower granulite facies; with magnesian assemblages manifest as amphiboles and iron-rich assemblages manifest as pyroxenes. This grade is supported by the absence of muscovite and the presence of sillimanite-orthoclase assemblages in the pelitic schists.

Graphite is present throughout the sequence and is locally very abundant (ADL36310).

The sample bags in which the core samples were submitted are marked with a drill hole number (PB2) and depths in meters, except for ADL36301. These depths are as follows :-

ADL 36302	292.78 - 292.89
03	317.62 - 317.76
04	339.57 - 339.71
05	344.02 - 344.10
06	348.09 - 348.75
07	349.59 - 349.72
08	359.42 - 359.54
09	366.84 - 366.97
ADL 36310	369.27 - 369.39
11	369.88 - 370.00
12	377.00 - 377.52
13	394.68 - 398.78
ADL 36314	434.45 - 434.57

These depths indicate that the chemical sediments extend to about 349 metres, with garnet-quartzite to about 369.5 metres, and pelitic schist below about 369.5 metres, i.e. an apparent thickness of garnet-quartzite of 26.5 metres.

These rocks show some similarities to the Mount Shannon Iron Formation, and Mangalo Schist in the Eyre Peninsula region, in particular in their content of graphite.

**

ADL 36301 : irregularly layered and schistose, magnetite-talc rock, with retrograde talc pseudomorphs after coarse anthophyllite prisms

This rock contains numerous irregular lenses, layers and grains of coarse magnetite (25%) to 15 mm long set in a schistose matrix of talc. Some of the talc (35%) occurs as pseudomorphs after coarse prismatic crystals up to 15 mm long, which are considered, by analogy with the crystals in sample ADL 36303, to be anthophyllite.

It is not clear what mineral has been replaced by the remaining talc, which is extremely fine grained and clouded yellow-orange with no definite texture.

The rock is cut by thin carbonate veins.

A DL 36302 : albite-quartz rock with apatite-magnetite segregations and minor actinolite

This rock consists of a massive, inequigranular aggregate of albite grains (7%) to 8 mm, partly to completely altered to sericite, abundant quartz grains (50%) to 15 mm, and minor green hornblende or actinolite grains (5%) to 10 mm.

Segregations of magnetite (20%) to 30 x 10 mm contain minor apatite and may have been derived from an immiscible oxide-phosphate melt. The magnetite is partly rimmed by calcite and chlorite and partly by the actinolite.

There is minor epidote and prehnite in the altered felspar.

ADL 36303 : quartz-magnetite-anthophyllite rock with retrograde talc and minor phlogopite

This rock has lenses and stringers of magnetite in two directions at right angles, from 0.5 to 10 mm wide. These make up about 25% of the rock, and are set in a coarse grained anthophyllite aggregate with minor quartz.

The anthophyllite crystals are prismatic and up to 15 mm long; i.e. similar in size and shape to the talc pseudomorphs in ADL 36301. They are partly altered to talc along subbasa;e fractures (these can also be seen in sample 36301), and locally have patches of fine grained interstitial talc.

Anhedral patches of quartz to 6 mm across, make up about 10% of the rock. A trace of pale greenish phlogpite is partly altered to chlorite.

ADL 36304 : layered, more or less gneissic, graphite, quartz-hypersthene rock

This is a finely layered rock composed largely of quartz (30%) and hypersthene (65%) with opaque plates of graphite (5%) more or less along the layering.

The orthopyroxene occurs as very large poikiloblastic grains to over 25 mm across (i.e. larger than the width of the thin section), with some lenses of smaller grains down to 0.5 mm. Deformed areas in the pyroxene have fine lamellae in what may be areas of twinned clinohypersthene.

The quartz occurs in lenses and layers from 0.5 to 10 mm wide and is anhedral with grains up to 6 mm across.

ADL 36305 : layered, gneissic, apatite-bearing quartz-ferrohypersthene rock, with disseminated coarse graphite

This rock is similar to sample 36304 but has a more granular orthopyroxene with grains from 0.5 to 6 mm across. This orthopyroxene is also more highly pleochroic and has a high 2V (about 90°) suggesting an Fe/(FE+Mg) atomic radio of 0.8 - 0.9. There are subbasal deformation bands, which are fairly broad, and prismatic fine deformation lamellae.

The quartz occurs in lenses, layers and disseminations. The layers are up to 10 mm across with grains to 3mm.

The graphite flakes are more randomly oriented than in sample 36304 but are thicker; they are mostly 0.5 - 1.5 mm across.

Apatite is a common accessory as anhedral grains to 1 mm long, usually in narrow apatite-rich layers.

ADL 36306 : magnetite, clinopyroxene-orthopyroxene, actinolite rock, with tremolite veins and secondary green and orange-brown clays; accessory magnetite disseminated and in layers

This rock is primarily a granular mixture of clinopyroxene orthopyroxene and actinolite in the ratio 25:30:40, with 5% scattered magnetite. The grains range from 0.2 to 1 mm, with magnetite smaller than 0.3 mm. The orthopyroxene is largely replaced by either green or orange-brown clays, possibly chlorite + vermiculite + ?goethite.

The rock is cut by a vein of tremolite 1 - 2 mm wide, locally containing talc and there is a lens of possible vermiculite in this tremolite vein.

A talc-limonite-magnetite vein about 2 mm wide, occurs along the vague layering (emphasised by clay alteration).

ADL 36307 : layered, coarse granular, garnetiferous quartzite, with minor biotite and trace pyrrhotite

This rock has layers to 10 mm wide containing about 10% garnet alternating with narrower garnet-free to garnet-poor layers which are dominated by coarse granulblastic quartz. Minor biotite defines a layer parallel schistosity, in the garnet-bearing layers.

The garnet is anhedral and 0.5 to 2 mm across, weakly elongate along the layering and weakly poikiloblastic. The quartz grains are anhedral and up to 10 mm across.

There are minor opaque oxides (? ilmenite) and sulphides (pyrrhotite).

ADL 36308 : layered, (biotite) very coarse garnet quartzite, minor fine pyrrhotite

This rock is similar to sample ADL 36307 but in the thin section has less well-defined banding and a weaker schistosity. In the hand specimen minor garnet-rich bands about 20 mm thick are quite clear within the relatively massive quartzite. It is also coarser grained than ADL 36307, with anhedral quartz grains locally over 15 mm across, and garnet anhedra to 4 mm.

The amount of garnet ranges from less than 1% to 25% in different parts of the slide. Biotite ranges in abundance up to 5% and occursas flakes to 1 mm.

Grains of sulphide (apparently pyrrhotite) are more abundant (2 - 3%) than in 36307 and up to 1 mm across, and are randomly disposed but mostly associated with biotite and/or garnet.

ADL 36309 : layered, (biotite) garnet quartzite,
with layers of pyrrhotite, pyrite,
minor graphite and chlorite,
trace chalcopyrite

This sample has garnet-sulphide layers up to 15 mm wide set in a quartzite matrix with quartz grains up to 20 mm across.

The smaller and thinner garnet-sulphide layers contain pyrrhotite grains and small lenses to 4 mm, and garnet grains 0.5 - 2 mm across, with minor biotite defining a weak layer-parallel schistosity.

The thicker layers contain abundant pyrite as anhedral grains to 8 mm across, partly enclosing anhedral garnet grains to 4 mm, and weakly aligned biotite flakes to 1.5 mm. Small patches of secondary chlorite of unknown origin, and minor small flakes and small clusters of graphite occur in these sulphide-bearing layers.

Limonite lines some grain boundaries and intragranular fractures. Trace extremely fine chalcopyrite accompanies some pyrrhotite.

ADL 36310 : quartz-garnet-biotite-sillimanite schist, with minor retrograde sericite and chlorite; irregular layers and aggregates of coarse pyrite, pyrrhotite, minor graphite trace chalcopyrite

This rock contains pyrite-rich aggregates, and irregular lenses over 20 mm wide, and pyrrhotite-rich layers to over 16 mm, enclosing weathered and partly altered, loosely aggregated sillimanite grains and partly altered biotite.

Lenses of garnet to 20 x 5 mm, contain pyrrhotite, and accessory ilmenite, graphite, rutile, chalcopyrite, quartz, sillimanite and biotite. The rest of the rock consists of irregular lenses of prismatic and fibrolitic sillimanite to 5 mm across, and biotite-quartz lenses to 3 mm, enclosing trace to accessory amounts of the other minerals listed above.

The most concentrated pyrite aggregate encloses a lens of coarse graphite 3 mm x 7 mm.

Most domains in the rock, apart from the pyrite aggregate, have a common orientation and elongation which is tightly folded, and this elongation is followed by the graphite and ilmenite crystals.

Amont the sulphides, pyrrhotite is dominant over pyrite, and there is only accessory chalcopyrite.

ADL 36311 : layered, biotite garnet quartzite with minor sillimanite and alkali felspar; accessory fine pyrrhotite disseminated and layered throughout

This rock is a fairly homogeneous, fine to medium grained garnet quartzite, but it has a layer some 20 mm thick containing about 15 - 20% alkali felspar.

The garnet quartzite contains 20 - 25% garnet grains from 0.5 to 4 mm, and quartz grains to 4 mm. A schistosity is defined by 5% biotite flakes and 3% ilmenite laths. The coarsest garnet grains are concentrated into a layer some 5 mm wide, parallel to the schistosity.

The alkali felspar grains are about 0.5 - 1 mm across and anhedral.

There is a moderate preferred orientation of the quartz, with the C-axes at a high angle to the schistosity.

ADL 36312 : sillimanite-garnet-biotite schistose gneiss with abundant chlorite, coarse pyrite, minor pyrrhotite

This rock is highly heterogeneous, with contorted aggregates, lenses and layers of garnet, biotite or sulphide 5 to 20 mm long, and smaller layers of sillimanite. The thin section was cut largely parallel to the schistosity and most of the biotite flakes are seen as basal sections.

The sillimanite is partly seen in end section, and partly in transverse section.

The garnet grains are up to 4 mm across and fractured and veined by chlorite. Chlorite is abundant adjacent to the sulphide lenses, and replaces biotite and sillimanite, and possibly other minerals not preserved elsewhere in the section.

Lenses of quartz on one end of the section are probably quartz veins of metamorphic origin.

Pyrite is by far the most abundant sulphide, as coarse (2 - 5 mm) coalescing grains, but a small lens of pyrrhotite occurs locally, including accessory fine chalcopyrite. Rutile is present in minor to accessory amounts.

ADL 36313 : altered biotite-garnet-quartz schistose fine gneiss, with parallel sericite-clay veins, and scattered pyrite

This rock consisted essentially of a layered schistose granuloblastic aggregate of about 15% biotite, 25% garnet, 5% pyrite, and 55% quartz. The biotite is now completely replaced by limonite-stained chloritic clay.

The average grain size is 0.5 - 2 mm and there is a strong schistosity, paralleled by layers of pyrite. Some of the pyrite occurs as thin lenticular veins.

Veins paralleling this schistosity occur at 5 - 10 mm spacings and consist of green, possibly phengitic micas (sericite), and oxidised limonite-stained clays, similar to those replacing the biotite.

ADL 36314 : biotite-sillimanite-garnet-quartz-plagioclase-alkali felspar schistose gneiss, with retrogressed cordierite, trace very fine pyrite

This rock can be described as a quartzofelspathic gneiss with biotite and minor aluminous silicates (garnet, sillimanite and retrogressed cordierite) . It has quite a good schistosity defined by biotite flakes and, locally, by sillimanite prisms.

Poikiloblasts of garnet to 5 mm across are scattered more or less randomly through the rock, and locally enclose trace very fine pyrite. Retrogressed cordierite is also randomly scattered and locally is present with dactylic inclusions of quartz, giving a myrmekite-like texture. There are also very few true (quartz-plagioclase) myrmekites. The quartz and felspars are granular with grains to 5 mm across. Alkali felspar makes up about 10% and plagioclase 25% of the rock.

APPENDIX 3

Rb-Sr Dating of Core from PB1

The Australian
Mineral Development
Laboratories

Flemington Street, Frewville,
South Australia 5063
Phone Adelaide 79 1662
Telex AA 82520

Please address all
correspondence to
P.O. Box 114 Eastwood
SA 5063
In reply quote:

amdel

0065

3 February, 1982

GS3/4/2/0

The Broken Hill Proprietary Company Limited,
41-47 Currie Street,
ADELAIDE, SA 5000

Attention: Mr M. Page

REPORT GS 2535/82

YOUR REFERENCE:	Order No. AE1244
MATERIAL:	2 Drill cores
LOCALITY:	Coober Pedy area
IDENTIFICATION:	ADL36264-5
DATE RECEIVED:	5 November, 1981
WORK REQUIRED:	Rb-Sr dating

Investigation and Report by: Dr Alan Webb

Chief - Geological Services Section: Dr Keith J. Henley
Manager, Mineral and Materials Sciences Division: Dr William G. Spencer

Keith Henley

for Norton Jackson
Managing Director

mhb/2

Pilot Plant: Osman Place
Thebarton S.A.,
Telephone 43 8053
Branch Laboratories:
Perth W.A.
Telephone 325 7311
Melbourne Vic.
Telephone 645 3093

0066

AMOCO MINERALS AUSTRALIA COMPANY

EXPLORATION LICENCE 1021

REPORT FOR FIRST AND SECOND QUARTERS, ENDING FEBRUARY 3rd, 1982

INTRODUCTION.

Exploration Licence 1021 covers the same ground as former E.L. 633. Exploration comprising airborne and ground geophysics and diamond drilling, was carried out on E.L. 633, initially by Amoco and then an Amoco-BHP Minerals Pty Ltd partnership.

Two 1981 diamond drill holes, PB I and PB 2, drilled to test very high amplitude magnetic and gravity anomaly enhancement of a linear trend in the northern part of E.L. 633, located silicate-carbonate-sulphide assemblages, with low-order anomalous gold and base metal values, near the base of an oxide facies banded iron formation. The BIF, of probable Lower Proterozoic age, is covered by plus 150 metres of Mesozoic sediments. Drill holes PB I and 2 were 8.5 km apart and it is proposed to test, an anomaly with moderate amplitude gravity and magnetic anomalies about halfway along strike between these holes, in 1983.The target is a thick sulphide facies BIF.

BHP have elected not to contribute to this work and their interest will be progressively diluted from 50%.

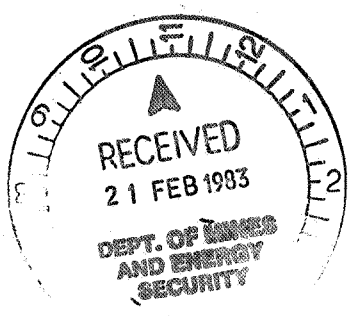
EXPLORATION.

The only work completed in the first two quarters was some geochemistry, additional to that carried out by BHP (as project managers). The Specific aim was to test for indications of tungsten mineralization in the silicate-carbonate-sulphide zones near the base of the BIF.

Analyses (X.R.F.) do show above-background tungsten values, to a maximum of 410 PPM. (see Appendix I). The material analysed comprised pulps of BHP'S initial fillet samples. Contamination from the filleting blade is a possibility.

EXPENDITURE.

Salaries		180
Assays		501
Annual rental in advance		996
Overheads/administration		160
Total	$	1837



FUTURE WORK.

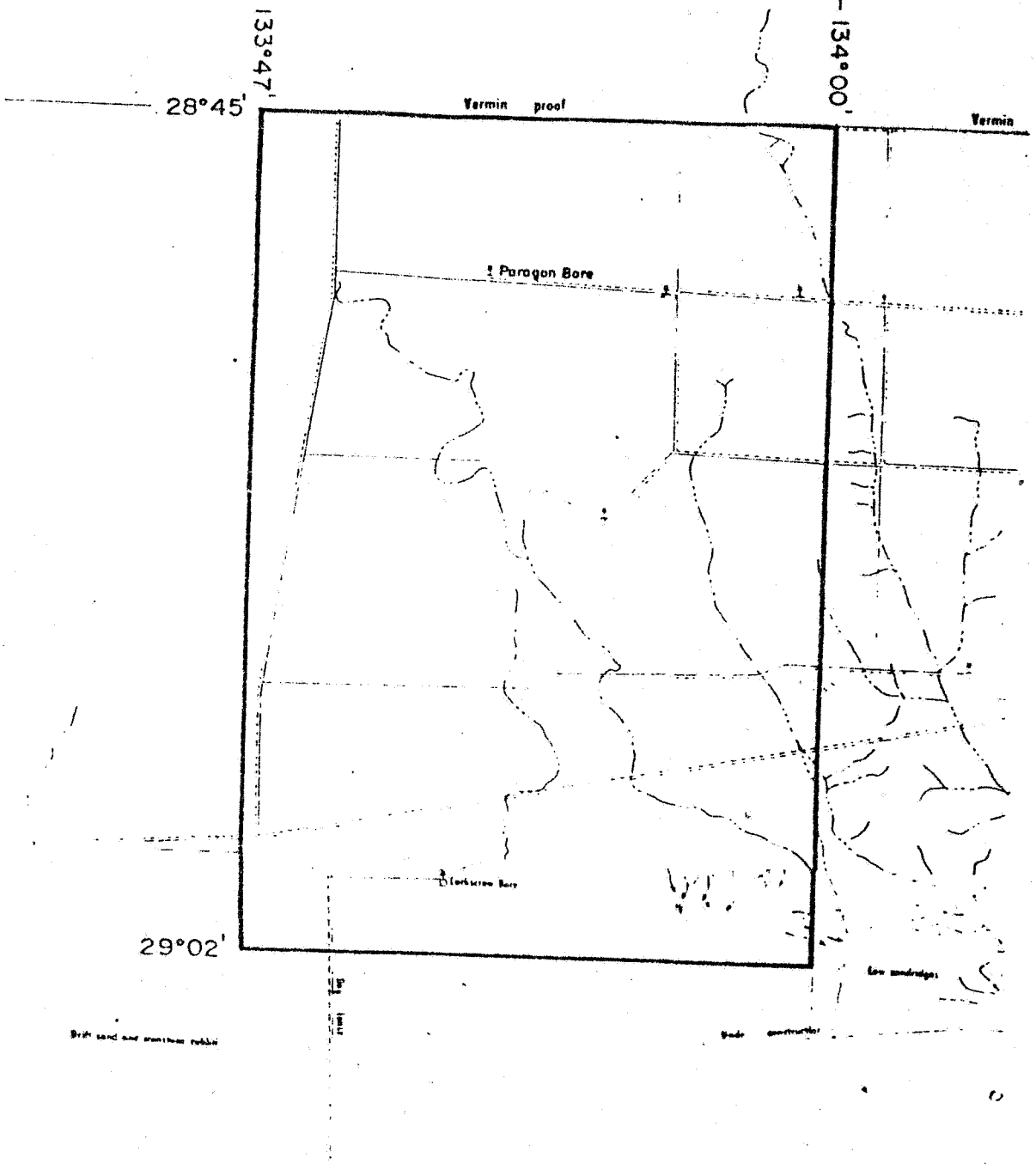
Immediate future work involves sampling split core from the zone indicated to be anomalous in tungsten.

Graham Miller
Senior Geologist

February 17th, 1983.

Attachment: geochemical analyses

0068



SCALE 1:250,000

KILOMETRES 5 0 5 10 15 20 25 KILOMETRES

EXPLORATION LICENCE No. ~~633~~ 1021

COMLABS Pty. Ltd.
COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

0069

JOB COM822562 O/N : W 17651

Results in ppm

	SAMPLE	U	As	Ba	Sn	Au
PBI 168-169m	ADL 36073	35	4	<10	<4	<0.05
169-170	ADL 36074	20	2	<10	<4	<0.05
170-171	ADL 36075	20	4	<10	<4	<0.05
171-172	ADL 36076	45	8	<10	<4	<0.05
172-173	ADL 36077	15	<2	<10	<4	<0.05
173-174	ADL 36078	15	<2	<10	<4	<0.05
PBI 310-311	ADL 36215	20	3	<10	<4	<0.05
311-312	ADL 36216	20	16	15	<4	<0.05
312-313	ADL 36217	65	14	<10	<4	<0.05
313-314	ADL 36218	20	3	20	<4	<0.05
314-315	ADL 36219	15	5	<10	8	<0.05
315-316	ADL 36220	<10	3	<10	6	<0.05
316-317	ADL 36221	10	3	<10	4	<0.05
317-318	ADL 36222	<10	<2	20	<4	<0.05
318-319	ADL 36223	<10	<2	<10	<4	<0.05
319-320	ADL 36224	<10	<2	<10	<4	<0.05
320-321	ADL 36225	<10	8	100	<4	<0.05
321-322	ADL 36226	10	7	165	<4	<0.05
322-323	ADL 36227	<10	3	<10	<4	<0.05
323-324	ADL 36228	<10	4	<10	<4	<0.05
324-325	ADL 36229	10	3	30	<4	<0.05
325-326	ADL 36230	10	5	320	12	<0.05
326-327	ADL 36231	<10	2	140	<4	<0.05
327-328	ADL 36232	<10	5	35	<4	<0.05
Dup 218-220	ADL 36233	10	<2	220	4	<0.05

ANALYTICAL REPORT

0070

JOB COM822562 O/N : W 17651

Results in ppm

	SAMPLE	W	As	Ba	Sn	Au
PB1 329-330	ADL 36234	25	<2	310	<4	<0.05
PB2. 356-358	ADL 36411	135	<2	140	<4	<0.05
358-360	ADL 36412	50	<2	80	<4	<0.05
360-362	ADL 36413	30	<2	140	<4	<0.05
362-364	ADL 36414	30	<2	175	6	<0.05
364-366	ADL 36415	125	3	65	<4	<0.05
366-368	ADL 36416	270	12	10	6	<0.05
368-370	ADL 36417	120	9	90	<4	<0.05
370-372	ADL 36418	140	<2	135	<4	<0.05
372-374	ADL 36419	210	<2	145	<4	<0.05
374-376	ADL 36420	240	<2	105	6	<0.05
376-378	ADL 36421	230	6	155	<4	<0.05
378-380	ADL 36422	80	40	180	<4	<0.05
380-382	ADL 36423	110	34	150	<4	<0.05
382-384	ADL 36424	100	12	80	<4	<0.05
384-386	ADL 36425	120	3	115	<4	<0.05
386-388	ADL 36426	100	<2	380	<4	<0.05
388-390	ADL 36427	410	<2	120	<4	<0.05
390-392	ADL 36428	155	<2	120	<4	<0.05
PB2 392-394	ADL 36429	165	<2	75	<4	<0.05

Method of Analysis : W As Ba Sn : XRF1
Au : AAS5A

BHP MINERALS LIMITED

AMOCO MINERALS AUSTRALIA

EXPLORATION LICENCE 633

PARAGON BORE, SOUTH AUSTRALIA

ANNUAL REPORT MAY 1982

M. PAGE

JUNE, 1982

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1. INTRODUCTION

Exploration Licence 633 lies in the Coober Pedy and Murloocoppie 1:250,000 sheet areas, the eastern boundary being some seventy kilometres west of Coober Pedy. (Figure 1) It comprises an area of flat to undulating sheep grazing land on Mabel Creek Station.

Outcrop is restricted to scattered patches of silcrete silicified Cretaceous siltstones and shales with sand dune cover becoming more prevalent in the west of the EL.

Interest in the area was generated when it was recognised that a broad gravity ridge, the Mabel Creek High, had with it associated magnetic complexes that gave an overall analogous geophysical setting to that known from the copper-uranium ore body at Olympic Dam. This project proposed to test areas of known gravity and magnetic anomalies with ground traversing and to follow-up the best targets with diamond drilling.

2. TITLES

Exploration Licence 633 was granted to Amoco Minerals on 26th May, 1980 for a one year period. This EL was subsequently renewed for a further one years tenancy. Amoco Minerals entered into a joint venture agreement with BHP Minerals over the area, with BHP Minerals acting as the managing partner.

The EL was renewed for a further one year period and expired on 26th May, ~~1983~~ 1982.

3. PREVIOUS EXPLORATION

Little exploration by other mining companies had been done in the vicinity of Exploration Licence 633 prior to the work of the Amoco/BHP Joint Venture. BP Minerals held several ELs to the north and northwest of EL 633 where they searched for coal in the Upper Permian Mount Toondina Formation. Several seams of coal were found but in general were found to occur on palaeohighs on the early Mesozoic weathering surface and were, as a consequence, discontinuous due to the strong dissection of the Mesozoic palaeosurface.

No other exploration for base metal deposits in the "basement" sequence had been done prior to the work of the Amoco/BHP Joint Venture.

4. EXPLORATION CARRIED OUT

Field work in EL 633 was in two major phases. As the target searched for was a geophysical one, the first phase of the exploration was to determine the areas of strongest magnetic and gravity response so that gridding on the ground would define drill targets.

An aeromagnetic survey in two areas of strong magnetic response depicted the local 1:250,000 aeromagnetic survey sheets, was conducted. The areas then considered to be of most interest were gridded, levelled and surveyed with gravity and ground magnetics to determine which, if any of the targets were to be tested with a drill hole.

The final phase, after the target selection, was to test the most interesting geophysical anomalies by drilling. A total of 4 holes were drilled in Exploration Licence 633, with three of the holes penetrating some depth into the "basement" sequence. These drill holes appeared to adequately explain the geophysical signatures obtained at the surface. A possible further target for base metals is the gravity high covered by grid line 388800E, where possible sulphide facies of BIF may cause the lack of appreciable magnetic response.

5. GEOLOGICAL SETTING

Exploration Licence 633 is situated entirely on the Mabel Creek gravity high, (Figure 2) an ENE trending structural province which forms a major gravity high to the NW of the Gawler Platform. The Mabel Creek High, consisting of Proterozoic or older metamorphic rocks is covered by a relatively thin cover of Permian and younger sediments (the Palaeozoic and Phanerozoic

sediments here are up to 200 metres thick, compared to a thickness of 470 metres from SADME stratigraphic hole Karkaro 1 from the Central Arckaringa Basin to the north and 330 metres thickness from SADME stratigraphic hole Wallira 2 from the Wallira Trough to the south).

The Mabel Creek High has associated with it various magnetic complexes, including several intense "bullseye" features which fall inside EL 633 (Figure 3). These were of particular interest for exploration for Olympic Dam style base metal deposits.

5.1 Stratigraphy

5.1.1 "Basement" sequence

This sequence was not seen in outcrops and before the exploration by the Joint Venture partners, the only information on the basement stratigraphy was from SADME stratigrpahic drill holes drilled as a part of synthesis on the geology of the Arckaringa Basin. Several holes penetrated through to the basement where they intersected granitic gneisses and granites subsequently dated to be at least 1,500 million years old (Webb, 1979).

The present phase of the exploration intersected basement consisting of at least 140 metres true thickness of folded banded iron formation overyling metamorphics with skarn-like affinities and thicknesses of garnetiferous granulites and gneisses and minor amphibolite. Age datings on feldspathic gneisses from drill hole PB1 deduced these rocks to be at least 2,650 million years old (Appendix 2E). Petrological studies from selected samples from drill hole PB2 noted similarities between the "basement" sequence and the Mount Shannon Iron Formation and Mangalo Schist of the Eyre Peninsula region (See Appendix 3D)

5.1.2 Permian

a) Boorthanna Formation (Plb)

The lowest-most Permian unit which consists of basal boulder conglomerate beds with clasts of the underlying gneissic and granulitic material in a groundmass of quartz-rich arenites. Other sub-units within the Boorthanna Formation include bands of sand, silt, shale, clay and dolomite.

b) Stuart Range Formation (Pls)

This is a grey to black sticky clay and shale with only very minor amounts of silt and sand, suggesting much quieter marine conditions existed than during the time of deposition of the Boorthanna Formation arenites and rudites.

c) Mount Toondina Formation (Plt)

Although not intersected in the drill holes in EL 633, this is a significant unit as in adjacent areas coal has been found in the upper part of this unit. The lower section includes sandstones, siltstones and some shales, while the upper unit includes shales and silstones and characteristically coals and carbonaceous shales.

5.1.3 Cretaceous

a) Cadna-owie Formation (Klc)

This is a coarse to medium-grained loosely packed and poorly consolidated quartz sandstone unit with a finer grained upper sandstone-siltstone unit. This unit is the local source for stock bore-water.

b) Bulldog Shale (Kmb)

The uppermost Cretaceous unit, the Bulldog Shale consists of soft slightly gritty siltstones and dominantly shales which have become silicified in places (notably around Coober Pedy where discontinuous lenses of precious and non-precious opal are found).

5.1.4 Recent

Thin development of red-brown clays and silts with pebbles of silcrete are the main recent lithology. Towards the west of the EL, east-west trending longitudinal sand dunes up to 5 metres high become common.

6. EXPLORATION PROGRAMME

6.1 Aeromagnetic Survey

A 964 line kilometre low level airborne magnetic and radiometric survey (90 metre sensor height with north-south flight lines 400 metres apart) was carried out by Geoex Pty.Ltd. of Adelaide.

This survey was designed to cover two belts of strong magnetic character within EL 633 as found on the Murloocoppie 1:250 000 aeromagnetic sheet, and give some indication of the continuity and style of magnetic response.

As can be seen from the results of the aeromagnetic survey (Figure 4), the anomalous zone from the northern survey is very strong (up to 15,000 gammas in the strongest portion) while the most intense area from the southern block is up to 5,000 gammas. One notable feature discernable from this survey is the apparent linearity within these strongly magnetic zones. In particular the eastern end of the northern magnetic block possibly represents a folded originally tabular magnetic source.

6.2 Geophysical Gridding

Gridding, levelling and gravity/magnetometer surveying of five discrete aeromagnetic anomalies for a total of 103 line kilometres was done in Exploration Licence 633 (Figure 5). Stations were pegged at 100 metre intervals and levelled with a dumpy level and staff. Distances were measured by tape.

Gravity readings were taken at every 100 metre stations using a LaCoste and Romberg gravity metre and magnetometer readings every 25 metres using a Unimag to give the results recorded in Figures 6 and 7.

In general the anomalies tested were found to have substantial coincident magnetic and gravity responses, although Anomaly 2 consisted of twin magnetic peaks with an intermediate gravity high.

6.3 Drilling

Exploration in EL 633 was for an Olympic Dam style of basemetal deposit, (a deposit with a coincident gravity/magnetic signature) so the geophysical gridding indicated there were several possible targets within the EL.

Three holes were drilled into coincident or near-coincident gravity) magnetic anomalies and an further hole was drilled into a central gravity high without an associated magnetic high to test the basement geology. A total of 602 metres of rotary and 597 metres of diamond drilling were done in the EL.

6.3.1 DDH PB1 (356.2m)

Diamond drill hole PB1 was sited on the strongest coincident gravity and magnetic anomaly, Anomaly 1, which had peak responses for gravity and magnetics of 11 milligals and 17,000 gammas respectively (Appendix 1)

This drill hole passed through 152 metres of Permian and younger sediments before passing through basement metamorphics until the hole was terminated at 356.2 metres (Appendix 2A). The "basement" sequence consisted of a thick sequence of banded iron formation from 152-317 metres, dipping on average at 45^{o} to give an estimated minimum true thickness of BIF of 120 metres. The BIF was composed almost entirely of quartz and magnetite, some hematite and very minor pyroxene, amphibole chlorite and pyrite. There is little evidence to suggest whether the BIF has a sedimentary or volcanic origin.

Iron oxide content in the sequence is mainly between 15-30%.

The sulphides within the banded iron formation were low in basement values.

Below the banded iron formation from 317-329 metres were a sequence of rocks described by Central Mineralogical Services as having skarn-like affinities (Appendix 2D). These lithologies included pyrrhotite mafics, sphaleritic calc-silicate, skarns and marbles. By 329 metres, the sequence passed into feldspathic garnet gneisses with amphibolite bands, which the above-mentioned CMS report believed were significantly different in metamorphic style to the overlying skarns and consequently of possibly different age.

Two samples (one from the banded iron formation; the other from the feldspathic gneiss) were submitted to AMDEL for Rb-Sr geochronology. Only the feldspathic gneiss was considered suitable for dating as the quantities Rb and Sr in the BIF were too low for the technique to be used. A possible range of ages for the feldspathic gneiss was 2650-3310 million years (Appendix 2E).

6.3.2 DDH PB2 (437m)

After the first drill hole failed to intersect lithologies similar to those from the Olympic Dam area, it was decided that diamond drill hole PB2 should be sited on the gravity high between the twin magnetic peaks of Anomaly 2. It was hoped that this drill hole would not go through a large thickness of banded iron formation but another dense source material. The gravity response from Anomaly 2 was 8 milligals, while the magnetic peaks were about 14,000 gammas (Appendix 1). (It was believed that the lack of coincidence of the magnetic peaks with the gravity peak may have indicated the presence of a folded structure, the magnetic peaks representing the BIF flanks and the central gravity high dense overlying or underlying, possibly sulphidic material).

This hole passed through 176 metres of Permian and younger sediments before passing into basement metamorphics until 437 metres where the hole was terminated. The metamorphic sequence consisted of another thick unit of banded iron formation from 176-334 metres. dipping on average at 30^{o} to give an estimated true thickness of BIF of at least 140 metres. Again the BIF was dominantly quartz and magnetite, but with some hematite and certainly with more of the minor minerals such as anthophyllite (in places with talc pseudomorphing after it), hypersthene and some sulphides (pyrite and pyrrhotite). Again total iron content was of the order of 15-30% (Appendix 3A).

Underlying the banded iron formation, from 334-349 metres was a transitional zone with decreasing amounts of banded iron and increasing amounts of orthopyroxene (hypersthene), minor clinopyroxene, anthophyllite, actinolite and garnet. Graphite was also a common accessory mineral. After the unit medium-grained garnetiferous granulite was the dominant lithotype until about 364 metres where biotite content increases to about 15% and consequently the rock texture becomes more schistose or gneissic. Several sulphide

bands were found between 364-395 metres where coarse banded pyrrhotite is overgrown and cross cut by coarse euhedral pyrite. Only trace chalcopyrite was found in these sulphide bands. Below 395 metres the lithology is mainly garnetiferous gneiss with trace finely disseminated pyrite (Appendix 3c).

There is some overall similarity between the basement sequences intersected in PB1 and PB2. The banded-iron formation in each hole is reasonably similar, both being gnerally fine to medium-grained, well-banded and largely of a simple mineralogy. The basal member of each BIF sequence is very similar, being a coarse-grained glassy quartzite with blebs and stringers of remobilised sulphides. Beneath this is a unit characteristically with Fe and Mg silicates and carbonates. The lower most sequences in each hole consist of regional, medium-grade lithologies, dominantly garnetiferous and feldspathic gneisses and granulites.

6.3.3 DDH PB3 (287m)

Diamond drill hole PB3 was sited near the centre of a broad gravity high in the middle of Exploration Licence 633, to test the "background basement lithologies". There was no associated magnetic high with the gravity peak. This hole passed through 187.25 metres of flat-lying sedimentary rocks before hitting basement. The sequence included highly folded coarse feldspathic garnetiferous granulites and gneisses, with minor amphibolite bands. No sulphide mineralisation was intersected (Appendix 4A).

This sequence would appear to be much older than the banded iron formation of PB1 and PB2 and probably of similar age to the amphibolite-facies metamorphics found in the lower parts of the earlier drill holes.

6.3.4 RDH PB4 (118.4m)

This rotary precollar was drilled over a moderately intense coincident gravity/magnetic anomaly in the area of the southern aeromagnetic survey. The gravity peak was about 5 milligals, with a 7,000 gamma magnetic peak.

The hole hit basement at 118 metres and intersected what appears to be glassy quartzite with minor quantities of magnetite (again probably a BIF). Due to the distinct lack of success in finding basemetals in banded-iron formation in the north of the EL, this hole was not continued at depth into the basement by diamond drilling (Appendix 4A).

6.4 Geochemical Analysis

Complete sets of samples were taken for the basement rocks from each of drill hole PB1 and PB2, wi h analysis of Cu, Pb, Zn and Ag done on all samples and many other elements tested on selected pieces of quarter core. Core from PB1 was sampled as well by using a core grinder to give 1 metre samples to test the background values of Cu, Pb, Zn, Ag and some Au in the various lithotypes. Analytical data for PB1 is recorded in Appendix 2B and 2C).

Core from PB2 was also sampled in total by grading to give 2 metre samples. These were also analysed for Cu, Pb, Zn, Ag and every tenth sample for Au. (Appendix 3B and 3C).

Only randomly selected pieces of quarter-core from PB3 were sampled and these were all analysed for Cu, Pb, Zn, Ag, Mn, Au and Ba. (Appendix 4B and 4C).

In general, analytical values and standard deviations for anomalous samples have been determined for the samples obtained by grading the core for both PB1 and PB2. As can be seen, threshold values for each of Cu, Pb and Zn is low, and notably lower in the BIF sequences than in the basement gneisses and granulites (Appendix 5). Several anomalous samples were naturally found but no major trend can be determined between lithotypes and sample analysis values, other than that basemetals values were slightly elevated in sulphide bands.

6.5 Geophysical Modelling

Some two-dimensional modelling of the ground geophysical data in conjunction with known densities and magnetic susceptibilities intersected drill core was attempted for Anomaly 1, to determine whether the lithologies drilled could explain adequately the large geophysical anomalies in the area.

The modelling did not provide any unique or absolute solutions entirely compatible with the results from drilling, however, it appears likely that the magnetite banded-iron formations were responsible for both the gravity and magnetic anomalism within EL 633. Possible demagnetisation or loss of remanence (this may explain the lack of magnetic peak with the gravity peak at PB2) complicates the interpretation of the distribution, shape and likely dip direction of the banded-iron formation.

The causative body appeared to be a tabular structure some 500m thick with subcrop topography raised to a depth of 250m and with a further three ridges striking approximately east west; the upper ridges have a maximum elevation of the order of 150-200 metres below the present surface and widths possibly of the order of 200m. Such a

configuration could feasibly be due to a strongly folded dense BIF sequence in a sequence of reasonably dense metamorphics (the garnetiferous gneiss from 360m depth in PB2 had a density of approximatley 3.6 g/cm^3), the BIF folds causing the above-mentioned strike ridges (Appendix 7).

6.6 Banded Iron Formation Investigation

The banded-iron formation intersected in diamond drill holes PB1 and PB2 appeared to be a possible resource of iron ore and consequently three selected samples of the BIF were sent to BHPs Whyalla steel plant for beneficiation testing. The report on this work is included in Appendix 8.

The chemical testing demonstrated that for PB1 there existed an upper and lower magnetite - BIF (i.e. samples ADL 36264 and 36266) with an intervening hematite - BIF (i.e. sample ADL 36265). Total iron values for the three samples from PB1 and also the above samples from PB2 gave values of about 30% Fe. This compares with average grades of 60+% Fe for operating mines in the Middleback Ranges near Whyalla. However, the samples tested from PB1 were very easily beneficiable to give high grade concentrates from all three samples, with high recovery of the magnetite present. The magnetite concentrate was considered to be suitable for pelleting and have possible application as a dense medium, as in coal washing. (Appendix 8).

Several problems exist in consideration of the banded-iron formation as a possible iron ore source. The depth of at least 150 metres to BIF in the northern anomalous block, and 118 metres to probable, but as yet unproved BIF in the southern anomalous block, provides a major obstacle in any future development of the area. Also, the much lower grades than operating mines in the Middlebacks (30% c.f. 60+%) is another major problem, in spite of the simplicity of beneficiation of iron from the Paragon Bore BIFs.

These problems indicate that the banded-iron formations from Paragon Bore are not a viable exploration target at present, but a further indication that a large iron formation province occurs in South Australia.

7. CONCLUSIONS

Exploration in EL 633 failed to find significant basemetal concentrations in the basement sequence. Large coincident or near-coincident gravity/magnetic anomalies in the area appear to be due to a sequence of folded banded-iron formations, of at least Proterozoic age, unconformably overlain by Permian and younger sedimentary rocks.

The banded-iron formation is a significant deposit, as it is at least 140 metres true thickness, and was found in two discrete drill holes, 9 kilometres apart. Percentage Fe in the banded-iron from the two holes is approximately 30%. Beneficiation of the iron from the BIF is simple by wet magnetic separation to give high grade concentrates for high recoveries of magnetite present. However, the banded iron formation is at least 150 metres deep and at present would seem to be of little interest as a future potential resource because of this and a combination of other factors.

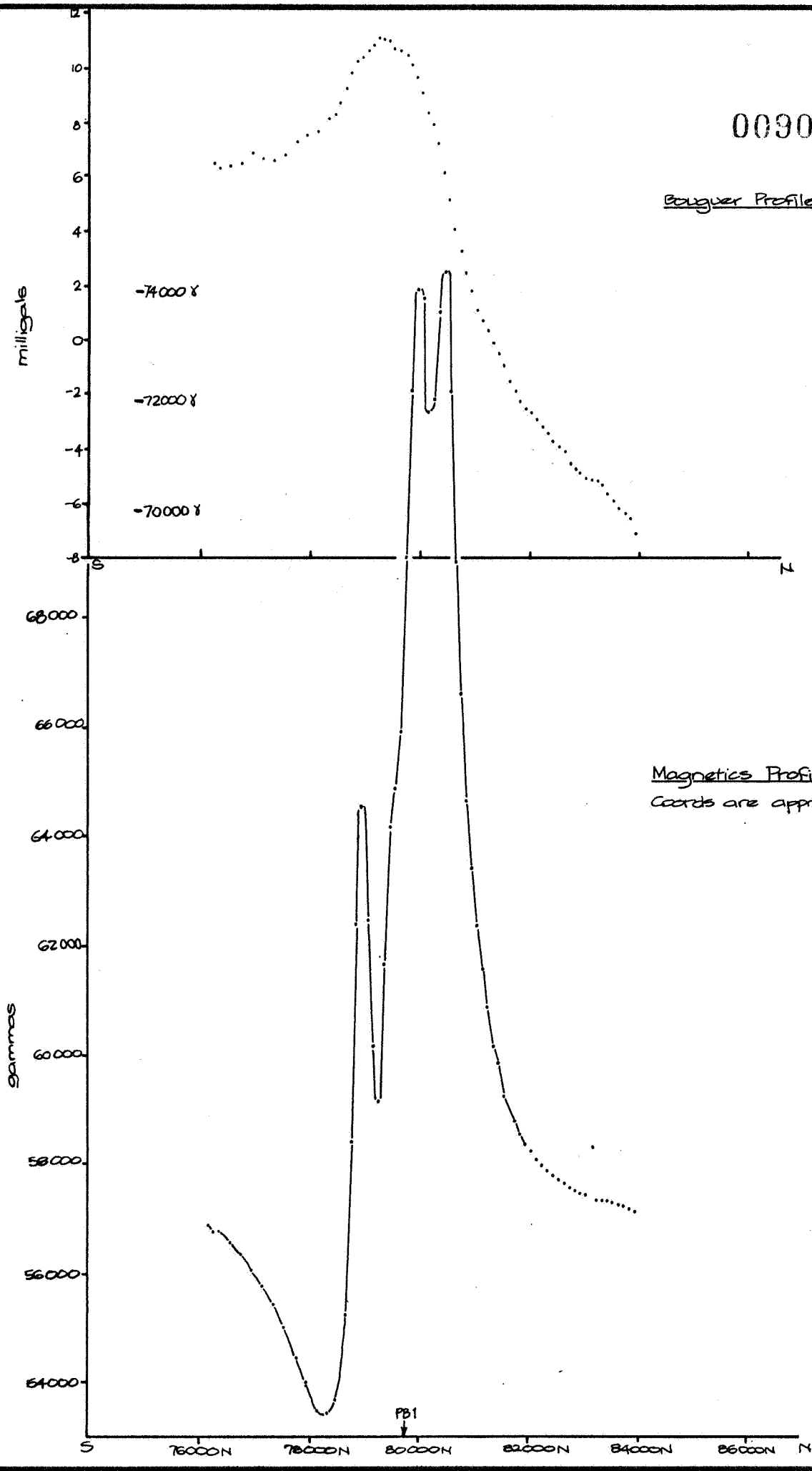
The main target for further exploration is in the vicinity of grid line 388800E where a gravity high with only minor coincident magnetic anomaly may represent a lateral change from banded iron to sulphide facies jaspilitic formations as in a Gamsberg-style deposit.

APPENDIX 1

PROFILE COMPARISONS FOR MAGENTICS AND GRAVITY

THROUGH PB1, PB2 AND LINE 388800E

0090



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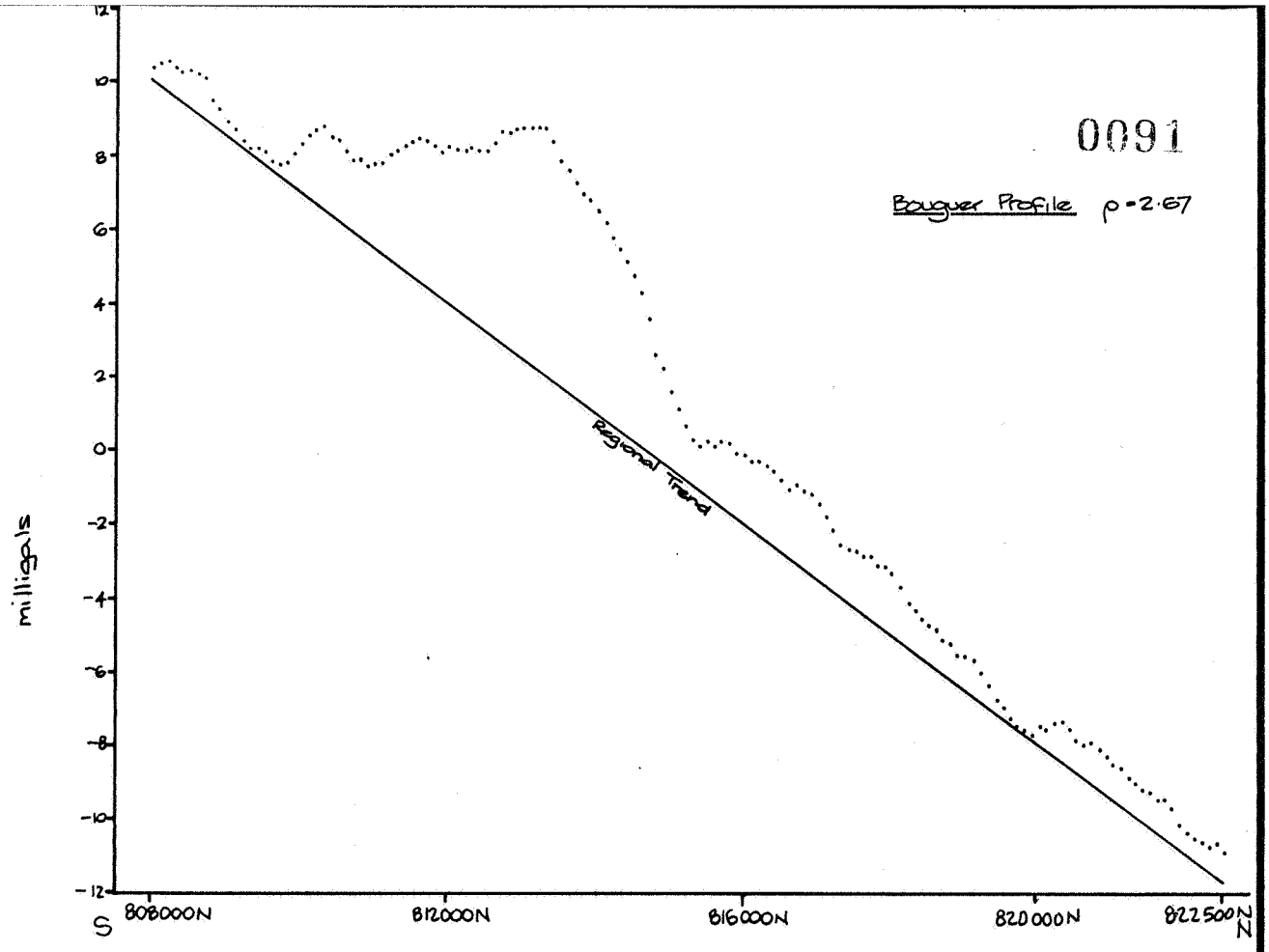
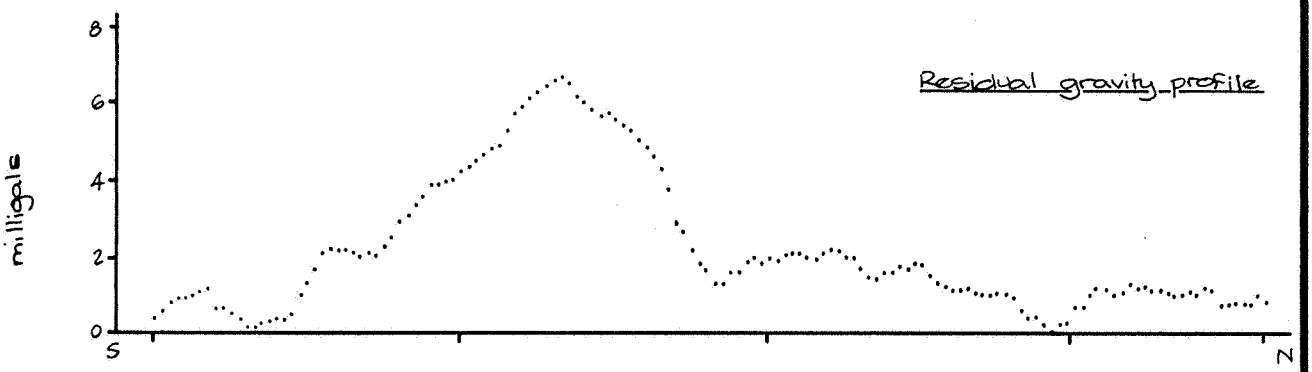
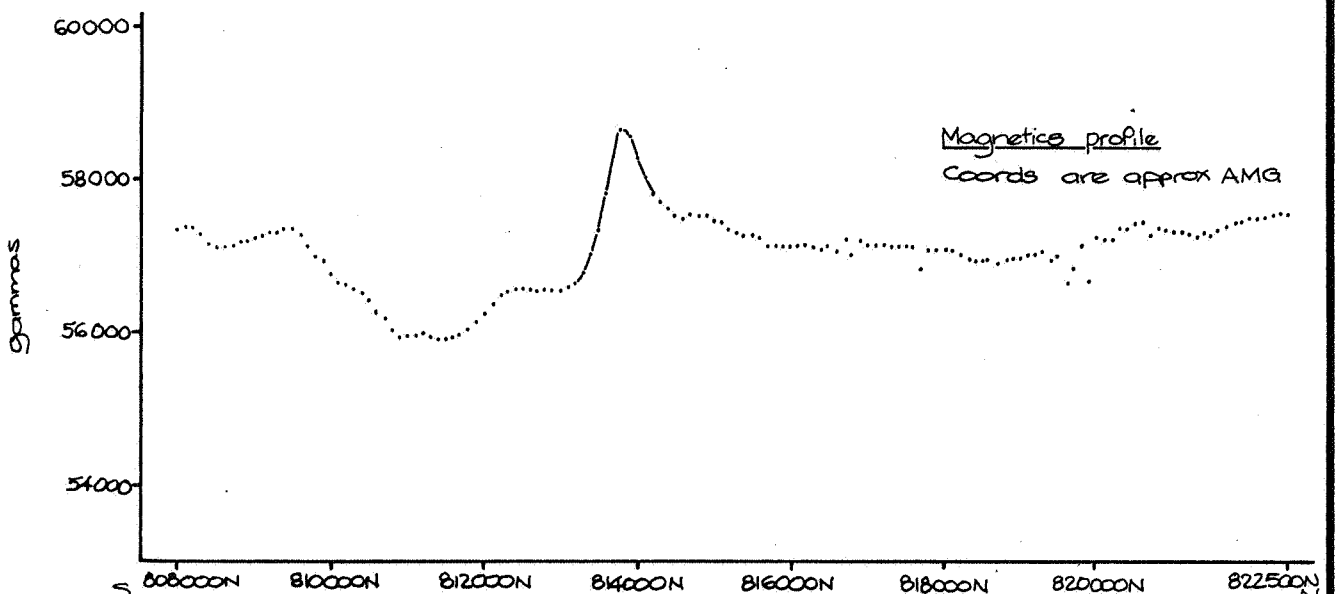
Date: 20-4-82		Drawing No.: A4-186

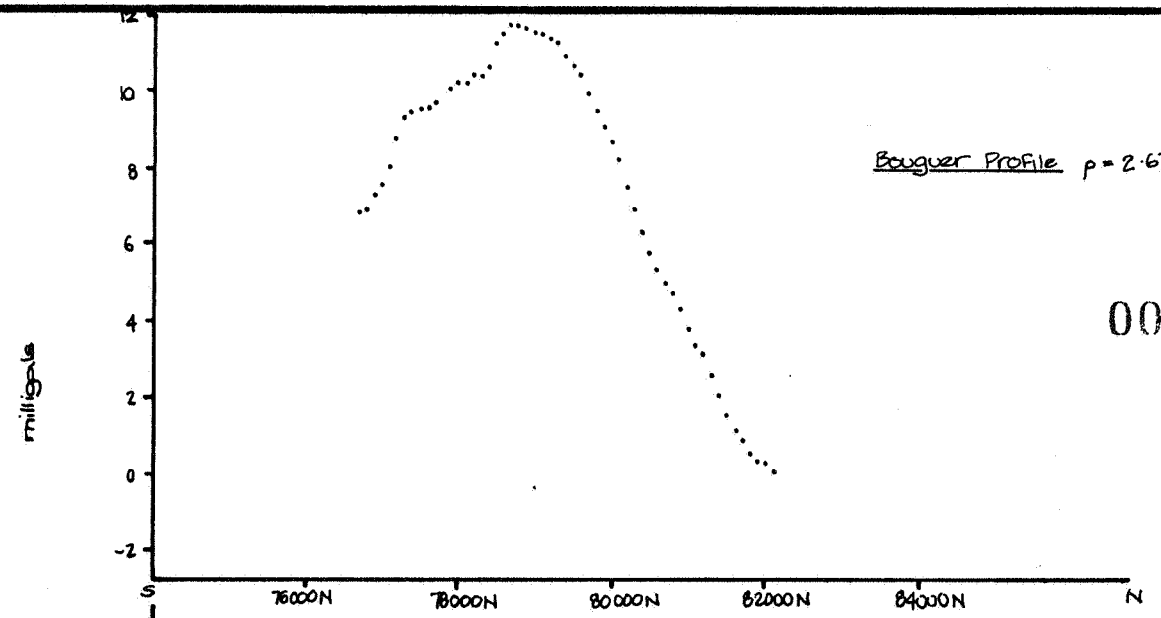
0091







Centre Adelaide	THE BROKEN HILL PROPRIETARY CO. LTD. E.L. 633 PARAGON BORE, E.L. BIG TALLARINGA WELL, S.A. MAGNETICS AND GRAVITY PROFILES LINE 388 800 E	Project No. 6-8670-25
Date 20-4-82		Drawing No. A4-187



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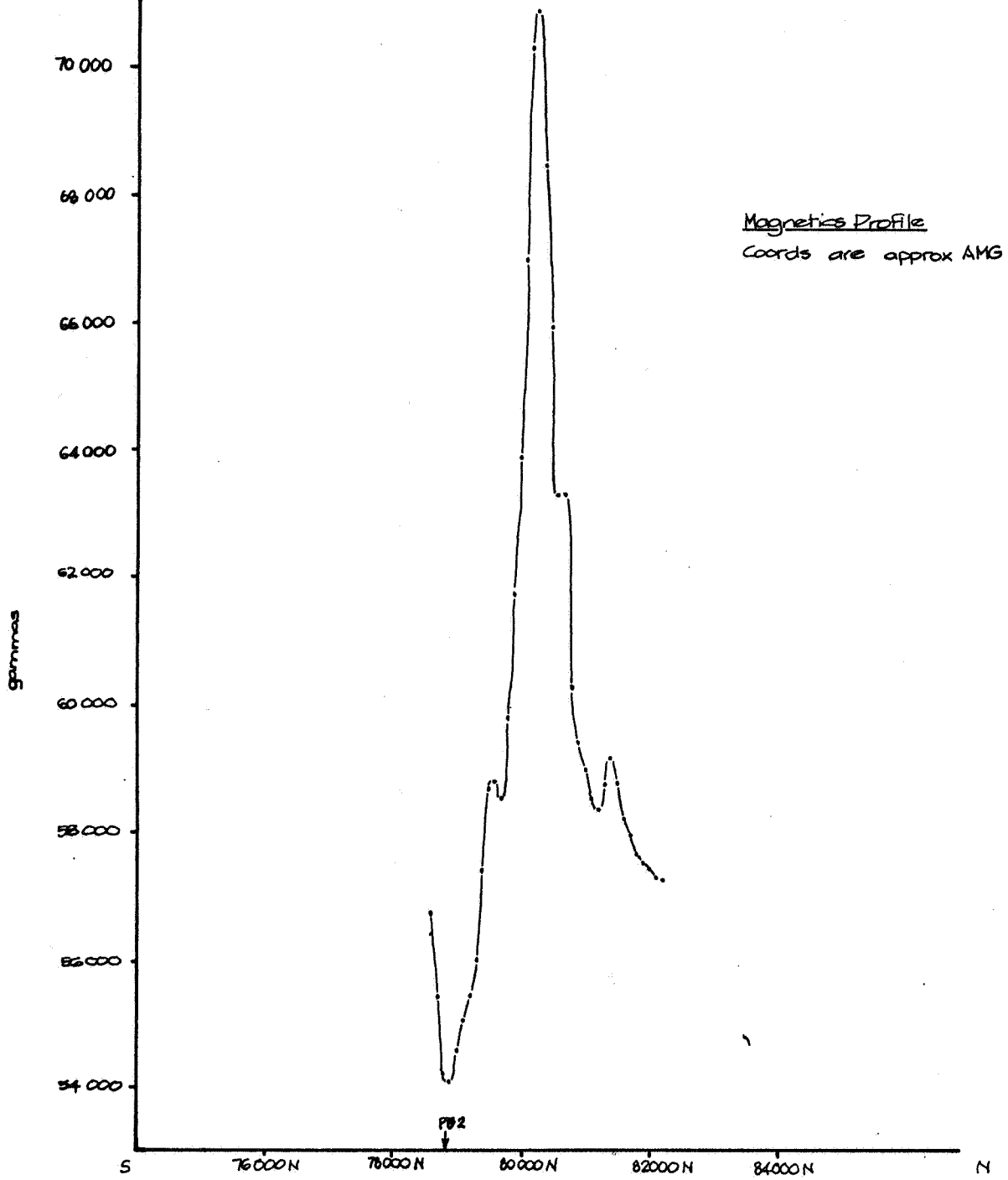


Centre Adelaide	THE BROKEN HILL PROPRIETARY CO. LTD. E.L.633 PARAGON BORE, E.L.816 TALLARINGA WELL, S.A. MAGNETICS AND GRAVITY PROFILES LINE 85300E	Project No. G-8658-26
Date 20-4-82		Drawing No. A4-188

APPENDIX 2

DIAMOND DRILL HOLE PB1

A. Summary and Detailed Logs

B. Geochemical Sample Data

C. Geochemical Analyses

D. Petrology

E. Geochronology

DETAILED GEOLOGICAL HOLE LOG

0094

THE BROKEN HILL PTY CO LTD. · PROJECT E.L. 633 PARAGON BORE DRILL HOLE PB1

Location or local co-ordinates 79750N 93500E (NE Anomaly) R.L. Collar (Datum) 216metres

Map Reference Murloocoppie SH53-2 Co-ordinates (Grid) 812950N 393850E

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar	Aust. Diamond	I. Pringle	Foxmobile	Rock Roller		152.5m	6/8-9/8/81
Main Hole	Drilling P/L	"	"	Diamond		356.2m	10/8-5/9/81

GN MN Magnetic Declination

Depth	Decl'n	Brg (Mag)	Hole dia.	From	To
	Vertical		HQ	0	152.5m
			NQ	152.5	356.2
			BQ	273.0	274.6

Casing HQ casing cut twice; 81 metres could not be removed

Static water level 87m Date

Logged by M. Page Date 4.9.81

Remarks

From	To	Interval	Recovery	% Rec.	GEOLOGICAL DESCRIPTION	Remarks
0	5	5m	chips		Red-brown gravel and sand; clayey in part	RECENT
5	24	19	"		White & yellow alunitic clay with abundant quartz grit & angular limonitic clasts.	
24	30	6	"		Very fine, pink brown & lilac clay with some grit; very soft to touch and when squeezed gives off lots of water	CRETACEOUS (Bulldog Shale)
30	40	10	"		White & yellow plastic clay with minor grit which forms small clay balls.	
40	50	10	"		More plastic clay which forms large sticky lumps that clog up the rock roller bit. Yellow & grey in colour.	
50	58	8	"		Plastic clay is now becoming quite black with increasing grit content; grit is fine to medium sand.	
58	70	12	"		Fine grey-yellow-brown silt & sand grains; loosely-packed.	
70	84	14	"		Coarser, more competent sand to fine grave; grains up to 2mm across.	CRETACEOUS (Cadna-owie FM)
84	90	6	"		Finer grey sandstone, as seen from 58-70m	
90	104	14	"		Coarse, loose sand with minor white clay flakes; grains sub-rounded to angular & dominantly from 0.5 to 3mm.	

SYMBOLS AND ABBREVIATIONS

DETAILED GEOLOGICAL HOLE LOG

THE BROKEN HILL PTY CO LTD. PROJECT E.L. 633 PARAGON BORE DRILL HOLE PB1 0095

Location or local co-ordinates _____ R.L. Collar (Datum) _____

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							

GN MN Magnetic Declination

Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks 100% unless stated otherwise

From	To	Interval	Recovery	%Rec.	GEOLOGICAL DESCRIPTION	Remarks
04	110	6	chips		Sand now very fine grained to silty and has a black clayey matrix.	PERMIAN (Stuart Range Formation)
110	122	12	"		Fine sand with increasing amount of sticky grey and soft yellow clay.	
122	152	30	"		Dominantly sticky grey clay & soft yellow clay with minor amounts of fine grit.	
52	176.9	24.4	24.4	100%	10-15% magnetite in a banded to poorly-banded BIF with abundant coarse patches of magnetite	Precambrian
176.9	179.3	2.4	2.4		White welded translucent quartzite with very little bedded magnetitie, but coarse patches of same at 177.6 and 178.65m.	
179.3	187.1	7.8	7.8		BIF with many soft-sediment movement textures present, especially between 179.25-180.55m and 186.20-187.15m. Here have 40% magnetite as very fine grains (much finer than anywhere else in the core) with well-developed slump structures (185.40m, 185.85m) and possible sand dykes (179.97m).	Pyrite in slumped material at 185.55m
187.10	203.8	16.7	16.7		BIF with from 15-30% magnetite; well-banded.	Very minor fracturing
203.8	217.0	13.2	13.2		Welded white quartzite with 5-10% magnetite in bands with some associated with chlorite (may be coarser remobilised magnetite along	

SYMBOLS AND ABBREVIATIONS

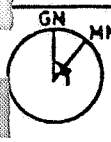
DETAILED GEOLOGICAL HOLE LOG

THE BROKEN HILL PTY CO LTD. · PROJECT E.L. 633 PARAGON BORE DRILL HOLE PB1

Location or local co-ordinates _____ R.L. Collar (Datum) 0096

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							



Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks _____

From	To	Interval	Recovery	%Rec.		GEOLOGICAL DESCRIPTION	Remarks
						chloritised fractures). Most of the bedding	
						has vanished due to metamorphism; bedding	
						only seen where magnetite present.	
17.0	222.5	5.50	5.50			Unit transitional between above and below	
						units; mainly a grey-white magnetitic	
						quartzite.	
222.5	245.9	23.4	23.4			Well-banded BIF starting at about 20%	
						magnetite content, but up to 30-40%	
						magnetite around 236.00m and back to 20%	
						magnetitie by 245.90m. The more magnetite	
						unit has quite discrete magnetite and	
						quartzite bands.	
245.90	248.10	2.20	2.20			Mostly white-grey quartzite with up to 10%	
						bands of magnetite, plus irregular coarse-	
						grained patches of magnetite (especially at	
						245.40m).	
248.10	249.48	1.38	1.38			Green chloritic rock with up to 50% mag-	
						netite and coarse patches of hematite (eg	
						249.34m). Carbonate veins common where	
						hematite abundant.	
249.48	257.75	7.27	7.27			Well-banded BIF, with quartzite as discrete	
						bands between the magnetite layers which	
						occupy 30-40% of the rock. Quartzite bands	
						slumped in part and possible cross-bedding	
						at 251.60m.	

SYMBOLS AND ABBREVIATIONS

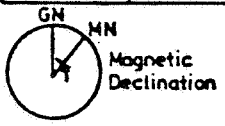
DETAILED GEOLOGICAL HOLE LOG

THE BROKEN HILL PTY CO LTD. · PROJECT E.L. 633 PARAGON BORE DRILL HOLE PB1

Location or local co-ordinates _____ R.L. Collar (Datum) _____

Map Reference _____ Co-ordinates (Grid) _____ 0097

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							



Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks _____

From	To	Interval	Recovery	%Rec.	GEOLOGICAL DESCRIPTION	Remarks
257.75	263.75	6.0	6.0		BIF but not as well-banded as above unit. Magnetite content is 25-30%; coarsely crystalline patch at 261.90m.	
263.75	281.05	17.3	16.9	95%	Grey BIF with 30-40% magnetite. The bands generally 1cm with distinct quartzite layers separating the magnetite bands. Bedded magnetite is medium to coarse grained. The quartzite bands are regular to lensoidal. Coarse recrystallised magnetite patches at 264.70m and 278.70m.	Tectonically brecciated & reconstituted BIF at 280.60m with green chlorite groundmass.
281.05	295.70	14.65	14.10	95%	White-grey BIF with magnetite content of 15-20% as mainly fine grains.	
295.70	299.65	3.95	3.75	95%	Transitional change from BIF to quartzite. Some fracturing, which has been rewelded, has displaced beds up to 2cm from original position.	
299.65	302.00	2.35	2.10	95%	White, welded, translucent quartzite with few traces of original bedding.	Minor fracturing.
302.00	310.00	8.00	8.00		White-grey magnetitic quartzite with the magnetite content of the BIF from 10-20%. Generally well-banded, however, has white welded quartzite bands with irregular coarse-grained magnetite patches (e.g. 305.10-305.42, 303.70-304.00m).	Minor sheared schistose material with chlorite & fine grey mica. (eg 306.46m, 303.20m)

SYMBOLS AND ABBREVIATIONS

DETAILED GEOLOGICAL HOLE LOG

THE BROKEN HILL PTY CO LTD. · PROJECT E.L. 633 PARAGON BORE DRILL HOLE PB1 0098

Location or local co-ordinates _____ R.L. Collar (Datum) _____

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							

GN MN Magnetic Declination

Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks _____

From	To	Interval	Recovery	%Rec.	GEOLOGICAL DESCRIPTION	Remarks
310.0	314.35	4.35	4.35		Massive, white, welded quartzite, with many small pits with a carbonate lining. Pyrite is common in this unit with a band of 80% pyrite from 311.67-311.97m and also at 312.35-312.36m. Less regular patches at 311.39m, 312.80m, 312.92m, 313.00m and 313.23m. (these are mainly vein-fill). With the pyrite from 311.67-311.97m find a soft, black mineral and also at 313.88-313.96m.	
314.35	317.35	3.00	3.00		BIF with up to 70% magnetite over a 10cm section but averagin about 20%. This decreases to 5% by 317.35m. Bladed crystals of amphibole in the magnetite-rich bands.	
317.35	318.15	0.80	0.75	95%	Mainly quartzite, with blebs of black to green subspherical to elongate amphibole and chlorite in fractures. Minor irregular patches of pyrite filling inter-grain spaces.	Very fractured at 317.45m.
318.15	320.50	2.35	2.15	95%	Carbonate consisting of white, calcite-rich, coarse, bladed, massive to poorly-bedded rock, with abundant black spheroids of magnetic black mineral. These spheroids become more abundant and by 320.10m is a black magnetite-rich carbonate in a black green dolomite. Pyrite in fractures and open pore space.	Stylolites & minor fracturing.
320.5	324.80	4.30	4.00	95%	Transition from above carbonate unit into soft pyrrhotitic & in part quartzitic unit.	10% pyrrhotite from

SYMBOLS AND ABBREVIATIONS

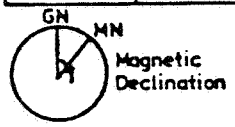
DETAILED GEOLOGICAL HOLE LOG

THE BROKEN HILL PTY CO LTD. · PROJECT E.L. 633 PARAGON BORE DRILL HOLE PB1

Location or local co-ordinates _____ R.L. Collar (Datum) 0099

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							



Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks _____

From	To	Interval	Recovery	%Rec.	GEOLOGICAL DESCRIPTION	Remarks
					Has abundant green-brown-black bladed crystals (possibly silicified carbonate) and where this is abundant have pyrrhotite to 10%. Also garnetiferous.	323.77–324.77m.
324.80	325.15	0.35	0.32	95%	Carbonate unit with abundant black magnetic spheroids.	
325.15	326.85	1.70	1.60	95%	Massively to poorly-bedded white-grey quartzite with intergrowths of pink garnet.	Talc along fractures.
326.85	328.46	1.61	1.45	90%	Carbonate unit with abundant black magnetic spheroids.	Has fine veinlets of ~~silvery mag~~ netic mineral esp. from 327.89–328.06
328.46	345.66	17.20	16.50	95%	Garnet gneiss, with the garnet in places totally silicified. Has interbands of black soft, micaceous, very fine-grained material with small (1mm) grains of either feldspar or garnet (especially at 335.15m). Also have red-orange hematitic-looking mineral along fractures. Pyrite also along fractures.	
345.66	347.10	0.44	0.40	95%	Highly chloritic rock which is quartzitic where fractured. Minor pyrite in fractures.	Becoming fractures by 347.10m.
347.10	347.84	0.74	0.74		Very hard siliceous rock with veins of red-orange hematite cross-cutting red-green garnet gneiss. This is calcite-veined in	

SYMBOLS AND ABBREVIATIONS

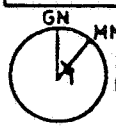
DETAILED GEOLOGICAL HOLE LOG

THE BROKEN HILL PTY CO LTD. · PROJECT E.L. 633 PARAGON BORE DRILL HOLE PB1

Location or local co-ordinates _____ R.L. Collar (Datum) 0100

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							



Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks _____

From	To	Interval	Recovery	%Rec.	GEOLOGICAL DESCRIPTION	Remarks
					places.	
347.84	348.45	0.61	0.61		Carbonate with black magnetic spheroids.	
348.45	356.2	7.75	7.75		White-grey garnet gneiss with garnet as spheroids up to 1cm across. Chloritic patches occur from 352.80-352.95m, 353.10-353.38m and 355.83-356.00m and also as scattered grains throughout the quartzite.	

SYMBOLS AND ABBREVIATIONS

Sample No.	Drill Hole	Depth(m)	Analysed For	Petrological Study
ADL 36001	PB1	169.60-169.89	Cu,Pb,Zn,Ag,%Fe,Au	C.M.S.
002		172.61-172.67		
003		174.93-175.08		
004		175.58-175.78		0101
005		177.55-177.67		
006		200.80-200.95		
007		233.55-233.70		
008		233.90-234.10		
009		234.20-234.30		
010		248.61-248.76		
011		280.50-280.65		
012		311.79-311.94		
013		320.56-320.67		
014		324.30-324.42		
015		324.80-324.94		
016		335.15-335.39		
017		350.00-350.25		
018		155.49-155.73	Cu,Pb,Zn,Ag,SiO_2,Al_2O_3,	
019		168.95-169.17	CaO,MgO,S,TiO ,V,Fe(acid	
020		185.83-186.08	sol+total)Ce,Ba,Sn,Mn,	
021		197.98-198.33	Au,P,F,Sr,Zr,Nb,U,Th,Y	
022		207.94-208.18		
023		224.02-224.33		
024		235.90-236.20		
025		269.80-270.10		
026		274.60-275.00		
027		289.60-290.05		
028		312.83-313.08		
029		315.55-315.92	Cu,Pb,Zn,Ag,Ce,Ba,Sn,	
030		318.88-319.01	Mn,Au,P,F,Sr,Zr,Nb,U,	
031		322.52-322.67	Th,Y	
032		327.93-328.09		
033		333.23-333.50		
034		344.50-344.79	Cu,Pb,Zn,Ag,Ce,Ba,Sn,	
035		345.88-346.20	Mn,Au,P,F,Sr,Zr,Nb,U,	
036		347.80-348.44	Th,Y	
037		351.22-351.55		
038		355.96-356.17		
039		312.25-312.50		
040		249.02-249.30		
041		324.64-324.81		
042		162.80-163.03	Cu,Pb,Zn,Ag,SiO_2,Al_2O_3,	
043		178. -178.79	CaO,MgO,S,TiO_2,V,Fe (acid	
044		192.77-192.97	sol + total)Ce,Ba,Sn,Mn	
045		214.35-214.55	Au,P,F,Sr,Zr,Nb,U,Th,Y	
046		244.00-244.27		
047		251.80-252.00		
048		260.80-261.01		
049		278.50-278.82		
050		302.81-302.98		
051		307.80-308.20		
052			Nb,Zr,Y,Sr,Rb,U,Th,Sn	
053			Sc,Li,F,Mo,V,Cr,Co,Ni	
054			Cu,Ag,Zn,As,Pb,Co_2,Au	
055				
056				
057		152.50-153.00	Cu,Pb,Zn,Ag (Au every	
058		153.00-154.00	tenth sample after	
059		154.00-155.00	ADL 36060)	

Sample No.	Drill Hole	Depth (m)	Analysed For	Petrological Study
ADL 36060	PB1	155-156	Cu,Pb,Zn,Ag (Au	
061		156-157	every tenth sample)	
062		157-158		0102
063		158-159		
064		159-160		
065		160-161		
066		161-162		
067		162-163		
068		163-164		
069		164-165		
070		165-166	Au	
071		166-167		
072		167-168		
073		168-169		
074		169-170		
075		170-171		
076		171-172		
077		172-173		
078		173-174		
079		174-175		
080		175-176	Au	
081		176-177		
082		177-178		
083		178-179		
084		179-180		
085		180-181		
086		181-182		
087		182-183		
088		183-184		
089		184-185		
090		185-186	Au	
091		186-187		
092		187-188		
093		188-189		
094		189-190		
095		190-191		
096		191-192		
097		192-193		
098		193-194		
099		194-195		
100		195-196		
101		196-197		
102		197-198		
103		198-199		
104		199-200		
105		200-201		
106		201-202		
107		202-203		
108		203-204		
109		204-205		
110		205-206	Au	
111		206-207		
112		207-208		
113		208-209		
114		209-210		
115		210-211		
116		222-212		
117		212-213		
118		213-214		
119		214-215		
120		215-216	Au	

Sample No.	Drill Hole	Depth (m)	Analysed For	Petrological Study
ADL 36121	PB1	216-217	Cu,Pb,Zn,Ag (Au)	
122		217-218		
123		218-219		
124		219-220		0103
125		220-221		
126		221-222		
127		222-223		
128		223-224		
129		224-225		
130		225-226	Au	
131		226-227		
132		227-228		
133		228-229		
134		229-230		
135		230-231		
136		231-232		
137		232-233		
138		233-234		
139		234-235		
140		235-236	Au	
141		236-237		
142		237-238		
143		238-239		
144		239-240		
145		240-241		
146		241-242		
147		242-243		
148		243-244		
149		244-245		
150		245-246	Au	
151		246-247		
152		247-248		
153		248-249		
154		249-250		
155		250-251		
156		251-252		
157		252-253		
158		253-254		
159		254-255		
160		255-256	Au	
161		256-257		
162		257-258		
163		258-259		
164		259-260		
165		260-261		
166		261-262		
167		262-263		
168		263-264		
169		264-265		
170		265-266	Au	
171		266-267		
172		267-268		
173		268-269		
174		269-270		
175		270-271		
176		271-272		
177		272-273		
178		273-274		
179		274-275		
180		275-276	Au	
181		276-277		
182		277-278		
183		278-279		

Sample No.	Drill Hole	Depth (m)	Analysed For	Petrological Study
ADL 36184	PB1	279-280	Cu,Pb,Zn,Ag	
185		280-281		
186		281-282		0104
187		282-283		
188		283-284		
189		284-285		
190		285-286	Au	
191		286-287		
192		287-288		
193		288-289		
194		289-290		
195		290-291		
196		291-292		
197		292-293		
198		293-294		
199		294-295		
200		295-296	Au	
201		296-297		
202		297-298		
203		298-299		
204		299-300		
205		300-301		
206		301-302		
207		302-303		
208		303-304		
209		304-305		
210		305-306	Au	
211		306-307		
212		307-308		
213		308-309		
214		309-310		
215		310-311		
216		311-312		
217		312-313		
218		313-314		
219		314-315		
220		315-316	Au	
221		316-317		
222		317-318		
223		318-319		
224		319-320		
225		320-321		
226		321-322		
227		322-323		
228		323-324		
229		324-325		
230		325-326	Au	
231		326-327		
232		327-328		
233		328-329		
234		329-330		
235		330-331		
236		331-332		
237		332-333		
238		333-334		
239		334-335		
240		335-336	Au	
241		336-337		
242		337-338		
243		338-339		
244		339-340		
245		340-341		
246	↓	341-342	↓	

Sample No.	Drill Hole	Depth (m)	Analysed For	Petrological Study
ADL 36247	PB1	342-343	Cu,Pb,Zn,Ag	
248		343-344		
249		344-345		
250		345-346	Au	0105
251		346-347		
252		347-348		
253		348-349		
254		349-350		
255		350-351		
256		351-352		
257		352-353		
258		353-354		
259		354-355		
260		355-356	Au	
261		356-357		
262				Rb-Sr dating
263				↓
264		152-220	$Fe, SiO_2, Al_2O_3, P, CaO$)	Beneficiation
265		220-280	$MgO, Mn, S, TiO_2, Cu, Zn$)	Testing
266		280-320	K_2O)	↓

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COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

JOB COM 811308

Results in ppm

0106

	SAMPLE	Cu	Pb	Zn	Ag	%Fe	Au
	ADL 30058	26	20	22	<1	5.50	0.20
(ADL 36001)	PB1 169.6-169.89m	10	8	12	<1	37.0	0.20
(ADL 36002)	172.61m	24	12	16	<1	22.0	0.10
(ADL 36003)	174.93-175.08m	8	4	12	<1	40.0	<0.05
(ADL 36004)	175.58-175.78m	8	4	8	<1	41.0	<0.05
(ADL 36005)	177.55-177.67m	10	<4	6	<1	7.40	<0.05
(ADL 36006)	200.8-210.95m	8	<4	12	<1	56.0	<0.05
(ADL 36007)	233.55-233.70m	20	20	12	<1	23.4	<0.05
(ADL 36008)	233.90-234.10m	8	<4	8	<1	25.0	<0.05
(ADL 36009)	PB1 234.20-234.30m	8	4	10	<1	36.0	<0.05

Method of Analysis - Cu, Pb, Zn : AAS 1
Ag : AAS 3
Fe : AAS 4
Au : AAS 5 special

COMLABS Pty Ltd
COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

JOB COM811496 O/N : B670/500

Results in ppm

0107

DEPTH	SAMPLE	Cu	Pb	Zn	Ag	Au	%Fe
248.61-248.76m	ADL 36010	10	<4	12	<1	<0.05	53.3
280.50-280.65m	ADL 36011	6	<4	10	<1	<0.05	28.9
311.79-311.94m	ADL 36012	230	55	14	6	<0.05	40.4
320.56-320.67m	ADL 36013	135	130	1050	<1	<0.05	14.3
324.30-324.42m	ADL 36014	20	<4	180	<1	<0.05	32.6
324.80-324.94m	ADL 36015	8	32	90	<1	<0.05	7.40
335.15-335.39m	ADL 36016	22	<4	50	<1	<0.05	7.20
350.00-350.25m	ADL 36017	22	4	26	<1	<0.05	4.20

Method of Analysis : Cu Pb Zn : AAS1
Ag : AAS3
Au : AAS5A
Fe : AAS4

COMLABS Pty Ltd
COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

JOB COM811591 O/N : AE 1143

0108

DRILL HOLE PB1

Results in ppm

Depth	SAMPLE	Cu	Pb	Zn	Ag
155.49 - 155.73	36018	10	<4	10	<1
168.95 - 169.17	36019	12	<4	14	<1
185.83 - 186.08	36020	8	<4	14	<1
197.98 - 198.33	36021	6	<4	10	<1
207.94 - 208.18	36022	8	<4	6	<1
224.08 - 224.33	36023	6	<4	8	<1
235.90 - 236.20	36024	10	<4	10	<1
269.80 - 270.10	36025	8	<4	8	<1
274.60 - 275.00	36026	6	<4	8	<1
289.60 - 290.05	36027	6	<4	8	1
312.83 - 313.08	36028	8	<4	8	<1
315.55 - 315.92	36029	1100	70	22	4
318.88 - 319.01	36030	185	16	40	3
322.52 - 322.67	36031	10	<4	16	<1
327.93 - 328.09	36032	12	32	28	1
333.23 - 333.50	36033	32	<4	20	<1
344.50 - 344.79	36034	20	4	200	1
345.88 - 346.20	36035	70	<4	70	<1
347.80 - 348.44	36036	12	<4	18	<1
351.32 - 351.55	36037	16	<4	32	<1
355.96 - 356.17	36038	55	<4	24	<1
312.25 - 312.50	36039	10	12	100	<1
249.02 - 249.30	36040	26	<4	32	<1
324.64 - 324.81	36041	10	<4	16	<1
162.80 - 163.03	36042	10	<4	10	<1

.../ 2

COMLABS Pty Ltd
COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

JOB COM811591 O/N : AE 1143

0109

Results in ppm

Depth	SAMPLE	Cu	Pb	Zn	Ag
178.52 - 178.79	36043	6	<4	10	<1
192.77 - 192.97	36044	22	<4	10	<1
214.35 - 214.55	36045	6	<4	10	<1
244.00 - 244.27	36046	8	<4	10	<1
251.80 - 252.00	36047	8	<4	8	<1
260.80 - 261.01	36048	10	<4	8	<1
278.50 - 278.82	36049	28	<4	10	<1
302.81 - 302.98	36050	10	<4	6	<1
307.80 - 308.20	36051	6	<4	10	<1

Method of Analysis : Cu Pb Zn : AAS1
Ag : AAS3

COMLABS Pty Ltd
COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

JOB COM811591 O/N : AE 1143

0110

Results in ppm

SAMPLE	%SiO2	%Al2O3	%CaO	%MgO	%S	%TiO2	V
36018	72.2	0.17	0.06	0.08	0.09	<0.01	<10
36019	42.2	0.09	0.03	0.20	0.04	<0.01	<10
36020	42.3	0.15	0.15	0.91	0.05	<0.01	<10
36021	41.1	0.09	0.06	0.12	0.08	0.05	<10
36022	83.6	0.88	0.28	1.15	0.03	0.05	<10
36023	55.0	0.13	0.32	0.66	0.03	0.05	<10
36024	59.4	0.04	0.08	0.10	0.05	0.05	<10
36025	21.2	0.19	7.00	6.80	0.03	0.10	<10
36026	38.9	0.09	0.17	0.13	0.03	<0.01	<10
36027	53.0	0.09	0.11	0.13	0.04	<0.01	<10
36028	64.6	0.11	1.40	1.65	0.04	<0.01	<10
36042	49.0	0.15	0.06	0.15	0.01	<0.01	<10
36043	53.0	0.17	0.08	0.30	0.01	<0.01	<10
36044	56.2	0.09	0.04	0.08	0.02	<0.01	<10
36045	48.9	0.55	1.85	3.00	<0.01	<0.01	<10
36046	54.6	0.02	0.04	0.10	0.02	<0.01	<10
36047	50.6	0.09	0.14	0.17	0.03	<0.01	<10
36048	46.6	0.04	0.04	0.07	0.01	<0.01	<10
36049	33.4	0.04	0.18	0.61	0.02	<0.01	<10
36050	92.5	0.25	0.11	0.51	0.01	<0.01	<10
36051	45.4	0.23	0.04	0.38	0.03	<0.01	<10

Method of Analysis :
Al2O3 CaO MgO : AAS6
SiO2 : COL9
TiO2 : COL4
S : VOL2
V : AAS3

COMLABS Pty Ltd
COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

JOB COM811591 O/N : AE 1143

0111

Results in ppm

SAMPLE	Acid Sol %Fe	Total %Fe	
36018	19.8	19.8	
36019	40.5	40.5	
36020	39.2	39.3	
36021	40.8	40.8	
36022	8.40	8.70	X
36023	29.1	29.6	
36024	27.4	28.1	
36025	38.7	45.4	
36026	42.7	42.7	
36027	32.7	32.7	
36028	22.1	22.2	
36042	34.8	34.7	
36043	32.8	32.8	
36044	29.1	29.0	
36045	25.8	27.1	
36046	27.3	28.7	
36047	27.6	31.3	
36048	28.5	33.9	
36049	43.3	44.1	
36050	2.20	2.40	X
36051	36.6	36.5	

Method of Analysis : Acid Sol Fe : Acid Sol/VOL
: Total Fe : Fusion/VOL

COMLABS Pty Ltd
COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

JOB COM811591 O/N : AE 1143

0112

Results in ppm

SAMPLE	Ce	Ba	Sn	Mn	Au	%P	P
36018	<20	<10	<4	38	<0.05	0.05	<50
36019	<20	<10	14	44	<0.05	0.05	<50
36020	<20	<10	10	60	<0.05	<0.05	<50
36021	<20	<10	10	50	<0.05	<0.05	<50
36022	<20	<10	<4	90	<0.05	<0.05	<50
36023	<20	<10	<4	140	<0.05	0.05	<50
36024	<20	<10	6	60	<0.05	<0.05	<50
36025	<20	<10	8	350	<0.05	0.05	<50
36026	<20	<10	<4	34	<0.05	0.05	<50
36027	<20	<10	10	24	<0.05	0.05	<50
36028	<20	<10	4	200	<0.05	0.05	<50
36029	<20	<10	<4	55	<0.05	0.15	<50
36030	<20	<10	<4	34	<0.05	<0.05	<50
36031	<20	<10	4	250	<0.05	0.05	<50
36032	<20	<10	4	9400	<0.05	0.05	<50
36033	<20	<10	<4	400	<0.05	0.05	<50
36034	<20	<10	<4	4600	<0.05	0.05	<50
36035	<20	<10	<4	4600	<0.05	0.05	<50
36036	30	560	6	130	<0.05	<0.05	<50
36037	50	780	<4	135	<0.05	0.05	100
36038	30	500	<4	420	<0.05	0.10	900
36039	30	120	<4	5800	<0.05	0.05	150
36040	40	145	<4	90	<0.05	0.05	100
36041	<20	75	<4	170	<0.05	0.05	<50

Method of Analysis : Ce Ba Sn : XRF1
Mn : AAS2
Au : AAS5A
P : COL1
F : SIE3

COMLABS Pty Ltd
COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

JOB COM811591 O/N : AE 1143

0113

Results in ppm

SAMPLE	Sr	Zr	Nb	U	Th	Y
36018	4	<4	4	<4	<4	<2
36019	<2	<4	3	<4	<4	<2
36020	3	<4	3	<4	10	<2
36021	<2	<4	3	<4	<4	<2
36022	3	6	3	<4	<4	3
36023	<2	<4	3	<4	<4	<2
36024	<2	<4	<2	<4	<4	<2
36025	12	4	4	<4	<4	<2
36026	<2	<4	3	<4	<4	<2
36027	<2	<4	4	<4	<4	<2
36028	<2	<4	3	<4	<4	<2
36029	3	4	4	<4	<4	<2
36030	<2	4	3	<4	<4	<2
36031	4	<4	4	<4	20	<2
36032	26	<4	4	<4	<4	<2
36033	<2	4	6	<4	<4	<2
36034	12	42	6	<4	6	18
36035	18	4	4	<4	4	<2
36036	160	80	7	6	24	7
36037	490	125	7	<4	12	5
36038	220	55	8	<4	<4	10
36039	50	34	6	<4	<4	6
36040	24	95	14	<4	8	14
36041	32	80	4	<4	<4	10

Method of Analysis : Sr Zr Nb U Th Y : XRF1

COMLABS Pty. Ltd.
COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

JOB COM812011 O/N : B 670

0114

DRILL HOLE PB1

Results in ppm

Depth	SAMPLE	Cu	Pb	Zn	Ag	Au
152.5-153m	ADL 36057	130	<4	145	<1	
153 - 154	ADL 36058	95	<4	105	<1	
154 - 155	ADL 36059	85	<4	85	<1	
155 - 156	ADL 36060	32	<4	40	<1	<0.05
156 - 157	ADL 36061	30	<4	36	<1	
157 - 158	ADL 36062	26	<4	34	<1	
158 - 159	ADL 36063	30	4	36	<1	
159 - 160	ADL 36064	38	<4	46	<1	
	ADL 36065	75	4	110	<1	
	ADL 36066	44	<4	55	<1	
	ADL 36067	44	<4	50	<1	
	ADL 36068	22	<4	38	<1	
164 - 165	ADL 36069	16	<4	40	<1	
	ADL 36070	22	<4	40	<1	<0.05
	ADL 36071	34	<4	50	<1	
	ADL 36072	24	<4	34	<1	
	ADL 36073	20	<4	34	<1	
169 - 170	ADL 36074	26	4	42	<1	
	ADL 36075	14	4	28	<1	
	ADL 36076	28	<4	34	<1	
	ADL 36077	24	<4	36	<1	
	ADL 36078	28	<4	40	<1	
174 - 175	ADL 36079	16	<4	36	<1	
	ADL 36080	42	<4	70	<1	<0.05
	ADL 36081	50	<4	60	<1	

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ANALYTICAL REPORT

0115

JOB COM812011 O/N : B 670

Results in ppm

Depth	SAMPLE	Cu	Pb	Zn	Ag	Au
	ADL 36082	26	<4	36	<1	
	ADL 36083	90	6	105	<1	
179 - 180	ADL 36084	6	<4	22	<1	
	ADL 36085	22	<4	38	<1	
	ADL 36086	32	<4	40	<1	
	ADL 36087	32	<4	42	<1	
	ADL 36088	36	4	48	<1	
184 - 185	ADL 36089	44	4	55	<1	
	ADL 36090	18	4	30	<1	<0.05
	ADL 36091	26	4	38	<1	
	ADL 36092	24	8	34	<1	
	ADL 36093	16	<4	24	<1	
189 - 190	ADL 36094	32	<4	38	<1	
	ADL 36095	26	<4	32	<1	
	ADL 36096	18	<4	22	<1	
	ADL 36097	18	<4	22	<1	
	ADL 36098	12	<4	18	<1	
194 - 195	ADL 36099	12	<4	20	<1	
	ADL 36100	10	<4	20	<1	<0.05
	ADL 36101	10	40	20	<1	
	ADL 36102	18	18	26	<1	
	ADL 36103	22	6	30	<1	
199 - 200	ADL 36104	10	<4	18	<1	
	ADL 36105	12	<4	28	<1	
	ADL 36106	20	<4	36	<1	

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ANALYTICAL REPORT

JOB COMP12011 O/N : E 670 0116

Results in ppm

Depth	SAMPLE	Cu	Pb	Zn	Ag	Au
	ADL 36107	34	<4	26	<1	
	ADL 36108	34	<4	32	<1	
204 - 205	ADL 36109	18	4	22	<1	
	ADL 36110	32	6	32	<1	<0.05
	ADL 36111	28	4	26	<1	
	ADL 36112	40	<4	34	<1	
	ADL 36113	18	<4	18	<1	
209 - 210	ADL 36114	18	<4	24	<1	
	ADL 36115	22	<4	26	<1	
	ADL 36116	16	<4	22	<1	
	ADL 36117	20	<4	22	<1	
	ADL 36118	14	<4	26	<1	
214 - 215	ADL 36119	20	<4	50	<1	
	ADL 36120	18	<4	22	<1	<0.05
	ADL 36121	20	<4	28	<1	
	ADL 36122	14	<4	18	<1	
	ADL 36123	20	<4	26	<1	
219 - 220	ADL 36124	30	<4	26	<1	
	ADL 36125	14	<4	20	<1	
	ADL 36126	14	<4	22	<1	
	ADL 36127	16	<4	24	<1	
	ADL 36128	10	<4	32	<1	
224 - 225	ADL 36129	14	<4	22	<1	
	ADL 36130	12	<4	22	<1	<0.05
	ADL 36131	12	<4	18	<1	

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ANALYTICAL REPORT

JOB COM812011 O/N : P 670

0117

Results in ppm

Depth	SAMPLE	Cu	Pb	Zn	Ag	Au
	ADL 36132	12	<4	16	<1	
	ADL 36133	16	<4	26	<1	
229 - 230	ADL 36134	230	<4	240	<1	
	ADL 36135	170	6	145	<1	
	ADL 36136	95	4	95	<1	
	ADL 36137	32	<4	44	<1	
	ADL 36138	26	<4	34	<1	
234 - 235	ADL 36139	24	<4	32	<1	
	ADL 36140	22	<4	30	<1	0.05
	ADL 36141	34	<4	50	<1	
	ADL 36142	22	<4	34	<1	
	ADL 36143	8	<4	22	<1	
239 - 240	ADL 36144	8	<4	16	<1	
	ADL 36145	22	<4	38	<1	
	ADL 36146	40	<4	55	<1	
	ADL 36147	24	<4	24	<1	
	ADL 36148	12	<4	22	<1	
244 - 245	ADL 36149	10	<4	18	<1	
	ADL 36150	22	<4	34	<1	<0.05
	ADL 36151	145	<4	145	<1	
	ADL 36152	24	<4	40	<1	
	ADL 36153	22	<4	32	<1	
249 - 250	ADL 36154	20	<4	30	<1	
	ADL 36155	14	<4	26	<1	
	ADL 36156	10	<4	20	<1	

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ANALYTICAL REPORT

JOB COM812011 O/N : P 670

0118

Results in ppm

Depth	SAMPLE	Cu	Pb	Zn	Ag	Au
	ADL 36157	10	<4	22	<1	
	ADL 36158	8	<4	20	<1	
254 - 255	ADL 36159	20	4	14	<1	
	ADL 36160	12	<4	16	<1	<0.05
	ADL 36161	10	<4	18	<1	
	ADL 36162	10	<4	22	<1	
	ADL 36163	6	<4	18	<1	
259 - 260	ADL 36164	20	<4	30	<1	
	ADL 36165	8	<4	14	<1	
	ADL 36166	18	<4	18	<1	
	ADL 36167	16	<4	24	<1	
	ADL 36168	18	<4	30	<1	
264 - 265	ADL 36169	8	<4	18	<1	
	ADL 36170	10	<4	24	<1	0.05
	ADL 36171	18	<4	18	<1	
	ADL 36172	8	<4	14	<1	
	ADL 36173	6	<4	16	<1	
269 - 270	ADL 36174	10	<4	16	<1	
	ADL 36175	12	4	20	<1	
	ADL 36176	10	<4	18	<1	
	ADL 36177	12	6	20	<1	
	ADL 36178	16	<4	24	<1	
274 - 275	ADL 36179	55	4	55	<1	
	ADL 36180	26	<4	34	<1	<0.05
	ADL 36181	44	<4	50	<1	

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ANALYTICAL REPORT

0119

JOB COM812011 O/N : P 670

Results in ppm

Depth	SAMPLE	Cu	Pb	Zn	Ag	Au
	ADL 36182	36	<4	38	<1	
	ADL 36183	32	<4	40	<1	
279-280	ADL 36184	40	6	55	<1	
	ADL 36185	44	8	48	<1	
	ADL 36186	48	6	50	<1	
	ADL 36187	34	<4	40	<1	
	ADL 36188	38	6	42	<1	
284-285	ADL 36189	30	4	40	<1	
	ADL 36190	42	4	50	<1	<0.05
	ADL 36191	26	<4	40	<1	
	ADL 36192	34	<4	40	<1	
	ADL 36193	38	4	44	<1	
289-290	ADL 36194	34	<4	44	<1	
	ADL 36195	30	<4	32	<1	
	ADL 36196	65	6	75	<1	
	ADL 36197	95	8	100	<1	
	ADL 36198	28	8	40	<1	
294-295	ADL 36199	38	6	46	<1	
	ADL 36200	20	<4	30	<1	<0.05
	ADL 36201	16	<4	24	<1	
	ADL 36202	20	<4	32	<1	
	ADL 36203	24	<4	28	<1	
299-309	ADL 36204	1050	70	100	<1	control ?
	ADL 36205	20	<4	14	<1	
	ADL 36206	14	<4	20	<1	

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ANALYTICAL REPORT

JOB COM812011 O/N : B 670 0120

Results in ppm

Depth	SAMPLE	Cu	Pb	Zn	Ag	Au
	ADL 36207	10	<4	26	<1	
	ADL 36208	16	<4	34	<1	
304 - 305	ADL 36209	16	<4	32	<1	
	ADL 36210	8	<4	18	<1	<0.05
	ADL 36211	8	<4	20	<1	
	ADL 36212	10	<4	22	<1	
	ADL 36213	10	<4	20	<1	
309 - 310	ADL 36214	10	<4	20	<1	
	ADL 36215	10	<4	12	<1	
	ADL 36216	420	50	42	9	
	ADL 36217	540	165	34	7	
	ADL 36218	24	<4	22	<1	
314 - 315	ADL 36219	18	<4	28	<1	
	ADL 36220	12	<4	30	<1	<0.05
	ADL 36221	18	4	30	<1	
	ADL 36222	20	4	28	<1	
	ADL 36223	6	30	50	<1	
319 - 320	ADL 36224	6	28	110	<1	
	ADL 36225	38	400	480	1	
	ADL 36226	85	60	150	<1	
	ADL 36227	75	6	105	<1	
	ADL 36228	50	<4	85	<1	
324 - 325	ADL 36229	18	14	160	<1	
	ADL 36230	16	12	155	<1	0.10
	ADL 36231	10	50	450	<1	

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ANALYTICAL REPORT

JOB COM812011 O/N : P 670 0121

Results in ppm

Depth	SAMPLE	Cu	Pb	Zn	Ag	Au
	ADL 36232	26	16	350	<1	
	ADL 36233	55	12	40	<1	
329 - 330	ADL 36234	26	<4	44	<1	
	ADL 36235	44	8	80	<1	
	ADL 36236	95	4	80	<1	
	ADL 36237	60	<4	65	<1	
	ADL 36238	195	<4	185	<1	
334 - 335	ADL 36239	230	<4	220	<1	
	ADL 36240	195	4	180	<1	<0.05
	ADL 36241	32	4	60	<1	
	ADL 36242	20	6	50	<1	
	ADL 36243	42	6	48	<1	
339 - 340	ADL 36244	14	<4	55	<1	
	ADL 36245	65	<4	60	<1	
	ADL 36246	18	<4	28	<1	
	ADL 36247	32	<4	55	<1	
	ADL 36248	24	<4	65	<1	
344 - 345	ADL 36249	18	<4	55	<1	
	ADL 36250	75	<4	90	<1	0.05
	ADL 36251	1200	80	125	<1	control ?
	ADL 36252	95	6	80	<1	
	ADL 36253	28	16	60	<1	
349 - 350	ADL 36254	26	12	50	<1	
	ADL 36255	55	28	115	<1	
	ADL 36256	30	4	50	<1	

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COMLABS Pty. Ltd.
COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

JOB COM812011 O/N : B 670

0122

Results in ppm

Depth	SAMPLE	Cu	Pb	Zn	Ag	Au
	ADL 36257	40	<4	195	<1	
	ADL 36258	24	<4	32	<1	
354 - 355	ADL 36259	65	4	80	<1	
	ADL 36260	28	<4	24	<1	<0.05
356 - 357	ADL 36261	38	<4	24	<1	
	ADL 36262	18	<4	24	<1	
	ADL 36263	20	<4	50	<1	

Method of Analysis : Cu Pb Zn : AAS1
Ag : AAS3
Au : AAS5A

Central Mineralogical Services

39 Beulah Road
Norwood, S.A. 5067
Telephone 42 5659

Mr. M. Page
Geologist
The Broken Hill Proprietary Co. Ltd.
G.P.O. Box 1818
ADELAIDE / S.A. 5001

4th September, 1981

REPORT CMS 81/9/1

YOUR REFERENCE:	Order No. AE 1045
DATE RECEIVED:	1st September, 1981
SAMPLE NOS.:	PB 1 (169.60-234.30 m)
SUBMITTED BY:	M. Page
WORK REQUESTED:	Petrology

H.W. Fander, M. Sc.

CENTRAL MINERALOGICAL SERVICES

Date 4th September, 1981

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

IDENTIFICATION
PB 1
Metajaspilites

Job No. CMS 81/9/1 Date Received: 1.9.1981

Reference Order No. AE 1045

Sample No. PB 1 (169.60 - 234.30 m)

Nature of Sample: D.D. Cores

DESCRIPTION **SECTION No.** 38545 - 38551

a. Hand Specimen:

Banded quartz-magnetite rocks.

b. Microscopic:

These intersections consist of a series of well-banded quartz-magnetite rocks grading into magnetite-metaquartzites (metajaspilites) with varying amounts of hematite in addition to magnetite. The two major minerals quartz and magnetite show variable grainsizes, distribution and thickness of bands, and minor folding/faulting is evident in places.

The composition is uniform and very simple, and thus the rocks may be described collectively. They consist of subhedral to euhedral magnetite crystals, generally partly martitised, and polygonal to interlocking grains of clear quartz; hematite also occurs as small to large crystals in its own right, sometimes intergrown with magnetite or forming monomineralic bands.

Other minerals are virtually absent except in the 210.80 - 210.95 m intersection, where some bands contain coarse, subparallel hornblende crystals intergrown with magnetite, and traces of epidote. Elsewhere, there are isolated small muscovite flakes and carbonate patches.

The rocks were banded chemical sediments, i.e. banded iron formations, which were metamorphosed regionally (though thermal factors seem to have dominated over dynamic forces) to the amphibolite facies.

H.W. Fander, M. Sc.

0125

Central Mineralogical Services

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Mr. M. Page
Geologist
The Broken Hill Proprietary Co. Ltd.
G.P.O. Box 1818
ADELAIDE / S.A. 5001

30th September, 1981

REPORT CMS 81/9/48

YOUR REFERENCE:	Order No. AE 1401- Job No. B670/800
DATE RECEIVED:	21st September, 1981
SAMPLE NOS.:	ADL 36010 - ADL 36017
SUBMITTED BY:	M. Page
WORK REQUESTED:	Petrology

H.W. Fander, M. Sc.

REPORT CMS 81/9/48

D.D. Core Samples ADL 36010 - ADL 36017

Eight core samples were received for thin-section preparation and petrological examination; they are briefly described in the accompanying table.

Summary

All rocks are medium- to high-grade metamorphics, of sedimentary origin. Four samples are calc-silicate and related pyrometasomatic assemblages with a distinctive and unusual mineralogy of Mg-Fe silicate and associated oxides and sulphides.

ADL 36011 is a tectonic breccia; there is some uncertainty about the matrix in which the fragments are embedded; it may be a basic igneous, glassy phase (now altered), or simply a low-temperature chloritic phase equivalent to talcose alteration seen in some of the other rocks.

One of the rocks (36013) contains sphalerite (confirmatory assay needed) which is colourless, quite unusual in this context; sphalerites in such rocks are generally Fe-rich. Further work should be carried out, but may not be warranted at this stage.

ADL 36016 and 36017 are products of regional, medium-grade (amphibolite facies) metamorphism; they are conventional rocks, and contrast strongly with 36010-36015. The style of metamorphism is radically different, and the two groups of rocks belong to different units.

H.W. Fander, M. Sc.

Central Mineralogical Services

Sample No.	Rock Type - Composition	Fabric	Minor Minerals	Comments
ADL 36010 61-248·76 (T.S. 38802)	Magnetite-Diopside Rock. Medium- to coarsely-crystalline magnetite euhedra and yellow diopside fairly extensively altered to fine talc.	Random coarse, granular fabric; no relict features.	A few prismatic cummingtonite needles. Carbonate embedded in talc.	An Mg-Fe mineral assemblage of th skarn type, i.e. pyrometasomatic. Diopside is an unusual colour.
ADL 36011 50·50-260·65	Breccia. Angular fragments of magnetite/hematite-carbonate rocks and hematite-quartzites (sandstones) in a matrix of ultrafine talc/antigorite intergrowths.	Tectonic breccia fabric; faint relict ?igneous textures in matrix.	"Sandstone" fragments pervaded by fine carbonate.	Apparently an orthoquartzite was hematitised, carbonated, and vein by carbonate-magnetite, then brecciated, incorporated in ?basi
ADL 36012 311·79 311·94	Quartz-Sulphide Rock. Coarsely-granular quartz, large masses of coarse pyrite and marcasite, patches of pseudomorphous chlorite aggregates.	Coarse, vein-type fabric. Relict textures in chlorite are unspecific.	"Books" of relatively coarse chlorite (clinochlore).	Chlorite pseudomorphs after an Mg-Fe silicate. Rock is a vein or skarn-related type.
ADL 36013 320·56 320·67	Calc-Silicate Rock. Coarsely-crystalline carbonate with serpentine pseudomorphs after garnet, coarse phlogopite, masses of fine talc.	Crudely banded, generally coarse-grained. Good relict textures.	Pyrite, sphalerite patches. Fresh garnet. Scapolite. Diopside. Quartz.	Contact-metasomatic rock with complex mineral assemblage and textural relationships.
ADL 36014 324·30 324·42	Skarn. Mainly coarsely-granular to subhedral fayalite (Fe-olivine) and hedenbergite (Fe-diopside), subordinate garnet (almandine).	Crudely banded, coarse-grained. Intricate magnetite-anthophyllite intergrowths.	Broad zones of pyrrhotite, magnetite, anthophyllite. Chlorite.	Fe-rich pyrometasomatic mineral assemblage with retrograde zones.
ADL 36015 329·80 329·94	?Olivine Marble. Coarsely-crystalline dolomite or ankerite with serpentine pseudomorphs after ?olivine, steatitised diopside.	Coarsely-crystalline, typical marble fabric. No preferred orientation.	Dark green spinel. Magnetite veinlets and networks. Apatite.	Product of high-grade contact-metamorphism with subsequent alteration of unstable phases.
ADL 36016 335·15 335·39	Banded Amphibolite. Granular to prismatic hornblende and andesine, biotite and quartz. Coarserquartz-feldspar bands, biotite laminae.	Mostly typical amphibolite fabric, with gneissic bands.	Apatite conspicuous in biotite bands. Secondary chlorite.	Amphibolite-facies metasediment with typical fabric and composit contrasts with the other rocks.
ADL 36017 350·00-350·25 (T.S. 38809)	Garnet-Sillimanite Gneiss. Porphyroblasts of pink almandine, acicular sillimanite, granular quartz, and cordierite masses.	Well-developed gneissic fabric; garnet lenses up to 20 mm or more.	Ti-biotite laminae. Fine sulphide (pyrite/pyrrhotite).	Cordierite proxies for feldspars which are absent. Amphibolite-fac metasediment.

The Australian
Mineral Development
Laboratories

Flemington Street, Frewville,
South Australia 5063
Phone Adelaide 79 1662
Telex AA 82520

Please address all
correspondence to
P.O. Box 114 Eastwood
SA 5063
In reply quote:

amdel

0128

3 February, 1982

GS3/4/2/0

The Broken Hill Proprietary Company Limited,
41-47 Currie Street,
ADELAIDE, SA 5000

Attention: Mr M. Page

REPORT GS 2535/82

YOUR REFERENCE: Order No. AE1244

MATERIAL: 2 Drill cores

LOCALITY: Coober Pedy area

IDENTIFICATION: ADL36264-5 now ADL36262-3.

DATE RECEIVED: 5 November, 1981

WORK REQUIRED: Rb-Sr dating

Investigation and Report by: Dr Alan Webb

Chief - Geological Services Section: Dr Keith J. Henley
Manager, Mineral and Materials Sciences Division: Dr William G. Spencer

Keith Henley

for Norton Jackson
Managing Director

mhb/2

Pilot Plant: Osman Place
Thebarton S.A.,
Telephone 43 8053
Branch Laboratories:
Perth W.A.
Telephone 325 7311
Melbourne Vic.
Telephone 645 3093

Rb-Sr DATING OF DRILL CORE

1. INTRODUCTION

Two samples of drill core were received from Mr M. Page of The Broken Hill Proprietary Co. Ltd. with a request for Rb-Sr geochronology.

2. PROCEDURES

The samples were examined in thin section and Rb and Sr analyses of the pulverised samples made by XRF to determine the suitability of the samples for Rb-Sr dating. Only one sample was considered to be suitable for dating and the Sr isotopic composition of this sample was determined by mass spectrometry.

3. RESULTS

3.1 Petrography

Sample: ADL36262; TS44606

This is a dark, fine-grained rock with sharply defined, dark, parallel banding. It is a quartz-magnetite gneiss and the absence of any other silicate minerals is supported by the Rb and Sr analyses, both elements being present in concentrations <2 ppm. The sample is unsuitable for Rb-Sr geochronology.

Sample: ADL36263; TS44607

Hand Specimen:

This is a fine-grained, pink to brown coloured rock with a foliation defined by fine bands of dark mica.

Thin Section:

This is a fine to medium-grained rock with a grain size up to 2-3 mm, although many grains are much finer (∿0.05 mm). An optical estimate of its composition is:

	%
Quartz	45-50
Plagioclase	45-50
Biotite	<2
Opaques	trace

A gneissic foliation is defined by the larger quartz grains, which are elongated and aligned in a parallel fashion. Most grains exhibit undulose extinction.

Biotite occurs as thin flakes ∿0.1 mm in length, frequently kinked and altering to chlorite. The flakes show an alignment parallel to the elongated quartz grains.

Feldspar is altering to sericite and some of the twin lamellae show bending. Other grains are untwinned and some of these may be K-feldspar but identification is hampered by the sericitisation.

The sample would be suitable for Rb-Sr geochronology.

3.2 Geochronology

The isotopic analysis of ADL36265 is as follows:

Rb/Sr	$^{87}Rb/^{86}Sr$	$^{87}Sr/^{86}Sr$
0.507	1.4724	0.7665

Because only one sample was analysed, the initial $^{87}Sr/^{86}Sr$ ratio can not be determined so ages, based on likely values of initial ratio, must be calculated. These are:

Initial $^{87}Sr/^{86}Sr$	Age ($x10^6y$)
0.7000	3310
0.7100	2650

The rock is probably of late Archaean age but a more precise result can not be calculated from a single sample. This result is similar to dates reported on gneisses from the Tallaringa - Coober Pedy area by Webb (1979).

The constants used in the age calculation are:-

$$^{88}Sr/^{86}Sr = 8.3752$$

$$^{85}Rb/^{87}Rb = 2.600$$

$$\lambda^{87}Rb = 1.42 \times 10^{-11}\ y^{-1}$$

3.3 Reference

Webb, A.W., 1979: A geochronological investigation of the tectono-magmatic history of the Gawler Craton. Symposium on the Gawler Craton. (Extended Abstracts). Geol. Soc. Aust. S.A. Div. pp 9-11.

APPENDIX 3

DIAMOND DRILL HOLE PB2

A. Summary and Detailed Logs

B. Geochemical Sample Data

C. Geochemical Analyses

D. Petrology

DETAILED GEOLOGICAL HOLE LOG

0132

THE BROKEN HILL PTY CO LTD. PROJECT E.L. 633 PARAGON BORE DRILL HOLE PB2

Location or local co-ordinates 78850N 85300E (Anomaly 2) R.L. Collar (Datum) 203.304m

Map Reference Murloocoppie SH 53-2 Co-ordinates (Grid) 6811500N 385300E (AMG)

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar	Whitelands	L. Mellet	Mayhew 1000	Blades		176m	5-10/10/81
Main Hole	Action Core	V. Vietneks	Longyear 44	Diamond		437m	6/12-16/1/8

GN MN Magnetic Declination

Depth	Decl'n	Brg (Mag)	Hole dia.	From	To
433m	3° from vert.				

Casing 4" flush couple water bore casing to 150m; HQ casing to 177 111m HQ removed

Static water level 85m Date

Logged by M. Page Date 28.1.82

Remarks

From	To	Interval	Recovery	%Rec.	GEOLOGICAL DESCRIPTION	Remarks
0	3	3m	chips		Red-brown clay and minor gravel.	
3	21	18	"		Indurated white alunitic clay, pink clay and white calcrete.	
21	24	3	"		Soft pink-brown water-bearing clay which gives off abundant water when squeezed.	
24	46	22	"		White, yellow and pink-brown plastic sticky clay with some gritty bands.	
46	70	24	"		Gritty loose sand with a yellow-white clay matrix. The clay matrix steadily decreases downwards.	
70	114	44	"		Coarse loose quartz sand with very little clay matrix. At 72m lost circulation in the local aquifer and circulation stayed lost until 84m, where hit finer sand. Below 84m sand was still coarse but had more clay matrix.	
114	176	62	"		Mainly grey-black, but occasionally yellow and red sticky clay. A slightly gritty transitional unit is found from 114-126m. The unit becomes darker in colour until 134m and thereafter becomes paler until the end of this unit. Just above 176m were	

SYMBOLS AND ABBREVIATIONS

DETAILED GEOLOGICAL HOLE LOG

THE BROKEN HILL PTY CO LTD. PROJECT _____ DRILL HOLE PB2 0133

Location or local co-ordinates _____ R.L. Collar (Datum) _____

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							

GN MN Magnetic Declination

Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks _____

From	To	Interval	Recovery	%Rec.	GEOLOGICAL DESCRIPTION	Remarks
					gritty sands with minor conglomerate.	
176	225.5	49.5	NQcore	100%	Banded iron formation with black-grey	LCA(180m)=5
					serpentine-like mineral commonly	
					present, especially from 177.60 to	
					181.20m. With the serpentine, find	
					green chlorite and white needles of	
					anthophyllite (eg 186.7 to 187.7m).	
					The magnetite, which is the dominant	
					iron oxide, is fine to medium-grained	LCA(200m)=3
					and forms in bands that are fine	
					(<1mm) to moderate (1cm) and is	
					occasionally massive where little	
					banding is present due to lack of	
					differentiation into discrete quartz	
					and iron oxide bands. Total iron	
					oxides is about 20-25%.	LCA(220m)=7
225.5	239	13.5	NQcore	100%	Banded iron formation, distinguished	
					from adjacent units by its greater	
					total iron oxide content (25-30%)	
					and overall poorer banding which	
					gives the unit a darker grey	
					appearance. Hematite is minor to	
					absent. Iron oxide present as fine	
					equidimensional grains. Minor calcite	
					veining. In this unit find cross-	LCA(230m)=75
					cutting bands of garnet and amphibole	
					which may represent metamorphosed	
					basic intrusives/extrusives (e.g.	
					226.6 to 227.0m).	

SYMBOLS AND ABBREVIATIONS

DETAILED GEOLOGICAL HOLE LOG

THE BROKEN HILL PTY CO LTD. PROJECT _____ DRILL HOLE PB2

Location or local co-ordinates _____ R.L. Collar (Datum) 0134

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							

GN MN Magnetic Declination

Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks _____

From	To	Interval	Recovery	%Rec.	GEOLOGICAL DESCRIPTION	Remarks
239	245.8	6.8	NQcore	100%	Transitional unit between less-banded, more iron-rich above and the better-banded, more siliceous unit below. Hematite content is about 10% of total iron oxides, which total 20-25% of the rock. Banding is fine to moderate (<1mm to 1cm). Minor veins of amphibole and some of calcite.	LCA(240m)=70
245.8	323.25	77.45	NQcore	100%	A broad unit containing well-banded jaspilite with 20-25% total iron oxides. Banding is mainly of wider iron oxides (dominantly magnetite) and thinner quartz bands. Several characteristic subunits are included in this unit:-	LCA(260m)=50
					267.00-269.30m: banded jaspilite with veins of garnet and amphibole common.	LCA(280m)=45
					279.10-280.10m: coarse blebby magnetite in grey quartzite, with minor chlorite.	
					291.20-293.00m: coarse quartz hematite unit with blebby to angular grains of hematite in a white granular quartz matrix. Orthoclase occupies 10% of the rock. Minor green amphibole.	LCA(300m)=70
323.25	332.0	8.75	NQcore	100%	Coarse, blebby magnetite grains and some hematite blades in a fine to medium-grained grey quartzite. Total iron oxides is about 5-10%. Very	LCA(320m)=60°

SYMBOLS AND ABBREVIATIONS

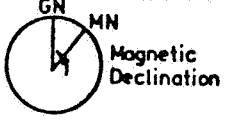
DETAILED GEOLOGICAL HOLE LOG

THE BROKEN HILL PTY CO LTD. PROJECT _____ DRILL HOLE PB2

Location or local co-ordinates _____ R.L. Collar (Datum) 0135

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							



Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks _____

From	To	Interval	Recovery	%Rec.	GEOLOGICAL DESCRIPTION	Remarks
					coarse iron oxides from 326.6 to 326.9m.	
332.0	334.5	2.5	NQcore	100%	Grey quartzite with discrete bands of magnetite from 0.2 to 3mm giving the core a striped nature. anthophyllite band from 333.0-333.45m. Total iron oxides is 5-10%.	
334.5	349.4	14.9	NQcore	100%	Zone below the banded iron formation with abundant white fibrous anthophyllite (especially from 334.5-339m). This is replaced in prominence by pale khaki-green orthopyroxene below 339m. From 341.85-341.95m and 346.20-348.46m medium to coarse red-pink garnet bands are found. Amphibolite is present from 348.46 to 349.40m. Sulphide is rare to absent (pyrite only).	LCA(340m)=7
349.4	364.6	15.2	NQcore	100%	Generally a fine to medium-grained garnetiferous granulite with bands of coarser (to 1cm) pink garnet and accompanying coarse welded white-grey quartzite. Minor fine-grained brassy mica gives the core a pitted nature on its surface.	LCA(360m)=7
364.6	395.0	30.4	NQcore	100%	Garnetiferous granulite as in above unit, but this unit is rich in	

SYMBOLS AND ABBREVIATIONS

DETAILED GEOLOGICAL HOLE LOG

THE BROKEN HILL PTY CO LTD. PROJECT _____ DRILL HOLE PB2

Location or local co-ordinates _____ R.L. Collar (Datum) 0136

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							

GN MN Magnetic Declination

Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks _____

From	To	Interval	Recovery	%Rec.	GEOLOGICAL DESCRIPTION	Remarks
					sulphide with major bands of coarse	
					pyrite and banded pyrrhotite as follows:	LCA(380m)=
					377.53-377.71m, 379.77-380.26m,	
					382.65-383.00m, 383.79-384.11m.	
					These all contain up to 80% sulphides	
					and minor chalcopyrite may be present	
					at 377.65m. All sulphides band	
					contain graphite and possibly	
					serpentine. Pyrite is late stage	
					and cross-cuts the pyrrhotite and	
					bedding. From 394.64-394.78m, well-	
					banded pyrite and pyrrhotite in fine	
					garnetiferous granulite is found.	
					Smaller pyrite bands are found from	
					389.00-389.01m and 390.40-390.42m.	
					From 381.40-384.11m garnetiferous	
					down to 5% but here find fine bands	
					and blebs of pyrrhotite common	
					(5-10%).	
395.0	437.0	42.0	NQcore	100%	Garnetiferous granulite which is	LCA(400m)=80
					slightly coarser grained than above	
					garnet units, and in which the	
					garnets are equidimensional. An	
					abundance of brassy mica can be	
					mistaken for pyrite, although pyrite	LCA(420m)=65
					content as fine disseminated grains	
					is up to 5%. A coarse feldspathic	
					unit is found from 426.5-426.8m.	
					At 400.7m find a 10cm unit of coarse	
					subhedral garnet and books of brown-	
					black mica.	

SYMBOLS AND ABBREVIATIONS

Sample No.	Drill Hole	Depth (m)	Analysed For	Petrological Study
ADL 36301	PB2	179.07-179.15	Cu,Pb	Pontifex
302		292.78-292.89		
303		317.62-317.76	Cu,Pb,Zn,Mn,Ag,Ba,Au	
304		339.57-339.71		
305		344.10-344.21		
306		348.59-348.75		
307		349.59-349.72		
308		359.42-359.59		
309		366.84-366.97	Cu,Pb,Zn,Mn,Ag,Ba,Au	
310		369.27-369.39		
311		369.88-370.00		
312		377.52-377.64		
313		394.68-394.78		
314		434.45-434.57		
315		366.97-367.22	Cu,Pb,Zn,Co,Mn,Ag,Mo,)	
316		369.26-369.74	Au,Ba,As,Sb)	
317		379.10-379.39		
318		379.75-380.01		
319		382.69-383.00		
320		383.80-384.09		
321		176.88-178.00	Cu,Pb,Zn,Ag	
322		178-180		
323		180-182		
324		182-184		
325		184-186		
326		186-188		
327		188-190		
328		190-192		
329		192-194		
330		194-196	Au	
331		196-198		
332		198-200		
333		200-202		
334		202-204		
335		204-206		
336		206-208		
337		208-210		
338		210-212		
339		212-214		
340		214-216	Au	
341		216-218		
342		218-220		
343		220-222		
344		222-224		
345		224-226		
346		226-228		
347		228-230		
348		230-232		
349		232-234		
350		234-236	Au	
351		236-238		
352		238-240		
353		240-242		
354		242-244		
355		244-246		
356		246-248		
357		248-250		
358		250-252		
359		252-254		
360		254-256	Au	

Sample No.	Drill Hole	Depth (m)	Analysed For	Petrological Study
ADL 36361	PB2	256-258	Cu,Pb,Zn,Ag	
362		258-260		
363		260-262		0138
364		262-264		
365		264-266		
366		266-268		
367		268-270		
368		270-272		
369		272-274		
370		274-276	Au	
371		276-278		
372		278-280		
373		280-282		
374		282-284		
375		284-286		
376		286-288		
377		288-290		
378		290-292		
379		292-294		
380		294-296	Au	
381		296-298		
382		298-300		
383		300-302		
384		302-304		
385		304-306		
386		306-308		
387		308-310		
388		310-312		
389		312-314		
390		314-316	Au	
391		316-318		
392		318-320		
393		320-322		
394		322-324		
395		324-326		
396		326-328		
397		328-330		
398		330-332		
399		332-334		
400		334-336	Au	
401		336-338		
402		338-340		
403		340-342		
404		342-344		
405		344-346		
406		346-348		
407		348-350		
408		350-352		
409		352-354		
410		354-356	Au	
411		356-358		
412		358-360		
413		360-362		
414		362-364		
415		364-366		
416		366-368		
417		368-370		
418		370-372		
419		372-374		
420	↓	374-376	Au	

Sample No.	Drill Hole	Depth (m)	Analysed For	Petrological Study
ADL 36421	PB2	376-378	Cu,Pb,Zn,Ag	
422		378-380		
423		380-382		
424		382-384		
425		384-386		
426		386-388		
427		388-390		
428		390-392		
429		392-394		
430		394-396	Au	
431		396-398		
432		398-400		
433		400-402		
434		420-404		
435		404-406		
436		406-408		
437		408-410		
438		410-412		
439		412-414		
440		414-416	Au	
441		416-418		
442		418-420		
443		420-422		
444		422-424		
445		424-426		
446		426-428		
447		428-430		
448		430-432		
449		432-434		
450		434-436	Au	
451		436-437		
452		176-230	SiO_2,Al_2O_3,CaO,MgO,	
453		230-280	TiO_2,S,V,Fe (acid sol	
454		280-344	+ total)	

COMLABS Pty. Ltd.
COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

JOB COM820170 O/N : B670/500 Sheet 004786

0140

Results in ppm

DEPTH	SAMPLE	Cu	Pb	Zn	Mn	Ag	Ba
317.62-317.76m	ADL 36303	8	<4	20	36	<1	<10
339.57-339.71m	ADL 36304	<2	<4	70	170	<1	<10
344.10-344.21m	ADL 36305	65	<4	115	480	<1	<10
348.59-348.79m	ADL 36306	95	<4	60	610	1	<10
366.84-366.97m	ADL 36309	250	8	260	1250	1	75
369.27-369.39m	ADL 36310	820	190	24	450	3	125
369.88-370.00m	ADL 36311	32	4	95	540	<1	230
377.52-377.64m	ADL 36312	820	70	60	830	1	280
394.68-394.78m	ADL 36313	155	20	24	830	<1	<10
434.45-434.57m	ADL 36314	44	<4	140	340	<1	510

Method of Analysis : Cu Pb Zn : AAS1
Mn : AAS2
Ag : AAS3
Ba : XRF1

COMLABS Pty. Ltd.
COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

0141

JOB COM820170 O/N : Sheet 004786 Additional Assay

Results in ppm

SAMPLE		Au
317.62 - 317.76m	ADL36303	<0.05
339.57 - 339.71m	ADL36304	0.05
344.10 - 344.21m	ADL36305	<0.05
348.59 - 348.75m	ADL36306	<0.05
366.84 - 366.97m	ADL36309	<0.05
369.27 - 369.39m	ADL36310	<0.05
369.88 - 370.00m	ADL36311	<0.05
377.52 - 377.64m	ADL36312	0.25
394.68 - 394.78m	ADL36313	<0.05
434.45 - 434.57m	ADL36314	<0.05

Method of Analysis : Au : AAS5A

COMLABS Pty. Ltd.
COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

0142

JOB COM820355 O/N : B 670/500 Sheet 4789

Results in ppm

DEPTH	SAMPLE	Cu	Pb	Zn	Co	Mn
366.97-367.22m	ADL36315	130	6	115	26	430
369.26-369.74m	ADL36316	480	160	670	100	175
379.10-379.39m	ADL36317	540	26	300	105	360
379.75-380.01m	ADL36318	470	42	115	90	380
382.69-383.00m	ADL36319	620	150	60	125	400
383.80-384.09m	ADL36320	330	28	90	105	770

Method of Analysis : Cu Pb Zn Co : AAS1
Mn : AAS2

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ANALYTICAL REPORT

0143

JOB COM820355 O/N : B 670/500 Sheet 4789

Results in ppm

SAMPLE	Ba	As	Sb	Ag	Mo	Au
ADL36315	15	16	<4	<1	6	<0.05
ADL36316	190	75	8	1	10	<0.05
ADL36317	290	60	4	1	8	<0.05
ADL36318	250	115	14	<1	10	<0.05
ADL36319	160	20	6	6	14	<0.05
ADL36320	280	22	4	1	8	<0.05

Method of Analysis : Ba As Sb : XRF1
Ag Mo : AAS3
Au : AAS5A

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ANALYTICAL REPORT

0144

JOB COM820519 O/N : Sheet 004795

PB2

Results in ppm

	SAMPLE	Cu	Pb	Zn	Ag
176·88 - 178m	ADL 36321	190	<4	130	<1
178m - 180m	ADL 36322	90	4	70	<1
	ADL 36323	60	<4	48	<1
	ADL 36324	55	<4	46	<1
	ADL 36325	42	<4	48	<1
	ADL 36326	22	<4	48	<1
188 - 190m	ADL 36327	38	<4	38	<1
	ADL 36328	48	<4	65	<1
	ADL 36329	20	<4	42	<1
	ADL 36330	36	6	50	<1
	ADL 36331	18	<4	22	<1
198 - 200m	ADL 36332	18	<4	22	<1
	ADL 36333	34	<4	34	<1
	ADL 36334	32	<4	34	<1
	ADL 36335	18	<4	26	<1
	ADL 36336	38	<4	44	<1
208 - 210m	ADL 36337	30	<4	36	<1
	ADL 36338	36	<4	46	<1
	ADL 36339	18	<4	32	<1
	ADL 36340	46	<4	50	<1
	ADL 36341	12	<4	30	<1
218 - 220m	ADL 36342	24	<4	20	<1
	ADL 36343	12	<4	14	<1
	ADL 36344	16	<4	16	<1
	ADL 36345	16	<4	26	<1

.../ 2

ANALYTICAL REPORT

JOB COM820519 O/N : Sheet 004795 0145

Results in ppm

SAMPLE	Cu	Pb	Zn	Ag
ADL 36346	8	<4	14	<1
228 - 230m ADL 36347	14	<4	16	<1
ADL 36348	8	<4	12	<1
ADL 36349	6	<4	8	<1
ADL 36350	6	<4	10	<1
ADL 36351	6	<4	14	<1
238 - 240m ADL 36352	12	<4	20	<1
ADL 36353	14	<4	16	<1
ADL 36354	4	<4	10	<1
ADL 36355	6	<4	14	<1
ADL 36356	10	<4	28	<1
248 - 250m ADL 36357	10	<4	32	<1
ADL 36358	14	<4	24	2
ADL 36359	6	<4	18	<1
ADL 36360	10	<4	16	<1
ADL 36361	10	<4	14	<1
258 - 260m ADL 36362	16	<4	32	<1
ADL 36363	10	<4	16	<1
ADL 36364	8	<4	30	<1
ADL 36365	12	<4	18	<1
ADL 36366	4	<4	10	<1
268 - 270m ADL 36367	6	<4	12	<1
ADL 36368	12	<4	20	<1
ADL 36369	6	<4	8	<1
ADL 36370	6	<4	12	<1

.../ 3

ANALYTICAL REPORT

0146

JOB COM820519 O/N : Sheet 004795

Results in ppm

	SAMPLE	Cu	Pb	Zn	Ag
	ADL 36371	6	<4	14	<1
278 - 280m	ADL 36372	8	<4	14	<1
	ADL 36373	350	<4	250	<1
	ADL 36374	60	<4	60	<1
	ADL 36375	36	<4	34	<1
	ADL 36376	30	<4	30	<1
288 - 290m	ADL 36377	24	<4	24	<1
	ADL 36378	24	<4	24	<1
	ADL 36379	32	<4	28	<1
	ADL 36380	26	<4	32	<1
	ADL 36381	16	<4	18	<1
298 - 300m	ADL 36382	46	<4	48	<1
	ADL 36383	48	4	55	<1
	ADL 36384	26	<4	34	<1
	ADL 36385	44	<4	40	<1
	ADL 36386	40	<4	40	<1
308 - 310m	ADL 36387	18	<4	20	<1
	ADL 36388	26	<4	28	<1
	ADL 36389	14	<4	18	<1
	ADL 36390	26	<4	26	<1
	ADL 36391	18	4	24	<1
318 - 320m	ADL 36392	22	<4	30	<1
	ADL 36393	36	<4	40	<1
	ADL 36394	28	<4	30	<1
	ADL 36395	28	<4	32	<1

.../ 4

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ANALYTICAL REPORT

0147

JOB COM820519 O/N : Sheet 004795

Results in ppm

	SAMPLE	Cu	Pb	Zn	Ag
	ADL 36396	36	<4	46	<1
328-330m	ADL 36397	180	<4	150	<1
	ADL 36398	38	<4	46	<1
	ADL 36399	38	<4	70	<1
334-336m	ADL 36400	10	<4	44	<1

Method of Analysis : Cu Pb Zn : AAS1
Ag : AAS3

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ANALYTICAL REPORT

0148

JOB COM820519 O/N : Sheet 004795

Results in ppm

	SAMPLE	Au
194-196m	ADL 36330	<0.05
214-216m	ADL 36340	<0.05
234-236m	ADL 36350	<0.05
254-256m	ADL 36360	<0.05
274-276m	ADL 36370	<0.05
294-296m	ADL 36380	<0.05
314-316m	ADL 36390	<0.05
334-336m	ADL 36400	<0.05

Method of Analysis : Au : AAS5A

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COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

0149

JOB COM820555 O/N : B 670/500 Sheet 4798

Results in ppm

	SAMPLE	Cu	Pb	Zn	Ag
336-338m	ADL 36401	14	6	30	<1
338-340m	ADL 36402	24	<4	65	<1
	ADL 36403	28	<4	80	<1
	ADL 36404	75	<4	250	<1
	ADL 36405	155	<4	140	<1
	ADL 36406	85	14	150	<1
348-350m	ADL 36407	110	10	150	<1
	ADL 36408	125	18	160	<1
	ADL 36409	260	80	250	<1
	ADL 36410	135	80	300	<1
	ADL 36411	135	70	250	<1
358-360m	ADL 36412	55	300	900	<1
	ADL 36413	95	400	1200	<1
	ADL 36414	46	55	400	<1
	ADL 36415	200	36	200	<1
	ADL 36416	280	8	120	<1
368-370m	ADL 36417	350	120	950	<1
	ADL 36418	115	10	150	<1
	ADL 36419	185	8	170	<1
	ADL 36420	155	12	140	<1
	ADL 36421	250	18	160	<1
378-380m	ADL 36422	290	26	160	<1
	ADL 36423	210	32	150	<1
	ADL 36424	390	38	130	<1
	ADL 36425	110	16	170	<1

.../ 2

ANALYTICAL REPORT

0150

JOB COM820555 O/N : B 670/500 Sheet 4798

Results in ppm

SAMPLE	Cu	Pb	Zn	Ag
ADL 36426	60	12	250	<1
388-390m ADL 36427	350	12	400	<1
ADL 36428	115	10	200	<1
ADL 36429	135	10	400	<1
ADL 36430	155	12	250	<1
ADL 36431	115	6	190	<1
398-400m ADL 36432	195	8	190	<1
ADL 36433	135	18	300	<1
ADL 36434	105	26	200	<1
ADL 36435	90	18	200	<1
ADL 36436	130	55	300	<1
408-410m ADL 36437	55	14	180	<1
ADL 36438	75	18	180	<1
ADL 36439	55	14	190	<1
ADL 36440	42	38	400	<1
ADL 36441	44	90	550	<1
418-420m ADL 36442	210	60	350	<1
ADL 36443	60	70	350	<1
ADL 36444	115	80	250	<1
ADL 36445	55	14	190	<1
ADL 36446	70	26	200	<1
428-430m ADL 36447	70	30	170	<1
ADL 36448	65	10	150	<1
ADL 36449	125	4	190	<1
ADL 36450	115	6	250	<1

.../ 3

ANALYTICAL REPORT

0151

JOB COM820555 O/N : B 670/500 Sheet 4798

Results in ppm

SAMPLE	Cu	Pb	Zn	Ag
436-437m ADL 36451	120	6	250	<1

Method of Analysis : Cu Pb Zn : AAS1
Ag : AAS3

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ANALYTICAL REPORT

JOB COM820555 O/N : B 670/50 Sheet 4798

0152

Results in ppm

PB2

SAMPLE		Au
354 - 356m	ADL 36410	<0.05
374 - 376m	ADL 36420	<0.05
394 - 396m	ADL 36430	<0.05
414 - 416m	ADL 36440	<0.05
434 - 436m	ADL 36450	<0.05

Method of Analysis : Au : AAS5A

Pontifex & Associates Pty. Ltd.

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A.H. 31 3816

26 KENSINGTON ROAD, ROSE PARK
SOUTH AUSTRALIA

P.O. BOX 91, NORWOOD
SOUTH AUSTRALIA 5067

0153

MINERALOGICAL REPORT NO. 3610

by A.C. Purvis, PhD

23rd February, 1982

TO:	Mr. M. Page, B.H.P. Exploration Co., G.P.O. Box 1818, ADELAIDE, S.A. 5001
YOUR REFERENCE:	Project B670, Despatch Sheet 004784
MATERIAL:	Drill Core samples
IDENTIFICATION:	ADL 36301 to ADL 36314
WORK REQUESTED:	Thin section and petrological description
SAMPLES & SECTIONS:	Returned to you with this report

PONTIFEX & ASSOCIATES PTY. LTD.

COMMENTS

These samples represent a sequence gradational from chemical sediments, largely banded iron formation; through a garnet quartzite unit into pelitic and quartzofelspathic metasediments. Sulphides are concentrated at or near the garnet-quartzite-pelitic schist boundary, and include pyrite, pyrrhotite and very minor chalcopyrite.

The silicate parts of the banded iron formations locally contain amphibole (anthophyllite, actinolite) and locally contain pyroxenes, usually only orthopyroxene, but with orthopyroxene dominant over clinopyroxene, in sample ADL36306, at the base of the banded iron formation.

The orthopyroxenes appear, on the basis of optical properties, to be iron-rich. This, together with the presence of amphiboles suggests conditions transitional between the upper amphibolite and lower granulite facies; with magnesian assemblages manifest as amphiboles and iron-rich assemblages manifest as pyroxenes. This grade is supported by the absence of muscovite and the presence of sillimanite-orthoclase assemblages in the pelitic schists.

Graphite is present throughout the sequence and is locally very abundant (ADL36310).

The sample bags in which the core samples were submitted are marked with a drill hole number (PB2) and depths in meters, except for ADL36301. These depths are as follows :-

ADL 36302	292.78 - 292.89
03	317.62 - 317.76
04	339.57 - 339.71
05	344.02 - 344.10
06	348.09 - 348.75
07	349.59 - 349.72
08	359.42 - 359.54
09	366.84 - 366.97
ADL 36310	369.27 - 369.39
11	369.88 - 370.00
12	377.00 - 377.52
13	394.68 - 398.78
ADL 36314	434.45 - 434.57

These depths indicate that the chemical sediments extend to about 349 metres, with garnet-quartzite to about 369.5 metres, and pelitic schist below about 369.5 metres, i.e. an apparent thickness of garnet-quartzite of 26.5 metres.

These rocks show some similarities to the Mount Shannon Iron Formation, and Mangalo Schist in the Eyre Peninsula region, in particular in their content of graphite.

**

ADL 36301 : irregularly layered and schistose, magnetite-talc rock, with retrograde talc pseudomorphs after coarse anthophyllite prisms

This rock contains numerous irregular lenses, layers and grains of coarse magnetite (25%) to 15 mm long set in a schistose matrix of talc. Some of the talc (35%) occurs as pseudomorphs after coarse prismatic crystals up to 15 mm long, which are considered, by analogy with the crystals in sample ADL 36303, to be anthophyllite.

It is not clear what mineral has been replaced by the remaining talc, which is extremely fine grained and clouded yellow-orange with no definite texture.

The rock is cut by thin carbonate veins.

A DL 36302 : albite-quartz rock with apatite-magnetite segregations and minor actinolite

This rock consists of a massive, inequigranular aggregate of albite grains (7%) to 8 mm, partly to completely altered to sericite, abundant quartz grains (50%) to 15 mm, and minor green hornblende or actinolite grains (5%) to 10 mm.

Segregations of magnetite (20%) to 30 x 10 mm contain minor apatite and may have been derived from an immiscible oxide-phosphate melt. The magnetite is partly rimmed by calcite and chlorite and partly by the actinolite.

There is minor epidote and prehnite in the altered felspar.

ADL 36303 : quartz-magnetite-anthophyllite rock with retrograde talc and minor phlogopite

This rock has lenses and stringers of magnetite in two directions at right angles, from 0.5 to 10 mm wide. These make up about 25% of the rock, and are set in a coarse grained anthophyllite aggregate with minor quartz.

The anthophyllite crystals are prismatic and up to 15 mm long; i.e. similar in size and shape to the talc pseudomorphs in ADL 36301. They are partly altered to talc along subbasa;e fractures (these can also be seen in sample 36301), and locally have patches of fine grained interstitial talc.

Anhedral patches of quartz to 6 mm across, make up about 10% of the rock. A trace of pale greenish phlogpite is partly altered to chlorite.

ADL 36304 : layered, more or less gneissic, graphite, quartz-hypersthene rock

This is a finely layered rock composed largely of quartz (30%) and hypersthene (65%) with opaque plates of graphite (5%) more or less along the layering.

The orthopyroxene occurs as very large poikiloblastic grains to over 25 mm across (i.e. larger than the width of the thin section), with some lenses of smaller grains down to 0.5 mm. Deformed areas in the pyroxene have fine lamellae in what may be areas of twinned clinohypersthene.

The quartz occurs in lenses and layers from 0.5 to 10 mm wide and is anhedral with grains up to 6 mm across.

ADL 36305 : layered, gneissic, apatite-bearing quartz-ferrohypersthene rock, with disseminated coarse graphite

This rock is similar to sample 36304 but has a more granular orthopyroxene with grains from 0.5 to 6 mm across. This orthopyroxene is also more highly pleochroic and has a high 2V (about 90°) suggesting an Fe/(FE+Mg) atomic radio of 0.8 - 0.9. There are subbasal deformation bands, which are fairly broad, and prismatic fine deformation lamellae.

The quartz occurs in lenses, layers and disseminations. The layers are up to 10 mm across with grains to 3mm.

The graphite flakes are more randomly oriented than in sample 36304 but are thicker; they are mostly 0.5 - 1.5 mm across.

Apatite is a common accessory as anhedral grains to 1 mm long, usually in narrow apatite-rich layers.

ADL 36306 : magnetite, clinopyroxene-orthopyroxene, actinolite rock, with tremolite veins and secondary green and orange-brown clays; accessory magnetite disseminated and in layers

This rock is primarily a granular mixture of clinopyroxene orthopyroxene and actinolite in the ratio 25:30:40, with 5% scattered magnetite. The grains range from 0.2 to 1 mm, with magnetite smaller than 0.3 mm. The orthopyroxene is largely replaced by either green or orange-brown clays, possibly chlorite + vermiculite + ?goethite.

The rock is cut by a vein of tremolite 1 - 2 mm wide, locally containing talc and there is a lens of possible vermiculite in this tremolite vein.

A talc-limonite-magnetite vein about 2 mm wide, occurs along the vague layering (emphasised by clay alteration).

ADL 36307 : layered, coarse granular, garnetiferous quartzite, with minor biotite and trace pyrrhotite

This rock has layers to 10 mm wide containing about 10% garnet alternating with narrower garnet-free to garnet-poor layers which are dominated by coarse granulblastic quartz. Minor biotite defines a layer parallel schistosity, in the garnet-bearing layers.

The garnet is anhedral and 0.5 to 2 mm across, weakly elongate along the layering and weakly poikiloblastic. The quartz grains are anhedral and up to 10 mm across.

There are minor opaque oxides (? ilmenite) and sulphides (pyrrhotite).

ADL 36308 : layered, (biotite) very coarse garnet quartzite, minor fine pyrrhotite

This rock is similar to sample ADL 36307 but in the thin section has less well-defined banding and a weaker schistosity. In the hand specimen minor garnet-rich bands about 20 mm thick are quite clear within the relatively massive quartzite. It is also coarser grained than ADL 36307, with anhedral quartz grains locally over 15 mm across, and garnet anhedra to 4 mm.

The amount of garnet ranges from less than 1% to 25% in different parts of the slide. Biotite ranges in abundance up to 5% and occursas flakes to 1 mm.

Grains of sulphide (apparently pyrrhotite) are more abundant (2 - 3%) than in 36307 and up to 1 mm across, and are randomly disposed but mostly associated with biotite and/or garnet.

ADL 36309 : layered, (biotite) garnet quartzite, with layers of pyrrhotite, pyrite, minor graphite and chlorite, trace chalcopyrite

This sample has garnet-sulphide layers up to 15 mm wide set in a quartzite matrix with quartz grains up to 20 mm across.

The smaller and thinner garnet-sulphide layers contain pyrrhotite grains and small lenses to 4 mm, and garnet grains 0.5 - 2 mm across, with minor biotite defining a weak layer-parallel schistosity.

The thicker layers contain abundant pyrite as anhedral grains to 8 mm across, partly enclosing anhedral garnet grains to 4 mm, and weakly aligned biotite flakes to 1.5 mm. Small patches of secondary chlorite of unknown origin, and minor small flakes and small clusters of graphite occur in these sulphide-bearing layers.

Limonite lines some grain boundaries and intragranular fractures. Trace extremely fine chalcopyrite accompanies some pyrrhotite.

ADL 36310 : quartz-garnet-biotite-sillimanite schist, with minor retrograde sericite and chlorite; irregular layers and aggregates of coarse pyrite, pyrrhotite, minor graphite trace chalcopyrite

This rock contains pyrite-rich aggregates, and irregular lenses over 20 mm wide, and pyrrhotite-rich layers to over 16 mm, enclosing weathered and partly altered, loosely aggregated sillimanite grains and partly altered biotite.

Lenses of garnet to 20 x 5 mm, contain pyrrhotite, and accessory ilmenite, graphite, rutile, chalcopyrite, quartz, sillimanite and biotite. The rest of the rock consists of irregular lenses of prismatic and fibrolitic sillimanite to 5 mm across, and biotite-quartz lenses to 3 mm, enclosing trace to accessory amounts of the other minerals listed above.

The most concentrated pyrite aggregate encloses a lens of coarse graphite 3 mm x 7 mm.

Most domains in the rock, apart from the pyrite aggregate, have a common orientation and elongation which is tightly folded, and this elongation is followed by the graphite and ilmenite crystals.

Amont the sulphides, pyrrhotite is dominant over pyrite, and there is only accessory chalcopyrite.

ADL 36311 : layered, biotite garnet quartzite with minor sillimanite and alkali felspar; accessory fine pyrrhotite disseminated and layered throughout

This rock is a fairly homogeneous, fine to medium grained garnet quartzite, but it has a layer some 20 mm thick containing about 15 - 20% alkali felspar.

The garnet quartzite contains 20 - 25% garnet grains from 0.5 to 4 mm, and quartz grains to 4 mm. A schistosity is defined by 5% biotite flakes and 3% ilmenite laths. The coarsest garnet grains are concentrated into a layer some 5 mm wide, parallel to the schistosity.

The alkali felspar grains are about 0.5 - 1 mm across and anhedral.

There is a moderate preferred orientation of the quartz, with the C-axes at a high angle to the schistosity.

ADL 36312 : sillimanite-garnet-biotite schistose gneiss with abundant chlorite, coarse pyrite, minor pyrrhotite

This rock is highly heterogeneous, with contorted aggregates, lenses and layers of garnet, biotite or sulphide 5 to 20 mm long, and smaller layers of sillimanite. The thin section was cut largely parallel to the schistosity and most of the biotite flakes are seen as basal sections.

The sillimanite is partly seen in end section, and partly in transverse section.

The garnet grains are up to 4 mm across and fractured and veined by chlorite. Chlorite is abundant adjacent to the sulphide lenses, and replaces biotite and sillimanite, and possibly other minerals not preserved elsewhere in the section.

Lenses of quartz on one end of the section are probably quartz veins of metamorphic origin.

Pyrite is by far the most abundant sulphide, as coarse (2 - 5 mm) coalescing grains, but a small lens of pyrrhotite occurs locally, including accessory fine chalcopyrite. Rutile is present in minor to accessory amounts.

ADL 36313 : altered biotite-garnet-quartz schistose fine gneiss, with parallel sericite-clay veins, and scattered pyrite

This rock consisted essentially of a layered schistose granuloblastic aggregate of about 15% biotite, 25% garnet, 5% pyrite, and 55% quartz. The biotite is now completely replaced by limonite-stained chloritic clay.

The average grain size is 0.5 - 2 mm and there is a strong schistosity, paralleled by layers of pyrite. Some of the pyrite occurs as thin lenticular veins.

Veins paralleling this schistosity occur at 5 - 10 mm spacings and consist of green, possibly phengitic micas (sericite), and oxidised limonite-stained clays, similar to those replacing the biotite.

ADL 36314 : biotite-sillimanite-garnet-quartz-plagioclase-alkali felspar schistose gneiss, with retrogressed cordierite, trace very fine pyrite

This rock can be described as a quartzofelspathic gneiss with biotite and minor aluminous silicates (garnet, sillimanite and retrogressed cordierite) . It has quite a good schistosity defined by biotite flakes and, locally, by sillimanite prisms.

Poikiloblasts of garnet to 5 mm across are scattered more or less randomly through the rock, and locally enclose trace very fine pyrite. Retrogressed cordierite is also randomly scattered and locally is present with dactylic inclusions of quartz, giving a myrmekite-like texture. There are also very few true (quartz-plagioclase) myrmekites. The quartz and felspars are granular with grains to 5 mm across. Alkali felspar makes up about 10% and plagioclase 25% of the rock.

APPENDIX 4

DIAMOND DRILL HOLE PB3 AND ROTARY DRILL HOLE PB4

A. Summary and Detailed Logs

B. Geochemical Sample Data

C. Geochemical Analyses

D. Petrology

DETAILED GEOLOGICAL HOLE LOG 0171

THE BROKEN HILL PTY CO LTD. PROJECT E.L. 633 PARAGON BORE DRILL HOLE PB3

Location or local co-ordinates 807000N 390600E R.L. Collar (Datum) approx. 206m

Map Reference Murloocoppie SH-53-2 Co-ordinates (Grid) 807000N 390600E

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar	Action Core	P. Vietneks	Longyear44	Tricone		156m	15-13/11/8
Main Hole	Action Core	P. Vietneks	Longyear 44	Diamond		287m	24/11-1/12

GN MN Magnetic Declination

Depth	Decl'n	Brg (Mag)	Hole dia.	From	To
287m	4° from vertical		HQ	0	156m
			NQ	156	287m

Casing 4" flush-couple water bore casing to 156m; HQ inside this, all removed.

Static water level 82m Date

Logged by M. Page Date 1.12.81

Remarks

From	To	Interval	Recovery	%Rec.		GEOLOGICAL DESCRIPTION		Remarks
0	1	1m	chips		RECENT	Red sand and caly with minor pebbles.		
1	5	4	"		BULLDOG SHALE	Hard indurated silicified white to pale brown calcrete and clay.		
5	30	25	"			Soft grey yellow and brown clay, becoming gritty before 30m.		
30	44	14	"		MT. STUART FORMATION	Medium to coarse loose sand, with bands of highly siliceous red-brown cement.		
44	80	44	"			Fine sand with interbands of soft pale grey clay and some clay matrix with the sand.		Cored from 46.9 to 51m
80	94	14	"		CADNA-OWIE FORMATION	Coarse gritty quartz sand, with grains rounded to subangular and up to 3mm across.		
94	106	12	"			Grey black fine shale and clay.		
106	130	24	"		BOORTHANNA FORMATION	Fine to medium-grained quartz sand with white to grey clay matrix and some black shale interbeds. In parts the sandstone is pyritic.		
130	176	46				Grey sticky clay with very little grit present. At 153m hit a hard band of indurated quartz grit with a black ferruginous cement. Below this went through 1.5m of grey micrite with yellow calcite veins. The unit alternated between the pale grey clays and grey micrite until 176m.		Cored from 156m due t water circulatio problems.

SYMBOLS AND ABBREVIATIONS

DETAILED GEOLOGICAL HOLE LOG

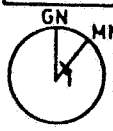
0172

THE BROKEN HILL PTY CO LTD. PROJECT _____ DRILL HOLE PB3

Location or local co-ordinates _____ R.L. Collar (Datum) _____

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							



Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks _____

From	To	Interval	Recovery	%Rec.		GEOLOGICAL DESCRIPTION	Remarks
176	184	8m	core	95%	BORTHANNA FORMATION	Interbedded calcareous shale/shaly micrite and fine to medium-grained sand. Shale shows slumping and soft sediment deformation. Minor clasts of angular to rounded red hematitic and feldspathic quartzites to 5mm appearing after 180m.	
184	187.25	3.25	core	80%	BORTHANNA FORMATION	Conglomeratic sandstone with rounded clasts of basement material (ie granitic gneiss, mafics, quartzites) up to 10cm across.	Angular unconformi at 187.2
187.25	271	83.75	core	100%		Garnetiferous and feldspathic granulite and minor quartzite. Dominant minerals are quartz, pink orthoclase and brassy to black biotite. Garnet becomes common in the sequence by 230m. Interbeds of amphibolite are found in this sequence, the bands being at: 191.00-191.25m, 223.70-224.80, 226.63-227.13, 234.60-236.70, 237.15-237.50m and 253.57-253.90m. Minor magnetite and calcite is found in these amphibolite bands. From 213.00-214.00 find a very coarse porphyroblastic unit of pink orthoclase, grey quartz and black biotite with very minor yellow muscovite. Here the feldspar crystals are up to 8cm across.	

SYMBOLS AND ABBREVIATIONS

DETAILED GEOLOGICAL HOLE LOG

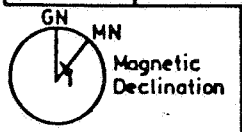
0173

THE BROKEN HILL PTY CO LTD. PROJECT _____ DRILL HOLE PB3

Location or local co-ordinates _____ R.L. Collar (Datum) _____

Map Reference _____ Co-ordinates (Grid) _____

	Contractor	Driller	Machine	Method	Sampling Tools	Depth	Date
Pre Collar							
Main Hole							



Depth	Decl'n	Brg (Mag)	Hole dia.	From	To

Casing _____

Static water level _____ Date _____

Logged by _____ Date _____

Remarks _____

From	To	Interval	Recovery	%Rec.	GEOLOGICAL DESCRIPTION	Remarks
271	287	16m	core	100%	Coarse-grained porphyroblastic unit of orthoclase, quartz, garnet, biotite and chlorite.	

SYMBOLS AND
ABBREVIATIONS

Sample No.	Drill Hole	Depth (m)	Analysed For	Petrological Study
ADL 36270	PB3	262.23-262.38		Pontifex
271		283.33-283.48		↓
272		186.97-187.25	Cu,Pb,Zn,Ag,Mn,Au,Ba	0174
273		191.88-192.11	↓	
274		197.00-197.20		
275		202.00-202.25		
276		206.96-207.22		
277		212.00-212.20		
278		216.79-217.00		
279		221.96-222.19		
280		226.83-227.10		
281		231.86-232.06		
282		237.00-237.23		
283		241.92-242.21		
284		246.92-247.12		
285		251.92-252.12		
286		257.01-257.26		
287		262.00-262.26		
288		266.85-267.05		
289		272.00-272.20		
290		276.87-277.07		
291		282.09-282.29		
292		286.80-287.00		

COMLABS Pty. Ltd.
COMPUTERISED ANALYTICAL LABORATORIES

0175

NATA REGISTERED No. 1526

Head Office and Central Laboratory
305 SOUTH ROAD,
MILE END SOUTH
STH. AUST. 5031
TEL.: (08) 43 5722
TELEX: AA89323

Queensland Preparation Laboratory
172 LAVARACK AVE.,
EAGLE FARM,
QUEENSLAND. 4007
TEL.: (07) 268 4748

OUR REF.: COM 820656

YOUR REF.: B670

004852

Dr. P. Haslett
BHP Exploration,
GPO Box 1818
ADELAIDE. S.A. 5000

30.4.82

Dear Peter,

RE: JOB COM 820656

Enclosed are the assays for the samples delivered to our laboratory on the 7th April, 1982.

Yours sincerely,

Harry Fishman
Managing Director

COMLABS Pty. Ltd.
COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

0176

JOB COM820656 O/N : B670 Sheet 004852

Results in ppm

SAMPLE	Cu	Pb	Zn	Mn	Ag	Au	Ba
ADL 36272	30	16	36	2100	<1	<0.05	180
ADL 36273	14	6	40	250	<1	<0.05	590
ADL 36274	8	6	85	700	<1	<0.05	350
ADL 36275	10	<4	90	600	<1	<0.05	410
ADL 36276	6	<4	55	450	<1	<0.05	720
ADL 36277	28	6	50	550	<1	<0.05	930
ADL 36278	26	4	85	180	<1	<0.05	670
ADL 36279	18	6	65	300	<1	<0.05	470
ADL 36280	75	8	60	450	<1	<0.05	230
ADL 36281	12	<4	18	350	<1	<0.05	870
ADL 36282	16	6	110	240	<1	<0.05	360
ADL 36283	16	4	65	190	<1	<0.05	570
ADL 36284	6	6	60	200	<1	<0.05	680
ADL 36285	32	4	50	400	<1	<0.05	210
ADL 36286	18	6	60	180	<1	<0.05	750
ADL 36287	12	6	44	160	<1	<0.05	730
ADL 36288	30	<4	50	220	<1	<0.05	220
ADL 36289	65	10	42	180	<1	<0.05	990
ADL 36290	12	<4	20	90	<1	<0.05	480
ADL 36291	10	<4	40	200	<1	<0.05	400
ADL 36292	32	<4	95	400	<1	<0.05	820

Method of Analysis : Cu Pb Zn : AAS1
Mn : AAS2
Ag : AAS3
Au : AAS5A
Ba : XRF1

Pontifex & Associates Pty. Ltd.

TEL. 332 6744
A.H. 31 3816

26 KENSINGTON ROAD, ROSE PARK
SOUTH AUSTRALIA

P.O. BOX 91, NORWOOD
SOUTH AUSTRALIA 5067

0177

MINERALOGICAL REPORT NO. 3563

8th January, 1982

TO:	Mr. M. Page, The B.H.P. Exploration Co., G.P.O. Box 1818 ADELAIDE, S.A. 5001
YOUR REFERENCE:	Despatch Sheet 004781 Project No. B670/200
MATERIAL:	Drill core
IDENTIFICATION:	ADL 36270 ADL 36271
WORK REQUESTED:	Thin section and petrographic description
SAMPLES & SECTIONS:	Returned to you with this report

PONTIFEX & ASSOCIATES PTY. LTD.

ADL 36270 : inequigranular, coarse (?sillimanite) biotite potassic 'granite or paragneiss'; apprently an antectic granite produced by high grade regional metamorphism, with associated alkali metasomtism

This rock has an inequigranular, to quite coarse (10 mm) allotriomorphic granular texture. About 65% of it consists of coarse anhedral crystals of K-spar (orthoclase), which are locally internally distorted and show weak, patchy alteration to clay ± sericite. They also contain rare, extremely fine intergrown albite, and rare small patches of myrmekite.

Subordinate, somewhat finer allotriomorphic quartz (20%) is randomly intergrown with the K-spar. Ragged flakes of biotite (10%) are scattered, and partly altered to chlorite, crowded with fine titaniferous grains. Locally these flakes are relatively concentrated to form discontinuous foliae.

Smaller crystals, including probable prisms locally in small complex bundles, of apparent sillimanite (as in 36271), (5 - 7%) are commonly intergrown with biotite, and completely altered to fine clays and/or sericite, with minute titaniferous grains.

Three rounded grains of zircon, 0.3 mm in size, have a random distribution.

ADL 36271 : sillimanite, K-spar, biotite, garnet, plagioclase gneiss; minor scattered magnetite; conceivably a similar genesis as 36270, but with a precursor of different composition (?or less extensively K-metasomatised)

This rock has a medium to fairly coarse, confused granulose-gneissic texture; with random quite coarse biotite forming only incipient and very localised foliation.

Basically it consists of a rather chaotic, granuloblastic aggregate of plagioclase (35 - 40%), and subhedral to amoeboidal-shaped garnet crystals (15 - 20%), and ragged brown to khaki biotite (15 - 20%), locally as foliae. The garnet appears to be almandine. Potash felspar (10%) occurs only locally but in fairly coarse, partly distorted, grains, rather the same as in 36270.

Minor prisms and small crystals of sillimanite (7 - 10%) are mainly intergrown with biotite. The alteration of these to skeletal clays $\pm$ sericite, withr elict sillimanite cores, allows the clay $\pm$ sericite replicas in 36270 to be interpreted as after sillimanite.

Minor irregular grains of magnetite (3 - 5%) and trace smaller zircon crystals are scattered.

APPENDIX 5

STATISTICS ON GEOCHEMICAL DATA FROM PB1 AND PB2

PARAGON BORE Cu, Pb, Zn ANOMALIES

PB1

BIF	152-317m	ADL 36057-36221
Basement	317-356.2m	ADL 36222-36261

BIF 164 samples

Mean Cu = 33.695 ppm
Population standard devn. for Cu = 57.543
Population variance for Cu = 3311.2

Mean Pb = 4.2378 (results <4ppm regarded as equal to 2ppm)
P.S.D. Pb = 13.555
P.V. Pb = 183.73

Mean Zn = 36.884
P.S.D. Zn = 27.882
P.V. Zn = 777.42

For Cu, using 2X S.A., cutoff point = 149ppm
Anomalous samples: ADL 36134, 36135, 36216, 36217

For Pb, cutoff point = 31ppm
Anomalous samples: ADL 36101, 36216, 36217

For Zn, cutoff point = 93 ppm
Anomalous samples: ADL 36057, 36058, 36065, 36083, 36134, 36135, 36136, 36151, 36197

Basement 39 samples

Mean Cu = 51.769 ppm
Population standard devn. Cu = 50.595
Population variance Cu = 2559.8

Mean Pb = 19.641 ppm (values <4 taken as 2)
P.S.D. Pb = 63.049
P.V. Pb = 3975.2

Mean Zn = 110.08ppm
P.S.D. Zn = 105.39
P.V. Zn = 11108

Cut off point for Cu = 153 ppm
Anomalous samples: ADL 36238, 36239, 36240

Cut off point for Pb = 146ppm
Anomalous samples: ADL 36225

Cut off point for Zn = 321 ppm
Anomalous samples: ADL 36225, 36231, 36232

PB2

BIF	176-334m	ADL 36321-36399
Basement	334-437m	ADL 36400-36451

BIF 79 samples

Mean Cu = 31.861ppm
P.S.D. = 46.861
P.V. = 2196.0

Mean Pb = 2.1266ppm (values <4 taken as 2)
P.S.D. = 0.58173
P.V. = 0.33841

Mean Zn = 35.013ppm
P.S.D. = 33.362
P.V. = 1113.0

Cut off point for Cu = 126ppm
Anomalous samples: ADL 36321, 36373, 36397

Cut off point for Pb = 3ppm (validity questionable)
Anomalous samples: ADL 36322, 36330, 36383, 36391

Cut off point for Zn = 102ppm
Anomalous samples: ADL 36321, 36373, 36397

Basement 52 samples

Mean Cu = 129.77ppm
P.S.D. = 87.677
P.V. = 7687.3

Mean Pb = 39.115ppm (values <4 taken as 2)
P.S.D. = 68.477
P.V. = 4689.1

Mean Zn = 261.52ppm
P.S.D. = 212.98
P.V. = 45363

Cut off point for Cu = 305ppm
Anomalous samples: ADL 36417, 36424, 36427

Cut off point for Pb = 176ppm
Anomalous samples: ADL 36412, 36413

Cut off point for Zn = 687ppm
Anomalous samples: ADL 36412, 36413, 36417

PB1 - PB2 COMBINED VALUES

BIF
Mean Cu = 33.099ppm
Mean Pb = 3.5514ppm
Mean Zn = 35.739ppm

Basement
Mean Cu = 96.341ppm
Mean Pb = 30.769ppm
Mean Zn = 196.62ppm

APPENDIX 6

GEOCHEMICAL ANALYTICAL TECHNIQUES

ELEMENT	COMLABS ANALYTICAL METHOD	RANGE OF DETECTION
Cu	AAS 1	4ppm - 1%
Pb	AAS 1	4ppm - 1%
Zn	AAS 1	2ppm - 1%
Ag	AAS 3	1-250ppm
Au	AAS 5A	0.05-50ppm
Al_2O_3	AAS 6	0.01%-10%
CaO	AAS 6	0.01%-10%
MgO	AAS 6	0.01%-10%
SiO_2	COL 9	1%-Max.
TiO_2	COL 9	0.01% Max.
S	COL 2	0.05%-10%
V	AAS 3	10-5000ppm
Acid Sol/Fe	Acid SOL VOL	10%-Max.
Total Fe	Fusion VOL	10%-Max.
Ce	XRF 1	20ppm-1%
Ba	XRF 1	10ppm-1%
Sn	XRF 1	4ppm-1%
Mn	AAS 2	4ppm-1%
P	COL 1	0.05%-Max.
F	SIE 3	50ppm-Max.
Se	XRF 1	2ppm-1%
Zr	XRF 1	4ppm-1%
Nb	XRF 1	2ppm-1%
U	XRF 1	4ppm-1%
Th	XRF 1	4ppm-1%
Y	XRF 1	4ppm-1%
Co	AAS 1	4ppm-1%
As	XRF 1	2ppm-1%
Sb	XRF 1	4ppm-1%
Mo	AAS 3	4-250ppm

GEOCHEMICAL ANALYTICAL TECHNIQUES

These are brief summaries of types of analyses used as per "Comlabs Price List, 1981".

AAS
- atomic absorption spectrophotometry; AAS 1-3 measures the acid soluble portion of the given elements.
- AAS 5A determines gold values, by aqua regia attack and subsequent extraction into an organic solvent containing a complexing agent.
- AAS 6 determines alkali and alkaline earth elements by hydrofluoric acid attack followed by sulphuric acid digestion.

XRF
- X-ray fluorescence spectrometry on pulverised, briquetted samples.

SIE
- Selective ion electrode analysis; in particular SIE 3 involves fusion of the sample followed by extraction of the fluoride.

VOL
- Accurate volumetric analysis
- VOL 1 determines total concentration of an element either by fusion (total Fe) or by dissolution in acid (acid soluble Fe).
- VOL 2 determines small quantities of sulphur, by high temperature evolution of the S.

COL
- Colorimetric analysis
- COL 1 determines phosphate levels by attack with boiling perchloric acid to develop the yellow molybdo-vanado-phosphate colour.
- COL 4 determines levels of titanium by fusion of the sample followed by acid attack and development of the yellow-peroxide colour.
- COL 9 determines silica levels by acid digestion to give coloured complexes.

ALL ANALYSES WERE PERFOMED BY COMLABS, ADELAIDE.

APPENDIX 7

PRELIMINARY GEOPHYSICAL MODELLING, EL 633 PARAGON BORE

Preliminary Geophysical Modelling - E.L. 633 PARAGON BORE

Six traverses delineate a coincident gravity and magnetic high over an area approximately 4 km square. Contours for both gravity and magnetic data show elongation in the ESE - WNW direction, are closed on the eastern side and partially closed on the west. The source of the anomaly maximum is therefore believed to be a set of bodies striking E-W to ESE - WNW and having a limited strike extent.

Quantitative modelling requires that three dimensional (limited strike-length) bodies be used, however, in view of the lack of geological data to constrain such a model, two dimensional (infinite strike length) bodies have been used. Such modelling in this instance must be regarded as semi-quantitative only, but it does assist in placing constraints on depth, width and size of possible causative bodies.

Modelling is confined to line 93500E. Geological control is provided by DDH-PB& on the line at 79750N. The borehole intersected ironstone between depths 153m and 325m with magnetic susceptibility averaging 100,000 units (i.e. 0.1 cgs units) and density contrast averaging 0.5 g/cc. All the models described herein use uniform susceptibility and density corresponding to these borehole samples.

The models use fictitious station numbers; "9500" corresponds to 76000N, "5750" to 74750N, (i.e. DDH-PBI) and "2500" to 83000N.

Gravity and magnetic profiles for line 93500E are shown in Figures 1 and 2. The magnetic data shows three maxima, implying an irregular or multiple source. The gravity data does not resolve separate maxima, but shows indications of unresolved multiple peaks.

Question: Can observed data be satisfied by multiple bodies with depth range 153 - 314m?

Answer: Figures 3 and 4 show gravity and magnetic response of a pair of E-W striking dykes of depth 153 to 314m (dotted line), response of a deeper tabular body (dashed line) and the combined response (solid line). It is clear that neither size nor breadth of the geophysical response can be explained without addition of the 3rd body, extending to depths hundreds of metres below the 314m figure.

Question: Can the shoulders of the gravity profile and the 3rd peak of the magnetic profile be modelled?

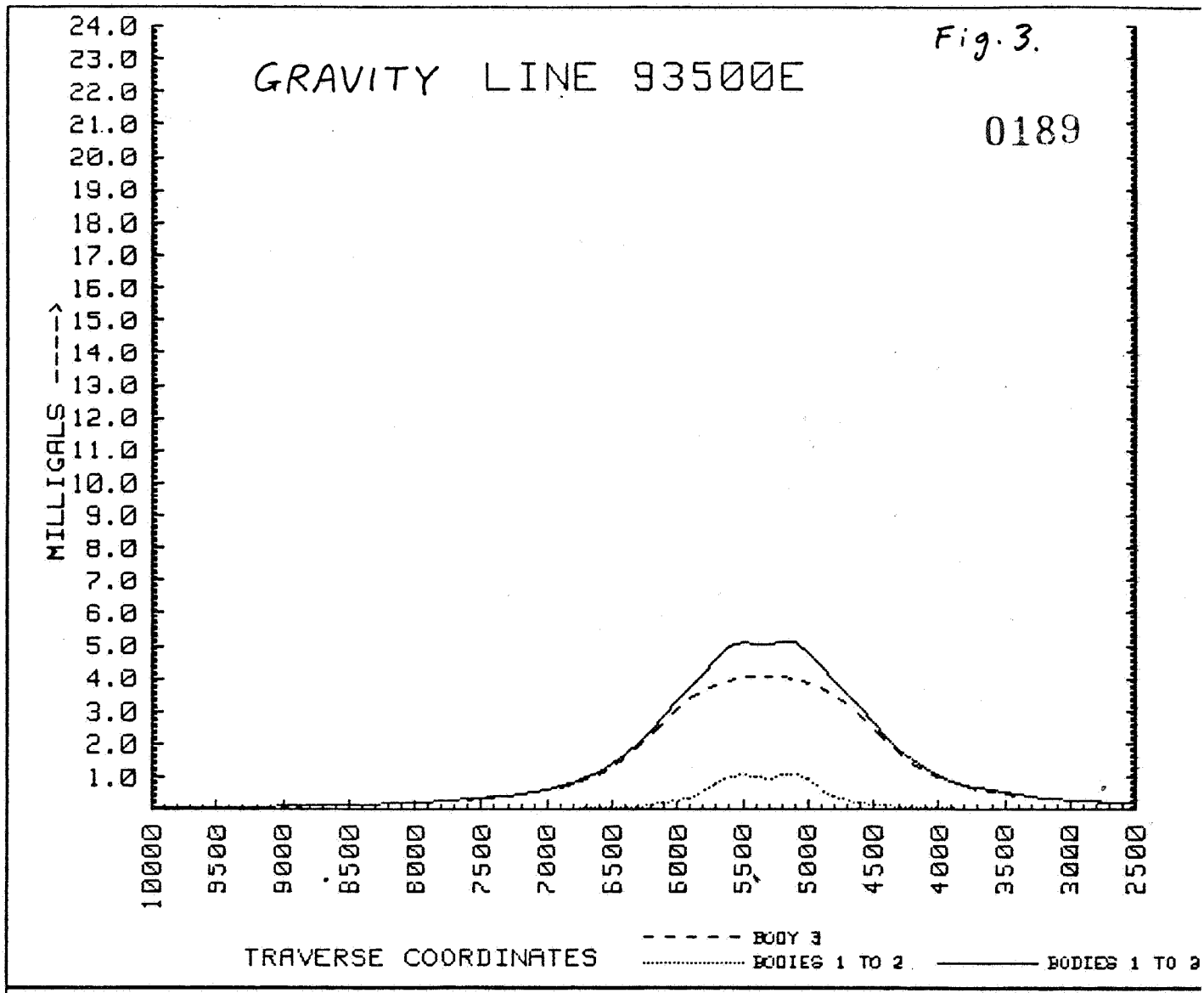
Answer: Figures 5 and 6 show improved correspondence of field and modelled data, achieved by adding a third shallow body and raising the upper surface of the deeper tabular body. This gives an acceptable match in gravity reponse. The fine peaks of the magnetic data are represented on the model response, but the flanks of the field data profile suggest that additional deep structure exists below that included in the model.

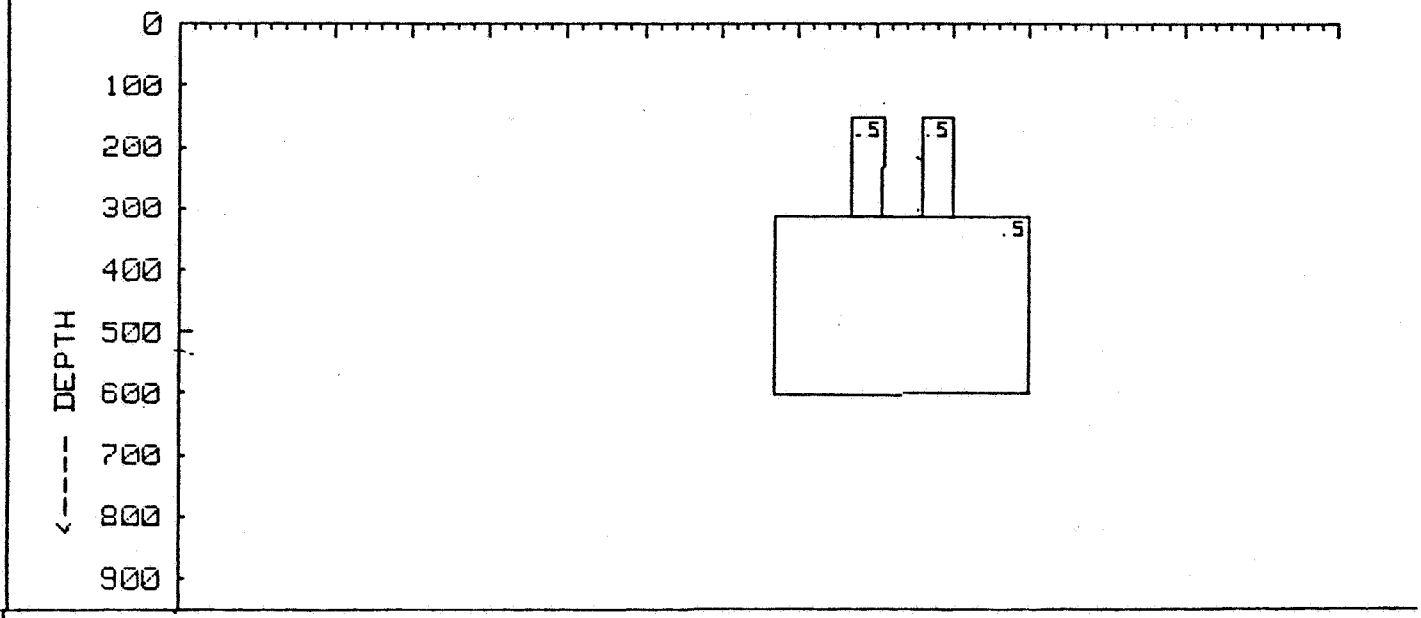
Question: What type of deeper structure?

Answer: Gravity and magnetic profiles on the northern side have slopes indicating that the body does not extend in that direction, but the body does extent to depths substantially greater than 500m. The gravity field shows a regional of the order 10 mgal over 6 km increasing to the south. Figures 7 and 8 show the effect of including a semi-infinite tabular body 550m thick at depth 550m, extending south from the anomaly maximum. This accounts for the observed regional gravity field, and improves correspondence of the magnetic model with data. Further adjustment to this 2-dimensional model are not warranted since the real causative body is 3-dimensional.

Fig. 3.

0189





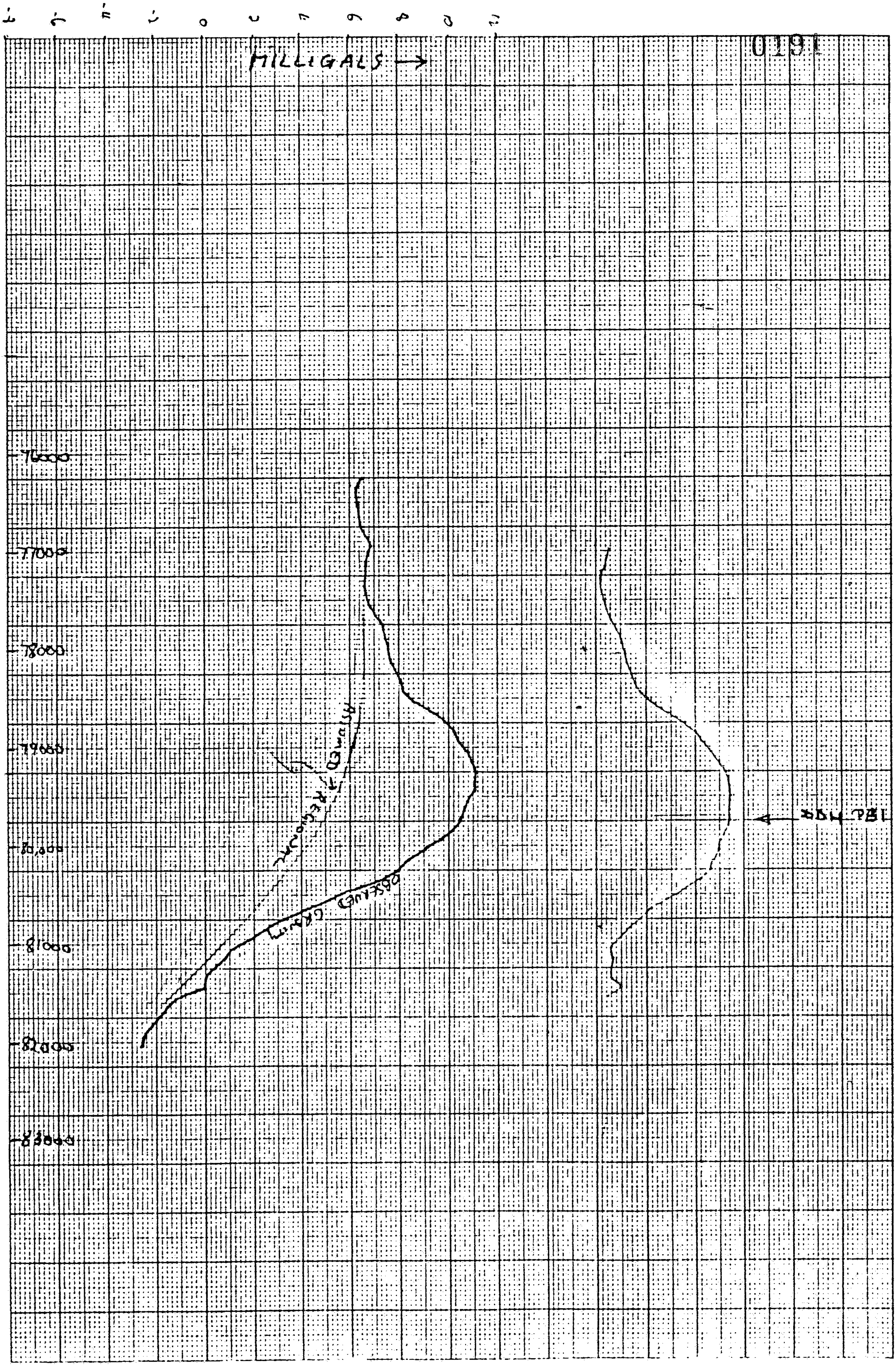
NOTE: DEPTH SCALE EXPANDED BY FACTOR X4

Conclusion

Two-dimensional modelling of the Paragon Bore gravity and magnetic ground data suggests that the causative body may be a tabular structure approximately 500m thick extending from the vicinity of the anomaly maxima to the south and east. The subcrop topography of the body has a raised section of width 1700m at a depth of the order 250m on which there are three ridges striking approximately east west with upper-surface depths of the order 150-200m and widths of the order 200m. Maximum depth extent of the causative body is poorly resolved by the geophysical data available, but it is unlikely to be less than 1 km.

These conclusions are to serve as a preliminary indication only. Additional modelling with the full data set of 6 traverses, strike-limited structures, and additional geological constraints should provide further constraints particularly of additional geological constraint can be provided.

MWA:jiw
21/10/81


MILLIGALS →
S
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77000
78000
79000
79250
79750
80,000
81000
82000
83000
N

Fig. 1.

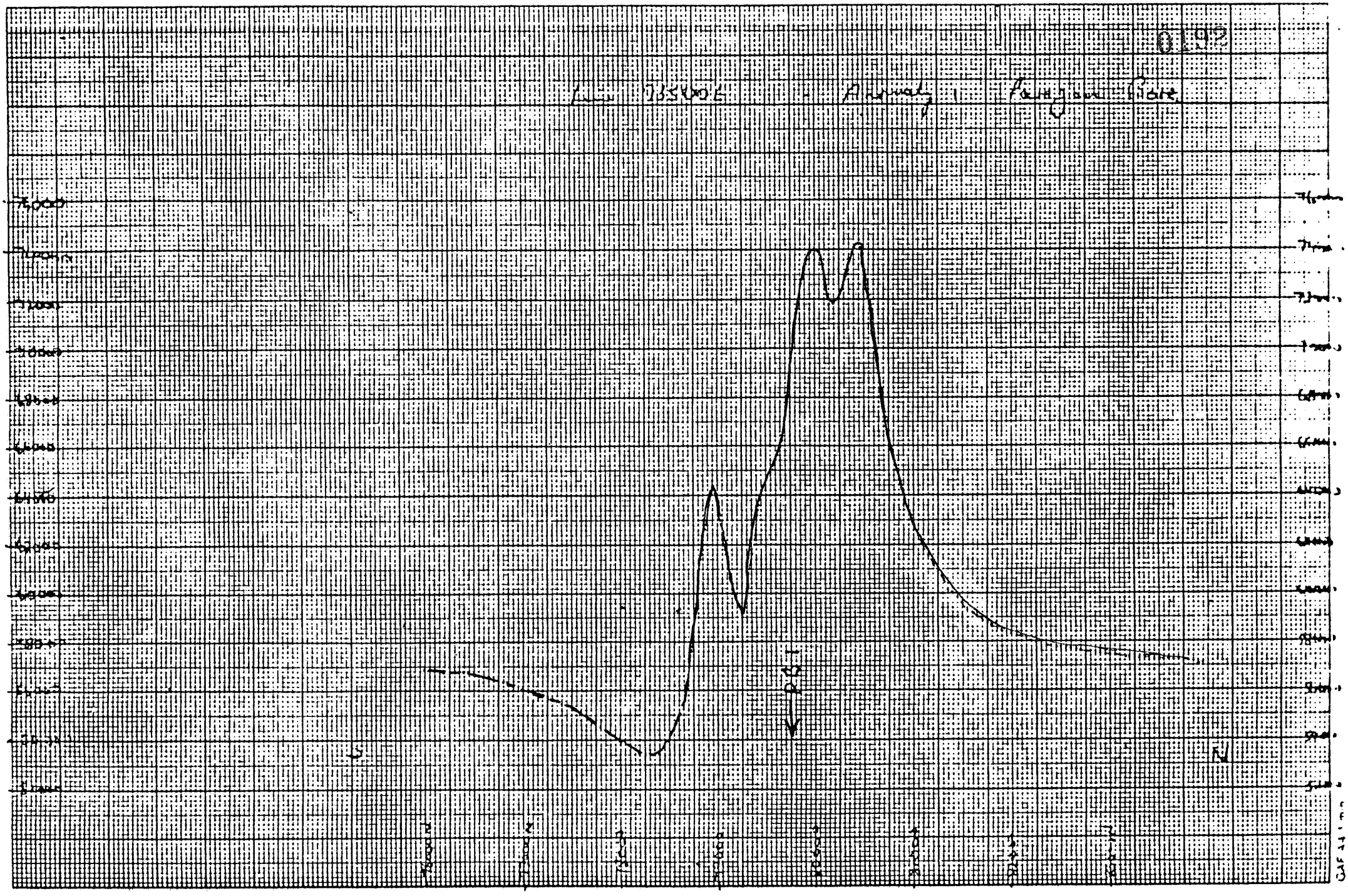
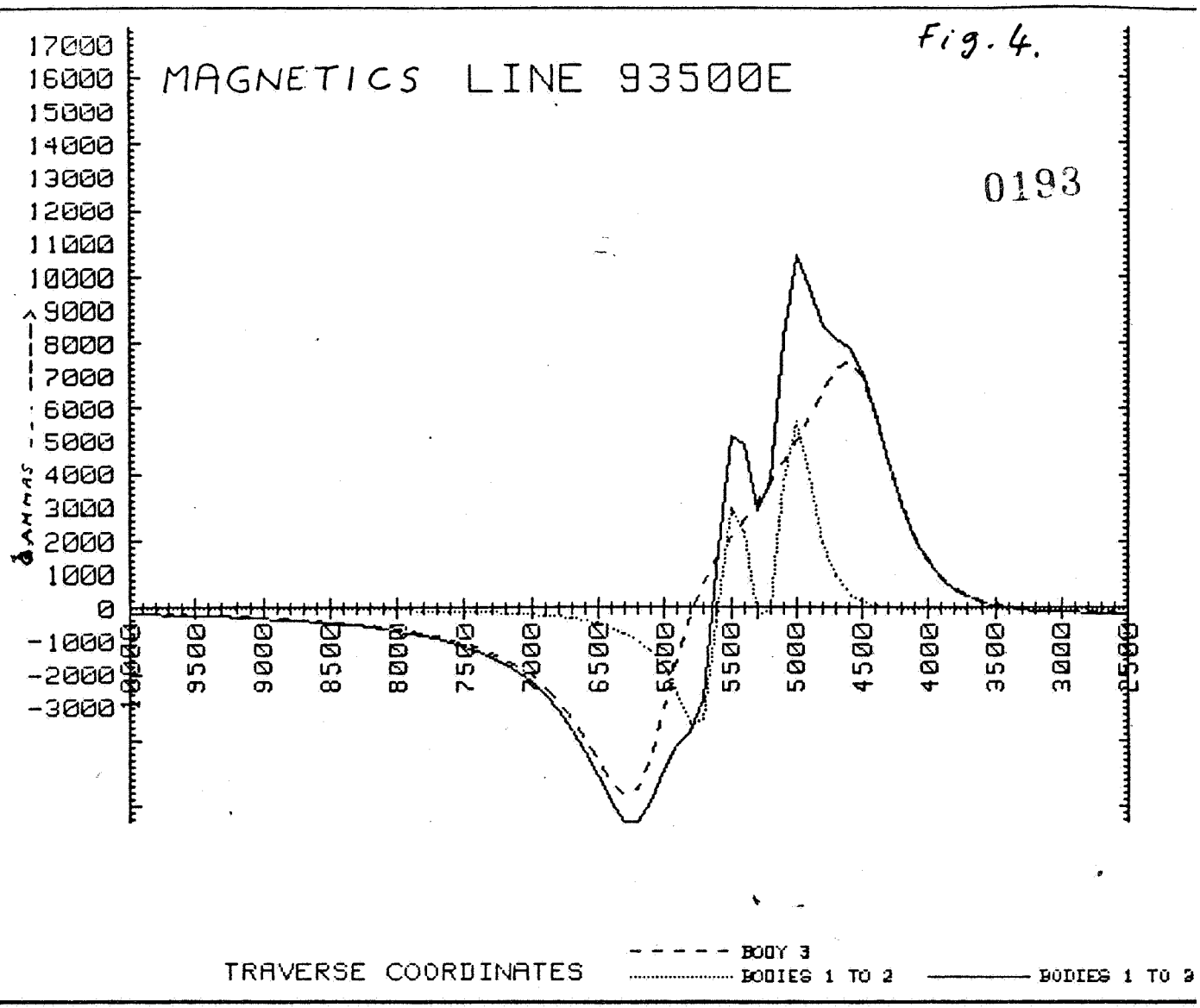
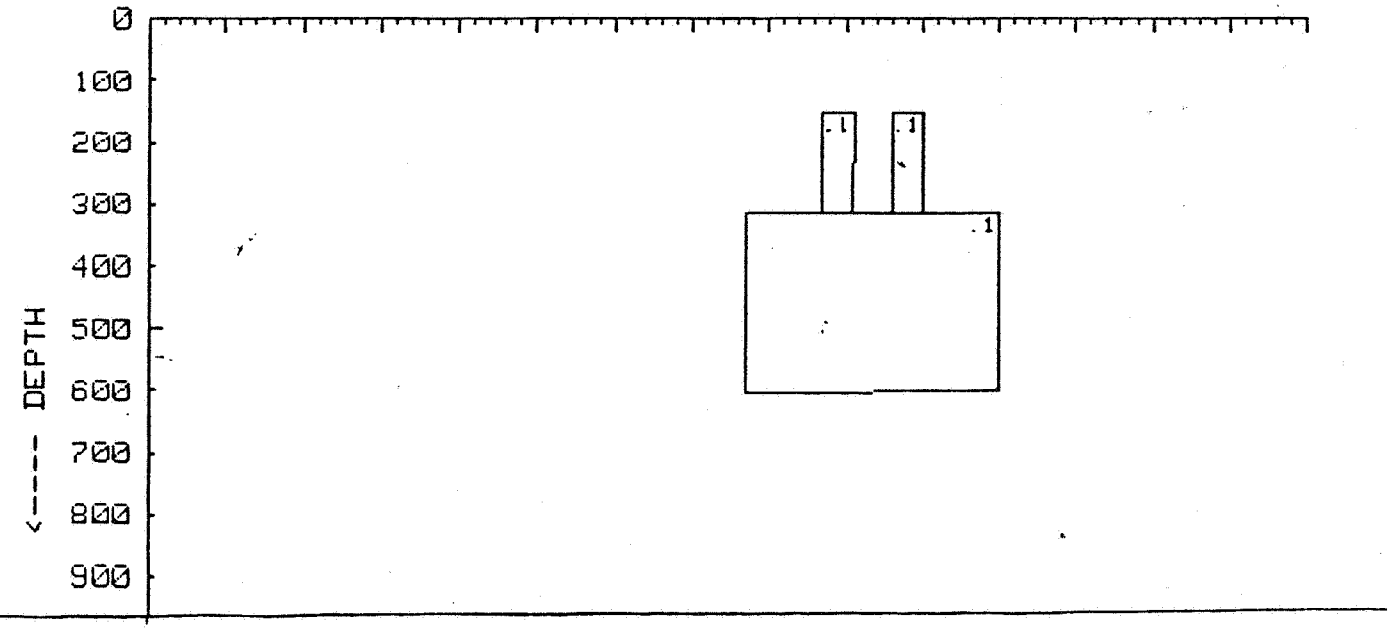


Fig 2

Fig. 4.





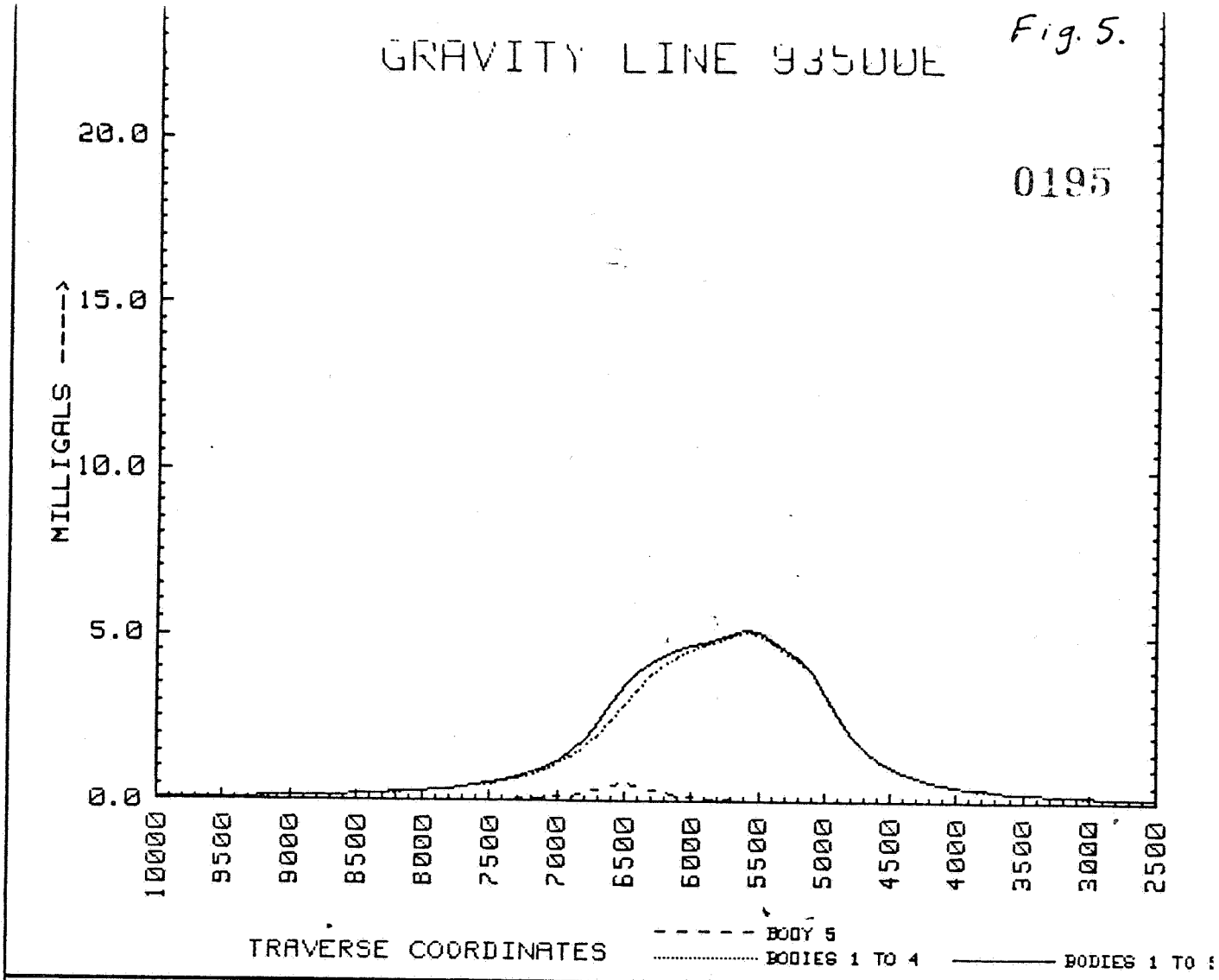
NOTE: DEPTH SCALE EXPANDED BY FACTOR X4

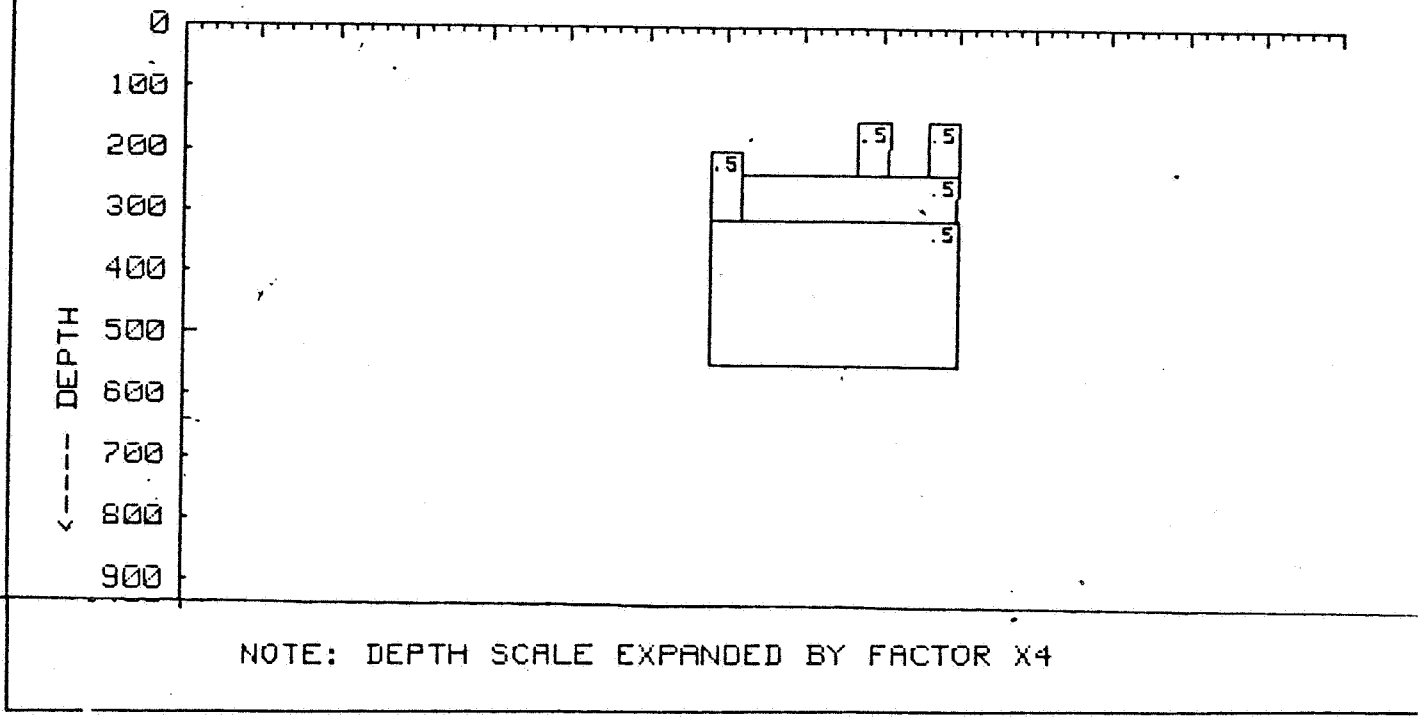
BODY COORDINATES FOR FIGURES 3 AND 4.

Body No.	DENSITY	VERTEX No.	X	Y
1	.50			
		1	5000.00	153.00
		2	5001.00	314.00
		3	5201.00	315.00
		4	5200.00	152.00
2	.50			
		1	5450.00	153.00
		2	5451.00	314.00
		3	5651.00	315.00
		4	5650.00	153.00
3	.50			
		1	4500.00	314.00
		2	4501.00	600.00
		3	6150.00	601.00
		4	6151.00	315.00

Body No.	~~DENSITY~~ SUSCEPTIBILITY	VERTEX No.	X	Y
1	.10			
		1	5000.00	153.00
		2	5001.00	314.00
		3	5201.00	315.00
		4	5200.00	152.00
2	.10			
		1	5450.00	153.00
		2	5451.00	314.00
		3	5651.00	315.00
		4	5650.00	153.00
3	.10			
		1	4500.00	314.00
		2	4501.00	600.00
		3	6150.00	601.00
		4	6151.00	315.00

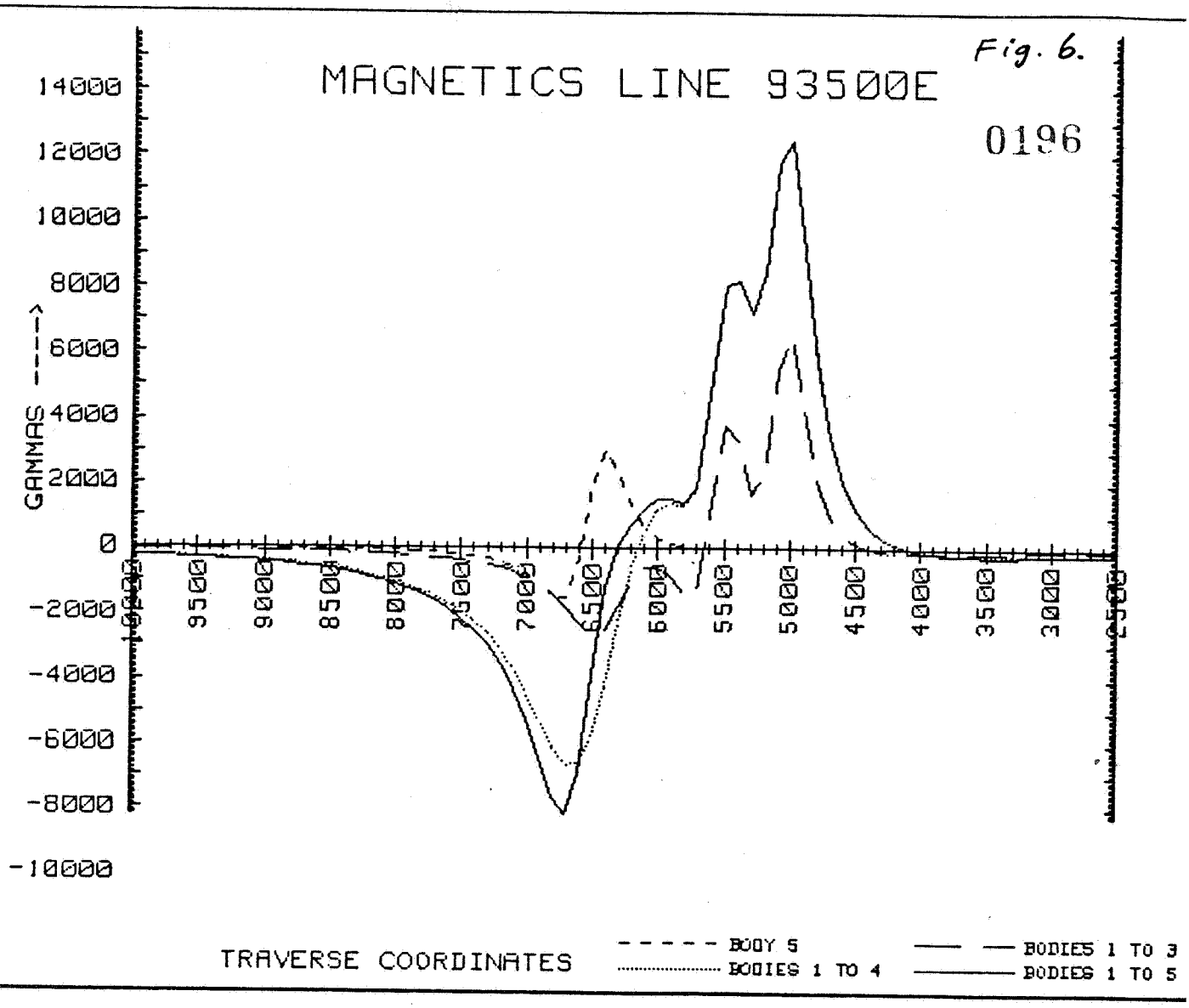
Fig. 5.

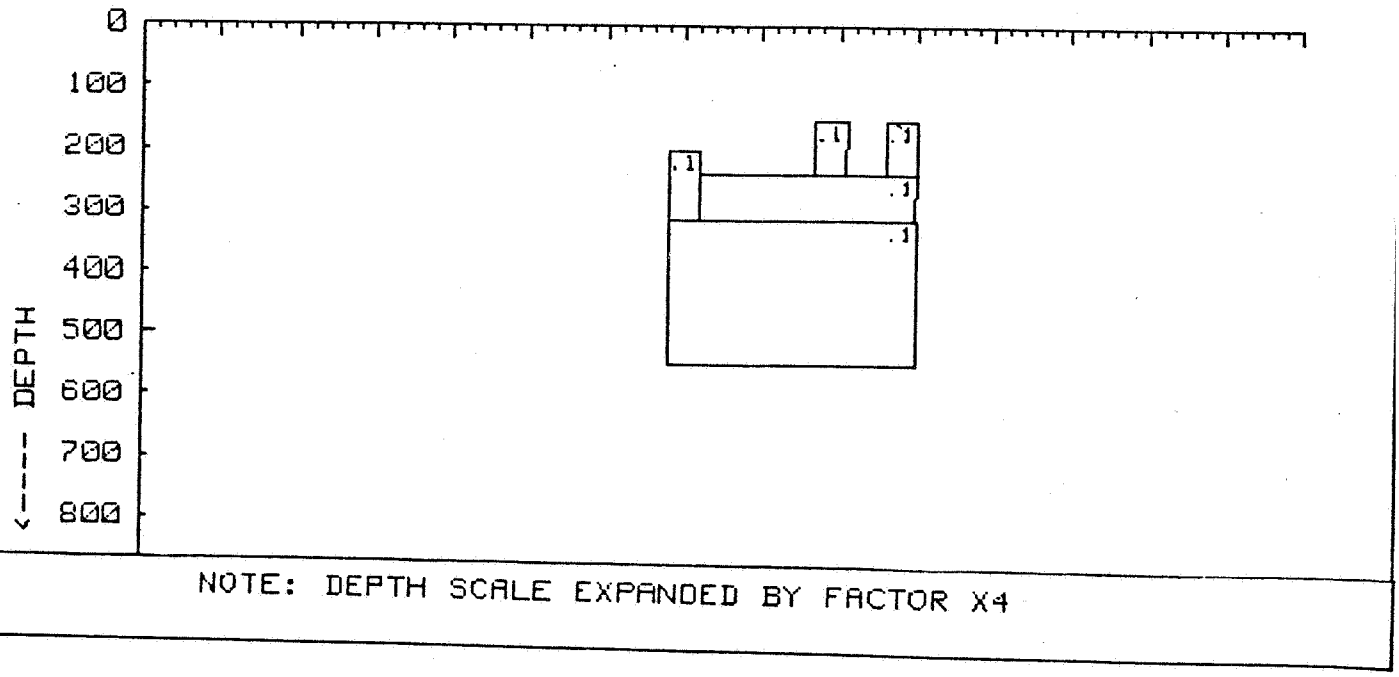




NOTE: DEPTH SCALE EXPANDED BY FACTOR X4

Fig. 6.





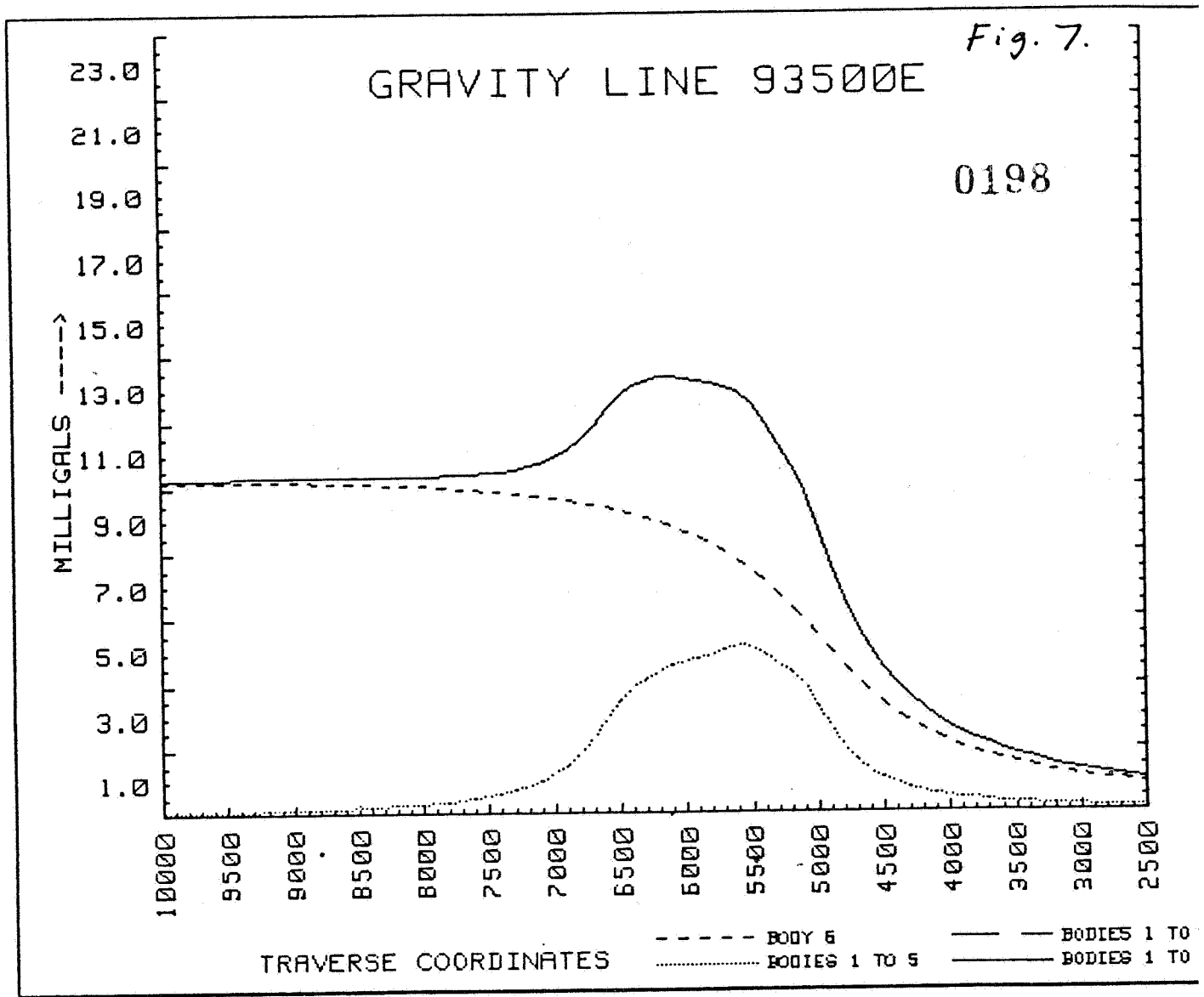
NOTE: DEPTH SCALE EXPANDED BY FACTOR X4

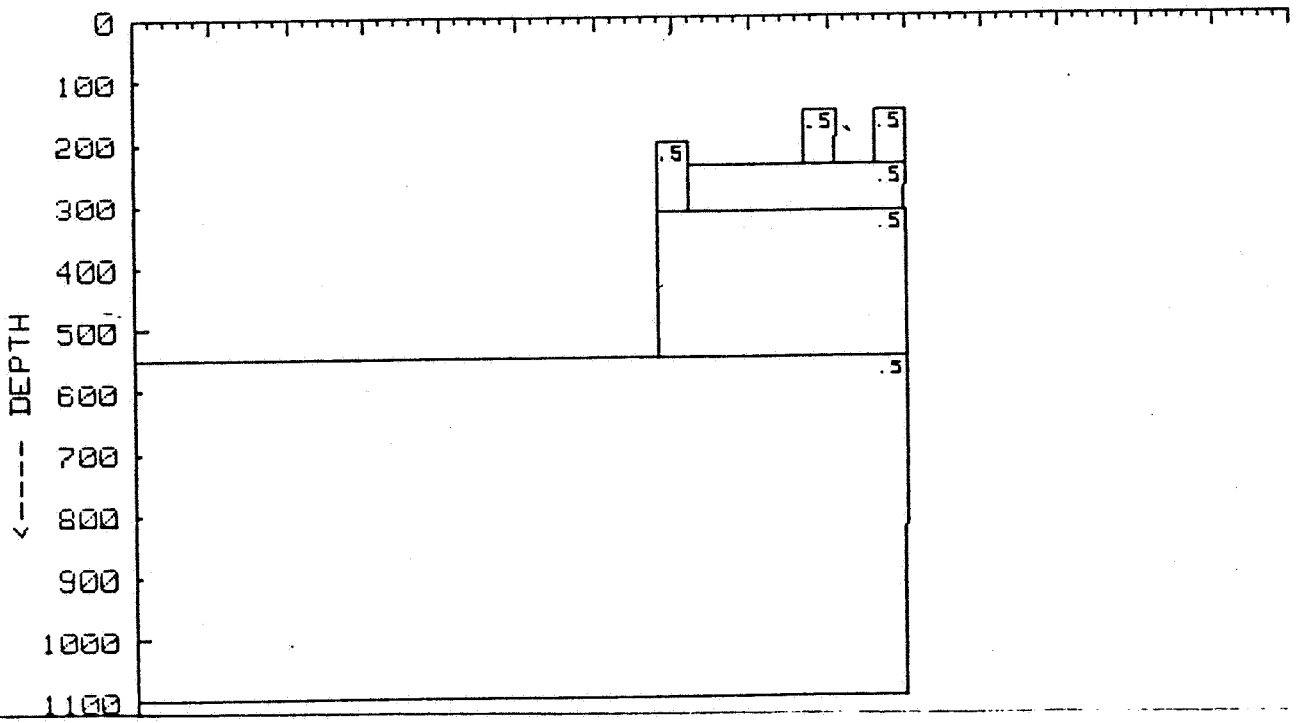
BODY COORDINATES FOR FIGURES 5 AND 6.

Body No.	DENSITY	VERTEX No.	X	Y
1	.50			
		1	5000.00	153.00
		2	5001.00	240.00
		3	5201.00	241.00
		4	5200.00	152.00
2	.50			
		1	5450.00	153.00
		2	5451.00	240.00
		3	5651.00	241.00
		4	5650.00	152.00
3	.50			
		1	5000.00	240.00
		2	5005.00	314.00
		3	6400.00	314.00
		4	6405.00	241.00
4	.50			
		1	5000.00	314.00
		2	5000.00	550.00
		3	6600.00	550.00
		4	6600.00	315.00
5	.50			
		1	6400.00	200.00
		2	6405.00	314.00
		3	6600.00	314.00
		4	6600.00	201.00

Body No.	SUSCEPTIBILITY	VERTEX No.	X	Y
1	.10			
		1	5000.00	153.00
		2	5001.00	240.00
		3	5201.00	241.00
		4	5200.00	152.00
2	.10			
		1	5450.00	153.00
		2	5451.00	240.00
		3	5651.00	241.00
		4	5650.00	152.00
3	.10			
		1	5000.00	240.00
		2	5005.00	314.00
		3	6400.00	314.00
		4	6405.00	241.00
4	.10			
		1	5000.00	314.00
		2	5000.00	550.00
		3	6600.00	550.00
		4	6605.00	315.00
5	.10			
		1	6400.00	200.00
		2	6405.00	314.00
		3	6600.00	314.00
		4	6605.00	201.00

Fig. 7.

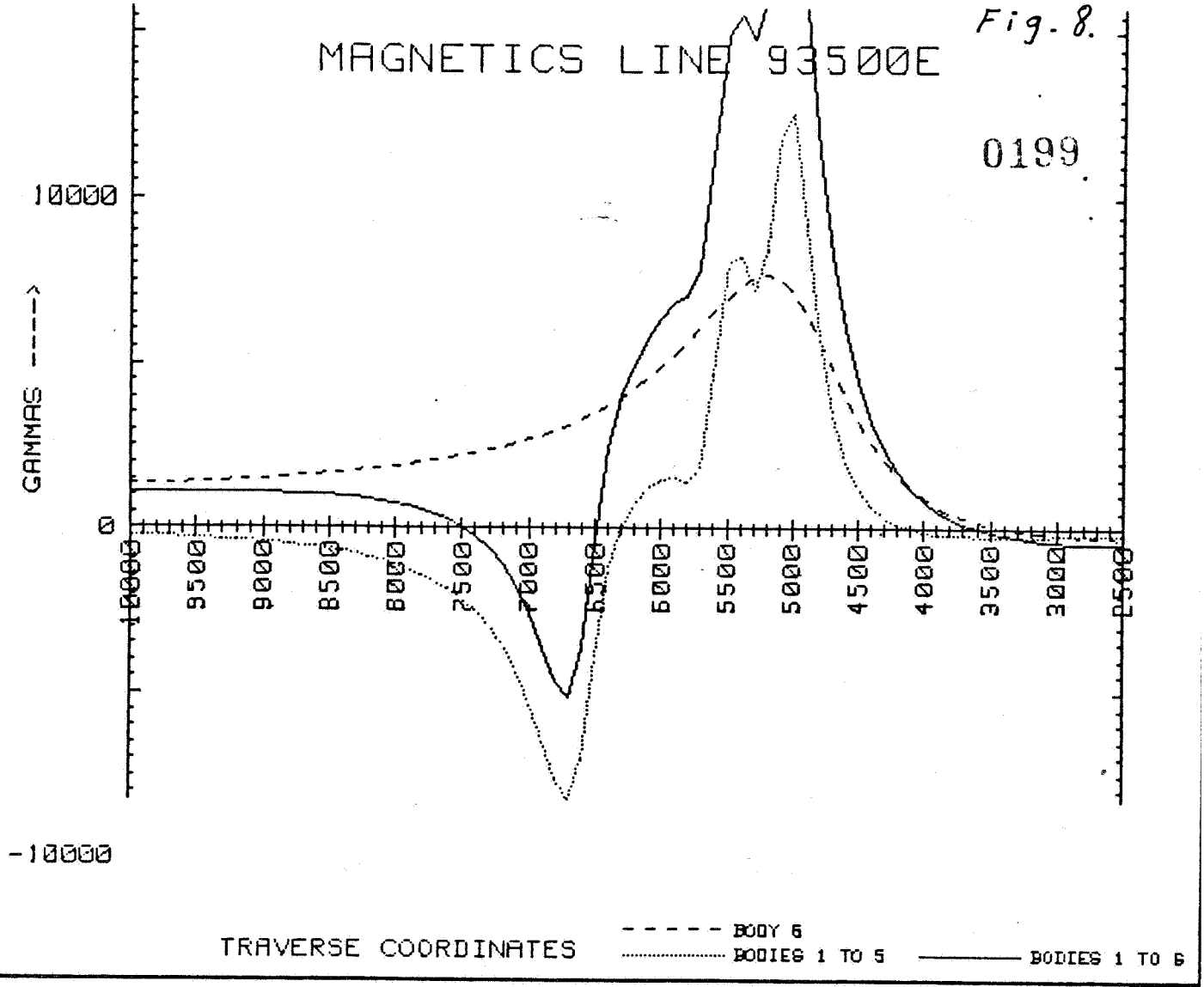


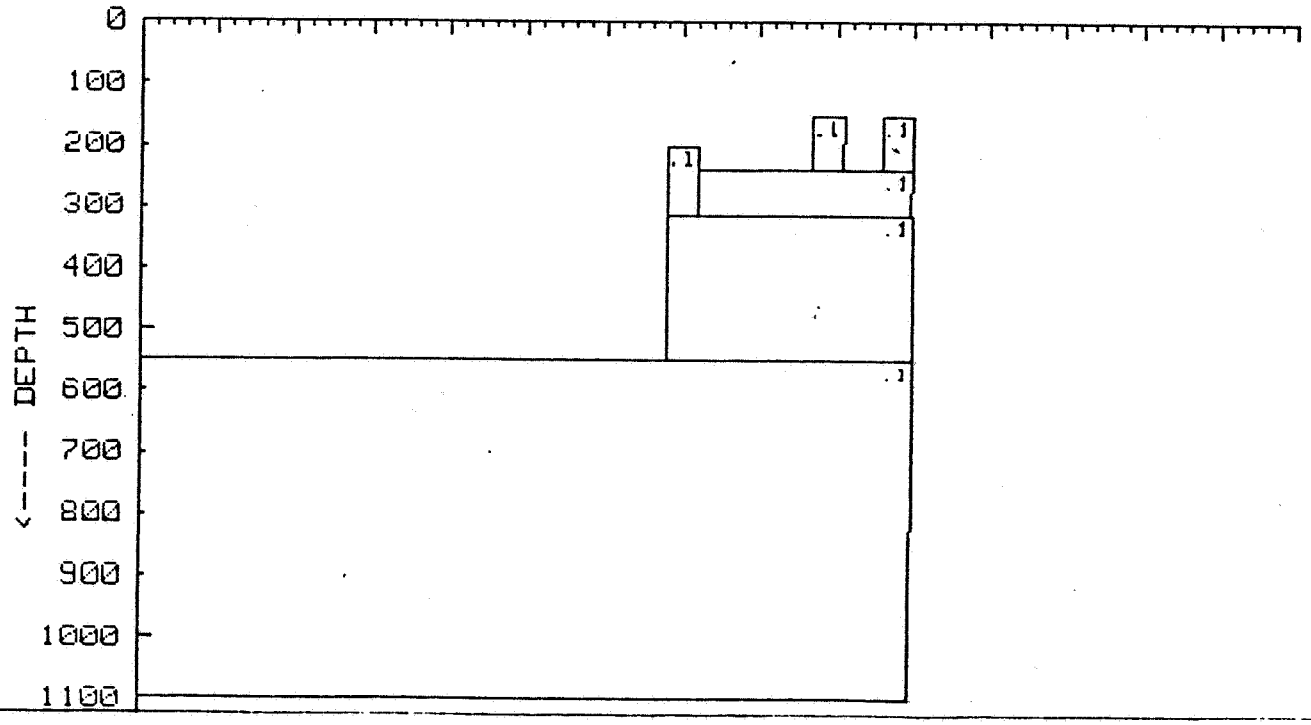


NOTE: DEPTH SCALE EXPANDED BY FACTOR X4

Fig. 8.

0199





NOTE: DEPTH SCALE EXPANDED BY FACTOR X4

BODY COORDINATES FOR FIGURES 7 AND 8.

0200

Body No.	DENSITY	VERTEX No.	X	Y
1	.50			
		1	5000.00	153.00
		2	5001.00	240.00
		3	5201.00	241.00
		4	5200.00	152.00
2	.50			
		1	5450.00	153.00
		2	5451.00	240.00
		3	5651.00	241.00
		4	5650.00	152.00
3	.50			
		1	5000.00	240.00
		2	5005.00	314.00
		3	6400.00	314.00
		4	6405.00	241.00
4	.50			
		1	5000.00	314.00
		2	5000.00	550.00
		3	6600.00	550.00
		4	6605.00	315.00
5	.50			
		1	6400.00	200.00
		2	6405.00	314.00
		3	6600.00	314.00
		4	6605.00	201.00
6	.50			
		1	5000.00	550.00
		2	5005.00	1100.00
		3	14000.00	1100.00
		4	14000.00	551.00

Body No.	SUSCEPTIBILITY	VERTEX No.	X	Y
1	.10			
		1	5000.00	153.00
		2	5001.00	240.00
		3	5201.00	241.00
		4	5200.00	152.00
2	.10			
		1	5450.00	153.00
		2	5451.00	240.00
		3	5651.00	241.00
		4	5650.00	152.00
3	.10			
		1	5000.00	240.00
		2	5005.00	314.00
		3	6400.00	314.00
		4	6405.00	241.00
4	.10			
		1	5000.00	314.00
		2	5000.00	550.00
		3	6600.00	550.00
		4	6605.00	315.00
5	.10			
		1	6400.00	200.00
		2	6405.00	314.00
		3	6600.00	314.00
		4	6605.00	201.00
6	.10			
		1	5000.00	550.00
		2	5005.00	1100.00
		3	14000.00	1100.00
		4	14000.00	551.00

APPENDIX 8

IRON ORE INVESTIGATIONS

A. Benefication Testing of Three Magnetite - Jaspilite Samples from EL 633.

B. Iron Sampling and Analysis Data

C.M.D.L. REPORT NUMBER 353

BENEFICIATION TESTING

OF

THREE MAGNETITE - JASPILITE SAMPLES

FROM

EL633, PARAGON BORE S.A.

BY

B.G. HAWKE

WHYALLA, S.A.
FEBRUARY 1982

TABLE OF CONTENTS

0203

1. SUMMARY

Three samples of magnetite-jaspilite core were supplied by the Exploration Department, Adelaide for evaluation. The samples were from the Paragon Bore area of South Australia.

Chemical analyses of head samples showed that, for two of the samples, between 75 and 80% of the iron was present as magnetite. For the other sample, only 26% of the iron was present as magnetite.

Wet magnetic separation tests were conducted after grinding to minus 147, 74 and 43 micrometres in size. High grade concentrates were obtained from all three samples with high recovery of the magnetite present. Grinding to a size of 100 micrometres or less would be necessary to achieve satisfactory liberation of the silica from the magnetite.

The magnetite concentrate would be suitable for pelletising and may have application as dense medium, e.g. for coal washing.

2. SAMPLES

Three samples of core from the Paragon Bore area of South Australia were supplied by the Exploration Department, Adelaide for magnetic separation to determine the recovery and grade of magnetite concentrate. The samples were from PB1 drilled in EL 633, held as a joint venture by BHP Minerals and Amoco Mining.

The samples were marked ADL 36264, ADL 36265 and ADL 36266.

3. EXPERIMENTAL

3.1 Sample Preparation

The three samples were crushed to minus 1.6mm in size. A portion of each was removed for vibro-grinding to minus 147 micrometres in size for full chemical analysis. The remainder was riffled to provide 15 gram weight portions for the wet magnetic separation test work.

3.2 Wet Magnetic Separation

Fifteen gram weight portions of each sample were wet ground using a stainless steel ball mill with a stainless steel ball charge to minus 147, 74 and 43 micrometres in size. The ground portions were subjected to wet magnetic separation using two Davis Tube magnetic separators operated in series under the conditions given below.

Davis Tube No. 1	(Recovery Machine)
Motor speed	90 rpm
Length of stroke	25.4 mm
Angle of tube	45 degrees from horizontal
Throughput volume	250 ml per minute
Time of oscillation	5 minutes
Davis Tube No. 2	**(Grade machine)**
Motor speed	240 rpm
Length of stroke	50.8 mm
Angle of tube	45 degrees from horizontal
Throughput volume	1000 ml per minute
Time of oscillation	7½ minutes

The products from each test were dried, weighed and prepared for chemical analysis.

Previous work, conducted between 1958 and 1960 on the wet magnetic separation of iron ores using the Davis Tube separators, showed that the Davis Tube No.1 would effectively recover all particles containing magnetic material, i.e. free magnetite and composite particles. The vigorous action of the Davis Tube No.2 allowed the composite particles to be washed from the predominantly liberated magnetite particles. Thus three products are obtained

Davis Tube Tailing 1	- Non-magnetic particles
Davis Tube Tailing 2	- Composite, middling particles
Davis Tube Concentrate 2	- Predominantly free magnetite particles.

For the Paragon Bore samples, very little Davis Tube Tailing 2 product was obtained so that these products were combined with the Davis Tube Concentrate 2 products for analysis.

4. RESULTS

0208

4.1 Head Analyses

The results of analyses, carried out on three head samples of the Paragon Bore magnetite jaspilites, are given in Table 4.1, opposite.

TABLE 4.1

ANALYSES OF HEAD SAMPLES

Sample No.	ANALYSIS - %													Approximate Proportion Fe as Magnetite
	Total Fe	Fe as FeO	SiO_2	Al_2O_3	P	CaO	MgO	Mn	S	TiO_2	Cu	Zn	K_2O	
ADL 36264	23.0	6.1	67	0.1	0.01	0.1	0.2	0.05	0.03	0.05	0.005	0.005	0.01	80%
ADL 36265	31.7	2.7	53	0.1	0.015	0.1	0.1	0.05	0.03	0.05	0.005	0.005	0.01	26%
ADL 36266	26.8	6.8	59	0.2	0.01	0.2	0.6	0.05	0.03	0.05	0.005	0.005	0.01	76%

4.2 Wet Magnetic Separation

0210

The results of Davis Tube wet magnetic separation tests carried out on Sample No. ADL 36264, ADL 36265 and ADL 36266, after grinding to minus 100, 200 and 325 mesh Tyler in size, are given in Table 4.2, 4.3 and 4.4, respectively.

Complete analyses for the Davis Tube products are detailed in the Appendix, Section 6.

TABLE 4.2

SAMPLE NO. ADL 36264

Ground to Minus	Product	% Wt.	% Analysis				Distribution %			
			Fe	Fe as FeO	SiO_2	Al_2O_3	Fe	Fe as FeO	SiO_2	Al_2O_3
147 micrometres	D.T. Con.	27.6	61.9	20.6	14	0.1	74.4	94.0	5.8	16.0
	D.T. Tail	72.4	8.1	0.5	87	0.2	25.6	6.0	94.2	84.0
	Head	100.0	22.9	6.0	67	0.2	100.0	100.0	100.0	100.0
74 micrometres	D.T. Con.	25.0	69.4	23.1	3.0	0.1	74.5	95.1	1.1	7.7
	D.T. Tail	75.0	7.9	0.4	88	0.4	25.5	4.9	98.9	92.3
	Head	100.0	23.3	6.1	67	0.3	100.0	100.0	100.0	100.0
43 micrometres	D.T. Con.	22.4	70.3	23.6	1.4	0.1	72.8	97.2	0.5	3.4
	D.T. Tail	77.6	7.6	0.2	88	0.8	27.2	2.8	99.5	96.6
	Head	100.0	21.6	5.4	69	0.6	100.0	100.0	100.0	100.0

TABLE 4.3

SAMPLE NO. ADL 36265

0211

Ground to Minus	Product	% Wt.	% Analysis				Distribution %			
			Fe	Fe as FeO	SiO_2	Al_2O_3	Fe	Fe as FeO	SiO_2	Al_2O_3
147 micrometres	D.T. Con.	9.1	71.2	21.1	1.1	0.1	21.5	87.6	0.2	9.1
	D.T. Tail	90.9	26.0	0.3	60	0.1	78.5	12.4	99.8	90.9
	Head	100.0	30.1	2.2	55	0.1	100.0	100.0	100.0	100.0
74 micrometres	D.T. Con.	9.2	70.7	23.5	0.9	0.1	20.9	92.2	0.2	4.8
	D.T. Tail	90.8	27.1	0.2	59	0.2	79.1	7.8	99.8	95.2
	Head	100.0	31.1	2.3	54	0.2	100.0	100.0	100.0	100.0
43 micrometres	D.T. Con.	9.3	70.5	22.8	1.3	0.2	21.5	92.1	0.2	2.9
	D.T. Tail	90.7	26.4	0.2	61	0.7	78.5	7.9	99.8	97.1
	Head	100.0	30.5	2.3	55	0.7	100.0	100.0	100.0	100.0

TABLE 4.4

SAMPLE NO. ADL 36266

Ground to Minus	Product	% Wt.	% Analysis				Distribution %			
			Fe	Fe as FeO	SiO_2	Al_2O_3	Fe	Fe as FeO	SiO_2	Al_2O_3
147 micrometres	D.T. Con.	26.8	68.2	22.3	5.3	0.2	75.3	96.4	2.2	19.7
	D.T. Tail	73.2	8.2	0.3	85	0.3	24.7	3.6	97.8	80.3
	Head	100.0	24.3	6.2	64	0.3	100.0	100.0	100.0	100.0
74 micrometres	D.T. Con.	25.0	70.7	23.0	1.4	0.3	73.7	96.2	0.5	16.7
	D.T. Tail	75.0	8.4	0.3	85	0.5	26.3	3.8	99.5	83.3
	Head	100.0	24.0	6.0	64	0.5	100.0	100.0	100.0	100.0
43 micrometres	D.T. Con.	25.0	71.4	23.1	0.7	0.2	75.3	96.3	0.3	7.7
	D.T. Tail	75.0	7.8	0.3	85	0.8	24.7	3.7	99.7	92.3
	Head	100.0	23.7	6.0	64	0.7	100.0	100.0	100.0	100.0

5. DISCUSSION OF RESULTS

5.1 Sample ADL 36264

This sample was insufficiently liberated after grinding to minus 147 micrometres in size to yield a low silica concentrate. Liberation improved with the fineness of grind. A very high grade concentrate was obtained after grinding to all minus 43 micrometres and a 97.2% recovery of the magnetite, contained in the sample, was achieved.

5.2 Sample ADL 36265

This sample was liberated at 147 micrometres yielding a high grade concentrate at high recovery of the contained magnetite. However only 26% of the iron was present as magnetite in the feed so that a poor recovery of total iron occurred. Thus weight recovery from material of this type would be low.

5.3 Sample ADL 36266

This sample appeared similar in grade and properties to Sample ADL 36264. After grinding to minus 147 micrometres in size, a marginal concentrate analysis was obtained indicating incomplete liberation of some silica. Finer grinding improved liberation yielding a very high grade concentrate at high recovery of magnetite present in the sample.

5.4 General

The three Paragon Bore magnetite-jaspilite samples were readily beneficiated by wet magnetic separation to yield high grade concentrates for high recoveries of the magnetite present. All samples contained oxidized iron mineral. Grinding to a size of 100 micrometres or less should give satisfactory liberation of the silica from the magnetite.

The concentrate obtained from beneficiation of Paragon Bore magnetite-jaspilite would be suitable as feed to a pellet plant because of the low impurity levels. Consideration should be given, also, to the use of the magnetite concentrate as a dense medium for coal washing, for example.

B.G. Hawke
Metallurgist

M.J. Wort
Metallurgist in Charge C.M.D.L.

I.A. Thomson
Superintendent Minerals Planning and Development

6. APPENDIX - COMPLETE ANALYSES OF DAVIS TUBE PRODUCTS

Table 6.1 shows complete analyses performed on the products obtained in the wet magnetic separation tests conducted on Samples ADL 36264, ADL 36265 and ADL 36266.

TABLE 6.1

COMPLETE ANALYSES OF DAVIS TUBE PRODUCTS

0215

SAMPLE NO.	PRODUCT IDENTITY	% ANALYSIS												
		Fe	Fe as FeO	SiO_2	Al_2O_3	P	CaO	MgO	Mn	S	TiO_2	Cu	Zn	K_2O
PB1 ADL 36264	-147u D.T. Con.	61.9	20.6	14	0.1	0.005	0.1	0.1	0.05	0.01	0.05	0.005	0.005	0.01
	-147u D.T. Tail	8.1	0.5	87	0.2	0.010	0.1	0.2	0.05	0.03	0.05	0.005	0.005	0.03
	- 74u D.T. Con.	69.4	23.1	3.0	0.1	0.010	0.1	0.1	0.05	0.01	0.05	0.005	0.005	0.01
	- 74u D.T. Tail	7.9	0.4	88	0.4	0.015	0.1	0.2	0.05	0.05	0.05	0.005	0.005	0.04
	- 43u D.T. Con.	70.3	23.6	1.4	0.1	0.010	0.1	0.1	0.05	0.01	0.05	0.005	0.005	0.01
	- 43u D.T. Tail	7.6	0.2	88	0.8	0.010	0.1	0.2	0.05	0.03	0.05	0.005	0.005	0.05
PB1 ADL 36265	-147u D.T. Con.	71.2	21.1	1.1	0.1	0.010	0.1	0.1	0.05	0.01	0.05	0.005	0.005	0.01
	-147u D.T. Tail	26.0	0.3	60	0.1	0.020	0.1	0.1	0.05	0.03	0.05	0.005	0.005	0.05
	- 74u D.T. Con.	70.7	23.5	0.9	0.1	0.005	0.1	0.1	0.05	0.01	0.05	0.005	0.010	0.01
	- 74u D.T. Tail	27.1	0.2	59	0.2	0.020	0.1	0.1	0.05	0.02	0.05	0.005	0.005	0.04
	- 43u D.T. Con.	70.5	22.8	1.3	0.2	0.010	0.1	0.1	0.05	0.01	0.05	0.010	0.010	0.01
	- 43u D.T. Tail	26.4	0.2	61	0.7	0.020	0.1	0.2	0.05	0.02	0.05	0.005	0.005	0.04
PB1 ADL 36266	-147u D.T. Con.	68.2	22.3	5.3	0.2	0.005	0.1	0.2	0.05	0.01	0.05	0.005	0.005	0.01
	-147u D.T. Tail	8.2	0.3	85	0.3	0.020	0.5	0.7	0.05	0.04	0.05	0.005	0.010	0.05
	- 74u D.T. Con.	70.7	23.0	1.4	0.3	0.010	0.1	0.2	0.10	0.01	0.05	0.005	0.010	0.01
	- 74u D.T. Tail	8.4	0.3	85	0.5	0.015	0.4	0.7	0.05	0.04	0.05	0.005	0.005	0.05
	- 43u D.T. Con.	71.4	23.1	0.7	0.2	0.005	0.2	0.2	0.05	0.01	0.05	0.005	0.010	0.01
	- 43u D.T. Tail	7.8	0.3	85	0.8	0.020	0.4	0.7	0.05	0.04	0.05	0.005	0.005	0.04

WH/CMDL/82/353:

BENEFICIATION TESTING OF THREE MAGNETITE-JASPILITE SAMPLES FROM EL 633 PARAGON BORE S.A.

KEY WORDS:

PARAGON BORE, MAGNETITE-JASPILITE, MAGNETIC SEPARATION

ABSTRACT:

Wet magnetic separation tests were conducted on three core samples from PB1, Paragon Bore, S.A. The concentrates obtained were high in grade and high recoveries of the magnetite present were obtained. Grinding to a size less than 100 micrometres was indicated to achieve satisfactory liberation.

REFERENCE:

Hawke, B.G. "Beneficiation Testing of Three Magnetite-Jaspilite Samples from EL 633 Paragon Bore S.A." B.H.P. Central Mineral Dressing Laboratory, WH/CMDL/82/353.

COMLABS Pty. Ltd.
COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

JOB COM820280 O/N : Sheet 004787

Results in ppm

0217

SAMPLE	ADL 36264	ADL 36265	ADL 36266
%SiO2	59.7	50.9	59.4
%Al2O3	0.24	0.14	0.81
%CaO	0.21	0.56	1.80
%MgO	0.38	0.61	2.10
%TiO2	0.08	<0.01	0.05
%S	0.04	0.03	0.55
%Fe Acid Soluble	27.6	33.4	22.3
%Fe Total	27.9	33.5	23.2
V	<10	<10	<10

Method of Analysis :

Al2O3 MgO CaO	:	AAS6
SiO2	:	COL9
TiO2	:	COL4
S	:	VOL2
Fe	:	VOL
V	:	AAS3

SAMPLE ANALYSIS FOR IRON - PB1

BANDED IRON FORMATION INTERVAL (m)	BULK SAMPLES (C.M.D.L.)		FILLET SAMPLES (COMLABS)		QUARTER-CORE SAMPLES (COMLABS)			
	Sample No.	Total Fe Analysis	Sample No.	Total Fe Analysis %	Sample No.	Interval (m)	Total Fe Analysis %	Analytical Code
152.5			ADL 36057		ADL 36018	155.49-155.73	19.8	B
					36042	162.80-163.03	34.7	B
					36109	168.95-169.17	40.5	B
					36001	169.60-169.89	37.0	A
					36002	172.61-172.69	22.0	A
					36003	174.93-175.08	40.0	A
	ADL 36264	23.0		27.9	36004	175.58-175.78	41.0	A
					36005	177.55-177.67	7.4	A
					36043	178.52-178.79	32.8	B
					36020	185.83-186.08	39.3	B
					36044	192.77-192.97	29.0	B
					36021	197.98-198.33	40.8	B
					36006	200.80-200.95	56.0	A
					36022	207.94-208.18	8.7	B
					36045	214.35-214.55	27.1	B
220			ADL 36124					
			ADL 36125		ADL 36023	224.02-224.33	29.6	B
					36007	233.55-233.70	23.4	A
					36008	233.90-234.10	25.0	A
					36009	234.20-234.30	36.0	A
	ADL 36265	31.7		33.5	36024	235.90-236.20	28.1	B
					36046	244.00-244.27	28.7	B
					36010	248.61-248.76	53.3	A
					36047	251.80-252.00	31.3	B
					36048	260.80-261.01	33.9	B
					36025	269.80-270.10	45.4	B
					36026	274.60-275.00	42.7	B
					36049	278.50-278.82	44.1	B
280			ADL36184					

SAMPLE ANALYSIS FOR IRON - PB1

BANDED IRON FORMATION INTERVAL	BULK SAMPLES (C.M.D.L.)		FILLET SAMPLES (COMLABS)		QUARTER-CORE SAMPLES (COMLABS)			
	Sample No.	Total Fe Analysis %	Sample No.	Total Fe Analysis %	Sample No.	Interval (m)	Total Fe Analysis %	Analytical Code
			ADL 36185		ADL 36011	280.50-280.65	28.9	A
					36027	289-60-290.05	32.7	B
	ADL 36266	26.8		23.2	36050	302.81-302.98	2.4	B
					36051	307.80-308.20	36.5	B
					36012	311.79-311.94	40.4	A
					36028	312.83-313.08	22.2	B
320			ADL 36224					

ANALYTICAL CODES:

A Cu, Pb, Zn, Ag, Au %Fe

B Cu, Pb, Zn, Ag
Ba, Ce, Sn, Mn, Au, %P F
Sr, Zr, Nb, U, Th Y
%Fe (Acid Soluble and Total)
% SiO_2, % Al_2O_3, % CaO, % MgO, % S, % TiO_2, Y

QUARTER CORE SAMPLES AVERAGES:

152-220m	31.7%	(15 Samples)
220-280m	35.1%	(12 Samples)
280-320m	27.2%	(6 Samples)
152.5-320m	32.1%	33 Samples

COMLABS Pty. Ltd.
COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

JOB COM820520 O/N : B670/500 Sheet 4794 0220

Results in ppm

SAMPLE	36452	36453	36454
%SiO2	42.5	51.0	58.9
%Al2O3	0.40	0.25	0.56
%CaO	1.41	0.82	0.54
%MgO	2.20	1.28	0.84
%TiO2	0.06	0.04	0.08
Acid Sol %Fe	35.6	31.8	24.2
Total %Fe	36.3	32.2	26.5
%S	0.04	0.10	0.02
V	<10	<10	<10

Method of Analysis :

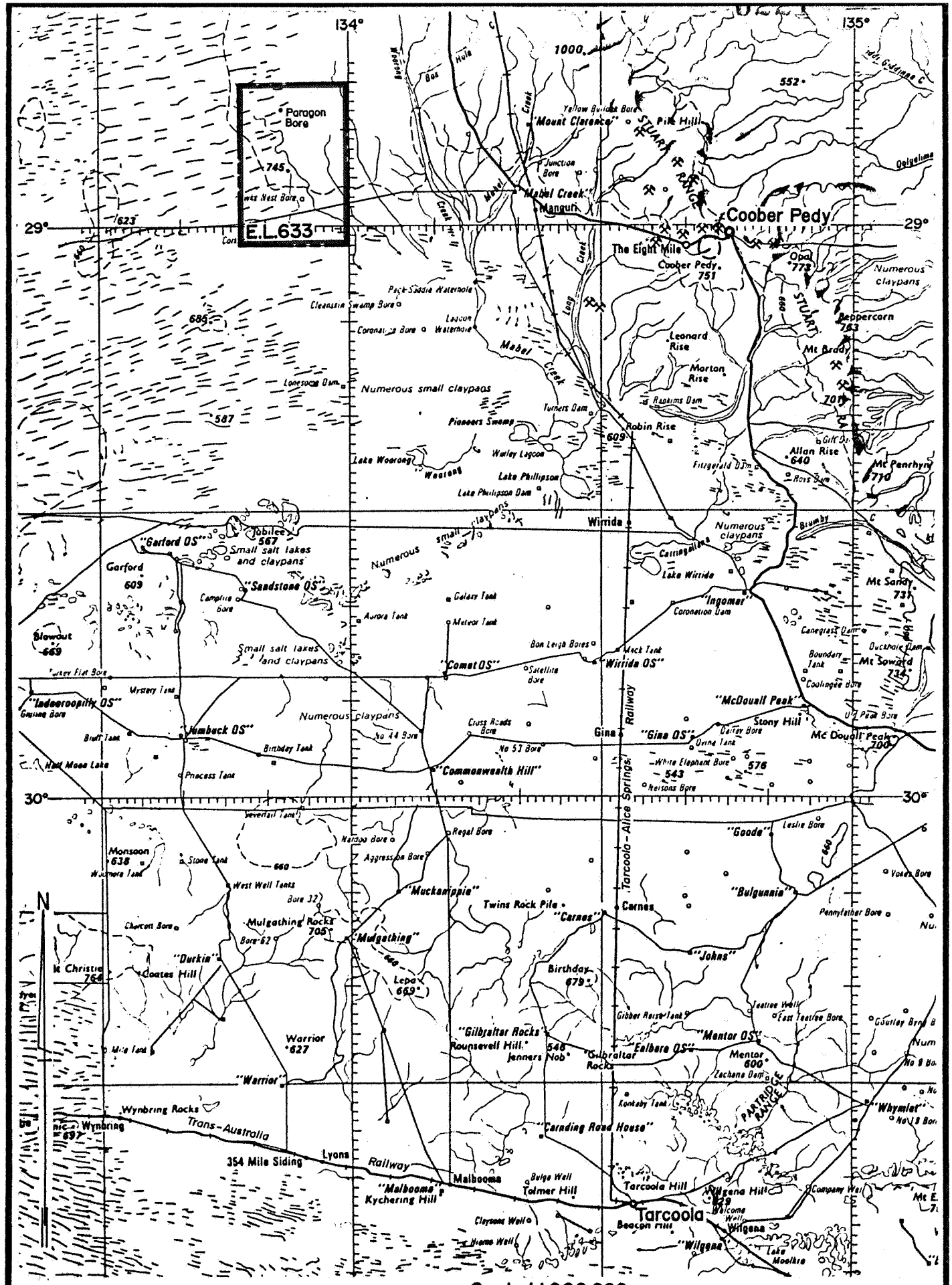
Al2O3 CaO MgO	:	AAS6
TiO2	:	COL4
SiO2	:	COL9
S	:	VOL2
Fe	:	VOL
V	:	AAS3

PB2

ADL 36452 176-230 m
36453 230-280 m
36454 280-344 m

BANDED IRON FORMATION DATA

	PB1	PB2
Depth	152-317m	175-334m
Apparent Thickness	165m	158m
LCA	45°	60°
True Dip	45°	30°
True Thickness	>120m	>140m



This map was photo-copied from TARCOOLA 1:1,000,000 W.A.C. (1975).

Fig. 1.

Centre: Adelaide	THE BROKEN HILL PROPRIETARY CO. LTD. E.L.633 PARAGON BORE, S.A. LOCATION MAP	Project No.: 6-B670-31
Date: 16-6-82		Drawing No.: A4-203

133°30'

134°00'

29°00'

E.L.816

E.L.633

351500E

364600E

365100E

365600E

368100E

388800E

398600E

384000E

384250E

385300E

385750E

386250E

391500E

392500E

393000E

393500E

394000E

394500E

380000E

383000E

383500E

384500E

385500E

394000E

394500E

395000E

395500E

806400N

Anomaly ①

Anomaly ②

Anomaly ③

Anomaly ④

Anomaly ⑤

Anomaly ⑥

Anomaly ⑦

Anomaly ⑧

Anomaly ⑨

TW1

TW2

PB1

PB2

PB3

PB4

Jindivick Bore

Bindabu Bore

Paragon Bore

Freshwater Bore

Black Oak Bore

Turkey's Nest Bore

Watchercallem Bore

Gordon's Corner Bore

Hawk's Nest Bore

Corkscrew Bore

Bellbird Bore

N

Scale 1:250,000

0 5 10 15 20kilometres

LEGEND

- PB2 ⊙ — B.H.P. Diamond drillhole
- ⊗ TW1 — B.H.P. Rotary drillhole
- Geophysical traverse
- E.L. boundary
- Track
- Fence
- Bore

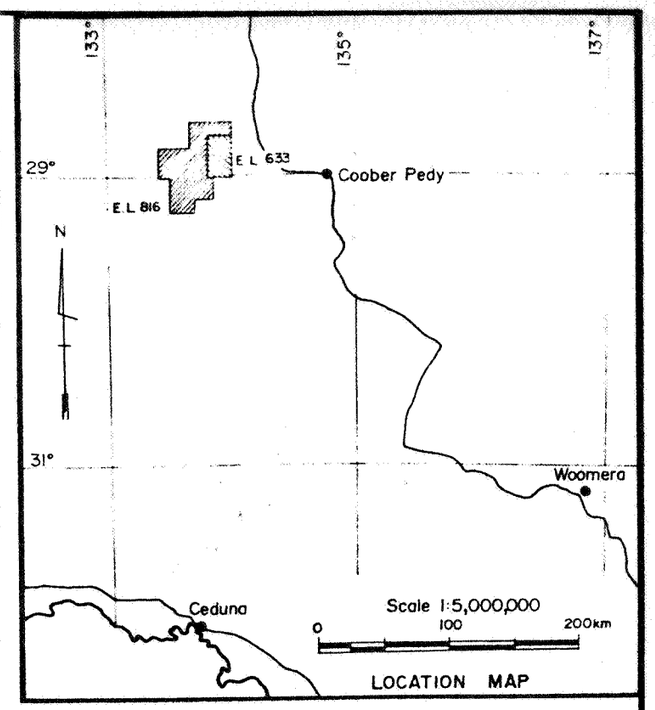


Fig. 5.

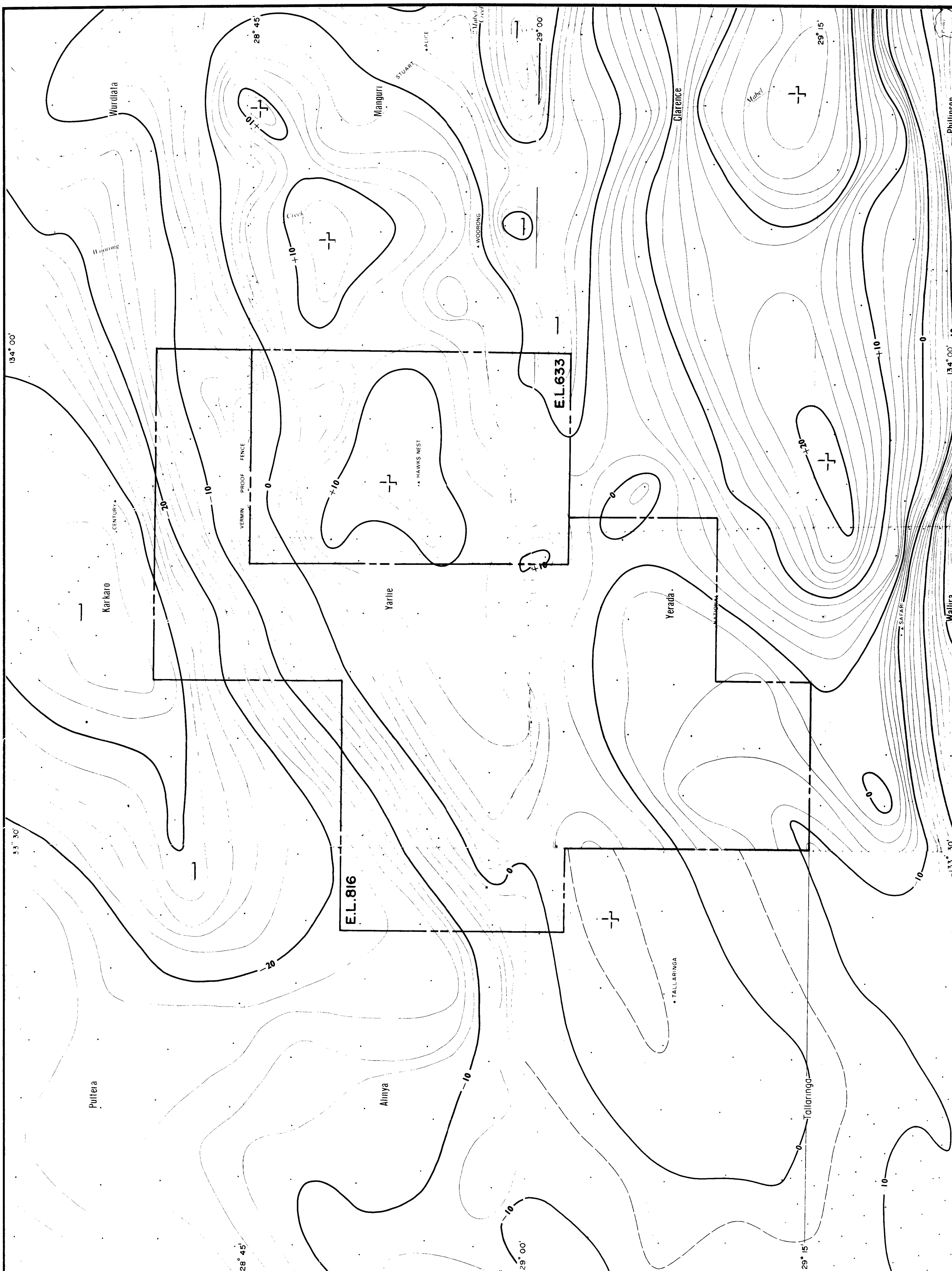
THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

E.L.816 TALLARINGA WELL,
E.L.633 PARAGON BORE, S.A.
LOCATION OF GEOPHYSICAL TRAVERSES
AND DRILL HOLES

0222

Revisions:

Prepared by : D.G.P	Centre : Adelaide	
Date : 23-4-82	Project No. 6-B660-B670-1	Drawing No. A3-79B
Drawn : A.R.V.		



LEGEND

Gravity anomaly - high

Gravity anomaly - low

Bouguer anomaly contours (milligals)

ρ = 1.90gms/cm³

Scale 1:250,000

0 5 10 15km

Contours taken from S.A.D.M. Bouguer anomaly map 1:250,000

3881-5

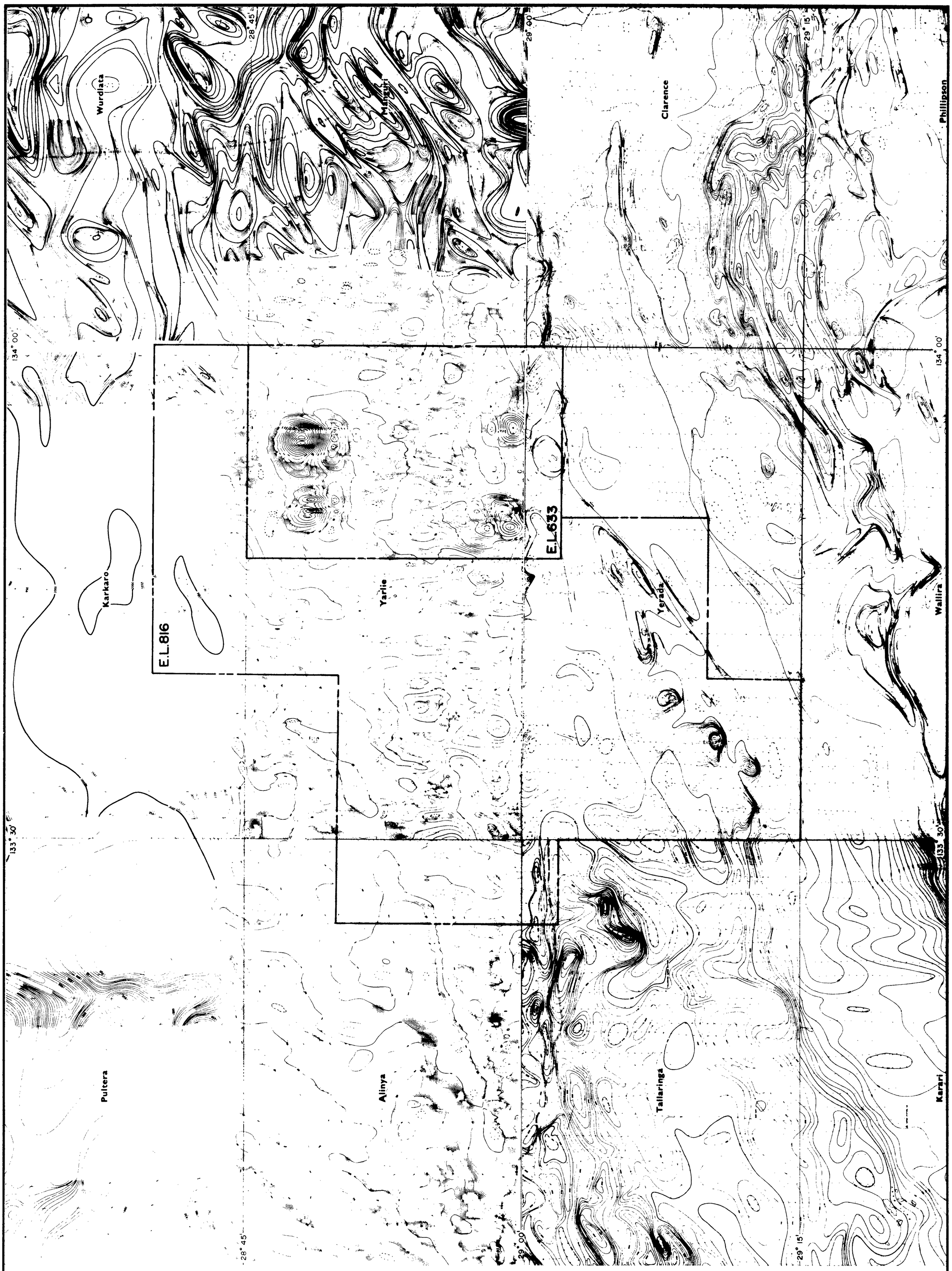
Fig. 2

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

E.L.633 PARAGON BORE
E.L.816 TALLARINGA WELL S.A.
BOUGUER GRAVITY CONTOURS

Drawn: D G P.	Date: 22-4-82	Centre Adelaide
Traced: S C F.	Project No 6-8660/8670-30	Drawing No: A2-324
Checked:		

Revisions



3881-6

Fig. 3

Revisions

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

E.L.633 PARAGON BORE
E.L.816 TALLARINGA WELL S.A.
TOTAL MAGNETIC INTENSITY CONTOURS

Drawn: D G P.	Date: 22-4-82	Centre: Adelaide
Traced: S C F.	Project No 6 — B660 B670 — 29	Drawing No.: A2-323
Checked:		

E.L. 816

E.L.633

Waterhole

Paragon Bore

Black Oak Bore

Anomaly ②

Anomaly ①

Anomaly ⑤

Turkey's Nest Bore

Anomaly ⑦

Jindivick Bore

Watchetcallem Bore

Gordan's Corner Bore

Hawks Nest Bore

K659

Anomaly ⑥

Bindabu Bore

Anomaly ③

Anomaly ④

Bellbird Bore

Anomaly ⑧

Anomaly ⑨

E.L. 816

EL 633

29°02'
133°47'

133°25' 133°30' 35' 133°40' 45' 133°50' 55' 134°00'

35.000mE 36 37 38 39 40.000mE

6820000mN 6810000mN 6800000mN 6790000mN 6780000mN 6770000mN

28°50' 29°00' 29°10' 29°15'

679 678

N

Note:
All gravity values are relative to Solo's base station at 384 000mE/6793600 mN (4·47 mgals).
Using an observed gravity of 979201·45 at BM 2592, the observed gravity at the base station was read to be 979 226·17 mgals.

LEGEND

- E.L. boundary
- Track
- Fence
- Bore
- Stream
- Sand dunes
- Gravity traverse
- Gravity contours
  - Interval 1 milligal
  - $\rho = 2{\cdot}67$
  - Optic levelling
  - Stations every 100 metres

Scale 1:100,000
0 1 2 3 4 5 kilometres

Topographic detail taken from YARLIE, YERADA, ALINYA and TALLARINGA 1:100,000 Topo. base maps, S.A. Lands Dept

Fig. 6

LOCATION MAP

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

E.L.816 TALLARINGA WELL, E.L.633 PARAGON BORE, S.A. CONTOURED GRAVITY TRAVERSES

Drawn D.G.P./M.G.P.	Date 11-3-82	Centre Adelaide	
Traced A.R.V.		Project No. B660-22	Drawing No. AI-485
Checked		B670-22	
O.I.C.			

Revisions

3881-7

133°25' 133°30' 35' 133°40' 45' 133°50' 55' 134°00'

28°40'

35000mE 36 37 38 39 40000mE

E.L. 816

E.L. 633

Waterhole

Black Oak Bore

Paragon Bore

Anomaly ①

Anomaly ②

PB1

PB2

PB3

PB4

Anomaly ③

Anomaly ④

Anomaly ⑤

Anomaly ⑥

Anomaly ⑦

Anomaly ⑧

Anomaly ⑨

Turkeys Nest Bore

Watchercallem Bore

Hawks Nest Bore

Gordons Corner Bore

Jindivick Bore

Bindabu Bore

Bellbird Bore

TW1

TW2

K659

682 0000mN

681 0000mN

680 0000mN

679

678

677 0000mN

28°50'

29°00'

29°10'

29°15'

29°02'

133°47'

N

LEGEND

Ground magnetic traverse	E.L. boundary
Ground magnetic profile	Track
Base = 56 500 nT	Fence
Ground magnetic contours	Bore
500nT	Stream
1000 nT	Sand dunes
10 000 nT	PB4 Diamond drillhole
Magnetic low	TW1 Rotary drillhole

Total field readings every 25 metres

No drift correction

Fig. 7

Scale 1:100,000

0 1 2 3 4 5 kilometres

Topographic detail taken from YARLIE, YERADA, ALINYA and TALLARINGA 1:100,000 Topo base maps, S.A. Lands Dept

LOCATION MAP

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

E.L.816 TALLARINGA WELL, E.L.633 PARAGON BORE, S.A. GROUND MAGNETIC TRAVERSES

Drawn: DGP/MGP	Date: 10-3-82	Centre: Adelaide	
Traced: ARV		Project No. 6660 6670-23	Drawing No. AI-486
Checked:			
O.I.C.			

Revisions

3881-8

AMOCO MINERALS AUSTRALIA COMPANY

0223

EL 1021 PARAGON BORE

Report for third quarter, ENDing May 3rd, 1983.

Work carried out

The only work carried our during the quarter comprised geochemical and X.R.F. analyses of split core from 1981 diamond hole PB2. Analyses of filleted material from part of this hole in late 1982 had shown some tungsten anomalies which the split core analyses were designed to check.

No anomalous tungsten values were recorded from the split core analyses and it appears that contamination from the filleting blade was responsible for the original anomalies. Both sets of analyses are attached.

Expenditure

Expenditure for the quarter was:

Salaries	$165.00
Core Spliting	225.00
Analyses	211.25
Overheads/administration	60.00
	661.25

Cumulative expenditure on EL 1021 is now $2,498.25.

Future Work

Planned future work comprises the drilling of a 350 metre percussion hole to test the BIF horizon, located by diamond holes PB1 and PB2 half way between these hole locations. The magnetic response at this location is considerably less than at the two drilled locations and there is a possibility of sulphide facies BIF here.

Graham Miller
Senior Geologist

12/7/83

Attachments: 1. Analyses of filleted material PB2
2. Analyses of split core PB2

Attachment I.

ANALYTICAL REPORT

0224

JOB COM822562 O/P : P 17651

Results in ppm

	SAMPLE	W	As	Ba	Sn	Au
PBI 329-330	ADL 36234	25	<2	310	<4	<0.05
PB.2. 356-358	ADL 36411	135	<2	140	<4	<0.05
358-360	ADL 36412	50	<2	80	<4	<0.05
360-362	ADL 36413	30	<2	140	<4	<0.05
362-364	ADL 36414	30	<2	175	6	<0.05
364-366	ADL 36415	125	3	65	<4	<0.05
366-368	ADL 36416	270	12	10	[illegible]	<0.05
368-370	ADL 36417	120	[illegible]	[illegible]	[illegible]	<0.05
370-372	ADL 36418	140	<2	135	<4	<0.05
372-374	ADL 36419	210	<2	145	<4	<0.05
374-376	ADL 36420	240	<2	105	[illegible]	<0.05
376-378	ADL 36421	230	[illegible]	155	[illegible]	<0.05
378-380	ADL 36422	80	40	190	<4	<0.05
380-382	ADL 36423	110	34	190	[illegible]	<0.05
382-384	ADL 36424	100	12	[illegible]	[illegible]	[illegible]
384-386	ADL 36425	120	[illegible]	190	[illegible]	[illegible]
386-388	ADL 36426	100	<2	200	[illegible]	<0.05
388-390	ADL 36427	410	<2	120	<4	<0.05
390-392	ADL 36428	155	<2	120	<4	<0.05
P.B.2 392-394	ADL 36429	165	<2	75	<4	<0.05

Method of Analysis : W As Ba Sn : XRFI
Au : AAS5A

Fillet Powder: December 1982

COMLABS Pty. Ltd.
COMPUTERISED ANALYTICAL LABORATORIES

Attachment 2.

ANALYTICAL REPORT

0225

JOB COM830434 O/E : W 17737

Results in ppm

SAMPLE	Mo	Bi	W	Au	%F
PB2 364 to 366	22	8	<10	<0.01	-
PB2 366 to 368	46	<4	<10	<0.01	<0.01
PB2 368 to 370	20	<4	10	<0.01	-
PB2 370 to 372	32	<4	10	<0.01	-
PB2 372 to 374	18	6	<10	<0.01	-
PB2 374 to 376	32	10	<10	<0.01	-
PB2 376 to 378	18	<4	<10	<0.01	0.01
PB2 378 to 380	22	<4	10	<0.01	-
PB2 380 to 382	10	<4	<10	<0.01	-
PB2 382 to 384	28	<4	10	<0.01	-
PB2 384 to 386	20	<4	<10	<0.01	-
PB2 386 to 388	20	<4	<10	<0.01	-
PB2 388 to 390	20	<4	<10	<0.01	0.02

Method of Analysis : [illegible]

SPLIT Core APRIL 1983

A-79-63
EL 1021 [633] PARAGON BORE

0226

Amoco Minerals Australia Company
P.O. Box 47,
NORWOOD. S.A. 5067

28th December, 1983.

The Director General,
Department of Mines and Energy,
P.O. Box 151,
EASTWOOD. S.A. 5063

Dear Sir,

Please find enclosed a brief report on Exploration Licence 1021 for the six months to November, 3rd, 1983.

Subsequent to this reporting period, a 248 metre percussion/diamond drill hole was completed; this will be reported on in full during February.

At this stage no geochemical analyses results are available but a visual inspection of 60 metres of Pre-cambrian crystalline basement suggests no significant mineralization.

Should there be no interesting geochemistry the term of the Licence will not be extended from the amended expiry date of February 3rd, 1984.

Yours faithfully,

Graham Miller
Senior Geologist

AMOCO MINERALS AUSTRALIA COMPANY

Exploration Licence 1021, Paragon Bore

Report for the third and fourth quarters, ending November 3rd, 1983

No work was carried out during the period under review pending availablity of a drilling rig to drill a stratigraphic hole between previous diamond holes PB1 and PB2. No expenditure was incurred and cumulative expenditure remains at $2498.25.

Graham Miller
Senior Geologist

28.12.83

COMLABS Pty Ltd
COMPUTERISED ANALYTICAL LABORATORIES

0228

ANALYTICAL REPORT

JOB COM 800329

Results in ppm

SAMPLE	Cu	Zn	Pb	Co	ppb Hg
93500E78380N	10	18	10	4	-50
78850	12	14	16	-4	-50
79350	12	18	16	-4	-50
79850	18	34	20	4	-50
80350	18	38	20	6	-50
93500E80850N	12	24	14	-4	-50
91100E93350N	16	24	14	-4	50
93850N	8	12	8	-4	-50
94350N	18	34	14	4	50
91100E94850N	10	14	8	-4	-50
94925E90850N	12	30	12	4	-50
91350N	16	24	12	4	-50
91850N	8	12	4	4	50
92350N	6	12	6	-4	-50
94925E92850N	10	18	8	-4	-50
78850N88000E	18	38	20	6	-50
88500E	12	26	18	-4	-50
89000E	10	14	14	-4	-50
89500E	10	12	14	-4	-50
78850N90000E	14	24	16	4	-50
85000E91400N	12	18	14	-4	-50
91900N	10	20	14	4	-50
92400N	6	10	8	-4	-50
85000E92900N	16	22	16	-4	-50
84300E76550N	14	20	28	4	50
77050N	12	16	20	-4	-50
77550N	8	14	12	-4	-50
84300E78050N	8	8	12	-4	50

.../2

ANALYTICAL REPORT
JOB COM 800329
Results in ppm

SAMPLE	Cu	Zn	Pb	Co	ppb Hg
85300E79850N	8	10	10	-4	-50
85300E80850N	14	22	20	4	-50

Method of Analysis: Cu, Pb, Zn, Co AAS 1
Hg AAS 7

- denotes less than

0230

AMOCO MINERALS AUSTRALIA COMPANY

EXPLORATION LICENCE 1021

PARAGON BORE, SOUTH AUSTRALIA

FINAL REPORT

G.C. Miller
Senior Geologist

Adelaide, S.A.
April 1984

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0231

LIST OF APPENDICES

LIST OF PLANS

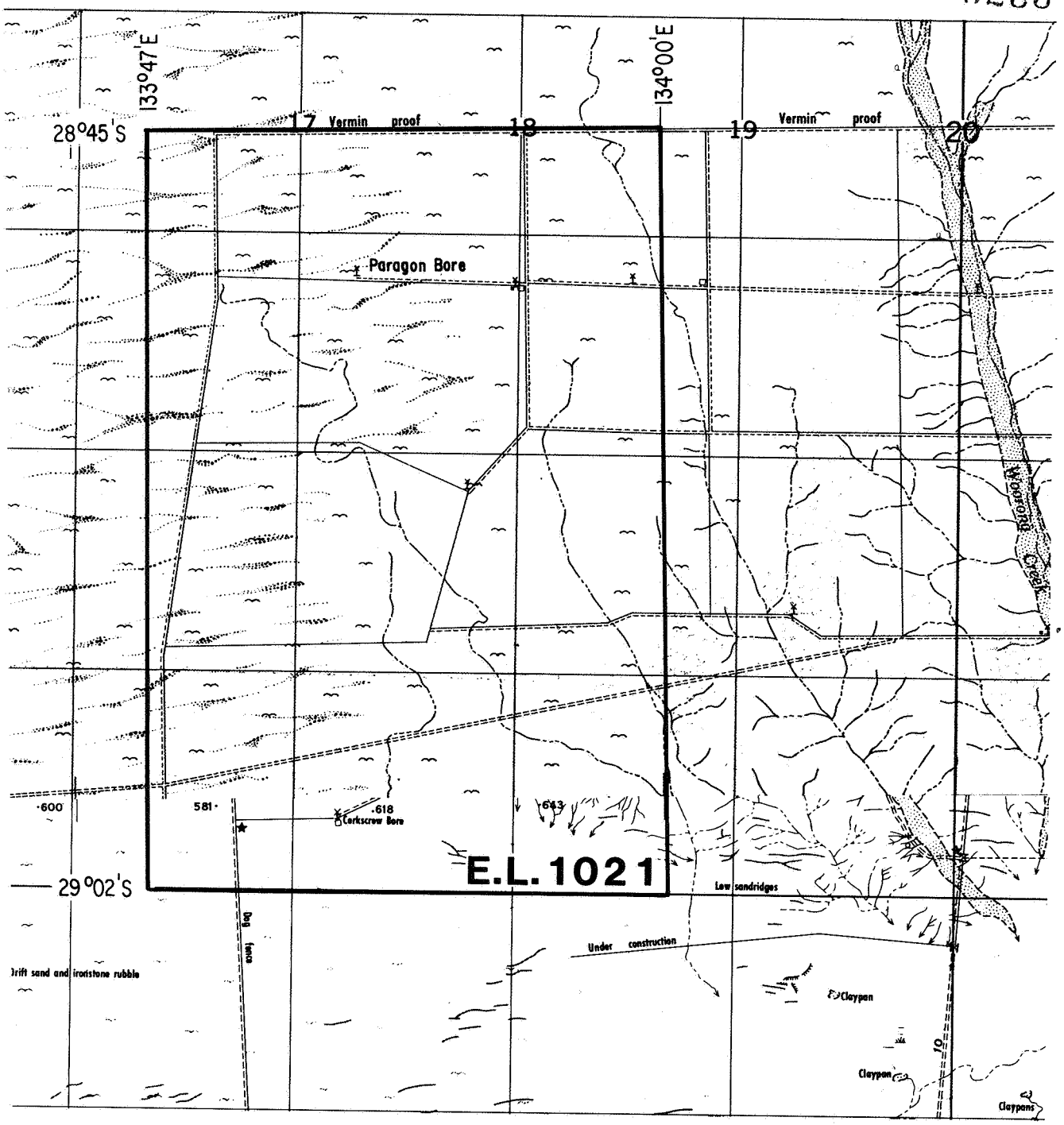
SUMMARY

0232

A 248.6 meter rotary percussion/diamond drill hole to test a 5 milligal gravity anomaly for a possible base and precious metal mineralized Lower Proterozoic sulfide facies BIF cut a sequence of quartz-feldspar-garnet-amphibole-(magnetite-biotite) rocks, with only trace pyrite, beneath 188 meters of Permian and younger cover.

Logging, petrology, geochemistry and magnetic susceptibility and specific gravity measurements have given no impetus for further exploration and the project has been terminated.

0233



N

0 5 10 15

KILOMETRES

AMOCO

Amoco Minerals Australia Company

Project		Nº
Project Partner		

E.L.1021 PARAGON BORE LOCATION PLAN

Map Ref. ANG	Latitude	Longitude
Surveyed	Date	Scale 1:250000
Drawn	Date	Drawing Nº

Report

Enclosure

INTRODUCTION

Exploration Licence 1021, covering 664 square kilometers was granted on August 4, 1982, for an initial term of twelve months, subsequently extended to eighteen months with an expiry date of February 3, 1984.

The Licence covered the same ground as former Exploration Licence 633, explored initially by Amoco and then by an Amoco-BHP Minerals Joint Venture. Exploration Licence 1021 remained part of the venture though BHP elected not to contribute to exploration costs. It was applied for with the specific aim of drill testing a 5 milligal residual gravity anomaly thought to possibly represent a Lower Proterozoic sulfide-facies BIF beneath plus 150 meters of Cretaceous and Permian cover.

Full details of exploration philosophy, geological setting, etc., are found in previous Amoco and BHP reports. In summary, we were testing buried source magnetic and gravity anomalies for polymetallic mineralization. "Olympic Dam" style mineralization was searched for initially, but following drill holes PB-1 and 2 in 1981-82 which located some anomalous base metal geochemistry in carbonate-silicate-sulfide facies rocks at the base of a thick (plus 200 meter) oxide facies BIF, it was considered that a sulfide facies BIF was an appropriate exploration target.

The 5 milligal target had a semi-coincident 1700 nano Tesla magnetic anomaly and was mid way along a ten kilometer east-west magnetic/gravity trend, near the ends of which PB-1 and 2 were drilled. The targets for these holes were 9 and 7.5 milligal gravity anomalies with semi-coincident 16000 and 13000 nano Tesla magnetic anomalies. It was the greatly reduced magnetic response with the 5 milligal anomaly that lead to the suggestion of considerable sulfide, rather than oxide, facies at this location.

As Exploration Licence 1021 activity up to November 3, 1983, essentially further geochemical analyses on PB-1 and 2 drill core, has already been reported on, this report covers the three months ending February 3, 1984.

Following the exploration activities described in this report a re-application for the ground was withdrawn.

EXPLORATION

During the period under review a 248.6 meter vertical rotary percussion/diamond hole was drilled to test the 5 milligal residual gravity anomaly and geochemical, petrological, magnetic susceptibility and specific gravity work carried out on cuttings and/or core.

Drilling

The hole was drilled at grid location 388,800E, 813.300N, the peak of the residual gravity anomaly and near the base of the southern flank of the magnetic anomaly. As only one hole was programmed and the dip direction was unknown, this location was considered most appropriate. It was anticipated the hole would probably intersect the southern part of the magnetic anomaly source body if it was north dipping, separate from, and above the major gravity anomaly source material (i.e. thin oxide facies BIF above sulfide facies).

The drilling contractor was Peter Nitschke Drilling of Hahndorf. The initial idea was for a completely percussion drilled hole to about 300 meters with a Bourne 2000 rig. Following excess water flow near the base of the Permian which could not be stemmed, however, a Longyear 38 was brought in. For budgetary reasons following the percussion drilling problems, the planned depth of the hole was reduced to about 250 meters, dependent on lithologies cut.

After cutting 105 meters of Cretaceous and 83.2 meters of Permian cover the hole entered (?Lower Proterozoic) crystalline basement at 188.2 meters. Basement rock was essentially quartz-feldspar-garnet-amphibole (magnetite, biotite), gneiss or granulite, with only very minor pyrite, dipping at 55° (to the north or south presumably). A written drill log is included as Appendix II, a graphical log as Plan W3034 and mineralogical descriptions (Pontifex) as Appendix IV.

Geochemistry

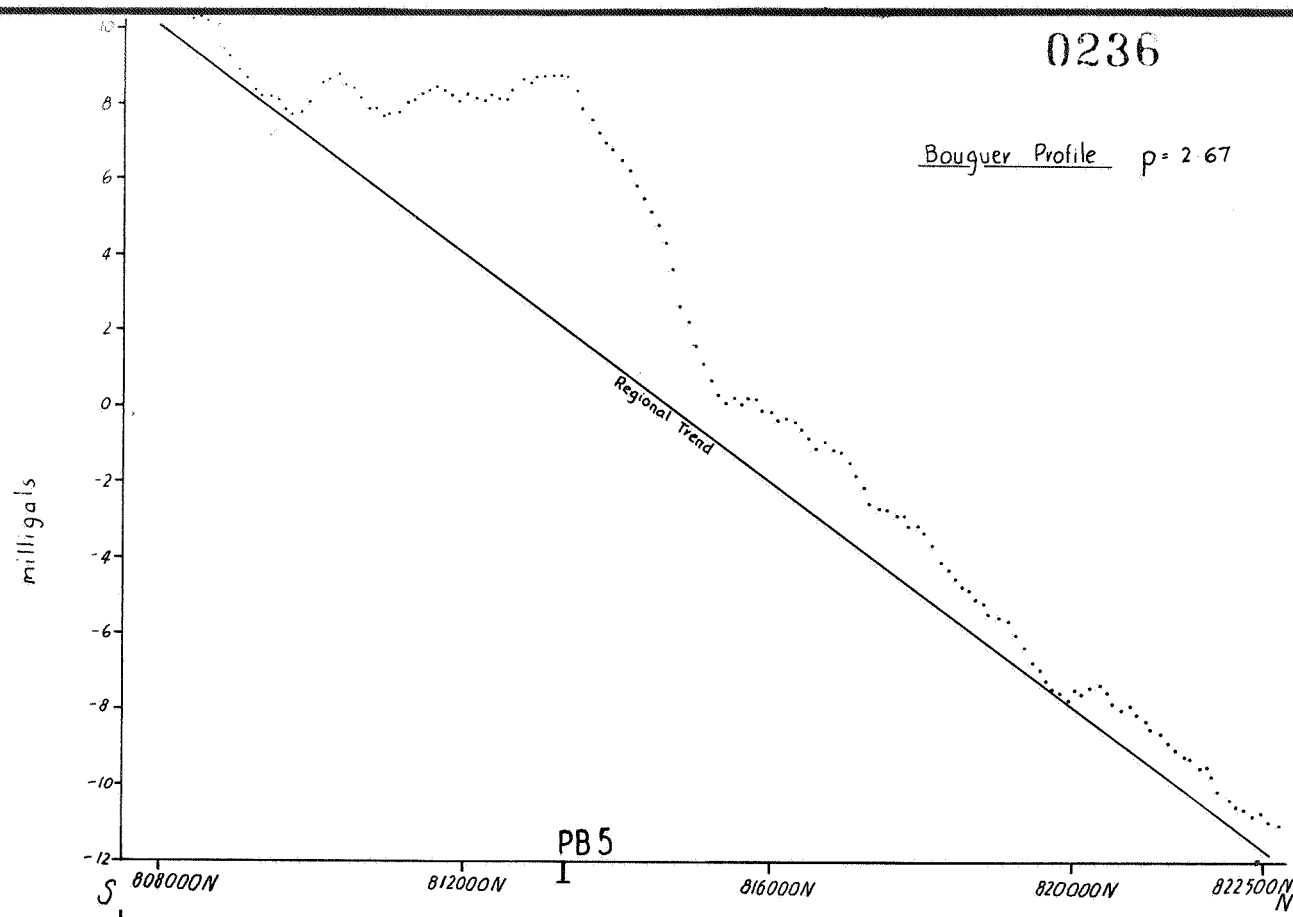
There was no interesting base or precious metal mineralization in drill core. A gold content of 0.05 ppm (versus a level of detection of 0.01 ppm) was detected in the ten meter interval (representing 5, two meter samples bulked together) from 170 to 180 meters near the base of the Permian Boorthanna Formation. The value was not considered interesting enough to justify a trip to the site to re-sample the relevant two meter intervals. Complete geochemical analyses are included as Appendix III.

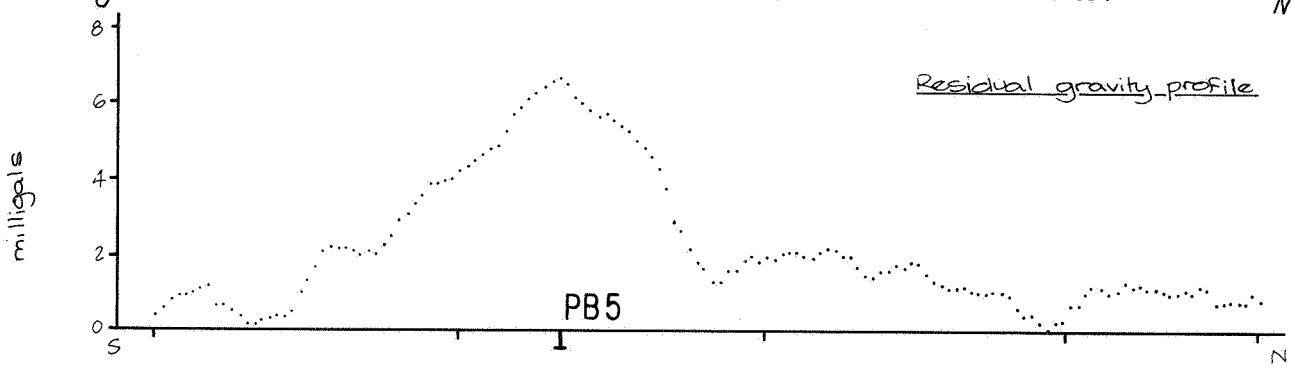
Magnetic Susceptibility and Specific Gravity

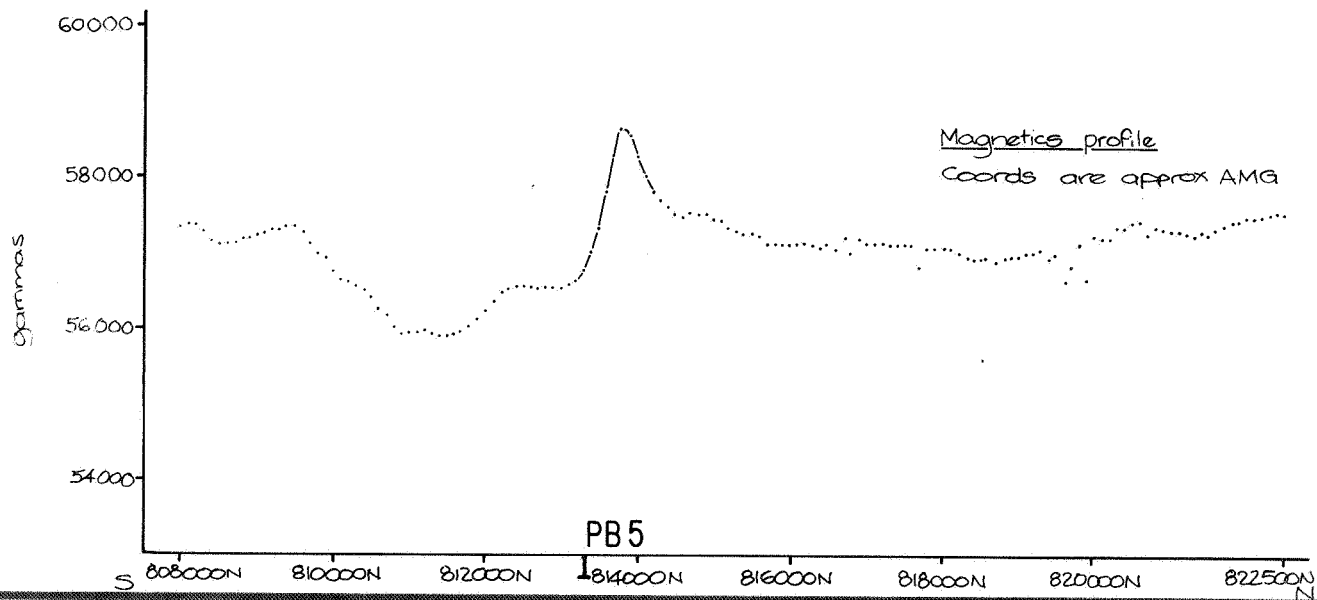
The results of magnetic susceptibility and specific gravity measurements made on drill core are shown on the written and graphical drill logs. Magnetic susceptibility was measured every 0.2 meters and specific gravity every two meters.

It can be seen that the first seven meters of core cut had a susceptibility about or better than 1500 x 10-5 S.I. while, over 5 meter averages, no other levels were over 500 and most less than 200. While no modelling has been attempted, the results appear consistent with the hole clipping the southern edge of a north dipping magnetic anomaly source.

0236

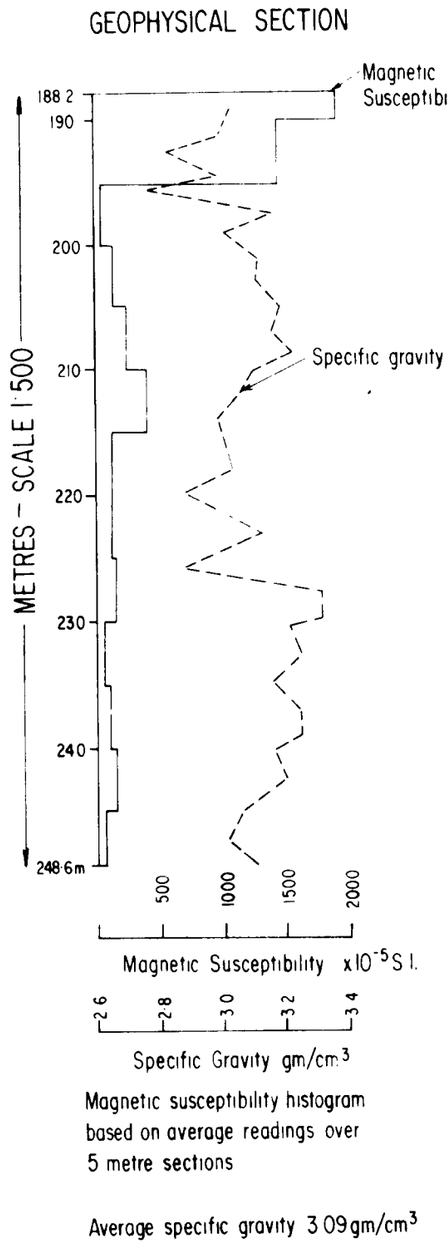






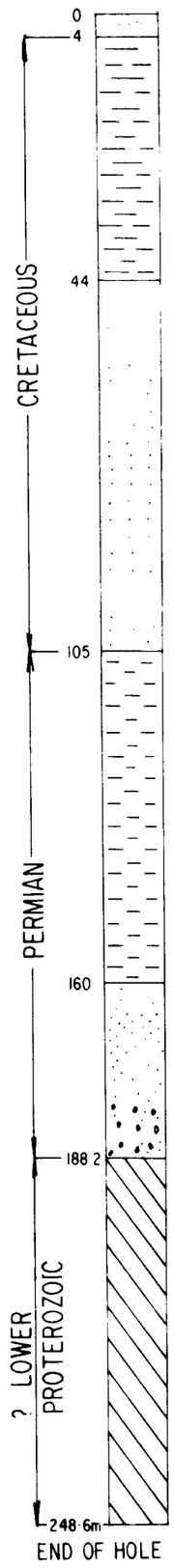
Centre Adelaide	AMOCO MINERALS AUSTRALIA COMPANY – BHP MINERALS PTY LTD	Project No. 6-8670-25
Date 20-4-82	E.L. 1021 PARAGON BORE SCALE: 1:100000	Drawing No. A4-187
	MAGNETIC AND GRAVITY PROFILES LINE 388800E	

P.B.5



Magnetic susceptibility histogram based on average readings over 5 metre sections

Average specific gravity 3·09 gm/cm³



ALLUVIUM

BULLDOG SHALE

white - blue grey - red brown siltstone and shale

CADNA-OWIE FORMATION

coarse to medium grained Loosely packed and poorly sorted quartz SANDSTONE

STUART RANGE FORMATION

grey sticky clay with minor SILTSTONE and SANDSTONE

BOORTHANNA FORMATION ?

quartz SANDSTONE with rounded gneissic, granitic and rhyolitic clasts near base

PRECAMBRIAN CRYSTALLINE BASEMENT

quartz - felspar - garnet - amphibole (magnetite biotite) gneiss or granulite

AVERAGE DIP OF FOLIATION IS 55°

Rotary / Percussion to 184m.
Diamond Drilled from 184 – 248·6m
Driller Peter Nitschke Drilling Pty Ltd
Date Drilled October - December 1983

LOCATION 813,300N
388 800E (A M G.)

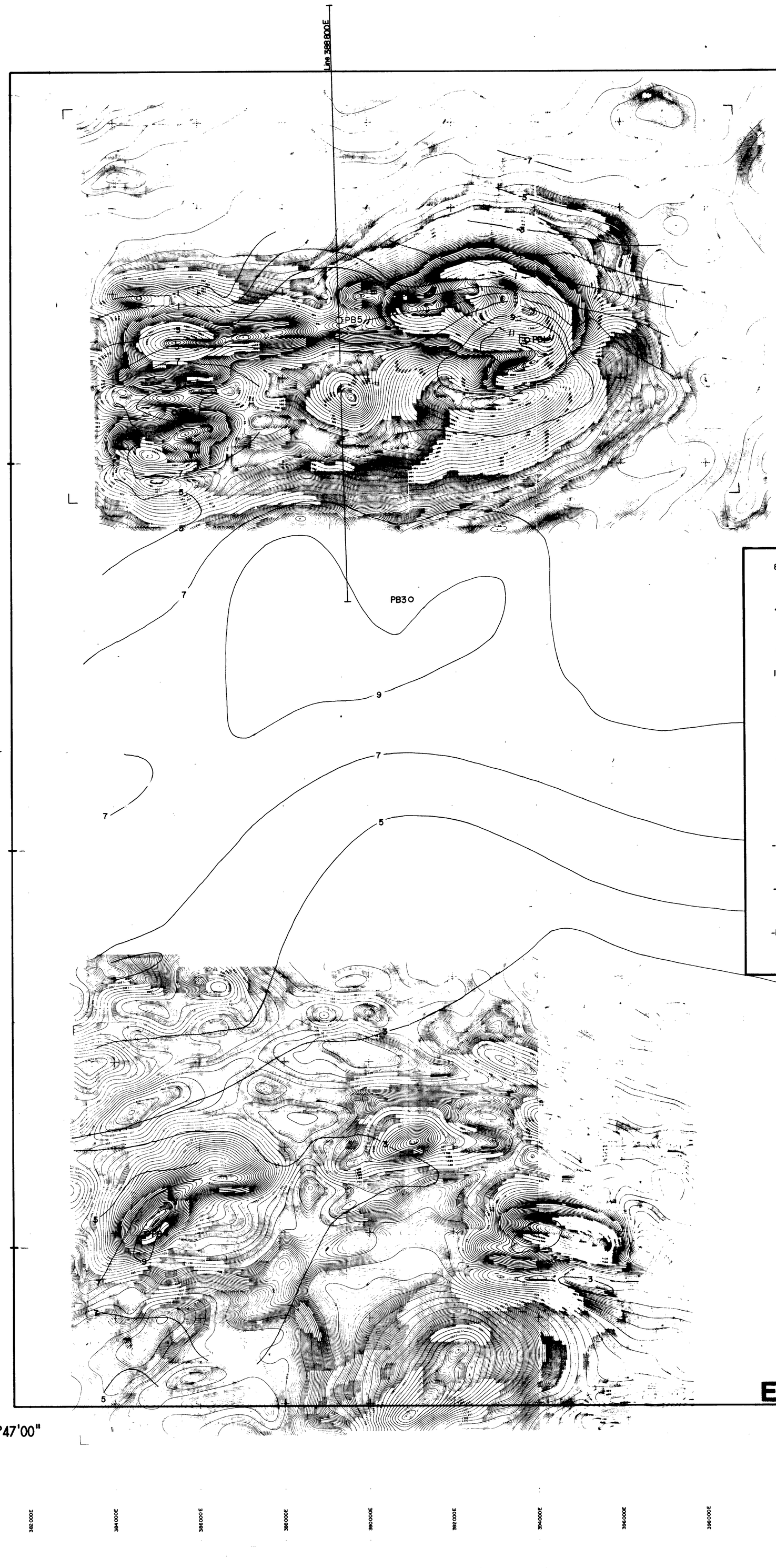
Amoco Minerals Australia Company

Project	PARAGON BORE		**Nº** A-79-63
Project Partner	**B.H.P. MINERALS PTY LTD**		
E.L.1021 (EX.633)			
Drill Hole PB5-Graphical Log			
Map Ref. ANG		**Latitude**	**Longitude**
Surveyed	G C. MILLER	**Date** 10 - 4 - 84	**Scale** As Shown
Drawn		**Date**	**Drawing Nº** W3034

Report

3381-9

Enclosure



STRATIGRAPHY

PB 1

0-152m	Cover sequence
152-310	B.I.F.
310-328	Carbonate unit, with pyrite, pyrrhotitic, magnetic spheroid and garnetiferous sections
328-356	Garnet gneiss

PB2

0-176m	Cover sequence
176-349	B.I.F.
349-364	Garnetiferous granulite
364-395	Garnetiferous granulite, pyrite/pyrrhotitic rich
395-437	Garnet gneiss

PB3

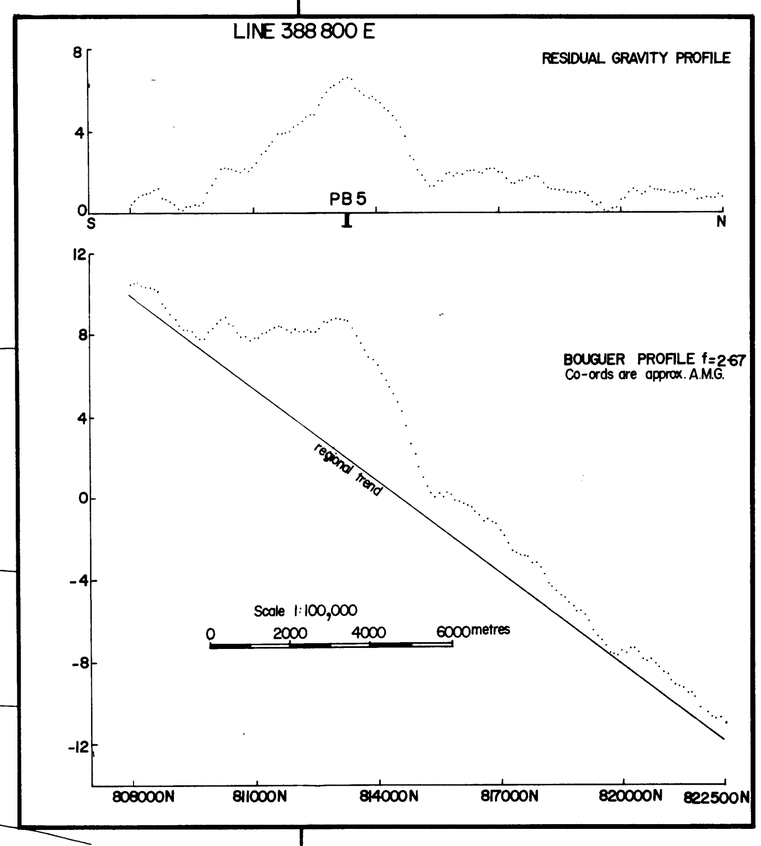
0-187m	Cover sequence
187-287	Garnet gneiss

PB4

0-118m	Cover sequence (pre-collar stopped when hard quartzite hit; whether this is basement or not is uncertain.

PB 5

0-188·2m	Cover sequence
188·2-248·6	quartz-felspar-garnet amphibole (magnetite, biotite) gneiss or granulite.



MAGNETIC CONTOURS (gammas)

- > 11000
- 9000 - 11000
- 7000 - 9000
- 5000 - 7000
- 3000 - 5000
- 1000 - 3000
- -1000 - 1000
- < - 1000

5 GRAVITY CONTOUR

The data presented is the residual magnetic intensity, after subtracting the international Geomagnetic Reference Field from the observed Total Magnetic Intensity. The data was corrected for diurnal drift using a base station magnetometer at COOBER PEDY Airfield. Latitude 29.033S, Longitude 134.717E, Altitude 229 Metres.

The sensor height was 3 metres. The adopted value for this location was 57369 nT.

Final datailed levelling of the data was performed, using tie-line crossover analysis. A simple 3 point filter was applied to the data, which was then gridded and contoured using a 100m by 100m mesh cell.

SURVEY BOUNDARY — CONTOUR INTERVAL 10nT

PROJECT NUMBER 80349 — SURVEYED MARCH 1980

Airborne geophysical survey and compilation by Geoex Pty Ltd

EQUIPMENT SPECIFICATIONS
Cessna A185E Aircraft
Geometrics G803 Magnetometer
Mc Phar SPECTRA 2 Spectrometer
Mc Phar 1024 Channel Analyser
24 Litre NaI (Tl) Detector
Bonzer Mark 10 Radar Altimeter
16mm Ground Tracking Camera
Digital Recording on 9 Track 800 bpi Industry Standard Magnetic Tape
Analogue Recording on Century 444 6 channel Recorder

The nominal flight line separation was 400 metres, and the nominal tie-line bearing was -90° degrees.
The observed mean sample interval in the flight direction was 41 metres, achieved with a nominal aircraft speed of 100 knots, and a reading interval of 0·8 seconds. The mean sensor height was 90 metres, using a towed bird configuration. The magnetometer accuracy is 1 nT, and the resolution 1·0 nT.

LOCALITY

N

0 1 2 3 4 5
KILOMETRES

Amoco Minerals Australia Company

Project BURRA			**Nº** A-79-63
Project Partner **BHP MINERALS**			
E.L. 1021 PARAGON BORE			
Aeromagnetic and Drill Hole Locations			
Map Ref. ANG SH53-2&6	**Latitude** 28°45'00"		**Longitude** 133°47'00"
Surveyed G.C.M.	**Date** 1·12·80	**Scale** 1:50 000	
Drawn	**Date** 1·9·81	**Drawing Nº** W1921	

Report

3881-10 Enclosure

Specific gravity measurements averaged out at 3.09 gm/cm3. This compares with an average of about 2.80 for non-mineralized quartzo-felspathic basement gneiss from the bottom of holes PB-1 and 2, four kilometers east and 4.5 kilometers west along the magnetic trend. (Oxide facies BIF in these holes had an average s.g. of 3.3 and the silicate-carbonate-sulfide facies rocks immediately below the BIF averaged 3.15.)

While, again, no modelling has been attempted it is probable the almost 0.3 gm/cm3 s.g. difference between PB-5 core and ordinary basement quartzo-felspathic gneiss is enough to account for the 5 milligal gravity anomaly.

Assessment

An assessment of data gathered suggests the hole cut a sequence of psammitic/pelitic/slightly ferruginous sediments, with a calcareous component or intercalated mafic volcanics, folded and metamorphosed to upper amphibolite facies. To use the BIF terminology, the rocks appear to be silicate-carbonate rather than sulfide facies.

As previously reported by BHP (Exploration Licence 633 Annual Report, May 1982), age dating of quartzo-felspathic gneiss from the bottom of drill hole PB-1 gave a figure of 2650 million years. The BIF's and silicate-carbonate-sulfide rocks from holes 1 and 2 belong, on looks, to the Lower Proterozoic Hutchinson Group, however, as probably do the PB-5 rocks.

EXPENDITURE

Total expenditure on the Licence in the eighteen months since inception was $27,805.10.

G.C. MILLER
Senior Geologist

April 1984

APPENDIX I

EXPENDITURE STATEMENT

AMOCO MINERALS AUSTRALIA COMPANY

EXPENDITURE FOR THE PERIOD AUGUST 4, 1982 TO MARCH 31, 1984

EXPLORATION LICENCE NO. 1021

Salaries and Wages	1,378.31
Supplies	
Supplies - maps	
Cookery	
Field Office Rent	
Field Supplies	
Freight	
Aircraft Charter	
Travel	
Communications	
Geophysics	
Consultants/Contractors	3,016.72
Drilling	15,721.47
Assays	1,482.55
Legal Fees	
Equipment Rental	
Equipment Operation & Maintenance	
Property Payments	1,001.00
Outside Services	352.36
	22,952.41
Overhead	4,852.69
	27,805.10

T.J. CONQUEST - ACCOUNTANT
199

APPENDIX II

DRILL LOG : PB-5

Amoco Minerals Australia Company

DRILL LOG — HOLE No. P.B 5 — PAGE 1 OF 2

				BORE HOLE SURVEY			INSTRUMENT					
PROJECT Paragon Bore No. A-79-63	ELEVATION meters	COMMENCED 22-10-83	Depth (m)	Dip	Bearing	Depth (m)	Dip	Bearing	Depth (m)	Dip	Bearing	
PROSPECT	DIP COLLAR 90°	COMPLETED 3-12-83										
CO-ORDINATES 813300 mN 388800 mE	CORE SIZE RP- NQ	TOTAL LENGTH 248·6 meters										
BEARING TN MN GN	LOGGED BY G.C.M.											

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %
0	4	Alluvium	
4	44	BULLDOG SHALE (CRETACEOUS) White-blue grey-red brown siltstone and shale	
44	105	CADNA-OWIE FORMATION (CRETACEOUS) Coarse to medium grained loosely packed and poorly sorted QUARTZ SANDSTONE	
105	160	STUART RANGE FORMATION (PERMIAN) Grey sticky clay with minor SILTSTONE and SANDSTONE	
160	188·2	BOORTHANNA FORMATION (PERMIAN) Quartz sandstone with rounded gneissic, granitic and rhyolitic CLASTS near base.	
188·2	248·6	CRYSTALLINE BASEMENT (LOWER PROTEROZOIC) Quartz-Feldspar-Garnet-Amphibole (magnetite, biotite) gneiss or granulite. Layering is poorly to well defined and has an average dip angle of 55°. Percentage and grain size of component minerals varies throughout. Major component averages are: quartz/feldspar : 50% amphibole : 30% garnet (pink brown) : 20% quartzo/feldspathic aggregates form a fine grained matrix for the rock; some red (hematite stained?) quartzo/feldspathic aggregates and veins may indicate a proximal granite intrusive. Amphibole (hornblende) is in essentially monomineralic fine grained layers in gneissic, and as crystals (to 10mm) in a quartz feldspathic matrix in granulitic rock. Magnetite (to several per-cent - particularly in the section 188·2 - 195m -) appears associated with amphibole. Garnet varies in grain size from 2 to 15mm (porphyroblastic) aggregates and occurs in both quartzo-feldspathic and amphibolitic layers. The section 220·1 to 222 is sheared and chloritized and there is scattered chlorite veining towards the base of the hole. Pyrite is extremely scarce through the hole, there are trace disseminations and a minor amount associated with chlorite veining.	

SAMPLE NUMBER	METERAGE From	METERAGE To	METERAGE Length	MAGNETIC SUSCEPTIBILITIES x 10^{-5} S.I.
				THERE WAS NO SIGNIFICANT TRACE OR PRECIOUS METAL MINERALIZATION FOUND IN THE HOLE. See Geochemical analyses result sheets.
				SPECIFIC GRAVITY'S gm/cm³
				188·2-190m 1930 (8 Readings Averaged)
				190·0-195m 1475 (23)
				195·0-200m 65 (25)
				200·0-205m 165 (25)
				205·0-210m 265 (25)
				210·0-215m 410 (25)
				215·0-220m 125 (21)
				220-225m 120 (25)
				225-230m 140 (25)
				230-235m 75 (24)
				235-240m 90 (23)
				240-245m 155 (25)
				245-248·6m 65 (19)

ASSAYS				
189·7m	= 3·03			
191·3m	= 3·01			
192·7	= 2·83			
195·7	= 2·76			
197·3	= 3·17			
199·0	= 3·06			
201·2	= 3·11			
203·3	= 3·11			
205·2	= 3·18			
207·0	= 3·15			
209·0	= 3·21			
211·0	= 3·11			
212·5	= 3·06			
214·3	= 2·99			
216·1	= 3·01			
218·4	= 3·03			
220·5	= 2·88			
223·4	= 3·13			
225·9	= 2·82			
227·4	= 3·32			
229·3	= 3·32			
230·6	= 3·22			
232·9	= 3·24			
234·8	= 3·17			
237·0	= 3·25			
238·5	= 3·25			
240·5	= 3·16			
242·3	= 3·20			
245·4	= 3·07			
246·6	= 2·93			
248·6m	= 3·11			

Amoco Minerals Australia Company

DRILL LOG — HOLE No. P.B. 5 — PAGE 2 OF 2

PROJECT	PARAGON BORE No.	ELEVATION meters	COMMENCED
PROSPECT		DIP COLLAR	COMPLETED
CO-ORDINATES	mN mE	CORE SIZE	TOTAL LENGTH meters
BEARING	TN MN GN	LOGGED BY	

BORE HOLE SURVEY			INSTRUMENT					
Depth (m)	Dip	Bearing	Depth (m)	Dip	Bearing	Depth (m)	Dip	Bearing

METERAGE From	METERAGE To	DESCRIPTION	MINERALIZATION %	SAMPLE NUMBER	METERAGE From	METERAGE To	METERAGE Length	ASSAYS
		There are Pontifex Thin Section (P.S.) descriptions for 190·6, 206·2 and 248·3 metres as well as three basement Pebbles from BOORTHANNA FORMATION above basement.						
				LAYERING DIP ANGLES (angles to short axis of core)				
				188·4m	= 55°			
				189·6	= 55°			
				190·5	= 60°			
				191·4	= 55°			
				192·1	= 55°			
				193·8	= 50°			
				194·8	= 55°			
				197·0	= 50°			
				198·5	= 60°			
				201·0	= 55°			
				202·9	= 45°			
				205·0	= 60°			
				207·0	= 55°			
				208·8	= 55°			
				211·6	= 60°			
				214·0	= 50°			
				216·1	= 55°			
				218·0	= 50°			
				220·9	= 45°			
				223·3	= 65°			
				225·0	= 65°			
				228·1	= 40°			
				230·0	= 60°			
				231·8	= 55°			
				233·9	= 55°			
				236·8	= 55°			
				239·0	= 55°			
				240·9	= 45°			
				243·3	= 45°			
				244·0	= 45°			
				246·1	= 50°			
				247·5	= 55°			

APPENDIX III

GEOCHEMICAL ANALYSES

COMLABS Pty. Ltd.
COMPUTERISED ANALYTICAL LABORATORIES

0245

Central Laboratory
305 SOUTH ROAD,
MILE END SOUTH
STH. AUST. 5031
TEL.: (08) 43 5722
TELEX: AA89323

NATA REGISTERED No. 1526

FBLogan BoEo & 102/'

OUR REF.: COM 832917

YOUR REF.: Order No. 18819

Mr. G. Miller,
Amoco Minerals Aust. Ltd,
6 The Parade,
NORWOOD SA 5067,

23.1.84

Dear Graeme,

RE: JOB COM 832917

Enclosed are the assays for the samples delivered to our laboratory on the 30th December 1983.

Yours sincerely,
COMLABS PTY LTD

per : Dany Halbook.

$ 201-00

Queensland Preparation Laboratory: 172 Lavarack Ave., Eagle Farm, Queensland. 4007 Tel.: (07) 268 4748

COMLABS Pty. Ltd.
COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

0246

JOB COM832917 O/N : 18819

Results in ppm

SAMPLE	Cu	Pb	Zn	Co	Bi	Au
PB5 0 to 10	16	32	50	6	4	<0.01
PB5 10 to 20	14	30	48	4	<4	<0.01
PB5 20 to 30	24	20	32	8	<4	<0.01
PB5 30 to 40	22	30	65	8	<4	<0.01
PB5 40 to 50	16	12	280	28	<4	<0.01
PB5 50 to 60	12	8	135	4	<4	<0.01
PB5 60 to 70	8	10	110	8	<4	<0.01
PB5 70 to 80	14	8	48	10	<4	<0.01
PB5 80 to 90	12	6	24	6	<4	<0.01
PB5 90 to 92	18	6	22	10	<4	<0.01
PB5 92 to 100	8	10	14	4	<4	<0.01
PB5 100 to 110	8	12	65	10	<4	<0.01
PB5 110 to 120	28	26	85	18	<4	<0.01
PB5 120 to 130	32	30	90	18	<4	<0.01
PB5 130 to 140	38	30	115	18	<4	<0.01
PB5 140 to 150	34	30	120	16	<4	<0.01
PB5 150 to 160	28	24	115	16	<4	<0.01
PB5 160 to 170	14	20	65	14	<4	<0.01
PB5 170 to 180	10	8	38	10	<4	0.05
PB5 180 to 190	10	10	46	10	<4	<0.01

Method of Analysis : Cu Pb Zn Co Bi : AAS1
Au : AAS5B

COMLABS Pty. Ltd.
COMPUTERISED ANALYTICAL LABORATORIES

305 SOUTH ROAD,
MILE END SOUTH
STH. AUST. 5031
TEL.: (08) 43 5722
TELEX: AA89323

NATA REGISTERED No. 1526

0247

OUR REF.: COM 840233

YOUR REF.: Order No. V 18840

Mr. G. Miller,
Amoco Minerals Division,
6 The Parade,
NORWOOD SA 5067,

17.2.84

Dear Graham,

RE: JOB COM 840233

Enclosed are the assays for the samples delivered to our laboratory on the 13th February 1984.

Yours sincerely,
COMLABS PTY LTD

per : P R Harvey

Parkson Bobs

$ 139-00

COMLABS Pty. Ltd.
COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

0248

JOB COM840233 O/N : W18840

Results in ppm

SAMPLE	Cu	Pb	Zn	Co	Pi	Au
188 TO 190	30	4	140	18	<4	<0.01
190 TO 192	30	10	260	16	<4	<0.01
192 TO 194	28	6	120	20	<4	<0.01
194 TO 196	24	16	150	18	<4	<0.01
196 TO 198	18	10	130	16	<4	<0.01
198 TO 200	12	8	130	16	<4	<0.01
200 TO 202	18	4	190	18	<4	<0.01
202 TO 204	34	4	180	12	<4	<0.01
204 TO 206	24	4	180	14	<4	<0.01
206 TO 208	24	4	110	14	<4	<0.01
208 TO 210	22	4	140	16	<4	<0.01
210 TO 212	30	10	240	14	<4	<0.01
212 TO 214	26	4	120	14	<4	<0.01
214 TO 216	16	4	140	12	<4	<0.01
216 TO 218	24	6	130	20	<4	<0.01
218 TO 220	28	48	130	12	<4	<0.01
220 TO 222	24	24	120	14	<4	<0.01
222 TO 224	34	4	120	14	<4	<0.01
224 TO 226	30	12	130	12	<4	<0.01
226 TO 228	38	8	110	22	<4	<0.01
228 TO 230	42	10	110	22	<4	<0.01
230 TO 232	34	6	95	20	<4	<0.01
232 TO 234	46	26	270	18	<4	<0.01
234 TO 236	26	8	130	14	<4	<0.01
236 TO 238	24	6	150	14	<4	<0.01

.../2

ANALYTICAL REPORT

0249

JOB COM840233 O/N : W18840

Results in ppm

SAMPLE	Cu	Pb	Zn	Co	Pt	Au
238 TO 240	42	10	110	14	<4	<0.01
240 TO 242	26	<4	90	12	<4	<0.01
242 TO 244	26	10	260	16	<4	<0.01
244 TO 246	65	8	150	20	<4	<0.01
246 TO 248	50	6	140	14	<4	<0.01

Method of Analysis : Cu Pb Zn Co Pt : AAS1
Au : AAS5B

APPENDIX IV

MINERALOGICAL REPORTS

Pontifex & Associates Pty. Ltd.

TEL. 332 6744
A.H. 31 3816

26 KENSINGTON ROAD, ROSE PARK
SOUTH AUSTRALIA

P.O. BOX 91, NORWOOD
SOUTH AUSTRALIA 5067

0251

MINERALOGICAL REPORT NO. 4228

14th February, 1984

TO: Mr. G. Miller,
Amoco Minerals Aust. Co.
6 The Parade,
NORWOOD S.A. 5067

YOUR REFERENCE: Order No. W18832

MATERIAL: Rock samples

IDENTIFICATION: 57516, 519 to 523
57528

WORK REQUESTED: Thin section and description

SAMPLES & SECTIONS: Returned to you with this report.

PONTIFEX & ASSOCIATES PTY. LTD.

BL 2217 1/7
BL 1021 3/7
BL 4043 3/7

57519 : "rhyolite" with ferromagnesian phenocrysts altered to iron-rich chlorite; accessory leucoxenised magnetite and lesser apatite.

Phenocrysts in this rock consist mostly of alkali felspar (15%) with slightly less abundant plagioclase and minor quartz. The felspar phenocrysts are up to 5 mm across and are variously altered. The alkali felspar is argillised and hematite stained, and rarely encloses patches of dark-green chlorite. The plagioclase is studded with sericite and epidote, and is possibly albitised. The quartz phenocrysts have typical volcanic resorbed outlines.

Ferromagnesian phenocrysts (5%) to 1 mm long are replaced by dark-green iron-rich chlorite, locally with minor sericite and quartz. Inclusions of apatite are common in these grains, and leucoxenised magnetite grains are enclosed in, or attached to them.

The groundmass is fine granular quartz and alkali felspar in sub equal abundance, with some chlorite and hematite. Vein-like coarser-grained patches occur through the groundmass and have small patches of interstitial chlorite.

Pebble from precollar - Just above basement.

57520 : rhyolitic or granitic protomylonite; with both deformed and undeformed quartz vein.

Grains of elongated quartz (12%), stressed and subhedral alkali felspar (10%) and plagioclase (10%) in this rock all about 2 mm in size, occur essentially as augen, (possibly, but not necessarily as sheared direct equivalents of the phenocrysts in No. 57519). These occur in a recrystallised, very fine grained quartzofelspathic matrix, with a moderately developed lattice orientation. This matrix consists of quartz, alkali felspar and plagioclase in subequal abundance with accessory disseminated magnetite.

Irregular veins of deformed quartz occur in the matrix and there are also crosscutting, planar, undeformed quartz veinlets.

This rock appears to have been an original rhyolitic volcanic, or possibly a granitic intrusive, sheared and recrystallised (protomylonite) with the development of augen, which as noted above may be entirely metamorphic and not necessarily the direct derivitive of former phenocrysts.

Pebble from Precallan - just above basement

5721 : layered coarse "gneiss", with layers of (quartz) plagioclase hornblende (high-grade amphibolite), and of (garnet) quartz felspar; accessory magnetite in amphibolite.

The metamorphic hornblende in the amphibolite layers in this rock is brownish-green, which is characteristic of high grade (uppermost amphibolite facies); (corresponds to the zone B conditions at Broken Hill). This hornblende occurs as coarse polygonal grains about 1 mm in size, with spheroidal to bleb-like inclusions of quartz, aggregated with minor, hematite-dusted plagioclase and minor scattered magnetite.

In the pale-coloured interlayers, rose-pink (?almandine-pyrope) garnet, occurs in a fairly coarse metamorphic aggregate of quartz and sericitised hematite-dusted plagioclase, some with minute inclusions of apatite.

Layers or veins in the amphibolite, 2 - 15 mm wide, are dominantly quartz, and hematite-dusted, weakly sericitised plagioclase (in part antiperthitic). One layer has large poikiloblasts of pink garnet enclosing quartz as well as minor opaque oxides, fresh to chloritised hornblende and apatite.

Stringers of greenish clays cut the rock.

Pebble from precollan - just above basement.

Pontifex & Associates Pty. Ltd.

TEL. 332 6744
A.H. 31 3816

26 KENSINGTON ROAD, ROSE PARK
SOUTH AUSTRALIA

P.O. BOX 91, NORWOOD
SOUTH AUSTRALIA 5067

0255

MINERALOGICAL REPORT NO. 4233

16th February, 1984

TO: Mr. Graham Miller,
Amoco Minerals,
6 The Parade
NORWOOD S.A. 5067

YOUR REFERENCE: Order No. W18836
A79.63, EL1021

MATERIAL: 4 core samples

IDENTIFICATION: PB5, 190.9
206.2
232.9
248.3

WORK REQUESTED: Thin section and description.

SAMPLES & SECTIONS: Returned to you with this report.

PONTIFEX & ASSOCIATES PTY. LTD.

EL 1021 PARAGON BORE

COMMENTS

The four PB5 core samples all have a similar composition, of coarse and more or less pegmatoidal quartz, slightly altered plagioclase ± garnet, irregularly interlayered with fairly high grade (upper amphibolite facies) schistose amphibolite composed of dark brownish-green hornblende, plagioclase, quartz, accessory magnetite and apatite.

Locally the leucocratic, quartz-plagioclase aggregate ± garnet layers cut across the foliation in the amphibolite, and tend to incorporate possible residual patches and lenses of the amphibolite. This suggests that the quartz-felspar is an intrusive phase, which invades and replaces the amphibolite. The amphibolite may be a metabasic rock (characterised by accessory magnetite and apatite); possibly however it is a meta-impure dolomite. The abundant garnet in both rock types may have formed by reaction between the intrusive and the amphibolite.

Sample 57521, previous Pontifex Report 4228, has a similar composition to those core samples, although it is finer grained and has a more regular gneissic layering: it may however have a similar genesis.

PB5, 190.6m : gneiss, with interlayers of schistose garnet amphibolite, and coarse granular quartz-, plagioclase ± garnet;
accessory magnetite and apatite.

Streaky dark green layers of high-grade garnet amphibolite up to 20 mm thick, are intercalated with pink-grey granulose layers of quartz and plagioclase ± garnet, and of similar thickness.

The amphibolite layers are dominated by strongly aligned granular greenish-brown hornblende with a grainsize of about 1 mm, together with minor plagioclase and quartz. Magnetite and apatite occur in minor to accessory amounts. In some of the layers there are large poikiloblasts of garnet, to 6 mm across, enclosing quartz and magnetite. The brownish colour of the hornblende is indicative of upper amphibolite grade of metamorphism.

The quartz-plagioclase layers tend to cut across the schistosity in the amphibolite layers. They contain partly sericitised, partly hematite-stained grains of antiperthitic plagioclase to 8 mm in size, with equally coarse grained quartz and rare alkalifelspar. Myrmekite occurs on the plagioclase-alkali felspar contents. Garnet in these layers is similar to that in the amphibolite but encloses amphibole and biotite as well as quartz, magnetite and apatite.

Veins of chloritic clays cutting this rock enclose lenses of coarse grained pyrite.

This rock is essentially a coarser grained equivalent of 57521 previously described in Pontifex Report No. 4228.

PB5 206.2 m: quartz-felspar-garnet rock with lenses of high grade amphibolite.

Macroscopically and in thin section this core is very similar to PB5, 190.9m. About 70% of it is composed of a more or less pegmatoidal aggregate of coarse anhedral quartz, subhedral plagioclase and garnet, with a grainsize of 2 - 8 mm, the larger grains being mostly of garnet. The garnet is poikiloblastic with inclusions of quartz, hornblende, less magnetite and apatite. The plagioclase is weakly sericitised and weakly stained by hematite. Some of the apatite is quite coarse (to 1 mm).

The amphibolite lenses consist of strongly oriented dark brownish-green hornblende with minor quartz, plagioclase, lesser magnetite and apatite. Accessory garnet occurs in some of these lenses, trace pyrite occurs in one.

PB5 232.9m: (high-grade) amphibolite, incorporating minor biotite, garnet, quartz, also accessory magnetite and apatite.

This is an irregularly layered schistose amphibolite, with green-brown hornblende grains (50%) to 2 mm in length, aggregated with a subequal abundance of weakly to moderately sericitised plagioclase.

Minor garnet occurs as porphyroblasts to 4 mm in diameter in the more highly felspathic lenses, and this garnet has rare inclusions of quartz. Minor biotite (3%), also lenses of quartz to 4 x 1 mm are scattered throughout along the foliation planes.

Accessory magnetite $\pm$ associated leucoxene, and accessory apatite grains are present.

PB5, 248.3 m: coarse "pegmatoidal" quartz-felspar incorporating vague metamorphic layers of high grade amphibolite, also lenses of coarse biotite;
abundant scattered garnet, accessory magnetite and apatite.

At least 50% of this sample consists of very coarse virtually pegmatoidal quartz, plagioclase and scattered poikiloblastic garnet crystals, all with grain size of up to 15 mm. This aggregate incorporates a localised lens of coarse biotite together with minor garnet, lesser hornblende, accessory magnetite, pyrite, quartz and apatite. The plagioclase in this domain is weakly sericitised but in not antiperthitic.

Streaky layers and patches of amphibolite, very similar to that from 190.6m, are incorporated within this quartz-felspar garnet aggregate, and these include small, non-poikiloblastic garnet grains, also magnetite which is totally or partly replaced by rutile.
In the thin section, a quartz-garnet layer about 5 mm thick, with minor magnetite, biotite and apatite, occurs between the amphibolite and the pegmatoid. A vein of chloritic and sericitic clays, with coarse pyrite, cuts the rock. Alteration of the biotite to clays and ?prehnite is possibly related to this veining.