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EL 186

PANDURRA

PROGRESS AND FINAL REPORTS TO LICENCE RENEWAL FOR THE PERIOD 7/4/75 TO 6/4/77

Submitted by
CSR Ltd
1977

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PRIMARY INDUSTRIES AND RESOURCES SA

CONTENTS ENVELOPE 2564

Transparencies In Cylinder 2564/1

TENEMENT: E.L. 186 - Pandurra.

TENEMENT HOLDER: C.S.R. Ltd.

REPORT: Quarterly Report E.L. 186 Period Ending 7th July 1975. Pgs. 3-29

PLANS: Location Map Rock Sample Locations In The Adelaide (Geosyncline) Area. Fig. 6. Pg. 26

REPORT: Interpretation Of Airborne Electromagnetic Survey Barringer 'Input' System Of The Yudnapinna Area S.A. July 1975. PMR 170/75. Pgs. 30-102

PLANS: Fourth Channel Contour Map Winnie Pinnie And Yudnapinna Areas Sheets 3 To 6. 2564(I)-1 To 4

Isomagnetic Contour Maps Winnie Pinnie And Yudnapinna Areas Sheets 3 To 6. 2564(I)-5 To 8

Electromagnetic Maps Winnie Pinnie And Yudnapinna Areas Sheets 3 To 6. 2564(I)-9 To 12

REPORT: Review Of Stratigraphic Petrography, Pandurra Area. August 1975. PMR 127/75. Pgs. 103-158

APPENDIX 1: Petrographic Notes Taken From Various Pacminex Pty. Limited Pandurra Petrographic Reports And Collated: These include PMR's 195/72, 73/74, 153/74, And 29/75; Also A Memorandum From P.J. Curtis To D.G. Tonkin Dated 4/9/1973, Entitled "Pandurra Thin Sections". Pgs. 159-235

APPENDIX 2: Memorandum From D.G. Tonkin To P.J. Curtis Dated 27/11/1974, Entitled "Pandurra Petrography". Pgs. 236-240

PLANS: Moonabie Formation, P.95. Fig. 1. Pg. 118

Moonabie Formation, P.96. Fig. 2. Pg. 118

Corunna Conglomerate, P.90. Fig. 3. Pg. 119

Corunna Conglomerate, P.91. Fig. 4. Pg. 119

Gawler Range Volcanics, P.24. Fig. 5. Pg. 121

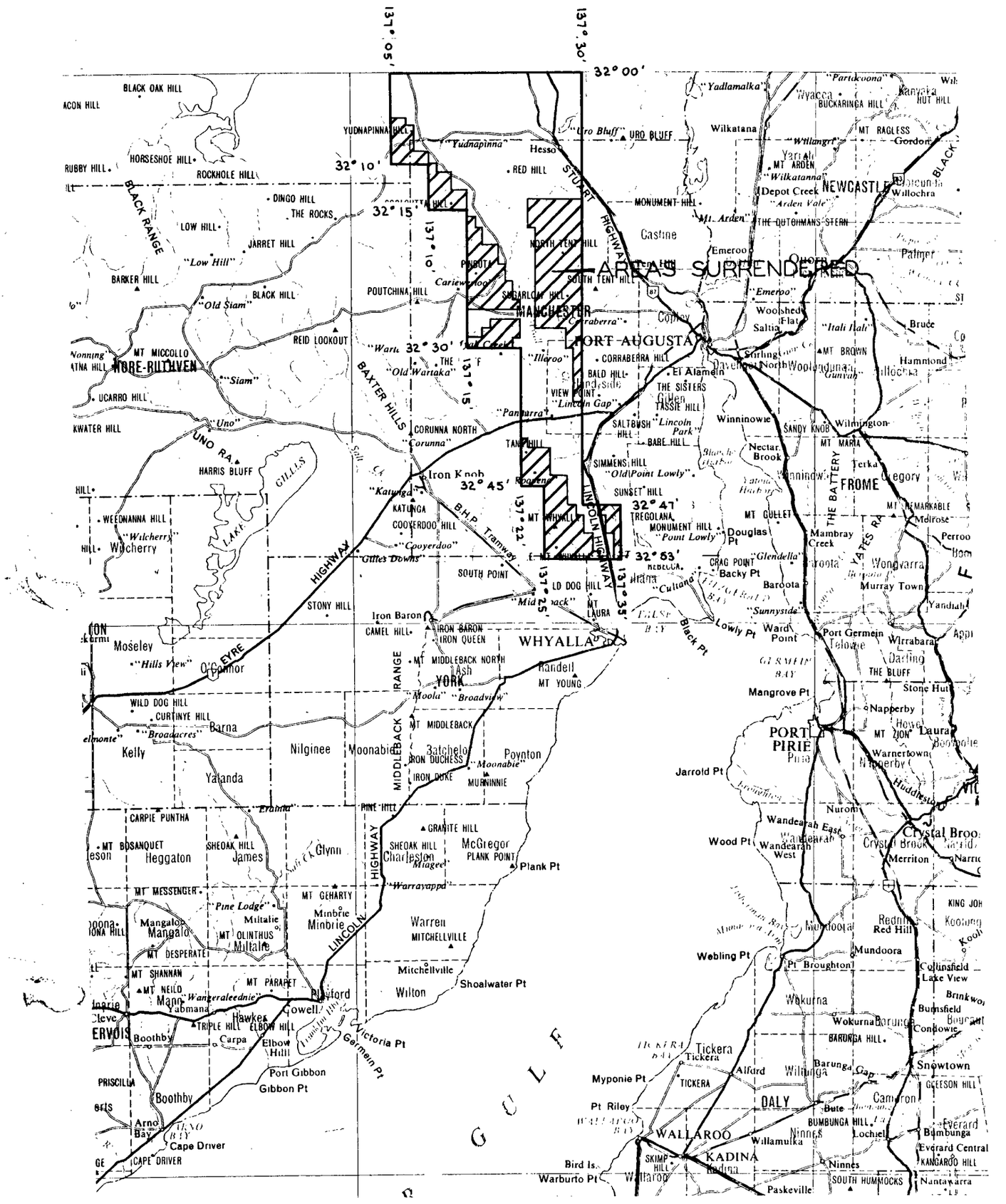
PLANS:	Roopena Volcanics, P.19. Fig. 6.	Pg. 122
	Roopena Volcanics, A9657 (Beda Bore Chip). Fig. 7.	Pg. 122
	Pandurra Formation: Basal Section, P.49A. Fig. 8.	Pg. 125
	Pandurra Formation: Basal Section, P.50B. Fig. 9.	Pg. 125
	Pandurra Formation: Basal Section, P.86. Fig. 10.	Pg. 127
	Pandurra Formation: Upper Section, P.443. Fig. 11.	Pg. 130
	Pandurra Formation: Upper Section, P.58. Fig. 12.	Pg. 132
	Pandurra Formation: Upper Section, P.83A. Fig. 13.	Pg. 132
	Elizabeth Creek Conglomerate, P.9. Fig. 14.	Pg. 135
	Elizabeth Creek Conglomerate, P.27. Fig. 15.	Pg. 135
	Woocalla Dolomite, P.28. Fig. 16.	Pg. 137
	Woocalla Dolomite, P.35. Fig. 17.	Pg. 139
	Woocalla Dolomite, EX50 (20m). Fig. 18.	Pg. 139
	Magazine Hill Clay, P.85. Fi g. 19.	Pg. 142
	Yudnapinna Beds, P.65. Fig. 20.	Pg. 142
	Yudnapinna Beds, EX96-86645. Fig. 21.	Pg. 146
	Yudnapinna Beds, EX142-97325. Fig. 22.	Pg. 146
	Whyalla Sandstone, P.51. Fig. 23.	Pg. 149
	Whyalla Sandstone, P.60. Fig. 24.	Pg. 149
	Whyalla Sandstone, P.66. Fig. 25.	Pg. 150
	Tregolana Shale (Clay), EX93-86587. Fig. 26.	Pg. 153
	Tregolana Shale (Silt), EX93-86587. Fig. 27.	Pg. 153
	Tregolana Shale, EX93-86589. Fig. 28.	Pg. 154
	Corraberra Sandstone, P.79. Fig. 29.	Pg. 156
	Corraberra Sandstone, A4223. Fig. 30.	Pg. 156
	Petrographic Sample Location Plan, Pandurra Area, S.A. E.L. 50. Drg. No. 2046.	2564(I)-13
REPORT:	Quarterly Report E.L. 186 Period Ending 7th October 1975.	Pgs. 241-245
PLANS:	Yudnapinna Input Survey Area E.L. 186 Pandurra, S.A. Fig. 1.	Pg. 243
	31 Proposed Drill Hole Locations In The Pandurra Area, S.A. Fig. 2.	Pg. 244
REPORT:	Borehole Level Survey April-Nov. 1975.	Pgs. 246-254
	Quarterly Report E.L. 186 Period Ending 7th January 1976. PMR 16/76.	Pgs. 255-273
APPENDIX 1:	32 Drill Hole Field Logs.	Pgs. 274-338

PLANS:	Locality Plan, Pandurra Area, E.L. 186 Showing Boundaries And Yudnapinna Outcrop Survey Area. Fig. 1.	Pg. 260
	32 Drill Hole Locations In The Pandurra Area, S.A. Fig. 2.	Pg. 263
	Stratigraphic Drill Hole & Geological Section Location Plan. Drg. No. 2037A.	2564(III)-1
	Geological Sections AA' To JJ'. Drg. No. I 534-1.	2564(III)-2
REPORT:	Quarterly Report E.L. 186 Period Ending 7th April 1976.	Pgs. 339-344
PLANS:	Locality Plan E.L. 186 Pandurra Area, S.A. Fig. 1.	Pg. 341
	Airborne Input Orientation Survey Flight Lines, Cariewerloo And Pandurra Areas. Fig. 2.	Pg. 342
	Proposed Drill Sites, Yudnapinna Input Survey Area. Fig. 3.	Pg. 343
REPORT:	Expenditure On Exploration To 30th June 1976.	Pg. 345
	Water Sample Analysis Advise.	Pgs. 346-349
	Quarterly Report E.L. 186 Period Ending 7th July 1976. PMR 165/76.	Pgs. 350-360
APPENDIX 1:	Field Drill Logs YD 1 To YD 15.	Pgs. 361-392
APPENDIX 2:	Classification Of Igneous Rocks, Pandurra Area.	Pgs. 393-467
PLANS:	1976 Drill Sites, Yudnapinna Input Survey Area. Fig. 2.	Pg. 356
REPORT:	Quarterly Report E.L. 186 Period Ending 7th October 1976. PMR 194/76.	Pgs. 468-482
APPENDIX 1:	Stratigraphic Interpretation Of Pandurra Area Drill Holes.	Pgs. 483-496
APPENDIX 2:	Preliminary Interpretation Of Airborne Magnetic Data For Yudnapinna Area, By R.J. Smith.	Pgs. 483-496
PLANS:	Location Map Mt. Gunson - Pandurra Areas, S.A. Fig. 1.	Pg. 474
	Petrographic Sample Location Plan Pandurra Area. Drg. No. I 534-3.	2564(IV)-1
	Drill Hole Locations And Interpretative Bedrock Lithology, E.L. 186 Pandurra Area. Drg. Nos. I 534-4A & I 534-4B.	2564(IV)-2 & 3
	Isomagnetic Contour Map Winnie Pinnie & Yudnapinna Areas. Sheet 1.	2564(IV)-4

PLANS:	Overlay To Isomagnetic Contour Map Winnie Pinnie And Yudnapinna Areas.	2564(IV)-5
	Stuart Shelf Level Survey E.L. 186.	2564(V)-1
REPORT:	Quarterly Report E.L. 186 Period Ending 7th January 1977. PMR 14/77.	Pgs. 506-518
APPENDIX 1:	List Of Equipment Used By Geoterrex In Geophysical Surveys.	Pgs. 519-521
PLANS:	Airborne Input Orientation Survey Flight Lines, Cariewerloo And Pandurra Areas. Fig. 2.	Pg. 514
	Proposed Resistivity Lines & Stream Deposit. Fig. 3.	Pg. 516
	Trial Input Survey Pandurra Area - Test 264/265. Drg. No. I 534-5.	2564(V)-2
	Trial Input Survey Cariewerloo Area - Test 264/265. Drg. No. I 534-6.	2564(V)-3
REPORT:	Final Report E.L. 186 Period Ending 7th April 1977. PMR 105/77.	Pgs. 522-533
APPENDIX 1:	Murdoch Geophysics Report No. 265 Part A - Text; Part B - Maps "A Resistivity Survey At Pandurra, Near Port Augusta, S.A. For Pacminex Pty. Ltd.	Pgs. 534-559
PLANS :	Pandurra Target, Location Of Resistivity And Magnetic Survey Lines. Fig. 2.	Pg. 530
	Magnetic Profile Location Plan E.L. 186 Pandurra Area. Drg. No. I 534-7.	2564(V)-4
	Magnetic Profiles (Gammas) E.L. 186 Pandurra Area. Drg. No. I 534-8.	2564(V)-5
	Resistivity Survey Pseudo Section Line 1. Plate 1.	2564(V)-6
	Resistivity Survey Pseudo Section Line 2. Plate 2.	2564(V)-7
	Resistivity Survey Pseudo Section Line 3. Plate 3.	2564(V)-8
	Resistivity Survey Pseudo Section Line 4. Plate 4.	2564(V)-9
	Resistivity Survey Pseudo Section Line 0. Plate 5.	2564(V)-10
	Resistivity Survey Pseudo Section Line 5. Plate 6.	2564(V)-11
	Resistivity Survey Pseudo Section Line 1 (500-1000). Plate 7.	2564(V)-12
	Resistivity Survey Interpreted Section 1, 2, 3, 4, 0, & 5. Plate 8.	2564(V)-13

PLANS: Contour Plan: r = 65 Metres Apparent Resistivity Data. 2564(V)-14
Plate 9.
Contour Plan: Resistivity Interpreted Depth To Basement. 2564(V)-15
Resistivity Sosunding Plates 11 To 28. Pgs. 560-577

SCHEDULE 'A'



SCALE 1:1,000,000

KILOMETRES 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 KILOMETRES

APPLICANT : CSR LIMITED

D.M. : 107/75 AREA : ~~2215~~ 1480 Square Kilometres

1:250 000 PLANS : PORT AUGUSTA

LOCALITY : PANDURRA AREA. Approximately 20 km east of Iron Knob.

E.L. No. : 186 EXPIRY DATE : ~~6.4.76~~ 6.4.77

186

2 "Q"

DATA AND REPORTS

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- 'MT. GUNSON area'

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2E

Data relating to exploration described in this Envelope may be included in some of the Envelopes here listed.

DATA AND REPORTS

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2F

ENVELOPE	CLASSIFICATION	CONTENTS
6591	Open	Index (to be prepared)
6593	Open	Cattlegrid: Geology.
6594	"	" Drilling summary data & Drilling logs.
6595	"	" Plans. (Includes flotation tests and concentrate grades)
6596	"	" Mine Period Reports.
6597	"	" Mill " "
6598	"	" Shipping Data.
		Reports.
6604	Open	Lagoon: A) Reserves - East Lagoon & West Lagoon orebodies. B) Geophysical Surveys on East Lagoon orebody (Larson, 1970). C) Plans (face geology, geology, grade control, mining).
6605	"	MG14 Deposit: Metallurgy
6606	"	Main Open Cut: "
6607	"	Cattlegrid: Metallurgy & Mineragraphy (1973 & 1974 studies).
6608	"	" 1975 Mineragraphy of Mill products & feed.
6609	"	" Flotation testing of diamond drillholes.
6610	"	" Mineragraphy of mill products 1975-1983 by Pontifex & Associates.
6611	"	PETROGRAPHIC STUDIES: Includes Cattlegrid Main Open Cut Lagoon Workings Powerline Embayment Pandurra Formation MG14 Gully
6612	"	DRILL LOGS: Main Open Cut Sheet and Main Open Cut deposit A) ABC GRID SERIES B) BGC (Biogeochem) GRID SERIES C) 3-4-XD series (9 holes) 3-13-XP series (Plateau area) MX GRID SERIES

D) Rod E. Jones XXX/XXX SERIES, 1981/1982.
E) 3-4-XP SERIES, 1971/1972 where X=1 to 325.
F) Notes/memos on exploration and drilling at Main Open Cut deposit.

6613 Open

DRILL LOGS:
A) HOUSE SHEET: ABC GRID SERIES
'R' SERIES
MAIN OPEN CUT SHEET:
'N' to 'L' series
(AUSTMINEX, 1966)
B) HOUSE SHEET: 3-3-XP SERIES.
(Mt. Gunson Mines Pty. Ltd., 1971/1972).
C) BGC GRID SERIES for:
HOUSE SHEET, Lines 4S to 30S South of TOWNSHEET.
(Austminex, 1967).
D) HOUSE SHEET - MN GRID
(Austminex, 1967/1968).
E) HOUSE TO MAIN SHEETS, Rod E. Jones XXX/XXX SERIES
of 800-770
to 870-540 (1981/1982).
F) MAIN OPEN CUT TO HOUSE SHEETS.
3-7-XP SERIES
(Mt. Gunson Mines, 1970-1972).
3-7-1P to
3-7-173P.

6614 "

DRILL LOGS - GUNYOT SHEET.
A) 1) Percussion drilling by Austminex, 1966-1967.
Millsite area.
2) ABC Grid (1966).
3) BGC Grid (1967) from lines 94N to 22N.
4) RAMSAY No. 1.
5) WATERHOLE No. 1.
B) Percussion drilling by Mt. Gunson Mines, 1971-72.
3-5-XP series
where X=1 to 32.

6615 "

GUNYAH LAKE SHEET:
Vol. 1) Report: Geochemical Test Survey, Gunyah Lake
(PMR Report 7/73, K.J. Maiden 1973).
Plans : Location of drillholes & I.P.
traverses.
: Location of drillholes - East
Lagoon & eastern area.
: IP surveys: proposed program.
: Bedrock Lithology.

6616 "

GUNYAH LAKE SHEET - DRILL LOGS:
Vol. 1A) MYSTERY AREA (1971).
3-6-XD series where X=1 to 7.
B) GUNYAH LAKE (1971-1972).
3-8-XD series where X=1 to 8.
Vol. 2A) MYSTERY AREA (1970-1972).
3-6-XP series where X-1 to 65.
Note: Both GUNYAH Sheet & HOUSE Sheet.
B) 3-12-XP series, (1971-1972)
where X=1 to 12.
South of HOUSE WORKINGS.

6617	Open	EAST LAGOON - DRILL LOGS: MT. GUNSON MINES PTY. LTD., 1970. 3-1-XP series where X=1 to 262.
6618	"	WEST LAGOON - DRILL LOGS: Mt. GUNSON MINES PTY. LTD., 1970-1972. 3-2-XP series where X=1 to 323.
6619	"	LAGOON AREA - DRILL LOGS: AUSTMINEX (1968) Diamond drillholes.
6620	"	LAGOON AREA - DRILL LOGS: AUSTMINEX (1966-1968) Auger drillholes. On grid: 6,520,000 to 6,521,000 mN and 707,000 to 709,000 mE.
6621	"	LAGOON AREA - DRILL LOGS: AUSTMINEX (1968). Vol. 1) Drilled on grid: 6,520,000 to 6,521,000 mN and all eastings up to 707,000 mE. Vol. 2) Drilled on grid: 6,521,000 to 6,522,000 mN and all eastings.
6622	"	LAGOON AREA - DRILL LOGS: AUSTMINEX (1967). Assorted drillholes.
6623	"	MAGAZINE HILL CLAY DEPOSIT: PACMINEX PTY. LTD., 1973-1974.
6624	"	PERNATTY LAGOON - DRILL LOGS: Western edge of Pernatty Lagoon. Regional Scout drilling by Pacminex in 1972, *5XX-XP series where *=F to L 5XX=505 to 520.
6625	"	MANGANESE WORKINGS (PERNATTY LAGOON): A) MT. GUNSON MINES PTY. LTD. memos of 1977. B) PACMINEX (1971-1972) percussion drilling of 3-10-XP series where X=1 to 20.
6626	"	WOOCALLA, IRONSTONE LAGOON, FAIR NELL MINE, SWEET NELL MINE, MONALENA: A) Geological plans and cross-sections. B) Pacminex, 1970. Drill logs - Sweet Nell Mine Fair Nell Mine 3-9-XP series where X=1 to 22. C) Pacminex, 1971. Drill logs - Woocalla area. 3-11-XP series where X=1 to 9. D) Pacminex, 1972. Drill logs - Monalena area (Woocalla). MONA XP series where X=1 to 16.

6627	Open	MG14 DEPOSIT: GEOLOGY AND DRILL LOGS, with plans and cross-sections. A) Pacminex (1973-1977) rotary percussion/hammer drilling of MG 1 to 21 29 to 41 82 to 100 B) Pacminex (1973-1975) rotary & diamond drilling of MG 14D to 93D (not inclusive). C) Pacminex (1983) drilling of MG501 to MG511. D) Relog of Woomera Bore and LY3.
6628	"	GULLY PROSPECT: Drilling and evaluation of copper resource. Drill logs of: GY1 to GY16 (1975) 3-7-127P to 3-7-129P 3-7-160P to 3-7-162P 3-7-165P 3-7-172P 3-7-173P.
6629	"	OAKDEN HILLS AND SELBY DAM: Pacminex (1973-1980). A) Regional rotary percussion, OK X series, i.e. OK1 to OK157. B) Geochemical drilling at: 1) OK3 Grid i.e. OK3-1 to OK3-86. 2) Selby Dam Grid i.e. holes 1 to 114. C) Diamond drilling - OK XD series i.e. OK36D "109-111D "113D "115D "119D.
6630	"	WINNIE PINNIE AREA: EL199 Pacminex (1976-1977). A) Interpretation of Input data. B) 1976 Rotary percussion drilling of 'input' anomalies, WP series, i.e. WP31 to WP88. C) Drill logs WP31 to WP88.
6631	"	LAKE WINDABOUT: EL199 Pacminex (1976). A) Drill testing of input targets in Lake Windabout district.. B) LW Series, Gamma ray logs. " " drillhole " .
6632	"	LAKE WINDABOUT: A) Drill logs - LW series, i.e. LW1 to LW97. B) Detailed diamond drill logs for: LW52,58,60-66 inclusive.
6633	"	LUCAS HILL: (=WEST LAKE WINDABOUT) Geophysical and Geological Logs.

6634	Open	POWERLINE EMBAYMENT: A) 1975 Summary report of exploration. B) 1977 Geophysical logging of PL32.
6635	"	POWERLINE EMBAYMENT: Drill logs, PL SERIES, i.e. PL1 to PL47 inclusive.
6636	"	BOOKALOO-LAKE DUTTON: Geophysical logging of drillholes, LD series BK series.
6637	"	BOOKALOO-LAKE DUTTON-LAKE MACFARLANE: Drill logs: Bookaloo BK1-BK22 Lake Dutton LD8-LD38 Lake MacFarlane MF1-MF13.
6638	"	LY SERIES DRILLING: A) LY2 (Cattlegrid) 1974 Geophysical logs. B) LY4-LY11 and 83/108 (East of Cattlegrid), 1983 Geological logs.
6639	"	BIOGEOCHEMISTRY: A) CATTLEGRID & MG14 AREAS (Pacminex 1978). B) PERNATTY LAGOON (Austminex, 1966).
6640	"	GROUNDWATER GEOCHEMISTRY - Stuart Shelf: Pacminex (1978) - Report PMR90/78.

6663	"	MT. WHYALLA BARITE DEPOSIT: Pacminex (1974) report - PMR 57/74.
6664	"	GEOLOGICAL MAPPING: Report: Elizabeth Creek area (Chisholm, 1974) Plans: Pernatty Lagoon Mt. Gunson Mines area Elizabeth Area Canegrass Dam area Wirrappa area.

6666 Open

DRILL LOGS - ELIZABETH CREEK & CANEGRASS AREAS:
EC23-EC54 (Elizabeth Creek)
TOC1-TOC4
SP1-SP19 (Snakepit)
3-14-19P to 3-14-41P (Canegrass Dam area)
3-14-1P to 3-14-46P (Canegrass field logs).

6667 "

DRILL LOGS-PANDURRA AREA (EL405):
Vol. 1. EX1-EX157
2. EX158-EX163 & YD1-YD15
3. EX164-EX184.
4.

Area	1:100 000	Drillholes
	6332	J12-J24
Roopena	"	P1-P4
"	"	J1-J11
"	"	I1
Cultana	6432	Q1, Q2
Cariewerloo	6333	Y1-Y6
"	"	T1-T5
"	"	X1-X3

6668 "

DRILL LOGS-WATER BORES in the MT. GUNSON area.

6669 "

DRILLING SUMMARIES:
3-1-X to 3-14-X series.

6670 "

DRILL LOGS-LAKE TORRENS AREA:
(see also ENV. 3769)
BDH1-BDH4
SLT101-SLT107
YAD1.

6674 "

ELECTROMAGNETIC SURVEYS:
A) Gunyah Lake, 1971 hand-held survey (1 plan only)
B) Cattlegrid & MG14 areas, airborne EM INPUT Test Survey by Geoterrex, 1973.
C) Winnie Pinnie area & Yudnapinna area, airborne electromagnetic survey, Barringer INPUT system, 1975. Geoterrex report 83-253 PMR Report 144/75.
D) Stuart Shelf (EL186, EL199), airborne EM INPUT survey by Geoterrex, 1975.
E) Mount Gunson Pulse Electromagnetic Test, 1977. (Ground Survey) PMR Report 58/77.
Cattlegrid anomaly & Anomaly 'J' (margin of Pernatty Lagoon).
F) Pandurra & Cariewerloo, airborne EM INPUT Survey by Geoterrex, 1977.

6675 "

REFRACTION SURVEYS:
A) Austral Exploration (1967)
Refraction Test Survey at Main Open Cut; West Lagoon; East Lagoon.
B) Austral Exploration (1973)
Reconnaissance Seismic Refraction Survey - Mt. Gunson area.

6676 Open

GRAVITY SURVEYS:

A) Gravity survey - Pandurra area, EL186. Survey by Solo Geophysics, PMR114/77.

B) Gravity anomaly 'A' - Site for drillhole LH1. Notes (1978).

C) Magnetic & gravity survey with levelling at Illeroo Grid (Pandurra area, EL534. Report by Solo Geophysics (1979), PMR87/79.

D) Gravity Survey with barometric levelling at Yudnapinna Reconnaissance Line, EL534. Report by Solo Geophysics (1979), PMR88/79.

E) Interpretation of Geophysics, Illeroo area, EL534. Report by Langron (1980) PMR10/80.

F) Gravity survey - Pernatty Lagoon area, EL543. Survey by Solo Geophysics (1980).

G) Gravity survey - Mt. Gunson area, 'Blue Mag' anomaly 1981.

6677 "

AEROMAGNETIC SURVEYS:

A) Report on stage 1 on the interpretation of results of airborne magnetometer survey covering SML139, 152.

B) Report on an aeromagnetic interpretation, Torrens map sheet, S.A. PMR80/75.

C) Plan, EL186, April 1977. Magnetic Profiles.

D) Geoex (1978) Survey.
Plans of: Aeromagnetic total intensity
: Profiles.

E) Report on airborne magnetic surveys over an area East of Lake Dutton (Pernatty & Bookaloo 1:63 360 sheets). PMR10/78.

6678 "

RESISTIVITY SURVEYS:

A) Resistivity Survey at Pandurra near Port Augusta for Pacminex Pty. Ltd. EL186. Report No. 265 by Murdoch Geophysics, 1977. PMR60/77.

B) A resistivity survey at Mt. Gunson, S.A. for Pacminex. (Survey in June 1976) EL199. Report No. 266 by Murdoch Geophysics, 1977. PMR142/76.

C) Evaluation of a resistivity survey at Mt. Gunson, June 1976. PMR173/76, EL199. (Localities: Cattlegrid; Oakden Hills; MG14).

D) Geophysical Survey at Cattlegrid, July 1973. Survey by CGG; PMR report 133/73.

6679 "

MISCELLANEOUS GEOPHYSICAL SURVEYS - MT. GUNSON AREA:

A) Report on a combined Induced Polarisation, Seismic and EM survey in the Mt. Gunson area. MacPhar Geophysics (1973).

B) Gravity and magnetic surveys on the North Pernatty Grid.
Lines 6,530,000N to 6,540,000N.
Solo Geophysics (1981).

C) Magnetic surveys of 'Blind Dyke', 1982-1983. Un-compiled plans and notes. Includes data of Solo Geophysics (1982).

6680 "

GEOPHYSICAL LOGGING OF DRILLHOLES-STUART SHELF:

A) Geophysical Logging of Drillhole PL32, Gunson area (i.e. Powerline Embayment). PMR138/77.

B) Geophysical logging of drillholes in the Mt. Gunson and Pandurra areas. PMR59/78.
i.e. OK117-OK120
OK128-OK129
WPB2-WPB4
WPB6
WOB10-WOB13
LW34, LW38, LW40
PL34
MG-11-3
PANDURRA AREA:
J12, J15, J16, J20, J21.

C) Geophysical logging of percussion drillholes, June-August 1978. PMR89/78. (EL332,338,339),
i.e. EC5
PL40
LD31
BK10-BK12
EX158-EX163

D) Geophysical logging in the lake Windabout, Powerline and Oakden Hills areas, EL339,
i.e. LW61-LW75
PL42-PL44
OK132-OK135
PMR Report 36/79.

F) Gamma logs - assorted drillholes.

6681 "

INDUCED POLARISATION SURVEYS:

1). IP Survey by Geoscience (1965) for Austminex, SML55.

2) IP and test resistivity survey by MacPhar Geophysics (1967-1968) for Austminex.

3) IP survey by Austral Exploration, 1971-1972, at: Main Open Cut
Gunyah Lake
East Lagoon
West Lagoon
Mystery
Sweet Nell areas.

4) Multi-mode I.P. survey by McPhar Geophysics, 1974 at: - Cattlegrid
- Gunyah Lake
PMR report 75/74.

6682 "

INDUCED POLARISATION SURVEY:
by SOLO GEOPHYSICS, 1983.
CATTLEGRID - MAIN OPEN CUT AREAS,
Includes: 'Haul Road' anomaly
'Dyke" anomaly.

6683	OPEN	'MOUNT GUNSON area' - regional plans and reports. Includes: A) Austminex (1966-1968) reports for SML 96, 121 and 139 - Pernatty Lagoon area. B) SADME articles on Mt. Gunson - extracted from Mining Reviews.
6714	"	MAIN OPEN CUT - plans
6715	"	CATTLEGRID - cross-sections.
6718	OPEN	HOUSE WORKINGS and GUNYOT workings. Plans only - sections, ore reserves, grade control and hole locations. Austminex Pty Ltd and Mount Gunson Mines Pty. Ltd.
6721	OPEN	CATTLEGRID: Surveying and engineering plans, pit development 1974-1986. Includes 1977 aerial survey.
6722	"	TOWN, CARAVAN PARK, SERVICES & TAILINGS DAM - surveying and engineering plans.
6723	"	CATTLEGRID - grade control for areas C2, C3 and Area IV. Predominantly plans - blasthole layout, top-of-ore, grade control plans and cross-sections.
6724	"	EAST LAGOON OREBODY - plans
6725	"	NORANDA AUSTRALIA Ltd (1967). Plans - Main Open Cut, House Workings, West Lagoon, East Lagoon, Mystery.
6726	OEPN	MAIN OPEN CUT - Cross-sections by Austminex Pty Ltd (1967-1968).
6727	"	WEST LAGOON - plans by Mount Gunson Mines and Austminex Pty Ltd. (Grade control, block plans, face geology, drillholes, cross-sections etc.)
6728	"	CATTLEGRID - Grade control plans for areas B2, B3 and B4 (east-northeast Cattlegrid). Plans of bottom-of-ore, top-of-ore, diamond drill-holes, diamond drilling influence areas as well as pit - and grade control - cross-sections.
6729	"	CATTLEGRID - End-of-period Survey Plans (1980-1982).

TOTAL: - 73 open file

CSR LIMITED

MT. GUNSON - STUART SHELF TENEMENTS

SML 96 (A)
Env. 625, 674
39 sq. km.
1.12.65 - 30.11.66

SML 121 (A)
Env. 674
508 sq. km.
1.8.66 - 30.11.66

SML 139 (A)
Env. 868, 906
629 sq. km.
1.12.66 - 30.11.68

SML 139 A (A, M, P)
Env. 1101, 1399, 1490
699 sq. km.
1.12.68 - 30.11.70

SML 494 (P, U)
Env. 1523
2461 sq. km.
5.11.70 - 4.11.71

SML 527 (P, U)
Env. 1563
699 sq. km.
3.12.70 - 2.12.71

SML 641 (P)
Env. 1855
1067 sq. km.
4.11.71 - 3.11.72

EL 29 (P)
Env. 2187
1067 sq. km.
7.12.72 - 19.7.73

EL 81 (Page 2)

EL 29 (Page 1)

EL 81 (M) Env. 2330, 2575 5631 sq. km. 20.7.73 - 19.7.75		EL 50 (M) Env. 2273 2215 sq. km. 23.3.73 - 22.3.75
EL 199 (C) Env. 2627 4895 sq. km. 20.7.75 - 19.7.77		EL 186 (C) Env. 2564, 2720 2215 sq. km. 7.4.75 - 6.4.77
EL 338 (C) Env. 3025 1705 sq. km. 5.8.77 - 4.8.79	EL 339 (C) Env.3026 2107 sq. km. 5.8.77 - 4.8.79	EL 332 (C) Env. 3024 1480 sq. km. 7.6.77 - 6.6.79
EL 542 (C) Env. 3701 1705 sq. km. 25.10.79 - 24.10.81	EL 543 (C) Env. 3703 2107 sq. km. 25.10.79 - 24.10.81	EL 534 (C) Env. 3552 1480 sq. km. 18.9.79 - 17.9.81
EL 950 (C) Env. 3703 1705 sq. km. 21.12.81 - 20.12.85 "Charlinga" TORRENS	EL 951 (C) Env. 3703 2107 sq. km. 21.12.81 - 20.12.85 "Mt. Gunson" TORRENS	EL 952 (C) Env. 3703 1480 sq. km. 21.12.81 - 20.12.85 "Pandurra" PORT AUGUSTA

Legend

1. Tenement No. (Company)
2. Env. No.
3. Area of tenement
4. Period of tenure
5. Tenement Name
6. 1:250 000 Sheet

Company abbreviations

A	Austminex Pty. Ltd.
P	Pacminex Pty. Ltd.
M	Mount Gunson Mines Pty. Ltd.
U	United Uranium N.L.
C	CSR Limited

QUARTERLY REPORT ON E.L. 186, PANDURRA AREA S.A. FOR THE PERIOD ENDING 7TH JULY, 1975

INTRODUCTION

Exploration Licence 186 replaces E.L. 50 and was granted to CSR Limited on the 7th April, 1975. All exploration work is carried out by Pacminex Pty. Limited, the exploration arm of the CSR Minerals Division. Three geologists are now based at Port Augusta and one at Mt. Gunson Mines to explore in this and the adjoining licence.

During the quarter the principal activities were :-

1. Preparation of a final report, not completed on an INPUT geophysical survey.
2. A petrological study.
3. Preliminary planning of drilling for target areas outlined by the previous two years work.

GEOPHYSICS

Preliminary results for the INPUT survey, made in February 1975, were received in April. The contractor, Geoterrex Limited of Ottawa, Canada, is still preparing a final report. This will include plans showing contours of INPUT and magnetic responses. A final report was received for INPUT surveys made at the same time in the adjacent E.L. 81, so the report for the Pandurra Area is expected shortly.

The data from the INPUT survey will be used to make a stratigraphic and palaeogeographic interpretation, based on existing drilling and outcrop mapping of recent programs. This will be followed up by a drilling programme, which will follow on completion of one that is already in progress in the adjacent E.L. 81, Pernatty Lagoon Area.

GEOLOGY

Collar elevations of Pacminex stratigraphic drill holes in the Tent Hill and Carriewerloo areas were surveyed by the South Australian Department of Mines. This data was passed on to Pacminex by the Geological survey in June of this year. This information will be used in the compilation of geological cross sections for the relevant portions of the Pandurra Area. It is hoped that stratigraphic holes in the northern portion of the lease, where significant underground water was indicated, will also be surveyed by the Department.

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28 JUL 1975
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PETROLOGY

P.J. Curtis, Pacminex petrologist, made a comparative petrological study of rocks collected in the Adelaide area, relating them to supposed Stuart Shelf equivalents. His report PMR 94/75, is appended.

DRILLING

Forty to fifty drill holes are planned. In the north-west corner of the lease area, drill holes will be sited to test interpretations based on the INPUT survey made over that area. Elsewhere drilling will be testing target areas indicated by earlier stratigraphic drill holes. This drilling will follow on from a programme now under way in the Pernatty Lagoon Area, E.L. 81. Commencement time will be dependent on the completion of that programme.

EXPENDITURE

Expenditure for the period 1st April to 30th June, 1975, was $3,084.

PACMINEX PTY. LIMITED

COMPARATIVE PETROGRAPHY OF ROCK SPECIMENS FROM THE ADELAIDE GEOSYNCLINE WITH SUPPOSED TIME EQUIVALENT SPECIMENS FROM THE STUART SHELF

PMR 94/75

P.J. CURTIS

SYDNEY
July, 1975

COPY NO.

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D.G. TONKIN	2
P.J. CURTIS	3
FIELD	4

CONTENTS

		PAGE NO.
1.	INTRODUCTION	1
2.	SUMMARY	2
3.	PETROGRAPHIC INVESTIGATION	4
4.	REFERENCES	12

APPENDICES

I	MEMO FROM D.G. TONKIN TO P.J. CURTIS ENTITLED 'SEVEN THIN SECTIONS' DATED 24/3/75
II	LOCATION MAP (In Pocket)

LIST OF ILLUSTRATIONS

FIGURES		FACING PAGE NO.
1	SPECIMEN 1	4
2	SPECIMEN 4	7
3	A 4224	7
4	SPECIMEN 6	9
5	85235	9

KEYWORDS

SOUTH AUSTRALIA
GEOSYNCLINE
9TAPLEY HILL
9STURT
9BRACHINA
SANDSTONE
9SEACLIFF
9SILTSTONE
REYNELLA
ADELAIDE
PROTEROZOIC
FORMATION
TILLITE
9STUART
CONTINENTAL SHELF
9WOOCALLA
9CORRABERRA

1. INTRODUCTION

Seven typical Adelaidean rock types from the geosynclinal environment in the Adelaide area were sent for comparison with supposed equivalent 'shelf' rocks (Stuart Shelf) from the Mount Gunson Area.

The results of this work, are included in this report.

A sketch map showing sample locations has not been received to date and will be included with the report later.

2. SUMMARY

Specimen 1 — The rock has some tillite characteristics but is more like a greywacke in thin section. It has many lithological and some textural similarities in the derived rock fragments to suggest equivalence to Elizabeth Conglomerate, yet there are apparent Whyalla Sandstone grains and Woocalla Dolomite fragments present.

Specimen 2 — There are some textural resemblances to Woocalla Shale but Specimen 2 has no carbonate, only clay mineral and fine quartz and is therefore in appearance more like the Tregolana Shale at Mount Gunson.

Specimen 3 — Very like Specimen 2 but with better developed banding and a great abundance of sub-angular and angular quartz. The rock has been subjected to mild shear which is a geosynclinal rather than a shelf characteristic. There are some mineralogical similarities to Woocalla basal shale (Woocalla Dolomite) of Sweet Nell, Mount Gunson.

Specimen 4 — A sandstone of mainly sub-angular grains, tightly packed, but the appearance of oligoclase and abundant magnetite would place it slightly younger in the Tent Hill Formation. The rock resembles Corraberra Sandstone at Mount Gunson. However, the more angular grains present are more in keeping with geosynclinal deposition and the presence of appreciable potash feldspar links the rock with Whyalla Sandstone. However, the rock is not typically flysch of geosynclinal deposition.

Specimen 5 — Shear effects of the siltstone are seen, but again with the presence of oligoclase among

other characters; shows that there is little kinship with the Whyalla Sandstone. Shear has destroyed any likeness of grains with the silty fraction so often seen intermixed with aeolian grains in the Whyalla Sandstone at Mount Gunson. The presence of potash feldspar is positive correlation with Whyalla Sandstone but the characteristic red cherts and fairly abundant heavy minerals (except a little tourmaline) are absent.

Specimen 6 — Very similar to the Yudnapinna Beds of the Pandurra area. In fact the resemblance is so similar that the specimen could be from shelf sedimentation in the Mount Gunson Area rather than from an equivalent in time geosynclinal deposit. The fine sub-angular > round quartz grains, chert, fresh oligoclase and microcline grains are present in similar proportions and shapes and sizes to some Yudnapinna rocks examined from the Pandurra area.

Specimen 7 — Similar textures, grain sizes and the presence of alternating bands of limonite-rich and poor rock and also absence of feldspar are characteristics of this Brachina Formation specimen and of the Mount Gunson Tregolana Shale. However, the Specimen 7 rock contains carbonate and carbonate in the Tregolana Shale at Mount Gunson has not been seen but the bands there are rich in clay minerals.

No other characteristics to link the ~~Brockman~~ Brachina Formation and Tregolana Shale are seen.

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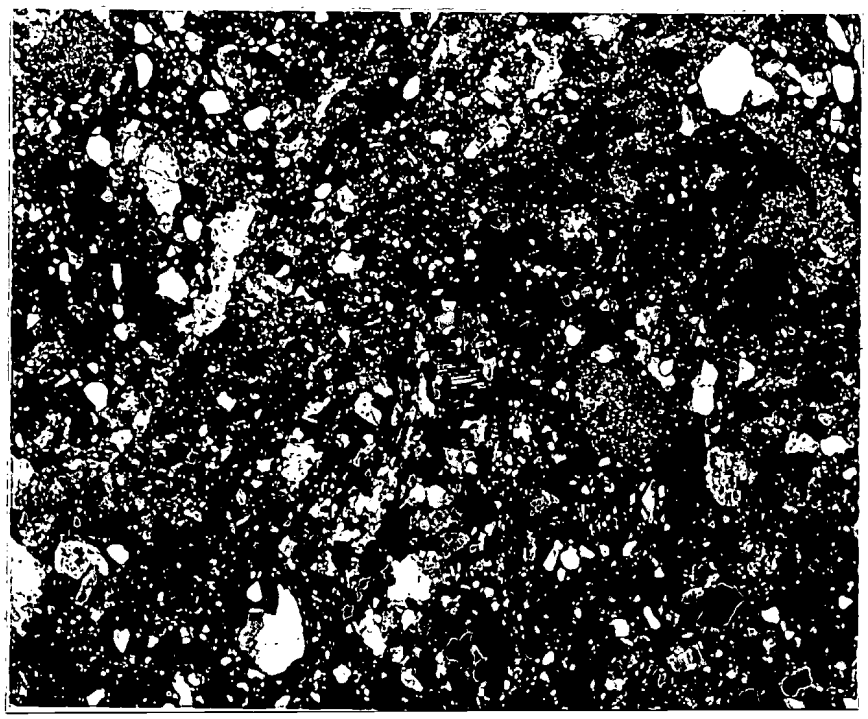


FIGURE 1 : Sturt Tillite; underlies Tapley Hill Formation. (Specimen 1).

Rock fragments and mineral grains of very variable lithologies, shapes and grain sizes are present. Twinned plagioclase with quartz occurs in rock fragment (centre of photograph). Quartz rock fragments occur as irregular mosaics (black, grey and white). Quartz mineral grains are flat black, grey and white and are commonly rounded. Carbonate is irregular in shape and dark speckled white. Chert grains are round (speckled black, grey and white). Fine matrix appears as specks of carbonate, sericite and quartz.

Cross nicols Magnification x15

3. PETROGRAPHIC INVESTIGATION

Specimen 1 Sturt Tillite; underlies Tapley Hill Formation. Possible equivalent to Elizabeth Conglomerate as seen in the Pandurra area. (Figure 1).

An undifferentiated rock which consists of the following grains, up to several millimetres in size.

(a) Carbonate fragments which are large (to 15 mm), commonly angular and some contain limonite after pyrite (?) bands. Some fragments contain stromatolite forms; usually the carbonate is of fine grain size (approx. 0.05 mm) and the grains are equigranular. These fragments occur to 30 percent of the rock. Larger fragments have cracks which are filled with detrital quartz.

(b) Quartz rock fragment, are commonly round as if derived from a conglomerate but constituent grains are sutured and vary to 8 mm. Some fragments contain grains of potash feldspar and others, grains of plagioclase (oligoclase). Yet others contain granophyre fragments. These fragments possibly occur to 15 percent of rock.

(c) Quartz mineral grains are of rounded Whyalla Sandstone species (to 0.5 mm) or are sub-angular or flat with rounded corners. Mostly of Whyalla Sandstone derivation. Overall occur to 12 percent of the rock.

(d) Fine chert occurs as mainly rounded fragments to 4 mm. Coarser cherty fragments contain limonite blebs or are chalcedonic

with included carbonate blebs containing opaque limonite. Micaceous cherty grains (to 8 mm) are mineralogically similar to those found in Whyalla Sandstone and which are to a less extent seen in the Pandurra Formation. Cherts present (including the really large ones are round or oblong with rounded corners). Grains occur to 20 percent.

(e) Albitised dolerite fragments (approx. 3 mm in size) are sub-angular and contain feldspar grains around 0.2 mm, interstitial fine limonite and sericite or fine granular carbonate. About 2 percent are present.

(f) A large perthite crystal and several large potash feldspar grains (several millimetres in size) are seen. With fresh angular oligoclase (to several millimetres) including the grains seen in quartz rock fragments, feldspar occurs overall to 5 percent.

(g) The mineral balance of the rock consists of fine angular to sub-angular quartz, carbonate, illite, kaolinite and chert, and some limonite.

The rock may be called a greywacke or tillite since it has characteristics of both rock types though the abundance of fine rock mineral material and the fragmental nature of large carbonate grains with fine fragments of the rock material forced into cracks in the carbonate fragments indicates probable tillite. The section (Figure 1) does not look anything like the photomicrograph of Sturt Tillite in Pettijohn (Reference 2) but does fulfill the requirements of a lithic greywacke as described by Carozzi (Reference 7).

The rock types present resemble carbonate from Woocalla Dolomite; derived cherts and round quartz grains from Whyalla Sandstone. There are similarities with large round quartz rock fragments, dolerite fragments, rounded chert and feldspathic quartzite as fragments found in Elizabeth Conglomerate. EX 88-86545. (Reference 4).

The rock may be the geosynclinal equivalent to the Elizabeth Conglomerate of the Pandurra area but the presence of stromatolite dolomite and grains identical to those of Whyalla Sandstone is puzzling and suggests the rock to be much younger.

Specimen 2 Tapley Hill Formation, from near base of unit. Believed equivalent to weathered Woocalla Dolomite.

The rock has a very fine grain-size (0.002 to 0.010 mm) with kaolinite > quartz > illite. Limonite blebs (approx. 0.004 mm) occur as scattered grains or aggregates and the limonite varies in density from 10 to 25 percent in the kaolinite, quartz, illite mixture. The bands are rarely more than 0.2 mm wide and are parallel.

The Woocalla Shale EX 50 section (Reference 3) shows limonite banding of similar width to that seen in Specimen 2 above, but there is a super abundance of carbonate over sericite in EX 50. Other Woocalla Shale specimens from the Pandurra area 86587 and 86589 - Reference 4, are sandy bands with some fine carbonate intercalations.

There are textural resemblances to Woocalla Shale from the Stuart Shelf environment particularly similarities to specimen EX 50, but the Tapley Hill Formation specimen has no carbonate, only

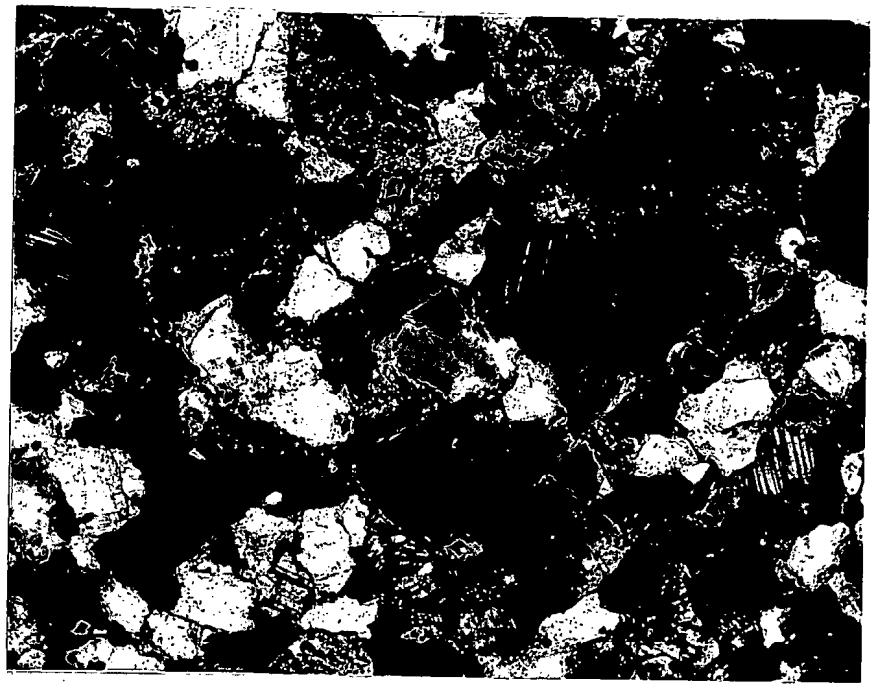


FIGURE 2 : Seacliff Sandstone; supposed equivalent of Whyalla Sandstone. (Specimen 4).

Irregular quartz grains, many show shadowy strain shadows. Microcline (centre left, non-parallel lamellae); plagioclase (right, centre; and near centre, right margin) shows lamellar twinning; micaceous chert grain (near top, centre, streaky black, grey and white). Minimal clay mineral matrix is present.

Cross nicols Magnification x95

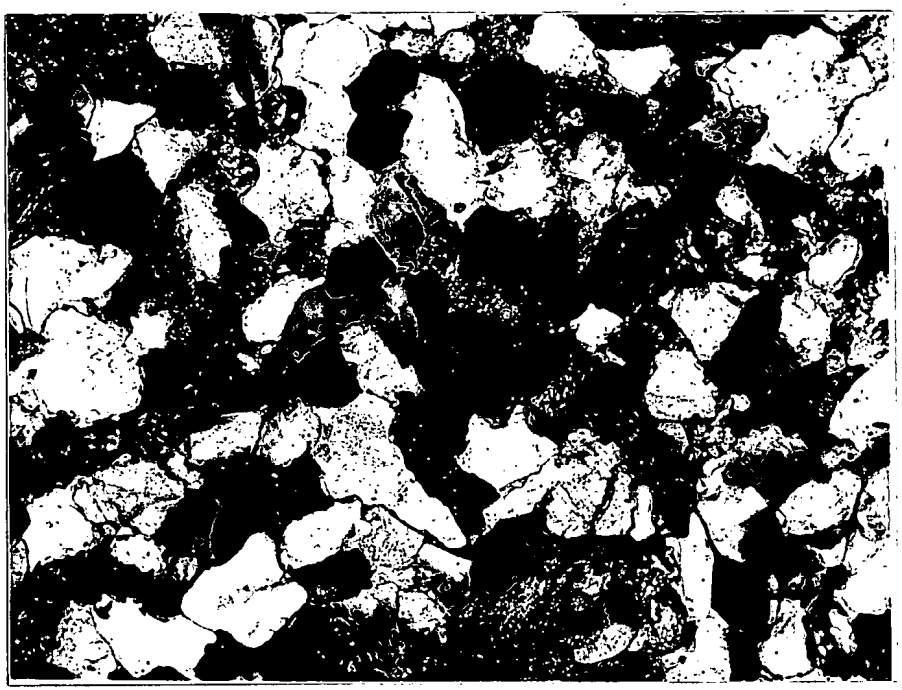


FIGURE 3 : Corruberra Sandstone, Mount Gunson. (A 4224).

Shows textural similarity of this rock to the Seacliff Sandstone shown in Figure 2. Microcline (cross-hatch twinning) occurs at centre of photograph and near left margin. Minimal matrix, subhedral quartz shapes, cherts (black and white mottling, centre right margin).

Cross nicols Magnification x95

sericitic shale bands and from that point of view and texturally, is more like Tregolana Shale as per Mount Gunson.

Specimen 3 — Tapley Hill Formation.

Very like Specimen 2, but banding is better developed and there is a greater abundance of sub-angular and angular quartz (up to 0.05 mm); also calcite is fairly abundant as fine lenticles to 0.03 mm wide. The rock was subjected to mild shear which cross-cuts banding at a 90° angle. Variations in bands (approx. 0.15 mm wide) as volume percent, are angular to sub-angular quartz, 3; opaques (approx. spheres, which are probably limonitised pyrite, approx. 0.01 mm) 2 to 10; sericite <1 to 1; kaolinite, 5; carbonate, the balance. This section is similar to specimen EX 50 (Woocalla Dolomite) but the latter is better differentiated into fine carbonate and less quartz occurs; also EX 50 was not sheared. No similarity with Tregolana Shale is seen as per Mount Gunson or elsewhere. However, the section is mineralogically somewhat similar to A 4233 (Woocalla Basal Shale, Sweet Nell), but there is a complete absence of sulphides in Specimen 3, and apparent absence of clay minerals from A 4233.

Specimen 4 — Seacliff Sandstone; supposed equivalent to Whyalla Sandstone. (Figures 2 and 3).

The section shows a sandstone with a range in quartz grain sizes from 0.05 to 0.5 mm, median 0.07 mm, most grains being of around median size. With little in the way of authigenic quartz the grains are largely sub-angular shapes of typical shelf facies. Certainly very few grains are aeolian as are seen in Whyalla Sandstone.

/....

Many quartz grains show strain effects. Of slightly smaller size range (0.05 mm to 0.5 mm) twinned potash feldspar and sharply twinned oligoclase plagioclase occur - possibly 1 percent plagioclase present and up to 2 percent potash feldspar, probably microcline occur, and both minerals are fresh. A little hematitic and cherty quartz occur (to 2 percent and around 0.08 mm in size), and the interstices is kaolinite which occurs between 3 and 5 percent. The quartz grains are mainly tightly packed together so that minimal silicification has produced patchy mosaics. The opaque mineral is sub-hedral magnetite (0.01 to 0.15 mm) and is present to 2 to 3 volume percent. Other heavy minerals present include rounded and scarce oblong pleochroic green and blue-grey (sodic ?) tourmaline (approx. 0.05 to 0.09 mm). No other heavy mineral is seen. Much limonitic detritus occurs within the section. The rock has not the appearance of Whyalla Sandstone at Mount Gunson but is more like Corraberra Sandstone selected from Mount Gunson hill (A 4224). Certainly the rock has not the appearance of typical flysch sandstone.

Specimen 5 Red siltstone band in Seacliff Sandstone.

The section shows a laminated siltstone with a mineralogy and texture unlike anything seen in the Whyalla Sandstone.

Again, shear effects are seen with quartz laminae up to 0.05 mm by 0.02 mm. Quartz (as mainly angular fragments) actually varies from a minimum of 0.005 mm with a median 0.035 mm and quartz is the dominant mineral present. There is a little fresh oligoclase plagioclase (approx. 0.04 x 0.02 mm) present, and microcline (approx.

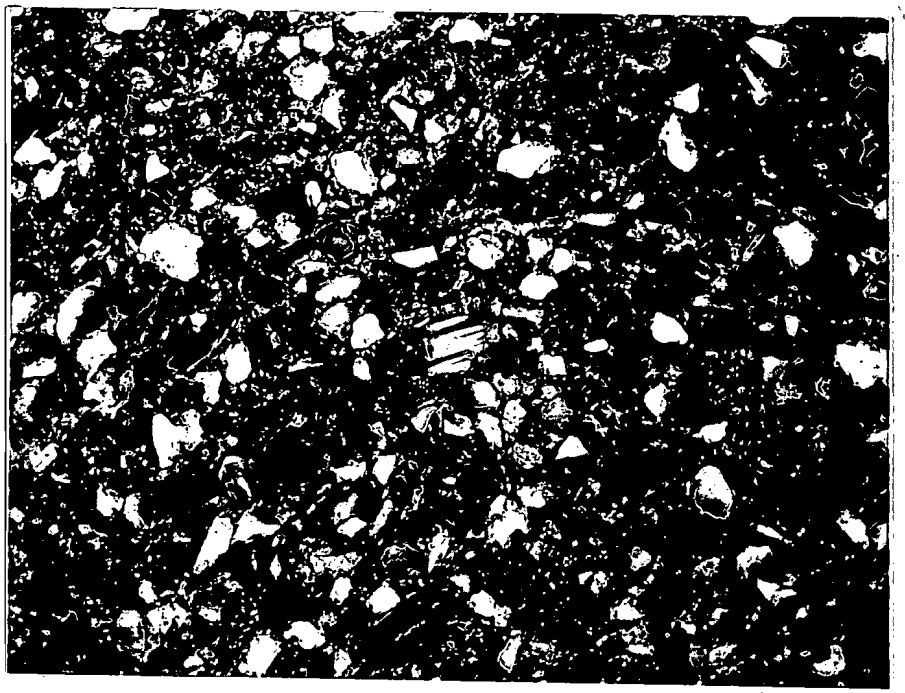


FIGURE 4 : Reynella Sandstone, possible equivalent to Yudnapinna Siltstone, underlies Seacliff Sandstone. (Specimen 6).

Small subangular and angular quartz grains of fairly regular size and fairly abundant interstitial carbonate (white, grey flecks). Potash feldspar grain is seen in centre of photograph (irregular lamellae, faint cross-hatch twinning). Cherts are dark speckled grey and black.

Cross nicols Magnification x92

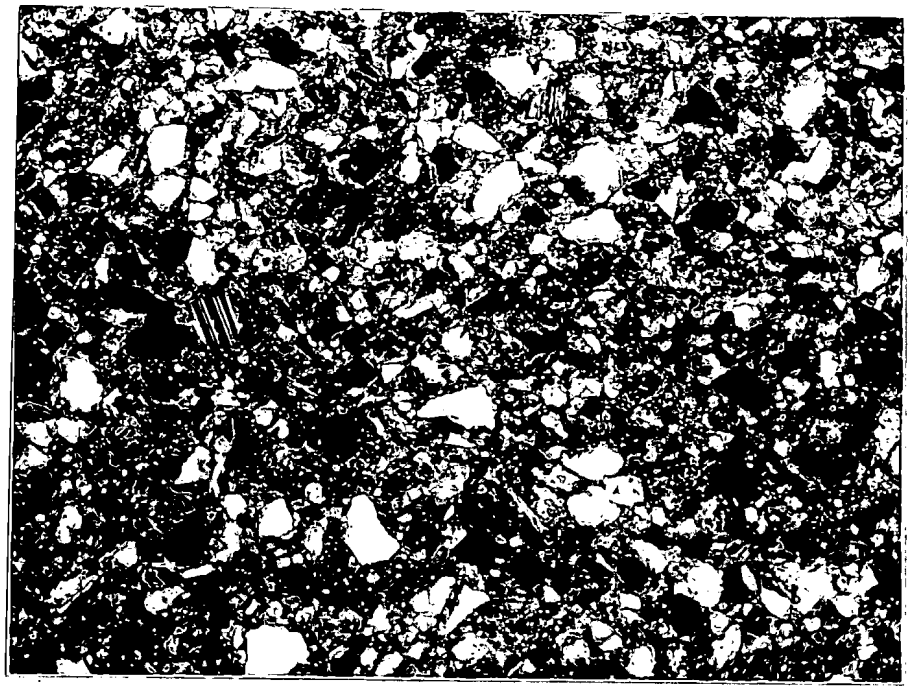


FIGURE 5 : Yudnapinna Beds, Drill hole EX 11, 34 to 37 m. (85235).

Very similar to Reynella Sandstone (Specimen 6) in mineralogy, quartz grain sizes and textures. Twinned plagioclase (near top centre; mid left from centre). Potash feldspar, untwinned (white, oblong fractured, near centre).

Crossed nicols Magnification x92

0.015 mm). Elongate sericite flakes, median 0.06 x 0.006 mm) occur to 3 volume percent, magnetite pseudomorphs of pyrite (?) to 5 percent and limonite dust to about 10 percent. There may be traces of carbonate and/or kaolinite in the interstices but these are difficult to identify at this fine grain size. The rock does not resemble anything seen from Whyalla Sandstone at Mount Gunson but is a deep water equivalent from the mineralogical and fine texture view point. The specimen is similar mineralogically (except for the greater abundance of iron minerals) with the Seacliff Sandstone, above.

Specimen 6

Reynella Siltstone, possible equivalent to Yudnapinna Siltstone, underlies Seacliff Sandstone. (Figures 4 and 5).

The rock consists of silt-size, mainly angular> sub-angular> round quartz grains (< 0.01 mm to 0.08 mm, median 0.04 mm) most of which show slight strain characteristics. The quartz corresponds to 70 percent of mineral present.

Fresh plagioclase (oligoclase) and microcline also occur and together amount to 2 percent volume; cherts, including micaceous cherts occur to 2 volume percent and are of similar grain size to median quartz grains. Carbonate occurs as granules (approx. 0.02 mm) and also interstitially with a limonite stain, to altogether approximately 20 percent. Sericite flakes, somewhat elongate (0.05 x 0.005 mm) occur to less than 1 percent. Magnetite to 3 percent.

No graded bedding is seen.

Except for the sparsity of magnetite and slight less angularity of quartz grains, there is a

marked similarity with Yudnapinna Beds (specimen 85235 - Reference 4) in size of grains and carbonate content.

There could be rather more potash feldspar in Specimen 6 than has been estimated (without mineral staining). A resemblance to fragments of Yudnapinna Beds in the thin section of specimen (Reference 4) is also noted although the much larger quartz grains which stud 85271 are absent in Specimen 6.

This apparently is unlikely a geosynclinal equivalent to the Yudnapinna Beds but is more like 'shelf' type Yudnapinna Beds.

Specimen 7 Brachina Formation. Supposed equivalent to Tregolana Shale. Overlies Seacliff Sandstone.

A fine grained rock of light and dark bands stained by fine particulate limonite. The bands vary from 0.07 to 0.3 mm in width and are fairly even. The very fine bands with both abundant concentrations and scattered limonite particles consist of mainly mosaics of very fine carbonate (0.004 to 0.02 mm); with minimal scattered illite and kaolinite flakes (1 to 2 percent); and limonitised pyrite spheres (approx. 0.06 mm) scattered to 10 volume percent. The darker bands only differ in having abundant very fine (< 0.001 mm) specks of limonite.

Elsewhere are discontinuous bands of single quartz, sub-angular to rounded grains mainly to 0.05 mm but up to 0.1 mm. Other bands are three and four deep quartz grains with interstitial carbonate grains. The quartz is of similar grain size to those seen in the single quartz bands. Occasionally round chert grains (approx. 0.02 mm) occur with the coarser quartz.

Tregolana Shale in the Gunson area (Mystery/ Pernatty Lagoon - Reference 6) is similar in grain size and shapes of quartz grains in fine bands. It is also similar in having limonite rich bands of similar thickness but at Gunson instead of being carbonate rich it is kaolinite rich and contains a fair amount of illite.

Both Gunson (A 4246 and A 4239 Tregolana Shale) and Specimen 7 are apparently free from feldspar grains. The rock of all three specimens appear to have accumulated in a similar kind of environment, the latter possibly nearer to the source of mineral detritus.

P.J. CURTIS
(LMB)

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4. Petrography of Pandurra Thin Sections, III. PMR 29/75. Pacminex Pty. Limited, Sydney, April, 1975.

5. Memorandum from P.J. Curtis to D.G. Tonkin entitled 'Pandurra Thin Sections' (p.2 to p.34). Dated 4th September, 1973.

6. Petrography of Mount Gunson Sediments, Parts 1 and 2. PMR 195/72. Pacminex Pty. Limited report, October, 1972.

7. CAROZZI. A.V. 'Petrography' Published by John Wiley & Sons, New York. 1960.

APPENDIX I

PACMINEX PTY. LIMITED

MEMORANDUM TO: MR. P.J. CURTIS OUR REF: DGT/LK

FROM: D.G. TONKIN DATE: 24/3/75 (typed 2/4/75)

7 THIN SECTIONS

The 7 thin sections I gave you last week are from rocks collected near Adelaide. They are rocks regarded by the Mines Department as geosynclinal equivalents to those at Gunson. Relationships are :-

Specimen 1: Sturt Tillite; Underlies Tapley Hills Fm. Possibly equivalent to "Elizabeth Conglomerate" as seen in Pandurra Area.

Specimen 2: Tapley Hill Fm., from near base of unit. Believed equivalent to Woocalla Dolomite.

Specimen 3: Tapley Hill Fm.

Specimen 4: Seacliff Sandstone; Supposed equivalent to Whyalla Sandstone.

Specimen 5: Red siltstone band in Seacliff Sandstone.

Specimen 6: Reynella Siltstone; Possible equivalent to "Yudnapinna Siltstone". Underlies Seacliff S.S.

Specimen 7: Brachina Fm., Supposed equivalent to Tregolana Shale. Overlies Seacliff S.S.

Could you please look at sections from this point of view?

D.G. TONKIN
(signed)

c.c. P.J.C.
R.W.G.

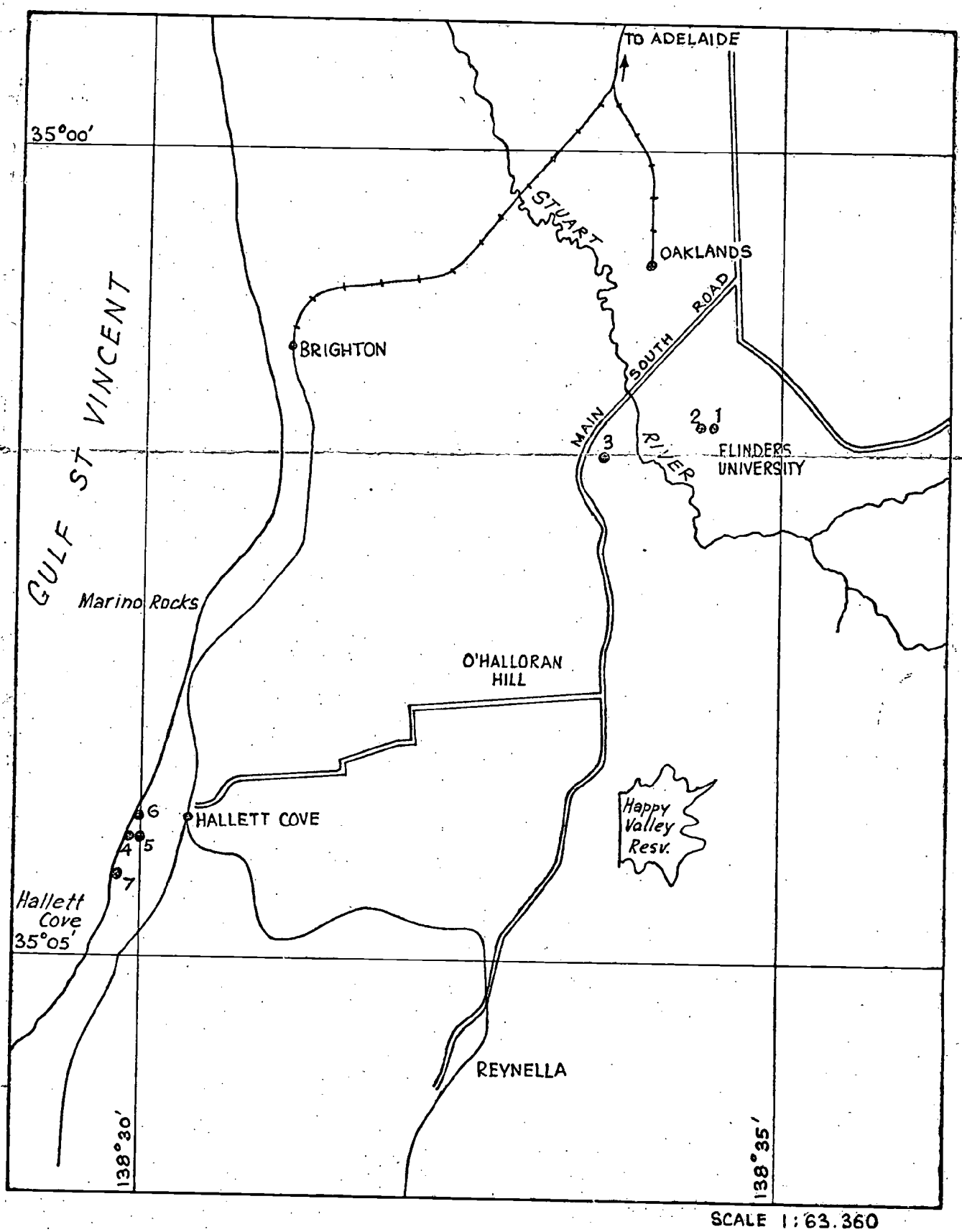


Fig 6 **LOCATION MAP ROCK SAMPLE LOCATIONS IN THE ADELAIDE (GEOSYNCLINE) AREA**

THIN SECTION SAMPLES TAKEN FROM ROCKS SUPPOSEDLY EQUIVALENT TO ROCKS OF THE STUART SHELF (PANDURRA-GUNSON AREA EL's 50.81)

P.J. Curtis

0027

MR. D.G. TOMKIN PJC/SS

P.J. CURTIS 9th July, 1975.

STAINING SLABS OF SPECIMENS 1 TO 7 FROM THE ADELAIDE AREA, FOR POTASH FELDSPAR.

Further to my report, "Comparative Petrography of Rock Specimens from the Adelaide Geosyncline with Supposed Time Equivalent Specimens from the Stuart Shelf", PMR 94/75, the rock slabs have now been unearthed and after discovery were straight away stained for potash feldspar.

The results are as follows :-

Specimen 1 : The Sturt Tillite contains scattered rounded matrix grains (approx. 0.5 mm) of potash feldspar to about 1 percent. The larger grains may be the perthite as described under para. (f) of the main report. An apparent Yudnapinna Siltstone fragment of about 5 mm contains about 10 percent potash feldspar (0.1 to 0.2 mm). It was not possible to match the stained slab face with the slide.

Specimen 2 : Contains illitic-rich bands only; these stain pale yellow with the sodium cobaltinitrite solution.

Specimen 3 : Contains no potash feldspar and very little illite.

Specimen 4 : Has abundant potash feldspar (7 to 10 volume percent), the grains varying in size from < 0.1 to 1.5 mm, median 0.1 mm. The high potash feldspar thus shown may prove the only relationship with Whyalla Sandstone, but more likely proves a relationship with the underlying Yudnapinna Beds which appear to contain a high potash feldspar content.

Specimen 5 : Shows few scattered potash feldspar grains (<<1 volume percent) up to 0.1 mm in size.

Specimen 6 : Indicates disseminated potash feldspar grains up to 5 volume percent ranging in size to 0.1 mm. The grains are quite round, and the high potash feldspar content shows a definite relationship with the Yudnapinna Beds we have seen from the Pandurra area.

Specimen 7 : Only blebs of illite occur.

Sorry I could not remember having received the slabs from you so made no determined effort to find them when preparing the main report. This emphasises the importance

of staining for potash feldspar when doing petrographic work on sandy sediments. Much of the feldspar looks water clear and is untwinned in thin-section.

Enclosed is a copy of your memorandum "7 Thin Sections" dated 24th March, 1975.

P.J. CURTIS

c.c. Library copy of PMR 94/75
Field copy of PMR 94/75
J.M. Heape (Mt. Gunson)
R.W. Gersteling

PACMINEX PTY. LIMITED

MEMORANDUM TO: MR. P.J. CURTIS OUR REF: DGT/LK

FROM: D.G. TONKIN DATE: 24/3/75 (typed 2/4/75)

7 THIN SECTIONS

The 7 thin sections I gave you last week are from rocks collected near Adelaide. They are rocks regarded by the Mines Department as geosynclinal equivalents to those at Gunson. Relationships are :-

Specimen 1: Sturt Tillite; Underlies Tapley Hills Fm. Possibly equivalent to "Elizabeth Conglomerate" as seen in Pandurra Area.

Specimen 2: Tapley Hill Fm., from near base of unit. Believed equivalent to Woocalla Dolomite.

Specimen 3: Tapley Hill Fm.

Specimen 4: Seacliff Sandstone; Supposed equivalent to Whyalla Sandstone.

Specimen 5: Red siltstone band in Seacliff Sandstone.

Specimen 6: Reynella Siltstone; Possible equivalent to "Yudnapiuna Siltstone". Underlies Seacliff S.S.

Specimen 7: Brachina Fm., Supposed equivalent to Tregolana Shale. Overlies Seacliff S.S.

Could you please look at sections from this point of view?

D.G. TONKIN
(signed)

c.c. P.J.C.
R.W.G.

AMR 170/75

0030

INTERPRETATION REPORT

AIRBORNE ELECTROMAGNETIC SURVEY

BARRINGER 'INPUT' SYSTEM

OF THE

YUDNAPINNA AREA

SOUTH AUSTRALIA

FOR

PACMINEX PTY. LIMITED

PART II of II

BY

GEOTERREX LIMITED

83-253

OTTAWA, Canada
July 1975

RECEIVED
10 NOV 1975
DEPT. OF MINES
SECURITY
2564-11

M. SAVAGE
J.E. HANSEN
Geophysicists.

geoterrex ltd.

TABLE OF CONTENTS

		Page
I.	INTRODUCTION	1
II.	PERSONNEL	3
III.	DATA PRESENTATION	4
IV.	INTERPRETATION - GENERAL	6
V.	INTERPRETATION OF SELECTED CONDUCTORS	10
	E. Yudnapinna	44
VI.	TABLE 1	101
VII.	CONCLUSIONS AND RECOMMENDATIONS	103

Accompanying this Report

Fourth Channel Contour Maps

- Yudnapinna, 4 sheets 1:25,000

Isomagnetic Contour Maps

- Yudnapinna, 4 sheets 1:25,000

Electromagnetic Maps

- Yudnapinna, 4 sheets 1:25,000

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I. INTRODUCTION

An airborne geophysical survey was flown for Pacminex Pty. Limited in South Australia by Geoterrex Pty. Limited, during the period 18th February to 26th February, 1975. The project was completed in seven productive flights from the airport of Whyalla, South Australia. This is part II of a two part report covering five areas. Part I contains the interpretation of the data gathered on the Lake Windabout, Oakden Hills and Lake Dutton Areas. The present report is Part II and contains the interpretation of the data gathered on the Winnie Pinnie and Yudnapinna Areas.

A test INPUT survey was flown over the Mount Gunson orebody in July 1973. The test established that since INPUT responds to changes in the Conductivity Thickness Product of a variable conductive layer, it is possible to map bedrock depressions containing conductive material. The present survey was flown for the purpose of mapping bedrock depressions which could contain base metal mineralization.

The survey was conducted with a Super Canso PBY-5A under registration VH-EXG which is operated by Executive Air Services on charter to Geoterrex Pty. Limited. It was equipped with the Barringer Mark V INPUT system, Geometrics 803 nuclear precession magnetometer, a Honeywell Visicorder, an APN-1 radio altimeter, a 50 Hz. monitor, and a 35 mm. continuous strip tracking camera.

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A total of 3686 line kilometres of INPUT data was gathered over five areas:

1)	Lake Windabout	372 line kilometres
2)	Oakden Hills	603 line kilometres
3)	Lake Dutton	275 line kilometres
4)	WINNIE PINNIE?	1185 line kilometres
5)	Yudnapinna	1251 line kilometres

Two lines on each of the Winnie Pinnie and Yudnapinna areas were extended beyond the eastern boundary for a distance of 22.5 kilometres in order to sample the surface conductivity over a broader region.

All lines were flown in an east-west direction. The line spacing was 400 metres. The aircraft survey altitude was maintained at a mean terrain clearance of 120 metres (400 feet). Navigation was by visual means using air photo mosaics at a scale of approximately 1:25,000.

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II. PERSONNEL

The following Geoterrex personnel participated in the field phase of the survey.

R. Laroche	-	Pilot
R. Edwards	-	Pilot
C. Moody	-	Copilot
W. Mitchell	-	Engineer
J. Gaw	-	Data Compiler
R. Hobbs	-	Data Compiler
G. Butt	-	Geophysicist

The line layout and area boundaries were prepared by Pacminex Pty. Limited under the direction of W. Langron.

The electromagnetic data was interpreted by J. Hansen with assistance from M. Savage.

The drafting and compilation of the electromagnetic data was accomplished by Geoterrex staff in Sydney and Ottawa under the direction of R. Pedersen, R. Schingh and P. Tallyhoe.

III. DATA PRESENTATION

Airphoto mosaics at a scale of approximately 1:25,000 provides the base for the geophysical maps for each of the three areas covered by this report. Each map is presented on a clear overlay to the mosaic and includes sufficient planimetry to allow correlation to other data maps of the areas. Ozalid copies of the maps are attached to this report.

The Fourth Channel Contour Map is a contour presentation of the fourth INPUT channel. A contour interval of 1/10 inch deflection at chart scale has been used. The amplitudes are measured from true zero level. A delay of 4.2 seconds has been used to relate the measurement instants on the INPUT records to the fiducial numbering sequence.

On the Isomagnetic Contour Maps the total field magnetic data are presented in conventional form by isomagnetic contours. The contour interval used is 10 gammas wherever gradient permits. Values are taken from an arbitrary datum.

There are two magnetometer traces on the INPUT records. One contains magnetic data at a scale of 40 gammas per inch (minimum step 2 gammas). The second trace records the same data at a coarser scale of 400 gammas per inch (minimum step 20 gammas). One reading is measured every 1.05 second. No lag is needed to plot the magnetic data.

The Electromagnetic Map is a presentation of the anomalies selected for discussion in this report. The symbolism appearing on these maps is identified in the map legend.

The original INPUT records containing the geophysical information are presented in a folder for each area. The various traces are identified by the appropriate line number.

The negative 35 mm tracking film is delivered in rolls and labelled according to the flight number.

One can refer to the flight log or to the information which is noted on each of the records in order to relate the film to the geophysical records and maps.

The point picking airphoto mosaics along with the tracking film must be consulted for accurate location for any ground followup investigations.

IV. INTERPRETATION - GENERAL

A test survey over the Mount Gunson orebody flown in 1973 established the application of INPUT for detecting bedrock depressions which could contain copper minerals. The reader is referred to the report on the Geoterrex INPUT Test Survey at Mount Gunson dated September, 1973. It is generally agreed that sulphide deposition took place from metal rich surface waters either from lakes or streams. In these cases deposition would be restricted to definite channels or to bedrock depressions.

To locate bedrock depressions we rely on changes in the Conductivity Thickness Product (CTP) as measured by the INPUT traces. An increase in amplitude of the INPUT anomalies reflects an increase in the CTP. The conductivity and thickness parameters are not separable by electromagnetics, therefore increases in amplitude will reflect either an increase in thickness or an increase in conductivity (or both) of a conductive surface layer. Changes in amplitude are also caused by changes in aircraft ground clearance. As a rule a 100 foot change in ground clearance from 400 feet will produce a 100% change in anomaly amplitude. Changes in ground clearance are noted on the aircraft altimeter trace. In the majority of cases, increases in amplitude can be adequately explained by a change in aircraft altitude, and these anomalies are not recommended for followup, although contour closures are evident on the Fourth Channel INPUT Contour Maps.

In our interpretation we have taken advantage of the information gathered by the 1973 test survey. The following criteria have been used:

1. Isolated closure on the 4th channel contours.

2. Anomalies of good definition and symmetrical shape are preferred.

3. Anomalies and closures measured in a relatively resistive background are preferred. We consider a background of less than two 1/10 inch units of uniform deflection on the 4th INPUT channel to be "relatively" resistive in the environments surveyed.

4. Closures on magnetic gradients or directly coincident with magnetic peaks are preferred.

5. Closures not coincident with pans, lakes or other drainage features are preferred.

The zones described in this report are rated according to the probability of being caused by bedrock depressions.

A 1st Priority selection is one which satisfies 4 or 5 of the above criteria, and is considered to have a high probability of being caused by a bedrock depression. A 2nd Priority selection satisfies 3 or 4 of the above criteria and a 3rd Priority selection is considered a marginal prospect.

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A number of INPUT peaks have been identified on the traces by marking the peaks and their offsets on the INPUT records. Some of these have not been included in zones and are not written up in this report because at this stage we consider that they are caused by phenomena other than bedrock depressions.

The most significant task regarding the interpretation of this data has been to separate those anomalies which have some probability of being caused by bedrock depressions, from those which are not significant. The criteria outlined above have been used. During followup the investigator should be aware of the following situations which can cause anomalies unrelated to bedrock depressions:

1. Massive sulphides or carbonaceous units underneath the overburden. These situations have been zoned and described when the data suggests their presence.

2. Increases in conductivity within a conductive layer of uniform thickness.

3. Channeling of secondary currents along shears or slumps within the overburden.

4. Mean terrain clearance changes of the aircraft and receiver.

5. Cultural conductors.

6. Decreases in thickness of a uniformly highly conductive surficial layer. For an explanation of this phenomenon the reader is referred to a paper by A.V. Dyck, A. Becker and L.S. Collet titled "Surficial Conductivity Mapping with the Airborne INPUT System".

V. INTERPRETATION OF SELECTED CONDUCTORS

In this section the anomalies considered to have a reasonable chance of being caused by bedrock depressions, as determined by the INPUT responses, are identified in zones and discussed in detail. The priority rating identifies our confidence level regarding the probable cause being a bedrock depression. Zone numbers, line numbers and fiducial numbers identify the selected conductors and the anomalies within them.

E. YUDNAPINNA AREA

This area is located immediately south of the Winnie Pinnie area and is contiguous with it. The north-northwesterly magnetic trends of the Winnie Pinnie area continue southward and predominate within the Yudnapinna area.

The north-eastern half of the area is covered by highly conductive overburden, whereas the southwestern half is covered by overburden which varies from weakly conductive to resistive.

A major magnetic trend parallels, and roughly coincides with, the contact between conductive and relatively resistive overburden. The majority of our selections for followup are located in the vicinity of the contact mentioned above and in the resistive region. A number of linear zones of conductivity coinciding with narrow magnetic trends are noted over the western part of the area. The majority of these conductors are located within the Pandurra Formation.

Lines 505 to 510 were reflown because the magnetometer was malfunctioning for portions of these lines. The magnetics were contoured from the data on the reflown lines labelled 505A to 510A while the 4th channel INPUT data was contoured from the original data. On the Electromagnetic Maps, and in our interpretation, we have used useful information from both the original lines and the reflights.

Lines 509A and 510A were extended 22.5 kilometres beyond the eastern boundary of the area. The overburden in this region is generally conductive. Ground followup of the anomaly on Line 509A at Fiducial 342.57 is recommended to sample an anomalous response on the extended lines.

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ZONE Y-1 2nd Priority

Line 511E Fiducial 200.15 19.9/5.2

The shape of this anomaly is good but there is no support on the adjacent lines, which is partly due to the lack of survey coverage because it occurs well beyond the boundary of the area. The anomaly coincides with the peak of a magnetic trend.

An examination of the altimeter trace indicates that the enhancement could be due to a decrease of aircraft altitude. To be absolutely certain of the cause ground followup would be required.

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ZONE Y-2

2nd Priority

Line 510W	Fiducial	197.11	49/4.7
511E		202.75	34/4.8

The narrow anomaly on Line 510 has a bedrock character. A double peaking is observed on the later channels, which is sometimes caused by flying up-dip of a dipping bedrock source. In this case, if the source is bedrock, the dip would be easterly. The anomaly on Line 511 has a good shape and it is broader, but it coincides with a decreased aircraft altitude. There is no suggestion of a bedrock source here. There is no direct magnetic support for the zone.

To assure adequate ground followup both anomalies should be checked.

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ZONE Y-3 3rd Priority

Line 517E Fiducial 333.73 38/5.9

This is a sharp, narrow anomaly located in a relatively resistive background. The INPUT anomaly coincides with an altimeter low so an altitude effect could be the cause. There is no support on adjacent lines. The anomaly does not have magnetic support.

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ZONE Y-4 — 2nd Priority

Line 515E	Fiducial	291.17	46.2/8.5
516W		330.90	53.5/7.0
517E		334.47	48.4/6.8

The three anomalies coincide with altitude lows but it is uncertain that an altitude effect can adequately explain the conductor. The anomaly shapes are good and a distinctive closure is noted on the 4th channel contour map. The zone is located near the peak of a broad magnetic trend.

To adequately explain this zone, ground followup of the anomaly on Line 516 is suggested.

ZONE Y-5 — 2nd Priority

Line 518N	Fiducial	371.44	60/16.0
519E		377.48	60/9.7
520W		018.16	60/9.0
521E		025.37	60/11.0
522W		060.87	60/8.9

This zone straddles a road or a trail, however it is unlikely that culture is the cause. The anomalies are broad but a distinct conductive trend is noted on the 4th channel contour map. The zone is located in a region of flat magnetics. A 10 gamma magnetic anomaly coincides with the INPUT peak on Line 518. To adequately explain the zone the anomalies on Lines 518 and 521 should be followed up.

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ZONE Y-6 — 2nd Priority

Line 510 Fiducial 193.99 60/8.2

ZONE Y-7 — 2nd Priority

Line 512N Fiducial 237.93 60/9.5

ZONE Y-8 — 3rd Priority

Line 515E Fiducial 297.00 40/6.0

The three, single line INPUT features listed above have a similar anomaly character. Each one has an altitude contribution to the anomaly amplitude but it is unlikely that an altitude effect can entirely explain the enhancement. The 4th channel contour maps indicate obvious closures coincident with the zones.

Zone Y-6 has been assigned a 2nd priority rating because it is located on a long magnetic trend. The anomaly on Line 512 at Fiducial 239.07 has not been indicated on the maps, but it is on the same trend and should be followed up if positive results are obtained on Zone Y-6. Zone Y-7 has a stronger amplitude than Zone Y-8 and has, therefore, been assigned a higher priority. Neither of the latter zones has magnetic support.

ZONE Y-9 — 3rd Priority

Line 517E	Fiducial	339.05	60/7.5
518W		368.10	60/7.9
519E		381.15	42.5/5.9

This zone is located on the side of a magnetic feature but there is no direct support. The anomalies show a slightly enhanced amplitude in a slightly conductive background. The anomaly shapes are poor.

Ground followup of the anomaly on Line 518 would adequately explain the source of this zone.

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ZONE Y-10 — 2nd Priority

Line	504W	Fiducial 47.50	24/4.0
	505AE	229.86	60/11.0
	505E	63.54	32/5.3

This zone is located near the peak of a long magnetic trend on which several other zones have been selected for followup. The narrow anomaly on Line 504 approximates the shape of a bedrock anomaly while the others are broader than would be typically expected from a bedrock source. The anomaly on Line 505A has an altitude contribution but it should be followed up. The anomaly on Line 504 should also be followed up.

0052

ZONE Y-11 — 2nd Priority

Line	507AE	Fiducial 273.98	60/8.1
	508AW	298.48	54/7.1
	509AE	316.19	42/5.2

This zone is located on the same magnetic trend as Zone Y-10 and the same general comments apply. Ground followup of the anomalies on Lines 508A and 509A should be conducted.

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ZONE Y-12 — 2nd Priority

Line	511E	Fiducial 210.13	31/4.5
	512W	235.33	57/5.2
	513E	254.67	53.5/5.0
	514W	280.87	46/6.0
	515E	298.61	47/5.5

Most of the anomalies within this zone are narrow, but of a relatively low amplitude on the later channels. They have a distinctly bedrock character, that is, they appear to be derived from a carbonaceous horizon or from massive sulphides. The INPUT peaks are located on or near magnetic trends. Since we consider a bedrock conductor more probable than a bedrock depression containing conductive surficial material, a 2nd priority rating has been assigned.

To adequately explain the zone, ground followup should be conducted on Lines 511 and 514. It is possible that the northern and southern halves of this zone are separate conductors.

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ZONE Y-13 — 2nd Priority

Line 516W	Fiducial	323.77	30.1/5.5
517E		341.98	52/7.0
518W		365.78	37/3.7

This zone is located on the same magnetic feature as the southern portion of Zone Y-12. A bedrock conductor is also a probable cause of this zone. The anomaly on Line 518 is located close to Rosies Dam but it is doubtful that a man-made conductor is the cause. To assure complete followup, the anomalies on Lines 517 and 518 should be examined.

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ZONE Y-14 — 1st Priority

Line 523E	Fiducial 67.93	46/3.5
525E	97.18	41/2.4
526W	120.48	22/1.5
527E	127.00	18/2.0
528W	150.35	20/1.5
529E	156.55	38/2.0

Some of the anomalies within this zone (Lines 526 and 527) have an excellent bedrock character and are almost certainly caused by either a narrow formational graphitic conductor or by massive sulphides. A bedrock depression is considered unlikely. The zone is located on a long magnetic trend on which several other zones have been selected.

ZONE Y-15 2nd Priority

Line 532W	Fiducial	209.23	29/1.8
533E		215.12	23/2.0

This zone is located at the juncture of two magnetic trends although the INPUT peaks do not coincide directly with the magnetic peaks. A bedrock conductor is considered the probable cause. Ground followup of the anomaly on Line 533 would adequately explain the source.

Zone Y-15 is located adjacent to Zone Y-16 but its strike length is much shorter.

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ZONE Y-16 — 2nd Priority

Line	524W	Fiducial 93.65	19/1.7
	526W	122.19	18/1.5
	527E	125.37	32/2.7
	528W	151.80	26/2.7
	529E	155.03	41/3.5
	530W	180.49	43/2.5
	531E	184.77	18/2.0
	532W	209.64	18/1.5
	533E	214.79	26/2.5
	534W	238.14	39/3.5

This zone is almost certainly of bedrock origin. The INPUT anomalies are generally of excellent character and coincide with a narrow low amplitude magnetic trend. The magnetic feature is very long and several other zones of anomalies, similar to those within Zone Y-16 have been selected. The INPUT conductors on this trend are separated by resistive portions hence, although the magnetic material appears to be related to the conductive material, the conductor is not as continuous as the magnetic material. Massive sulphides containing magnetic pyrrhotite could be the cause of this zone.

When selecting bedrock conductors with a massive sulphide potential, we generally prefer those which are of a short strike extent and have a directly coincident magnetic anomaly. On the present survey, the objective is to locate bedrock depressions but short, isolated bedrock conductors should also be followed up on a high priority basis. Zone Y-16 has been assigned to the 2nd priority category because of its length.

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To adequately explain the source of this zone, ground followup should be conducted on selected anomalies on Lines 524, 527, 529 and 534.

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ZONE Y-17 2nd Priority

Line 536W Fiducial 266.22 27/2.0

The shape on the later channels of this feature is broader than normal for a narrow bedrock source, although the anomaly is considered to probably be due to an extension of Zone Y-16. It is located on the same magnetic feature as Zones Y-16 and Y-19 but the magnetic anomaly is broader at this location.

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ZONE Y-18 — 2nd Priority

Line 536W	Fiducial	266.68	33/2.0
537E		273.21	20/1.5
538W		295.78	16/1.4
539E		376.70	28/1.7
540E		305.25	22/1.5
541W		326.94	13/1.3
542E		333.54	19/0.8
544E		361.51	21/1.2
546E		390.85	13/0.6
547W		412.98	24/0.8
548E		419.60	11/0.3

This is a long zone consisting of sharp, narrow, low amplitude anomalies of varying conductivity. The conductor coincides with a low amplitude magnetic trend. The INPUT conductor and magnetic material are probably related. The anomaly shapes suggest a bedrock source such as formational sulphides of varying volume with a possible pyrrhotite content. The decay is more rapid on some of the anomalies than we expect from typical massive sulphides.

Followup should be conducted on the anomalies selected on Lines 536, 539 and 547.

ZONE Y-19 — 2nd Priority

Line 538W	Fiducial	294.80	17/0.7
539E		377.60	52/3.1
540E		306.11	27/2.0
541W		325.84	36/2.2
543W		353.83	24/1.8
544E		363.19	14/1.0

This zone is located on a long magnetic trend extending across the entire length of the Yudnapinna areas. Several conductive zones have been selected on this trend. A bedrock conductor such as graphite or sulphides is considered more probable than a bedrock depression. Some of the rapidly decaying anomalies could be caused by conductive weathering products derived from the magnetic unit.

To assure adequate followup we suggest examining the anomalies on Lines 539 and 543 on the ground.

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ZONE Y-20 2nd Priority

Line	547W	Fiducial 411.2	29/1.3
	548E	421.38	11/0.2
	549W	439.62	13.9/0.9
	550E	339.62	18.9/1.0
	551W	455.81	30/1.0

This zone is located on the same magnetic trend as Zone Y-19. The peaks of these sharp anomalies align in the fashion of narrow, vertical conductors. The decay rate is rapid and, therefore, a surficial rather than a bedrock source is considered most probable. The most probable cause is conductive surficial material caused by the weathering of the coincident magnetic rock type. A bedrock depression is considered unlikely. Despite the probable surficial origin a check of the zone to establish its origin should be conducted on either Line 549 or 550.

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ZONE Y-21 — 2nd Priority

Line	554E	Fiducial 474.57	19/1.2
	555W	490.80	15/1.0
	556E	492.74	11/0.4
	557W	508.14	8/0.3
	559W	525.40	13/0.5
	561W	544.83	14/0.5
	562E	547.38	24/?

This zone is a continuation of Zones 19 and 20. The anomalies are similar to those of Zone 20 and similar conductive material will be the cause. Ground followup of the anomalies on Lines 555 and 561 should adequately explain the source of the INPUT responses.

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ZONE Y-22 — 2nd Priority

Line 565W	Fiducial	586.70	9/-
567AW		610.35	7/0.4
567W		607.13	9/0.5
568W		397.65	15/0.3
569E		403.43	12/0.4
570W		419.61	10/0.3

The INPUT responses on this zone are identical to those on Zones Y-20 and Y-21 and followup here is dependent on the results obtained on the latter selections. If followup is conducted a sampling of the anomalies on Lines 568 or 570 should adequately explain the cause.

questerre

ZONE Y-23 — 3rd Priority

Line 554E	Fiducial	476.23	12/0.7
555W		488.99	14/0.6

These anomalies are weak and decay rapidly. The sharp responses on Line 554 could be checked to explain the source but it is probably caused by surficial material, which is related to the magnetic trend on which the selection occurs. A bedrock depression is unlikely.

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ZONE Y-24 — 3rd Priority

Line 564E	Fiducial	569.47	9/0.2
565W		585.63	9/0.3
566E		592.00	9/0.5
567W		606.08	11/0.2

This zone is located on the same magnetic trend as Zone Y-23 and a similar cause is anticipated. For followup purposes any one of the above anomalies could be selected.

ZONE Y-25 — 3rd Priority

Line 565W	Fiducial	583.94	14/0.4
566E		593.07	12/0.4

ZONE Y-26 — 3rd Priority

Line 570W	Fiducial	419.09	24/1.2
571E		426.34	13/0.2

These zones consist of INPUT anomalies of identical character to those in Zones Y-23 and Y-24. A surficial source related to the coincident magnetic material is considered the probable cause.

If ground followup is decided upon, a field check of one anomaly within each zone will be adequate.

ZONE Y-27 — 3rd Priority

Line 566E	Fiducial	590.00	7/0.4
567AW		611.17	14/0.6
569E		402.34	14/0.4
570W		420.68	17/1.0

The INPUT anomalies on this zone are identical to those recorded over other zones in the vicinity. There is direct magnetic support on the two northern anomalies but the southern anomalies fall on a magnetic contact. The lack of direct and consistent magnetic support suggests that an alternative explanation for some of these zones could be conductive clays or gouge material trapped in a narrow fault or shear.

Any one or two of the above anomalies can be field checked of ground followup is required.

ZONE Y-28 — 1st Priority

Line 566E	Fiducial	588.51	12/1.1
567AW		612.51	37/2.0
569E		400.63	48/3.4
570W		422.14	35/2.8
571E		423.12	19/2.0

This zone is located beyond the boundary of the southwest corner of the area. Some survey lines crossed the conductor but it is open in both directions due to the lack of systematic survey cover. The zone coincides with the peak of a narrow 100 gamma magnetic trend.

The source could be either a bedrock conductor such as massive sulphides or graphite or a narrow bedrock depression, the former explanation is more probable. Ground followup is required on a high priority basis to establish the cause. The five anomalies listed above are all of good character, ground followup on any two or three of them should adequately explain the conductor.

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ZONE Y-29 — 3rd Priority

Line 562E	Fiducial	546.94	18/1.1
563W		567.33	21/1.2

This zone was located beyond the western boundary of the area and is on strike with Zone Y-27. A similar source is considered probable. The zone is open to the northwest. There is no magnetic support.

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ZONE Y-30

			2nd Priority
Line 539E	Fiducial	375.36	42/2.8
540E		304.18	43/1.8
541W		328.28	31/1.9
542E		332.42	47/3.0

ZONE Y-31

			2nd Priority
Line 544E	Fiducial	360.64	36/2.4
545W		384.88	19/1.2
546E		388.98	15/0.6

Both zones contain anomalies of a similar character and they are probably caused by similar sources. A very weak magnetic anomaly coincides partly with each zone.

Ground followup is required to establish the nature of the conductive material, a bedrock source is possible.

To assure adequate followup, the anomalies on Lines 539, 541 and 544 should be ground checked.

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0072

ZONE Y-32 — 3rd Priority

Line 548E Fiducial 417.93 24/1.3

ZONE Y-33 — 3rd Priority

Line 543W Fiducial 358.26 12.5/0.9

ZONE Y-34 — 3rd Priority

Line 548E Fiducial 416.37 23/1.2

The above zones are all single line selections of similar character. They are caused by a thin layer of near surface conductive material. Each selection is located on or near a weak magnetic feature.

These zones only require followup if some of the adjacent conductors such as Zones Y-18 Y-30 and Y-31 have positive results.

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ZONE Y-35 — 1st Priority

Line 509AE	Fiducial	317.83	60/12.5
510W		189.06	46/9.0
511E		211.0	39.2/8.3
512N		334.35	40.9/7.0
513E		255.57	43/6.5
		255.80	49/8.2
		255.98	49/7.6

The shapes of these anomalies is less than ideal for a narrow bedrock depression but an isolated closure is noted on the 4th channel contours and the zone coincides with the peak of a magnetic trend. For these reasons, the zone has been assigned to the 1st priority category.

For followup, two or three locations should be checked. The anomalies on Lines 511 and 512 are suggested locations as well as one of the peaks on Line 513, preferably the central peak.

0074

ZONE Y-36

3rd Priority

Line 516W	Fiducial	323.29	23/2.5
517E		342.78	39/2.4
518W		365.28	51.8/7.5
519E		384.50	60/7.5
		385.60	22/7.0
520W		011.38	55/12.8
521E		31.93	52.5/12.4
522W		54.70	51/12.0
523E		69.18	50/10.5
524W		90.28	41/6.0
525E		98.66	50.1/7.1

This is a broad zone of irregular shape and poorly defined anomalies. There is no direct or consistent magnetic support. As it stands, this zone is considered a poor target, however if positive results are obtained on any of the adjacent zones it should be upgraded.

Ground followup of the anomalies on Lines 518 and 523 should adequately explain this zone.

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ZONE Y-37 — 1st Priority

Line 514W	Fiducial	278.70	60/10.4
515E		300.08	50/9.2
		300.39	60/11.0
516W		322.60	35/2.9

On the 4th channel contour map this zone appears as an isolated closure adjacent to Zone Y-39. It is partially coincident with a magnetic feature. The sharp anomaly on Line 515 at Fiducial 300.08 is derived from a narrow, near surface conductor.

To assure an adequate explanation of the conductor, ground followup of the anomalies on Lines 515 and 516 is suggested.

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ZONE Y-38 — 3rd Priority

Line	508AW	Fiducial 294.16	60/15.0
	509AE	320.48	60/16.5
	510AW	370.00	60/14.3
	510W	186.58	49.1/11.8

This zone is located within a highly conductive background which is probably related to a specific geological unit. The zone is partially coincident with the peak of a strong magnetic feature, this is, however, considered fortuitous.

A variation within the overburden is considered the probable cause. Ground followup of the anomaly on Line 509A should adequately explain this zone.

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ZONE Y-39

2nd Priority

Line 512W	Fiducial	232.55	60/13.0
513E		357.76	45/12.0
514N		277.28	33/7.5
		278.02	60/8.6
515E		301.28	60/13.0
		301.82	41.8/11.0
516W		322.0	55.3/8.0
517E		343.84	55/10.2
		344.49	53/11.5
		345.10	60/12.9
518W		363.40	54/7.0
519E		387.75	32.3/9.6
520W		009.32	53.3/13.0

This is a broad zone of irregular shape. It is located adjacent to a region of widespread conductive surficial material and is probably caused by an outlier of this surficial unit. There is no magnetic support.

It is most probable that this zone has a geological rather than a structural cause. It is not certain that the entire zone has the same cause. To adequately sample the zone ground followup is suggested on the anomalies on Lines 513, 515 and 520.

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ZONE Y-40 3rd Priority

Line 526W Fiducial 118.19 47.5/9.2

This is a broad, single line selection of poor anomaly shape. It is located near the peak of a long magnetic trend and for this reason has been picked.

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ZONE Y-41 — 2nd Priority

Line 529E	Fiducial	159.00	26/2.4
530W		176.78	16/1.0

These anomalies are located in the immediate vicinity of Rogers Dam, so the peak locations should first be checked to determine if culture, such as metal fences or pipelines could be the cause. In the absence of culture, the anomaly on Line 529 would justify followup for a possible bedrock conductor. The zone coincides with the peak of a long magnetic trend.

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ZONE Y-42 — 2nd Priority

Line 533E Fiducial 217.18 29/2.4

ZONE Y-43 — 3rd Priority

Line 539E Fiducial 379.60 60/4.4

Zone Y-42 can be explained by the presence of a cultural conductor around Yudnapinna. The anomaly is sharp, narrow and of typical cultural character. It coincides with a weak magnetic feature. If culture is not located a bedrock source is possible.

Zone Y-43 consists of a single line anomaly of similar shape on the later channels to Zone Y-42. Culture is also possible here. In the absence of culture a surficial source is more likely than a bedrock source. There is no magnetic support.

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ZONE Y-44 — 1st Priority

Line 538W	Fiducial	292.28	35/2.5
539E		380.18	54/5.0
540E		308.72	49/4.3
541W		323.19	50/3.2
543W		351.18	29.5/2.0
544E		365.78	34/2.2
545W		379.65	45/2.8
546E		394.58	43/2.7
547W		408.91	23/0.9

There is considerable variation of anomaly shape and conductivity along this trend. The anomalies on Lines 539, 540 and 544 have a good shape and should be followed up on a high priority basis, particularly those on Lines 539 and 540. They appear to be caused by a bedrock depression or by conductive material trapped in a shear. The zone coincides with a long magnetic trend.

ZONE Y-45 — 2nd Priority

Line 534W	Fiducial	234.38	46.1/6.9
535E		247.58	44/8.9
536W		262.28	60/9.8
537E		277.23	60/9.0
538W		291.62	60/6.3

The anomalies of this zone are of a poor shape and of only slightly enhanced amplitude with respect to the surrounding surficial material. A broad but isolated closure is noted on the 4th channel contour map. The zone coincides approximately with a low amplitude magnetic trend.

Ground followup of the anomalies on Lines 535 and 538 should adequately explain the source of this zone.

The magnetic trend on which Zone Y-45 is located merges with a magnetic trend on which Zone Y-44 is located.

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ZONE Y-46 1st Priority 0083

Line 548E	Fiducial	424.39	60/5.6
549W		436.48	47.5/4.8
550E		442.14	39/3.5
552E		459.18	45/6.0
553W		469.92	60/7.0
554E		477.17	47/3.2

This zone is located in a resistive background. The anomalies are broad but of a good shape. They are of a low amplitude compared to some of the other features in the region, but there is a resemblance between some of these anomalies and the responses obtained at Mt. Gunson. The northern portion of the zone is of poor character and needs not be followed up unless followup on the southern three lines is positive. Zone Y-46 is located on a long magnetic trend. Y-44 and Y-48 have been selected on the same trend.

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ZONE Y-47 2nd Priority

Line 558E Fiducial 513.76 29/2.3

This is a relatively low amplitude feature isolated in a resistive region. The anomaly is similar to some of the responses within Zone 48 although its shape is better. There is no magnetic support.

A second priority rating has been assigned because of the isolation.

ZONE Y-48 — 2nd Priority

Line 557W	Fiducial	504.85	52/2.1
558E		514.31	32/1.3
559W		521.70	44/3.0
560E		531.48	34/3.0
		531.73	25/2.0
561W		541.00	21/1.2
		541.89	13/0.8

The anomalies on the northern portion of the zone are of poor shape and need only be followed up if results over the southern part are positive. The zone is partly coincident with a long magnetic trend. Zone Y-46, which is a 1st priority selection, is located on the same magnetic trend.

Ground followup of the two anomalies on Line 560 should adequately explain the source of this zone.

ZONE Y-49 — 2nd Priority

Line 531E	Fiducial	189.83	30.6/4.1
532W		204.44	47/5.5
533E		219.47	47/5.5

This zone is located near the peak of a long magnetic trend. The INPUT anomalies have a good shape but their amplitudes are only slightly enhanced, therefore the probability of locating a significant bedrock depression is considered low.

Ground followup of the anomaly on Line 533 should adequately explain this zone.

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0087

ZONE Y-50 — 2nd Priority

Line 537E	Fiducial	278.28	60/9.6
538W		290.73	60/8.1
539E		381.47	60/8.0
540E		310.07	44/8.0
541W		321.42	47/7.9
542E		338.69	45.5/7.1
543W		348.94	38/7.1
544E		368.00	53/8.3
545W		377.62	49/7.0

The anomalies within this conductive trend are of a poor shape. The zone is located near the peak of a magnetic trend.

For followup purposes, the anomalies on Lines 538 and 541 should be checked.

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ZONE Y-51 — 3rd Priority

Line 530W	Fiducial	173.15	46.9/8.0
531E		192.38	43/9.1
532W		202.38	31.2/8.0
		202.98	60/9.9
533E		221.97	44.9/8.6

This zone is located on a broad conductive trend which merges with a widespread surficial region to the north. The conductivity is probably of geological origin but the zone could be sampled at one or two of the above locations to assure adequate followup. It is located near the peak of a very long magnetic trend.

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ZONE Y-52 2nd Priority 0089

Line 535E	Fiducial	251.02	45/9.6
536W		259.80	43.4/9.2
537E		279.52	60/10.0
538W		288.98	50.9/10.0
539E		383.78	60/10.2
540E		311.98	53.8/8.4
541W		319.78	39.5/6.0

Zone Y-52 is located on the same conductive trend as Y-51 but a higher priority has been assigned because the anomaly shapes are better. Both zones coincide with a drainage feature. There is no magnetic support.

For adequate ground followup it would be sufficient to sample the anomalies on Lines 535, 538 and 540.

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ZONE Y-53 — 2nd Priority

Line	542E	Fiducial 341.00	49/6.2
	543W	347.84	35/6.0
	544E	368.70	46/9.2
	545W	376.50	51.5/7.0
	546E	397.63	45/2.2
	547W	406.54	38/6.1
	548E	425.42	50/4.5

This zone is partly coincident with the drainage feature on which Zone Y-52 is located, and a source similar to Zone 52 is possible. The zone has a strike direction perpendicular to the regional geology and crosses a broad magnetic trend on which several zones have been selected.

The anomalies on Lines 544 and 547 have a good shape and should be followed up. The latter selection coincides with the peak of the magnetic trend.

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ZONE Y-54 — 2nd Priority

Line 552E	Fiducial	460.75	48/6.0
553W		467.84	58/7.0
554E		479.42	55/7.3

This zone is located on the western edge of a broad region of surficial conductivity, and the enhanced responses could be due to an edge effect or a thickening of the overburden along the edge. The zone is partly coincident with a magnetic trend.

Ground followup of the anomalies on Line 553 or 554 should adequately explain the source of this zone.

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ZONE Y-55 — 1st Priority

Line 556E	Fiducial	496.48	45/6.3
557W		503.15	47/5.2
558E		515.86	53.5/7.9
559W		520.20	49/8.5

This zone is located on the same magnetic trend as Zone Y-54 but the anomalies are stronger and the shapes are better. It is located near the edge of a region of surficial conductivity, but there is a good chance that a bedrock depression could be the cause. It is located adjacent to a drainage feature so the conductivity could be caused by conductive material accumulated in a depression related to this feature.

The anomalies on Lines 556 and 558 should be followed up on the ground.

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0093

ZONE Y-56 — 3rd Priority

Line 552E	Fiducial	461.78	51.0/7.0
553W		467.05	41.5/5.9

This zone is located on a gently sloping magnetic feature. The anomaly peaks coincide with aircraft altitude lows. The enhanced anomalies are probably caused by an altimeter effect.

Ground followup of one of the above anomalies should adequately explain the source.

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ZONE Y-57 — 3rd Priority

Line 562E	Fiducial	553.94	48/5.9
563W		559.74	48.5/6.2

This zone is a poor prospect. The best anomaly is on Line 562 but it coincides with an altimeter low so it could be caused by an altitude effect. It is located on the same magnetic trend as Zone Y-55 and if a bedrock depression is actually located on Y-55, this zone should be followed up despite its poor rating.

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ZONE Y-58 — 2nd Priority

Line	566E	Fiducial 596.50	43.5/7.0
	567W	600.81	57/9.4
	568W	391.48	60/14.9
	569E	409.02	60/14.5
	570W	413.34	60/14.9
	571E	432.00	60/12.0

This zone is located within a highly conductive geological unit in the southeastern corner of the area. It is on the same magnetic trend as Zones Y-55 and Y-57 but the magnetic feature is broader here than farther to the north.

Ground followup of the anomalies on Lines 568 and 570 should adequately explain the source.

ZONE Y-59 3rd Priority

Line 539E Fiducial 386.38 60/8.4

The shape of this single line selection is good on the later channels. It is located within a conductive background and is probably caused by a change within this background rather than by a bedrock depression. The anomaly is located near the peak of a broad, low amplitude magnetic trend. Zone Y-38 is on the same trend.

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ZONE Y-60 — 3rd Priority

Line 548E	Fiducial	429.03	41.5/7.2
549W		431.28	45/8.5

This zone is located within a highly conductive surficial unit which extends along the eastern boundary of the area. It is similar to Zone Y-61. Both anomalies coincide with an altimeter low so an altitude effect is at least partly responsible. The zone is located on a magnetic gradient but there is no direct support.

Followup of one of the above responses, preferably the one on line 549, would adequately explain the source of these anomalies.

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ZONE Y-61 — 3rd Priority

Line 561W	Fiducial	536.13	60/9.9
562E		555.78	40/4.4
563W		557.50	60/8.6
564E		576.58	57/10.3

This zone is located within a region of conductive surficial material on the eastern edge of the survey area. A bedrock depression is considered an unlikely cause. Most of the anomalies coincide with a distinctive altimeter low so an altitude effect is probably largely responsible.

For followup one of the anomalies on Lines 563 or 564 can be checked.

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Table I

Summary of Selected Conductors

1st Priority	2nd Priority	3rd Priority
D. Winnie Pinnie Area		
WP-5	WP-1	WP-3
WP-7	WP-2	WP-4
WP-11	WP-6	WP-9
WP-34	WP-8	WP-10
	WP-12	WP-14
	WP-13	WP-15
	WP-17	WP-16
	WP-22	WP-18
	WP-23	WP-19
	WP-25	WP-20
	WP-26	WP-21
	WP-35	WP-24
	WP-39	WP-27
	WP-41	WP-28
		WP-29
		WP-30
		WP-31
		WP-32
		WP-33
		WP-36
		WP-37
		WP-38
		WP-40
E. Yudnapinna Area		
Y-14	Y-1	Y-3
Y-28	Y-2	Y-8
Y-35	Y-4	Y-9
Y-37	Y-5	Y-23
Y-44	Y-6	Y-24
Y-46	Y-7	Y-25
Y-55	Y-10	Y-26

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1st Priority	2nd Priority	3rd Priority
	Y-11	Y-27
	Y-12	Y-29
	Y-13	Y-32
	Y-15	Y-33
	Y-16	Y-34
	Y-17	Y-36
	Y-18	Y-38
	Y-19	Y-40
	Y-20	Y-43
	Y-21	Y-51
	Y-22	Y-56
	Y-30	Y-57
	Y-31	Y-59
	Y-39	Y-60
	Y-41	Y-61
	Y-42	
	Y-45	
	Y-47	
	Y-48	
	Y-49	
	Y-50	
	Y-52	
	Y-53	
	Y-54	
	Y-58	

VII. CONCLUSIONS AND RECOMMENDATIONS

1. Table I summarizes our interpretation of the INPUT data gathered over the Yudnapinna Areas. The priorities indicate the interpreted probability of the cause being a bedrock depression.

2. All 1st Priority and 2nd Priority targets should be followed up on a high priority basis. In some cases followup of all INPUT peaks listed within a zone should be conducted although a check of one or two peaks should, in most cases, be adequate to explain the cause.

3. Followup of the 3rd priority targets is also recommended but on a lower priority basis. The results on these will assist in determining the validity of the criteria used in this interpretation. If a significant number of these are indeed found to be caused by bedrock depressions, then the data should be re-examined with a view towards making more selections.

4. The anomaly occurring on the extended lines and mentioned in the introduction to the Yudnapinna area, should be followed up.

5. The centre of a closure or the individual anomaly peak is located close to the centre of the possible bedrock depression, (usually within 75 metres). The half peak widths, as indicated by brackets on the fourth channel of the INPUT traces, indicate the approximate width of the source. Ground followup should be

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conducted in a manner which assures that the anomaly is adequately traversed. Geochemistry combined with percussion drilling or ground resistivity are considered appropriate ground followup techniques.

6. Attention is attracted to the linear INPUT features coinciding with narrow magnetic trends located over the Pundurra Formation. These have geological causes but it is unlikely that they are caused by bedrock depressions.

7. The INPUT data should be reviewed and the data updated as new information becomes available.

Respectfully submitted,

J.E. Hansen

M. Savage

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Rosies Dam

Uneroo Dam

COMBINED AIRBORNE EM AND MAGNETOMETER SURVEY

BARRINGER "INPUT" ELECTROMAGNETIC SYSTEM

4th CHANNEL CONTOURS

WINNIE PINNIE and YUDNAPINNA AREAS

SOUTH AUSTRALIA

FOR

PACMINEX PTY. LIMITED

SHEET 3.

SCALE 1 : 25,000

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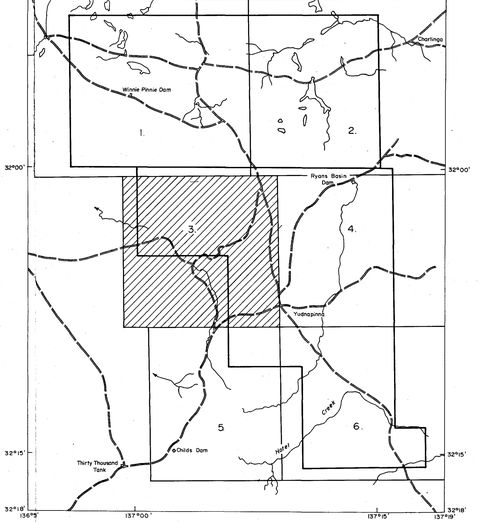
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2564(I)-1

GEOTERREX PROJECT No. 83-253

LOCATION MAP

SCALE 1 : 250,000



LEGEND

CONTOUR INTERVAL ..... 0·1 INCH AT RECORD SCALE

AMPLITUDE OF 4th CHANNEL MEASURED FROM ZERO LEVEL

LOW .....

COMBINED AIRBORNE EM AND MAGNETOMETER SURVEY

BARRINGER "INPUT" ELECTROMAGNETIC SYSTEM

4th CHANNEL CONTOURS

WINNIE PINNIE and YUDNAPINNA AREAS

SOUTH AUSTRALIA

FOR

PACMINEX PTY. LIMITED

SHEET 4.

SCALE 1 : 25,000

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2564(I)-2

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GEOTERREX PROJECT No. 83-253

LOCATION MAP

SCALE 1 : 250,000

LEGEND

CONTOUR INTERVAL ..... 0·1 INCH AT RECORD SCALE

AMPLITUDE OF 4th CHANNEL MEASURED FROM ZERO LEVEL

LOW .....

COMBINED AIRBORNE EM AND MAGNETOMETER SURVEY

BARRINGER "INPUT" ELECTROMAGNETIC SYSTEM

4th CHANNEL CONTOURS

WINNIE PINNIE and YUDNAPINNA AREAS

SOUTH AUSTRALIA

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SHEET 5.

SCALE 1 : 25,000

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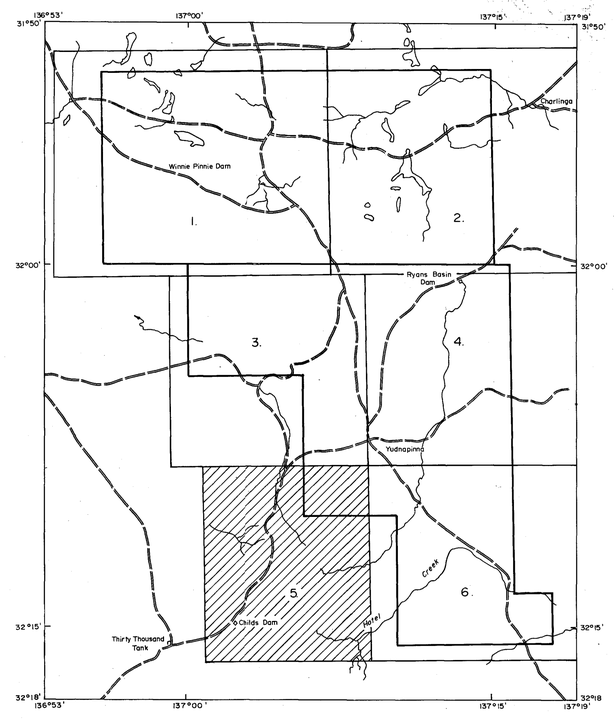
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L-544E
L-545W
L-546E
L-547W
L-548E

Childs Dam

LOCATION MAP

SCALE 1 : 250,000



LEGEND

CONTOUR INTERVAL ..... 0·1 INCH AT RECORD SCALE

AMPLITUDE OF 4th CHANNEL MEASURED FROM ZERO LEVEL

LOW .....

COMBINED AIRBORNE EM AND MAGNETOMETER SURVEY

BARRINGER "INPUT" ELECTROMAGNETIC SYSTEM

4th CHANNEL CONTOURS

WINNIE PINNIE and YUDNAPINNA AREAS

SOUTH AUSTRALIA

FOR

PACMINEX PTY. LIMITED

SHEET 6.

SCALE 1 : 25,000

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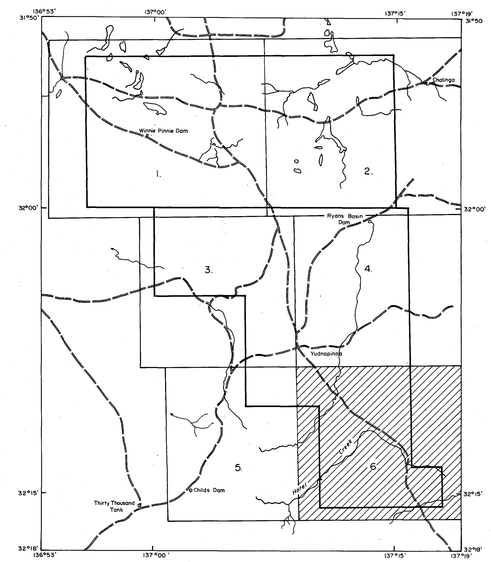
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LOCATION MAP

SCALE 1 : 250,000



LEGEND

CONTOUR INTERVAL ..... 0·1 INCH AT RECORD SCALE

AMPLITUDE OF 4th CHANNEL MEASURED FROM ZERO LEVEL

LOW .....

N

COMBINED AIRBORNE EM AND MAGNETOMETER SURVEY

BARRINGER "INPUT" ELECTROMAGNETIC SYSTEM

ISOMAGNETIC CONTOUR MAP

WINNIE PINNIE and YUDNAPINNA AREAS

SOUTH AUSTRALIA

FOR

PACMINEX PTY. LIMITED

SHEET 3

SCALE 1 : 25,000

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KILOMETRES

SURVEYED, COMPILED & INTERPRETED BY
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SYDNEY

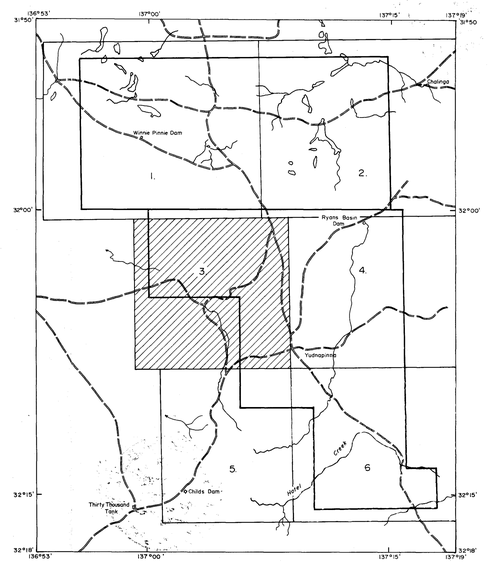
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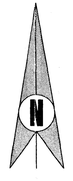
FLOWN IN FEBRUARY 1975

GEOTERREX PROJECT No. 83-253

LOCATION MAP

SCALE 1 : 250,000





LEGEND

100 GAMMAS .....

10 GAMMAS .....

MAGNETIC LOW .....

CONTOUR INTERVAL ..... 10 GAMMAS

Rosies Dam

Uneroo Dam

L-503W L-504W L-505E L-505AE L-506W L-507E L-507AE L-508AW L-508W L-509E L-509AE L-510W L-511E L-512W L-513E L-514W L-515E L-516W L-517E L-518W L-519E L-520W L-521E L-522W L-523E L-524W L-525E L-526W L-527E L-528W L-529E L-530W L-531E L-532W L-533E L-534W L-535E L-536W L-537E L-538W

COMBINED AIRBORNE EM AND MAGNETOMETER SURVEY

BARRINGER "INPUT" ELECTROMAGNETIC SYSTEM

ISOMAGNETIC CONTOUR MAP

WINNIE PINNIE and YUDNAPINNA AREAS

SOUTH AUSTRALIA

FOR

PACMINEX PTY. LIMITED

SHEET 4.

SCALE 1 : 25,000

0·5 0·25 0 0·5 1 1·5 2

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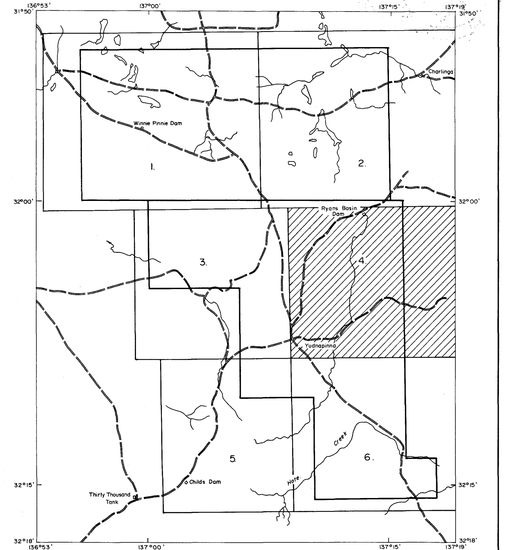
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LOCATION MAP

SCALE 1 : 250,000



LEGEND

100 GAMMAS .....

10 GAMMAS .....

MAGNETIC LOW .....

CONTOUR INTERVAL ..... 10 GAMMAS

30th OCT 75

COMBINED AIRBORNE EM AND MAGNETOMETER SURVEY

BARRINGER "INPUT" ELECTROMAGNETIC SYSTEM

ISOMAGNETIC CONTOUR MAP

WINNIE PINNIE and YUDNAPINNA AREAS

SOUTH AUSTRALIA

FOR

PACMINEX PTY. LIMITED

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SCALE 1 : 25,000

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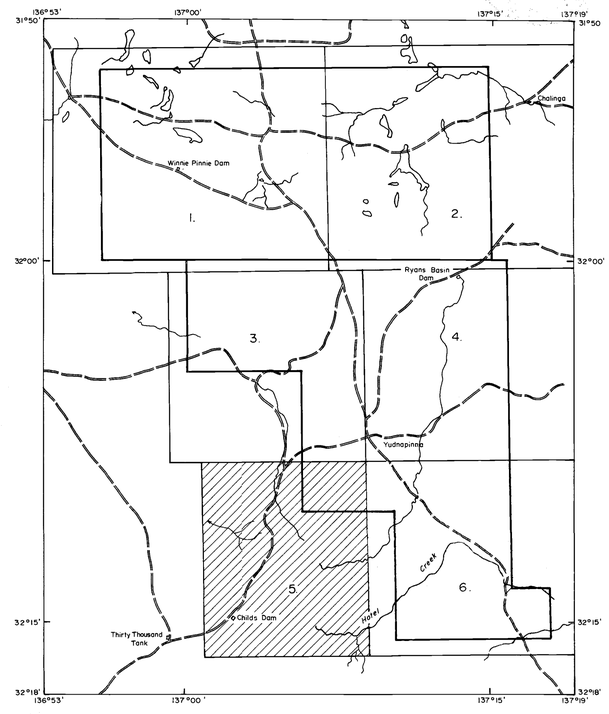
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L-539E
L-540E
L-541W
L-542E
L-543W
L-544E
L-545W
L-546E
L-547W
L-548E

Childs Dam

LOCATION MAP

SCALE 1 : 250,000



LEGEND

100 GAMMAS .....

10 GAMMAS .....

MAGNETIC LOW .....

CONTOUR INTERVAL ..... 10 GAMMAS

30-09-75

COMBINED AIRBORNE EM AND MAGNETOMETER SURVEY

BARRINGER "INPUT" ELECTROMAGNETIC SYSTEM

ISOMAGNETIC CONTOUR MAP

WINNIE PINNIE and YUDNAPINNA AREAS

SOUTH AUSTRALIA

FOR

PACMINEX PTY. LIMITED

SHEET 6.

SCALE 1 : 25,000

0.5 0.25 0 0.5 1 1.5 2

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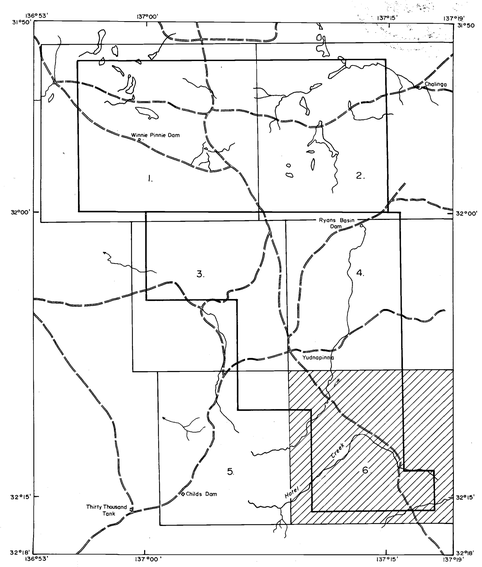
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LOCATION MAP

SCALE 1 : 250,000



LEGEND

100 GAMMAS .....

10 GAMMAS .....

MAGNETIC LOW .....

CONTOUR INTERVAL ..... 10 GAMMAS

30.06.75

COMBINED AIRBORNE EM AND MAGNETOMETER SURVEY

BARRINGER "INPUT" ELECTROMAGNETIC SYSTEM

EM PLAN MAP

WINNIE PINNIE and YUDNAPINNA AREAS

SOUTH AUSTRALIA

FOR

PACMINEX PTY. LIMITED

SHEET 3.

SCALE 1 : 25,000

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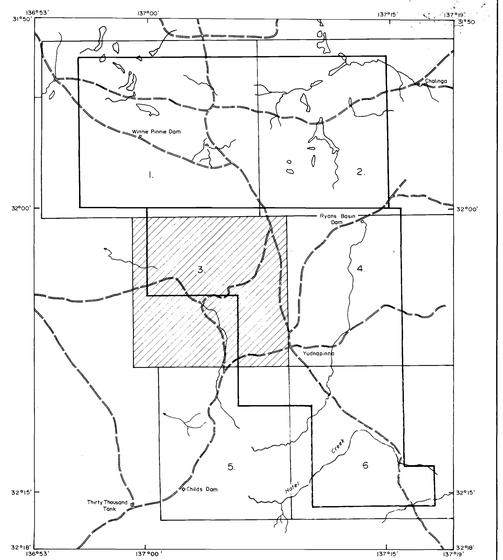
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FLOWN IN FEBRUARY 1975

GEOTERREX PROJECT No. 83-253

LOCATION MAP

SCALE 1 : 250,000



INPUT LEGEND

- 6 CHANNEL ANOMALY
- 5 CHANNEL ANOMALY
- 4 CHANNEL ANOMALY
- 3 CHANNEL ANOMALY
- 2 CHANNEL ANOMALY
- 1 CHANNEL ANOMALY

PEAK POSITION

- 1st and 4th. CHANNEL AMPLITUDES (e.g. 18/2.5 A)
- ALTITUDE (FEET) (e.g. 420)
- COINCIDENT MAGNETIC ANOMALY (GAMMAS) (e.g. 60γ)
- OFFSET MAGNETIC ANOMALY (e.g. 60γ)

NOTE: PRECISION SOUTH RADIALS TO 30th OCT. '75

GEOTERREX P/L
613A ELIZABETH STREET
REDFERN N.S.W. 2016

COMBINED AIRBORNE EM AND MAGNETOMETER SURVEY

BARRINGER "INPUT" ELECTROMAGNETIC SYSTEM

EM PLAN MAP

WINNIE PINNIE and YUDNAPINNA AREAS

SOUTH AUSTRALIA

FOR

PACMINEX PTY. LIMITED

SHEET 4.

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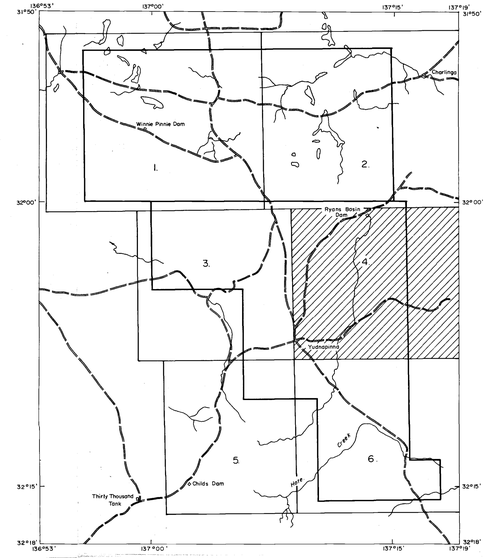
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2564(I)-10

GEOTERREX PROJECT No. 83-253

LOCATION MAP

SCALE 1 : 250,000



INPUT LEGEND

- 6 CHANNEL ANOMALY
- 5 CHANNEL ANOMALY
- 4 CHANNEL ANOMALY
- 3 CHANNEL ANOMALY
- 2 CHANNEL ANOMALY
- 1 CHANNEL ANOMALY
- PEAK POSITION
- 1st and 4th CHANNEL AMPLITUDES
- ALTITUDE (METERS)
- COINCIDENT MAGNETIC ANOMALY (GAMMAS)
- OFFSET MAGNETIC ANOMALY

NOTE: PROVISIONAL WITH RESPECT TO 26TH OCT. '75

GEOTERREX P/L
613A ELIZABETH STREET
REDFERN N.S.W. 2016

COMBINED AIRBORNE EM AND MAGNETOMETER SURVEY

BARRINGER "INPUT" ELECTROMAGNETIC SYSTEM

EM PLAN MAP

WINNIE PINNIE and YUDNAPINNA AREAS

SOUTH AUSTRALIA

FOR

PACMINEX PTY. LIMITED

SHEET 5

SCALE 1 : 25,000

0·5 0·25 0 0·5 1 1·5 2

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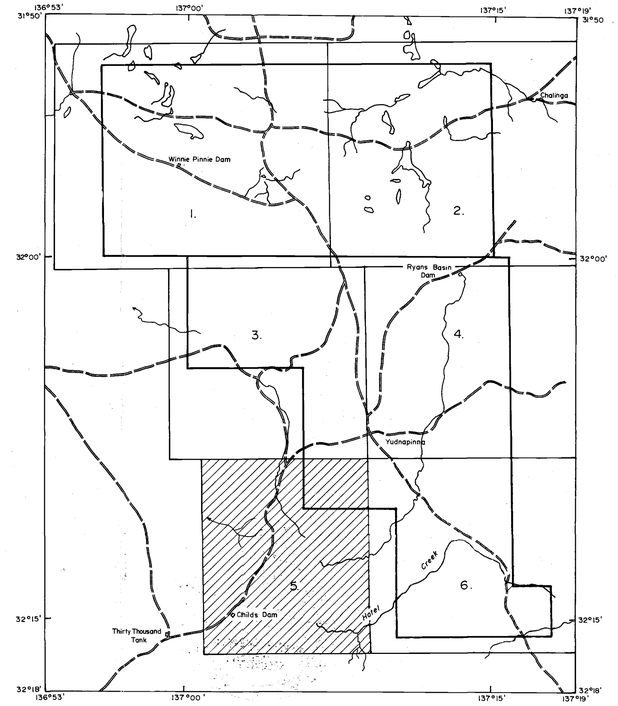
L-539E
L-540E
L-541W
L-542E
L-543W
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L-545W
L-546E
L-547W
L-548E

Y30 48/2·8 ▲ 400 10⅛ 43/1·8 ▲ 350 7⅛ 31/1·9 ▲ 410 8⅛ 47/3·0 ▲ 380
Y33 12·5/0·9 ▲ 410 20⅛
Y34 23/1·2 ▲ 380 80⅛
Y32 24/1·2 ▲ 400 14⅛
Y31 15/0·6 ▲ 440 39⅞
Y18 36/2·4 ▲ 390 8⅛ 19/1·2 ▲ 430
Y19 28/1·7 ▲ 420 27⅛ 22/1·5 ▲ 400 30⅛ 13/1·3 ▲ 410 24⅛ 19/0·8 ▲ 400 50⅛
52/3·1 ▲ 390 31⅛ 27/2·0 ▲ 430 35⅛ 36/2·2 ▲ 370 40⅛ 21/1·2 ▲ 380 45⅛ 13/0·6 ▲ 420 45⅛ 24/0·8 ▲ 410 45⅛ 11/0·3 ▲ 430 50⅛

Childs Dam

LOCATION MAP

SCALE 1 : 250,000



INPUT LEGEND

- 6 CHANNEL ANOMALY
- 5 CHANNEL ANOMALY
- 4 CHANNEL ANOMALY
- 3 CHANNEL ANOMALY
- 2 CHANNEL ANOMALY
- 1 CHANNEL ANOMALY
- PEAK POSITION
- 1st and 4th. CHANNEL AMPLITUDES (18/2.5 ▲)
- ALTITUDE (FEET) (▲ 420)
- COINCIDENT MAGNETIC ANOMALY (GAMMAS) (▲ 60)
- OFFSET MAGNETIC ANOMALY (▲ 60)

N

Note: Provisional with respect to 30th Oct. '75

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REDFERN N.S.W. 2016

COMBINED AIRBORNE EM AND MAGNETOMETER SURVEY

BARRINGER "INPUT" ELECTROMAGNETIC SYSTEM

EM PLAN MAP

WINNIE PINNIE and YUDNAPINNA AREAS

SOUTH AUSTRALIA

FOR

PACMINEX PTY. LIMITED

SHEET 6.

SCALE 1 : 25,000

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KILOMETRES

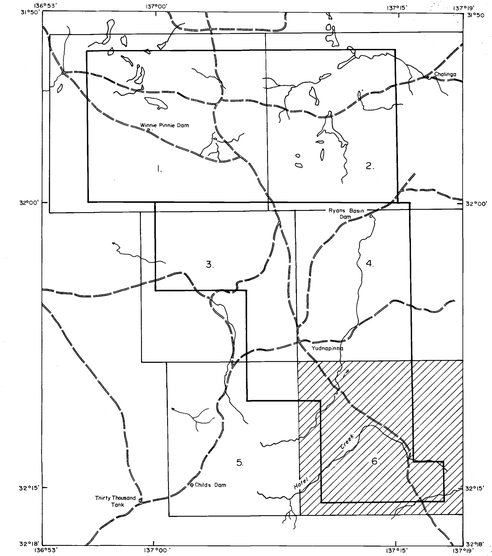
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LOCATION MAP

SCALE 1 : 250,000



INPUT LEGEND

6 CHANNEL ANOMALY
5 CHANNEL ANOMALY
4 CHANNEL ANOMALY
3 CHANNEL ANOMALY
2 CHANNEL ANOMALY
1 CHANNEL ANOMALY

PEAK POSITION
1st and 4th CHANNEL AMPLITUDES 18/2.5
ALTITUDE (FEET) 420
COINCIDENT MAGNETIC ANOMALY (GAMMAS) 60
OFFSET MAGNETIC ANOMALY 120

N

Model Projected Grid Related To 30th OCT '75

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REDFERN N.S.W. 2016

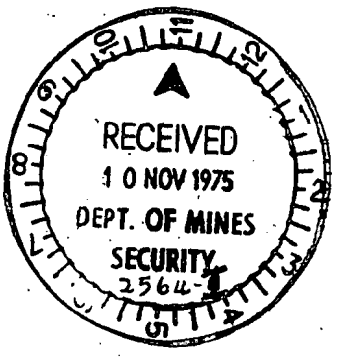
Prospect 405

0103

PACMINEX PTY. LIMITED

A REVIEW OF STRATIGRAPHIC PETROGRAPHY, PANDURRA AREA

PMR 127/75



SYDNEY
August, 1975

P.J. CURTIS

COPY NO. 5

0104

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CONTENTS

		PAGE NO.
1.	INTRODUCTION	1
2.	SUMMARY	2
3.	CLASSIFICATION AND DISCUSSION	10
3.1	Moonabie Formation	10
3.2	Corunna Conglomerate	10
3.3	Gawler Range Volcanics	11
3.4	Roopena Volcanics	11
3.5	Pandurra Formation - Basal Section	12
3.6	Pandurra Formation - Upper Section	16
3.7	Elizabeth Creek Conglomerate	19
3.8	Woocalla Dolomite	20
3.9	Magazine Hill Clay	23
3.10	Yudnapinna Beds	24
3.11	Whyalla Sandstone	28
3.12	Tregolana Shale	30
3.13	Corraberra Sandstone	31
4.	REFERENCES	32

APPENDICES

I PETROGRAPHIC NOTES TAKEN FROM VARIOUS PACMINEX PTY. LIMITED PANDURRA PETROGRAPHIC REPORTS AND COLLATED: THESE INCLUDE PMR'S 195/72, 73/74, 153/74 AND 29/75; ALSO A MEMORANDUM FROM P.J. CURTIS TO D.G. TONKIN DATED 4/9/1973, ENTITLED "PANDURRA THIN-SECTIONS".

II MEMORANDUM FROM D.G. TONKIN TO P.J. CURTIS DATED 27/11/1974, ENTITLED "PANDURRA PETROGRAPHY".

PLAN (IN POCKET)

PMX DWG NO.

2046 PETROGRAPHIC SAMPLE LOCATION PLAN, PANDURRA AREA, S.A. E.L. 50.

LIST OF ILLUSTRATIONS

FIGURES		FACING PAGE NO.
1	MOONABIE FORMATION, P.95	10
2	MOONABIE FORMATION, P.96	10
3	CORUNNA CONGLOMERATE, P.90	10
4	CORUNNA CONGLOMERATE, P.91	10
5	GAWLER RANGE VOLCANICS, P.24	11
6	ROOPENA VOLCANICS, P.19	11
7	ROOPENA VOLCANICS, A9657 (BEDA BORE CHIP)	11
8	PANDURRA FORMATION : BASAL SECTION, P.49A	13
9	PANDURRA FORMATION : BASAL SECTION, P.50B	13
10	PANDURRA FORMATION : BASAL SECTION, P.86	14
11	PANDURRA FORMATION : UPPER SECTION, P.43	16
12	PANDURRA FORMATION : UPPER SECTION, P.58	17
13	PANDURRA FORMATION : UPPER SECTION, P.83A	17
14	ELIZABETH CREEK CONGLOMERATE, P.9	19
15	ELIZABETH CREEK CONGLOMERATE, P.27	19
16	WOOCALLA DOLOMITE, P.28	20
17	WOOCALLA DOLOMITE, P.35	21
18	WOOCALLA DOLOMITE, EX50 (20 m)	21
19	MAGAZINE HILL CLAY, P.85	23
20	YUDNAPINNA BEDS, P.65	23
21	YUDNAPINNA BEDS, EX96-86645	26
22	YUDNAPINNA BEDS, EX142-97325	26
23	WHYALLA SANDSTONE, P.51	28
24	WHYALLA SANDSTONE, P.60	28
25	WHYALLA SANDSTONE, P.66	28
26	TREGOLANA SHALE (CLAY), EX93-86587	30
27	TREGOLANA SHALE (SILT), EX93-86587	30
28	TREGOLANA SHALE, EX93-86589	30

/....

FIGURES		FACING PAGE NO.
29	CORRABERRA SANDSTONE, P.79	31
30	CORRABERRA SANDSTONE, A4223	31

KEYWORDS

SOUTH AUSTRALIA
4PANDURRA
3SI 53-04
PETROGRAPHY
CLAY
FORMATION
4WHYALLA SANDSTONE
4TREGOLANA SHALE
4 CORRABERRA
4ELIZABETH CREEK SANDSTONE
4MOONABIE
4GAWLER RANGE VOLCANICS
4ROOPENA VOLCANICS
4WOOCALLA DOLOMITE
4CORUNNA CONGL
4MAGAZINE HILL
4YUDNAPINNA BEDS

1. INTRODUCTION

As requested in the memorandum from Mr. D.G. Tonkin to P.J. Curtis, dated 27th November, 1974, an attempt has been made to reclassify, compare and discuss the thin-sections of rock specimens supplied from the Pandurra area.

The original petrographic notes on these specimens are included in the Appendices.

0110

2. SUMMARY

2.1 Moonabie Formation

2.1.1 P.95. A medium and even-grained tuffaceous sandstone with potash feldspar, oligoclase and abundant chlorite and illite matrix.

2.1.2 P.96. A coarser, quartz conglomerate (c.f. P.95) with plagioclase, volcanic clasts and heavy minerals. Abundant clay minerals.

The abundant clay mineral of these rocks differentiate them from other sandstones of the series more than any other characteristic. Volcanic clasts present are basaltic or andesitic.

2.2 Corunna Conglomerate

The rocks are irregular in grain shapes and sizes and have an erratic fabric. Abundant chert, presence of appreciable opaque minerals and original roundness of most quartz grains or rock fragments are characteristic. The presence of microcline and volcanic clasts are characteristic of some specimens.

2.2.1 It is possible to subdivide these rocks on the basis of quartz grain size of fabric :-

a) conglomerate members, P.90, P.94

b) sandy members, P.91 to P.93.

or, 2.2.2 on the presence of potash feldspar, P.92 and P.94 with, and P.90, P.91 and P.93 with no potash feldspar.

2.3 Gawler Range Volcanics

P.24. A much altered porphyritic andesite.

/....

2.4 Roopena Volcanics

2.4.1 P.19. An argillised variolitic basalt.

2.4.2 Beda Bore Chip (A9657). An altered dolerite and though described as a volcanic rock by the S.A. Mines Dept. many years ago the then identified 'amygdules' appear in thin-section to be coronna structures of uralite around mainly altered pyroxene phenocrysts.

2.5 Pandurra Formation (Basal)

These rocks normally contain some potash feldspar, quartz grains were originally rounded and ferruginous chert and volcanic clasts are common. Divided into five sub-classifications :-

2.5.1 Fairly regular, largely quartz grains, originally rounded. Ferruginous cherts occur in most specimens and volcanic clasts of Roopena Volcanics occur in some specimens. No banding. EX 31A, P.11, P.12, P.22, P.87 and P.88B.

2.5.2 Very irregular grain sizes of quartz mineral grains and rock fragments (including quartz gneiss), abundant chert (clear and ferruginous) and volcanic clasts. Potash feldspar and some heavy minerals. No banding. P.18, P.20A, P.20B, P.25 and P.86.

2.5.3 Irregular sized quartz rock fragments and mineral grains, commonly rounded. Ferruginous cherts and some potash feldspar. Roughly banded with coarse/medium and medium/fine grains. P.50B and P.89.

2.5.4 Resembles some Yudnapinna specimens. Fine silty quartz matrix subrounded to angular ferruginous cherts, abundant potash feldspar and an abundant illite cement. EX 31B.

2.5.5 Resembles Elizabeth Creek Conglomerate specimen, P.29, equigranular, quartz-silicified with large round cherty pebbles. P.49A.

2.6 Pandurra Formation (Upper)

These are probably more like the Pandurra Formation rocks examined at Mount Gunson.

The differences between the two groups are quite broad and general. The basal members are less silicified (more clayey); more erratic in grain disposition, original quartz grains are more rounded; the rocks are more cherty (including more volcanic material) and more feldspathic. The upper members are commonly roughly banded, more silicified (with quartz) and cleaner looking, less feldspathic and commonly contain less chert and few (if any) volcanic clasts.

The upper division is subdivided as follows :-

2.6.1 Coarse and fine bands of quartz mineral grains and rock fragments (including quartz gneiss). The bands are variable, coarse and fine, and medium and fine grains. Rounded grains are common. P.31, P.43, P.48, P.51B, P.58, P.67, EX136-92717.

EX136-92717 is made up of mounted fragments of drill chips but most fragments correspond with this section.

P.31 and P.58 differ from the other members of this group in containing easily identifiable volcanic clasts.

2.6.2 Similar to 2.6.1 but completely unsorted, and faintly cherty in 85584. P.83A and 85584.

2.6.3 Grain sizes are finer generally than in 2.6.1 but the rock is 'clean' as in 2.6.1. Many round grains

occurred before silicification. Scattered larger quartz erratics occur in a fine matrix. Patchy clay mineral occurs in the interstices. P.21 and P.33.

P.21 has some ferruginous chert grains.

P.33 contains Liesegang rings of iron oxide.

2.6.4 These specimens differ from 2.6.1, 2.6.2 and 2.6.3 above in being rather cherty particularly with ferruginous chert, and more volcanic clasts occur. P.53 and P.84B.

Differences between these specimens are that coarse chert and volcanic clasts occur in P.53; coarse quartz is seen in P.84B. Both specimens are completely unsorted.

2.7 Elizabeth Creek Conglomerate

The specimens P.2, P.27, P.29 and P.57A contain rounded to subangular fragments of Pandurra Formation material derived from the formation.

Classification by fragments is as follows :-

2.7.1 Pandurra Formation (Basal)

P.3, P.9, P.29; also P.29 has a matrix fabric and mineralogy comparable with Basal Pandurra Formation.

2.7.2 Pandurra Formation (Upper)

P.2, P.27, P.57A; also P.57A resembles P.31, both erratics and matrix.

2.7.3 Individual pebbles from various sources including mainly the Roopena Volcanics. EX 88-86545.

2.8 Woocalla Dolomite

These are classified as follows :-

2.8.1 Dominantly fine dolomite. P.52, 97342, EX 50 (20 m).

2.8.2 Quartzose, cherty, chloritic sandstones/ siltstones. P.34 and P.35.

2.8.3 Quartzose bands, clay and/or carbonate matrix and bands. P.28, 97275, 97404 and 97427.

2.9 Magazine Hill Clay

P.6A, P.6B and P.85 have a possible Woocalla Dolomite (Shale) lithology.

P.81 is the only specimens with a distinct (fine kaolinitic clay) lithology which may be called Magazine Hill Clay.

2.10 Yudnapinna Beds

These are split into the following divisions :-

2.10.1 Typical Yudnapinna Beds of silt-size equigranular quartz grains, abundant potash feldspar and fine magnetite, with or without much larger sand-size grains of quartz or chert as scattered erratics. Rock cement is illite, carbonate or limonite. These are split into subdivisions :-

(a) Fine angular to subangular quartz with abundant rock 'cement' matrix. Large erratics are present as spherical quartz (or less so as subangular grains) and occasional ferruginous cherts or volcanic clasts occur as large grains 0.5 to 1 mm, also as erratics. 85235, 85271, 85713, 85739, 85846, 86645 and 97325.

(b) Coarser, silt/sandstone quartz of round to subangular aspect. Less interstitial 'cement' of very fine minerals. Round to subangular erratic grains (to 2 mm) of quartz mineral grains, quartz rock fragments, ferruginous cherts, clear cherts and altered volcanic clasts.

Coarser bands of round to subangular grains (0.1 to 0.5 mm) may also occur with a little intermingling fine silt-size quartz (P.65, 85893). The bands which vary 0.5 to 3 mm wide grade into finer silty bands. Rock cement is sparse and is mainly cherty or illitic. P.40, P.41A, P.65, EX 146 and 85893.

2.10.2 Subangular, equigranular quartz with abundant cherts, some chlorite, chert and clay mineral occur as abundant rock cement. An abundance of potash feldspar and heavy minerals is seen. This rock may not belong to Yudnapinna Beds and is thought to resemble a Woocalla Dolomite facies. P.46.

2.10.3 Rounded, equigranular quartz with fewer subangular grains. Resembles some Pandurra Formation rocks of basal (a) group. P.65A.

2.11 Whyalla Sandstone

2.11.1 P.51. A rough two modal quartz grain distribution is present with few large subrounded quartz mineral grains, finer silt-size angular quartz, a little microcline and common ferruginous cherts. Resembles group 2.10.1(b) Yudnapinna Beds, particularly 85893.

2.11.2 P.56. This is distinct, with overall large round quartz grains, limited silt-size quartz and abundant ferruginous cherts.

/....

2.11.3 P.60. Similar to P.51 with large rounded quartz, fine silt-size quartz and ferruginous chert of coarse and fine sizes, some fine silty bands are noted, also magnetite and tourmaline of silt-size. Very like 2.10.1(b), Yudnapinna Beds, particularly of P.40.

2.11.4 P.66. Very like P.60 where silty bands are absent. Large quartz grains, and ferruginous cherts occur and cherty volcanic grains are very round. Magnetite is abundant.

2.11.5 EX 137-97229 (transitional to Yudnapinna Beds). The section is somewhat similar to that of P.51 but there is more silt-size quartz in relation to the large quartz grains and small ferruginous cherts. There are abundant heavy minerals present. Resembles 2.10.1(b), Yudnapinna Beds, particularly P.41A.

2.11.6 EX 140-97292. Similar to P.51 in patches but large quartz grains and finer silt-size grains are locally more angular although abundant rounded grains of both modes occur. A little potash feldspar and minimal illite occur, also some small and large ferruginous cherts. Abundant magnetite and a little zircon are seen. An inhomogeneous part-rudaceous rock. Locally similar to Yudnapinna Beds, 2.10.1(b), particularly to P.41A.

From the evidence given by 97229 and 97292 there appears to be a transitional stage (e.g. Yudnapinna Beds Group 2.10.1(b) with Whyalla Sandstone).

2.12 Tregolana Shale

2.12.1 86587

(a) One mounted fragment is typically Tregolana Shale as described from the Mystery area in Mount Gunson

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(see notes in Appendix). It is finely bedded of mainly illite > kaolinite, fine cherty quartz and limonite. Variations in limonite concentration indicate bedding.

(b) The remaining fragment shows a rock with equigranular quartz of sandstone size, abundant potash feldspar, less fresh oligoclase and scattered biotite flakes, magnetite grains and kaolinite.

2.12.2 86589. As for 86587(b), but coarser grained and in addition to the minerals listed above is a little carbonate as grains the size of quartz in the rock.

It is thought that 86587(a) is Tregolana Shale, and 86587(b) and 86589 are either Corraberra Sandstone which the sections resemble or represent transition beds to Corraberra Sandstone.

2.13 Corraberra Sandstone

The specimens P.79 and P.80 are siltstone members of this sequence. They are similar in consisting of more or less equigranular quartz grains, subrounded to angular and clear in P.80; subangular to angular in P.79, with limonite staining. Potash feldspar and oligoclase are both abundant and fresh as is silt-size magnetite. Carbonate is appreciable as silt-size grains in P.80.

These specimens are similar in quartz grain shapes and the presence of potash feldspar and limonite to A4222 from the Mystery area (see Appendix).

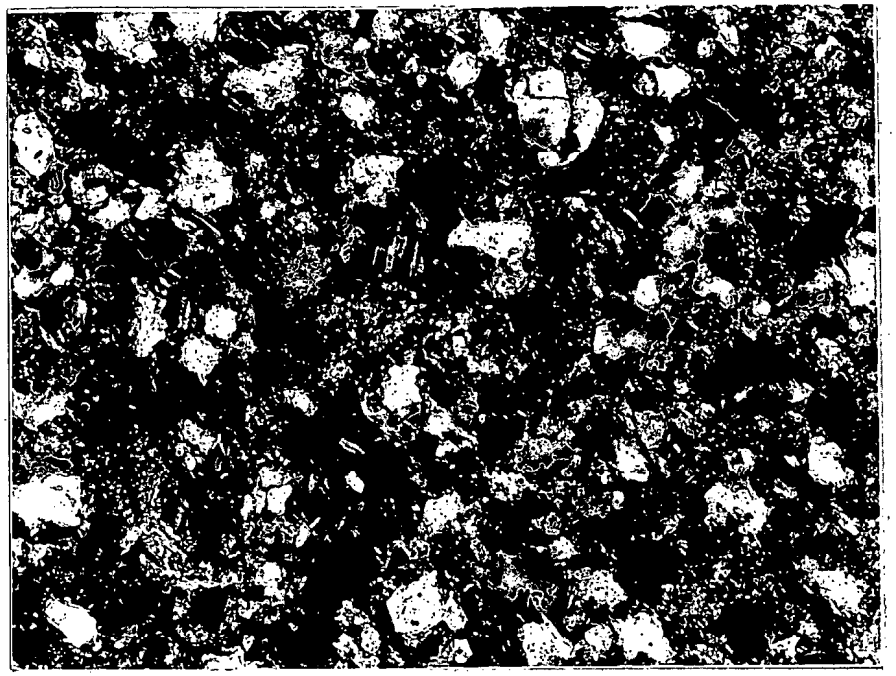


Figure 1 Moonabie Formation P95

A medium grained tuffaceous sandstone. Plagioclase (lamellar twins) is seen. Abundant chlorite, illite and fragmentary quartz occur.

Crossed nicols Magnification X 90

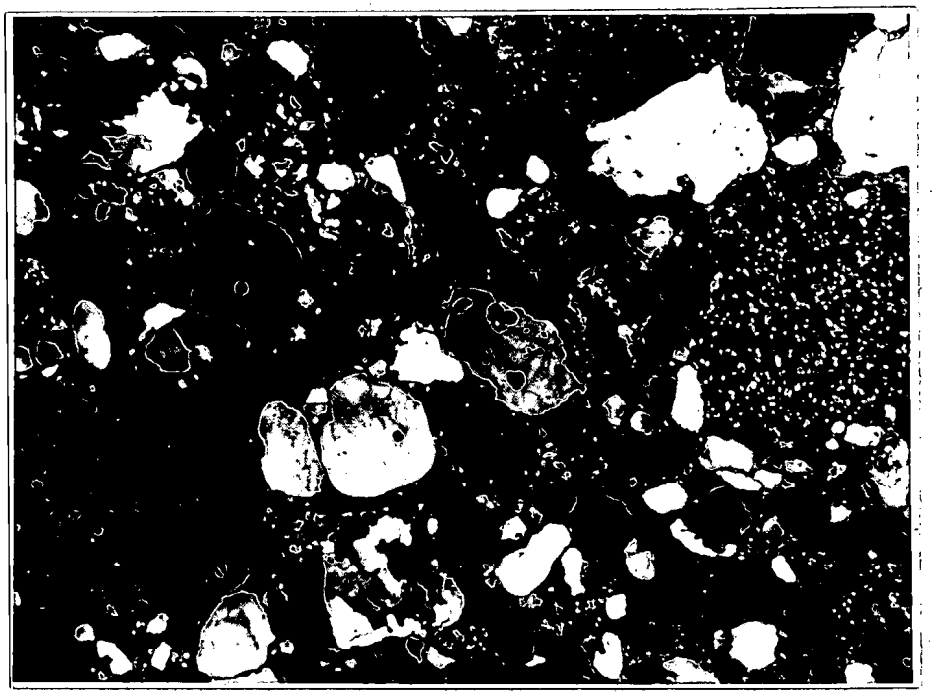


Figure 2 Moonabie Formation P96

Different from type displayed by Figure 1.

Coarse quartz conglomerate with abundant ferruginous cherts (speckled black and white).

Crossed nicols Magnification X 13

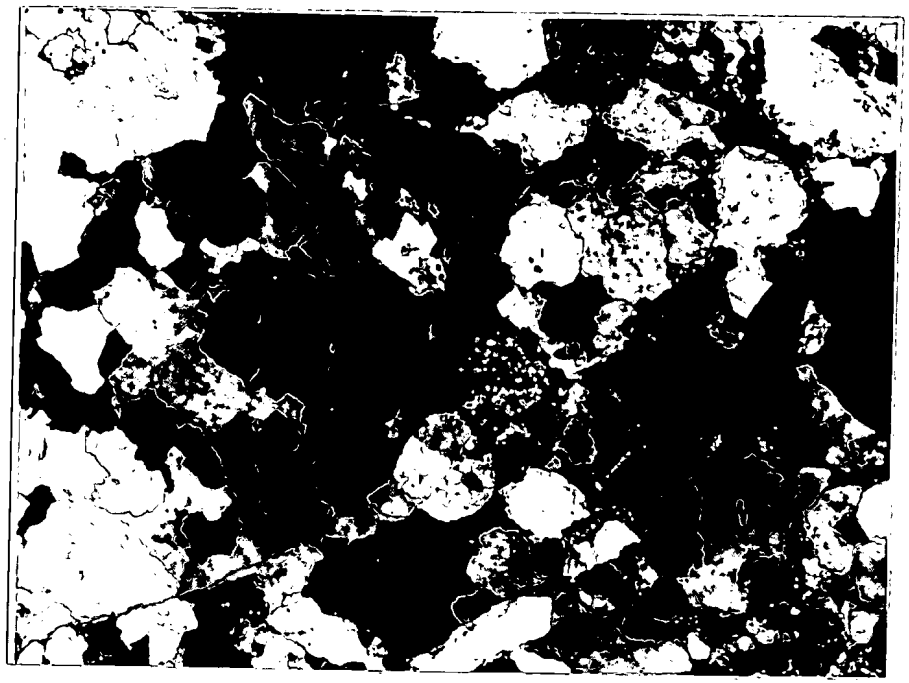


Figure 3 Corunna Conglomerate P90

Large pebble of quartz mosaics (left of photograph). Ferruginous chert (speckled - centre of photograph). Sutured quartz and chert make up matrix.

Crossed nicols Magnification X 12

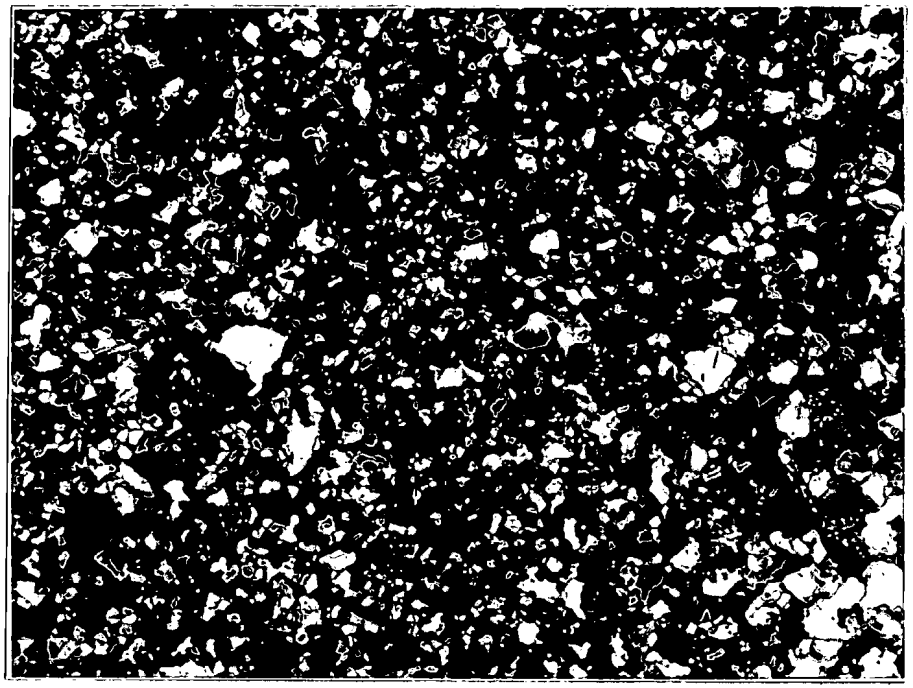


Figure 4 Corunna Conglomerate P91

Fine silty variety of the rock type. Sporadic large clasts of quartz rock fragments. Matrix of fine quartz and clay.

Crossed nicols Magnification X 13

3. CLASSIFICATION AND DISCUSSION

3.1 Moonabie Formation (P.95 and P.96)

3.1.1 P.95. This is a quartz wacke of mainly even grain with minor potash feldspar as well as abundant altering plagioclase and some fresh plagioclase. The typical resorption of quartz into illitic groundmass of greywackes (Ref. 1) is seen. Described as a tuffaceous sandstone or quartz wacke.

3.1.2 P.96. This is quite different from P.95 and should be put into a different subdivision. A conglomerate type rock with some quartz grains which are very rounded, occur, up to 2.5 mm. The matrix of illite, the volcanic clasts, presence of plagioclase, complete absence of potash feldspar and abundant heavy minerals are similar characteristics in P.95 and P.96. There may be chert grains in the P.95 rock of similar size to quartz grains but which are not easily recognisable because of resorption of grain boundaries.

Possibly these rocks are of similar mineral composition and provenance, and are of similar age, but texturally they are distinct and should be placed in distinct subdivisions.

3.2 Corunna Conglomerate (P.90, P.91, P.92, P.93 and P.94).

All specimens contain appreciable opaque mineral. Specimens P.91 to P.93 contain brown volcanic cherts, many of them similar to those seen in the Whyalla Sandstone but in the Corunna Conglomerate they vary from round to quite angular, probably depending upon the pre-diagenetic rock (quartz) fabric. Also in P.91 to P.93 quartz grains show a central rounded area of quartz with a subangular to angular diagenetic overgrowth of the mineral. The somewhat angular nature given by quartz overgrowths and irregular nature of grains in P.90, P.91 and P.93 are Pandurra Formation characteristics. However, the presence of abundant brown chert and volcanic clasts in

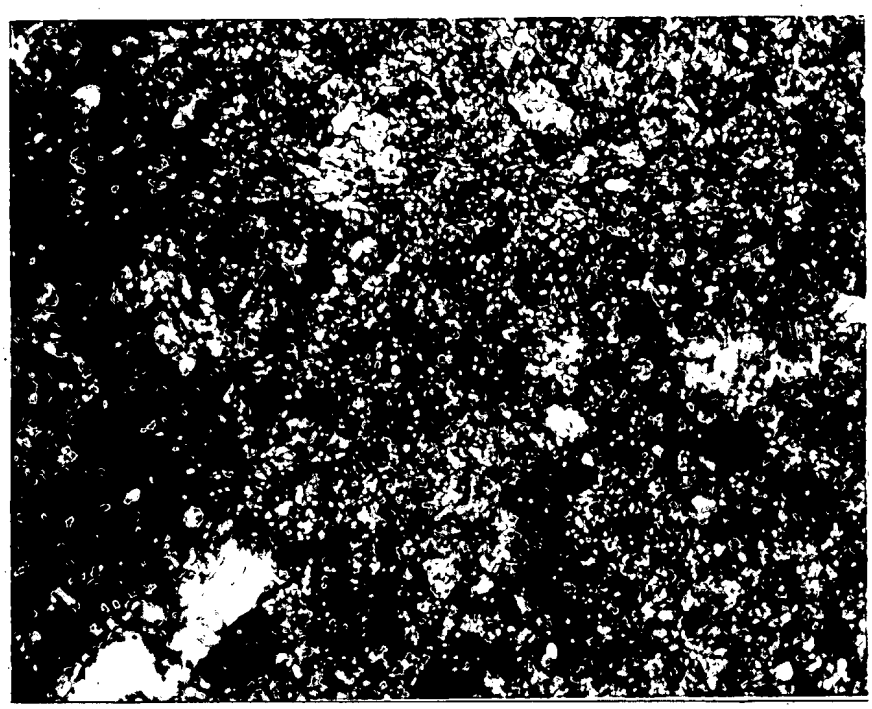


Figure 5 Gawler Range Volcanics P24

Kaolinised plagioclase phenocrysts (white, black specks) and some corroded quartz forms (white, smaller than feldspar phenocrysts). Groundmass is of clay mineral, secondary quartz and limonite with some large limonitised opaque minerals.

Crossed nicols Magnification X 16

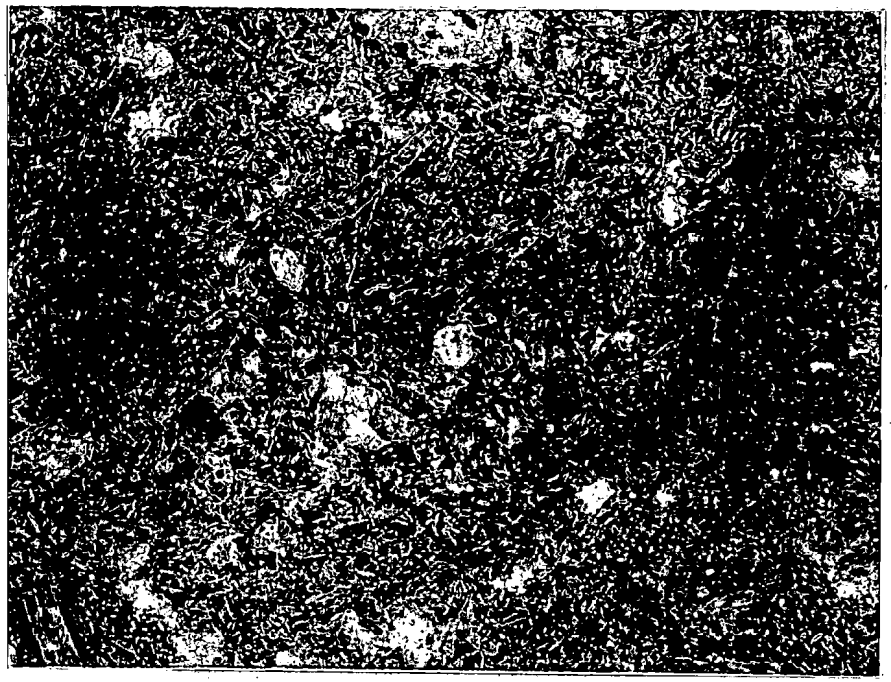


Figure 6 Roopena Volcanics P19

An altered mainly holocrystalline basalt. Phenocrysts and fine plagioclase occur. Vesicles of altered zeolite (?). Abundant opaque minerals are seen. Altered pyroxene shapes (centre).

Crossed nicols Magnification X 16



Figure 7 Roopena Volcanics (A9657 - Beda Bore Chip)

Decussate plagioclase and clusters of altered or part altered pyroxene (centre - white) with surrounding uralite (grey). Opaque mineral (black) is abundant.

Plain polarised light Magnification X 15

some specimens are characteristics of the Corunna Conglomerate facies, as in other quartzite rocks of the various stratigraphic series. None of the specimens could be called equigranular and are mainly grossly irregular.

The presence of abundant chert, volcanic clasts and original roundness of quartz and presence of appreciable opaque mineral are the essential primary characteristics of the rock suite.

The presence of microcline in some members may classify the specimens into potassic and non-potassic members, i,e. P.92 and P.94 potassic, remainder non-potassic.

Only one other subdivision is possible, i.e. by fabric - the more conglomeratic types P.90 and P.94 and the sandy members P.91 to P.93.

3.3 Gawler Range Volcanics (P.24)

For the one specimen examined, the description of an altered porphyritic andesite is sufficient. Although re-examination of the section shows as much as 7 to 10 percent of mainly secondary iron oxide present, and the quartz present is secondary, the rock remains a much altered porphyritic andesite, abundantly sericitised and argillised.

3.4 Roopena Volcanics (P.19, A9657 Beda-Bore Chip)

3.4.1 P.19. See original description (p9, Appendix I). A variolitic basalt of fine decussate plagioclase laths, large perfect single plagioclase phenocrysts and intergrowths of phenocrysts. Pyroxene shapes are filled with a greenish chlorite and chert. Vugs to 0.7 mm are now filled with secondary quartz and chert. All plagioclase (now albite?) is suffused with fine limonite. Iron oxides make up about 15 percent of the rock. An argillised variolitic basalt.

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P.24 is considerably more altered than P.19 and contains less iron oxide. Probably much of the groundmass of P.24 was glassy. There is evidence of a patchy variolitic texture of fine plagioclase laths but sericitisation has destroyed the overall fabric in P.19.

3.4.2 A9657 (Beda-Bore Chip). A hydrothermally altered dolerite showing a framework of decussate plagioclase, uralitised pyroxene and a little olivine replaced by serpophite, and corona structures of uralite around pyroxene or olivine shapes.

3.5 Pandurra Formation - Basal Section (P.11, P.12, P.18, P.20A, P.20B, P.22, P.25, P.49A, P.50B, P.86, P.87, P.88B, P.89, EX31A and EX31B).

3.5.1 P.11. Grains are rounded with authigenic angular overgrowths; quartz gneiss fragments, unsorted coarse rock fragments; occasional fresh microcline grains; ferruginous cherts are present but no volcanic types and rather unlike the ferruginous cherts seen in Whyalla Sandstone.

3.5.2 P.12. Similar to P.11 rounded quartz grains with authigenic quartz overgrowths; quartz gneiss rock fragments; large quartz rock fragment erratics; large rounded microcline grains are abundant. Many ferruginous cherts, round grains like those seen in Whyalla Sandstone. Closer to equigranularity compared with P.11.

3.5.3 P.18. More like Pandurra Formation as generally seen in Mount Gunson. Coarse subangular quartz grains, coarser than in P.11 and P.12; coarse fresh potash feldspars; abundant clear and ferruginous cherts; and tuffaceous looking clasts with some containing dispersed limonite particles and others dispersed fine magnetite.

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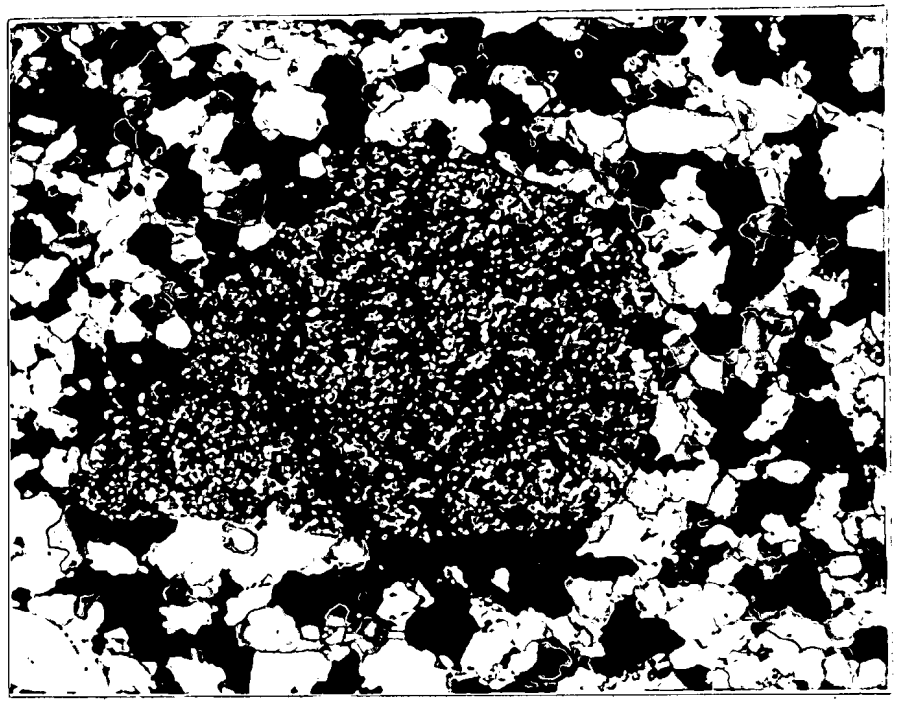


Figure 8 Pandurra Formation (Basal) P49 A

Fine silicified quartz mosaics with large rounded chert pebble (c.f. Elizabeth Creek Conglomerate)

Crossed nicols Magnification X 14

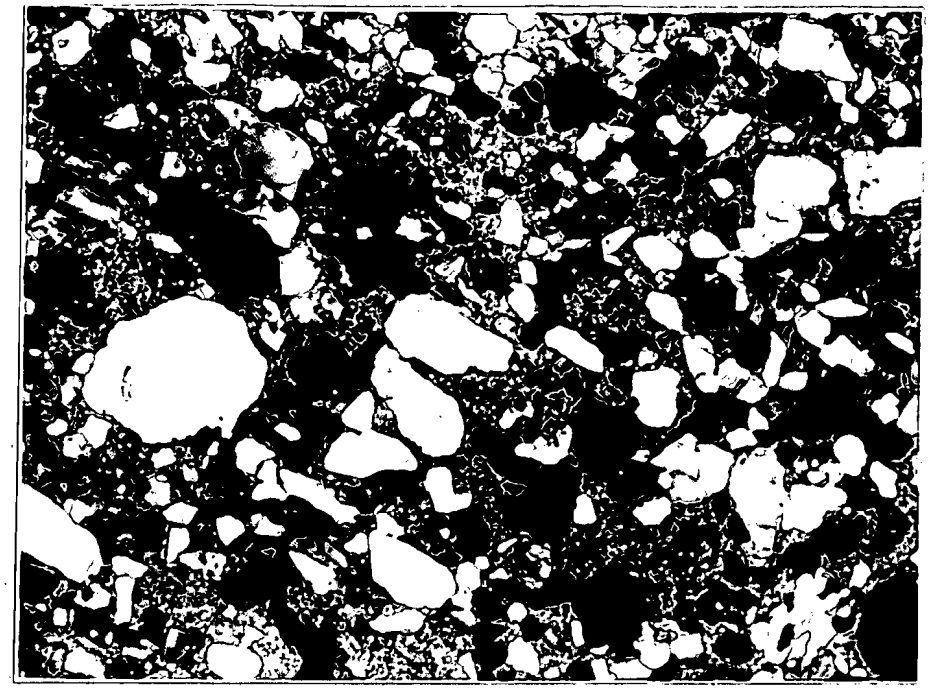


Figure 9 Pandurra Formation (Basal) P50 B

Very irregular quartz grain sizes. Quartz grain commonly rounded. Cherts present are speckled black and white. Clay mineral matrix (fine stipple)

Crossed nicols Magnification x 14

3.5.4 P.20A. As for P.18 but with coarse tourmaline grains. Coarse abundant potash feldspar occurs; a vermicular quartz grain; gneissose fragments of quartz; ferruginous chert (as per Whyalla Sandstone).

3.5.5 P.20B. As for P.18, P.20A, but with a coarser general grain size; abundant coarse potash feldspar; gneissose quartz rock fragments, quartz rock fragments, ferruginous cherts.

3.5.6 P.22. Like P.12. Fairly equigranular but rounded quartz grains with authigenic overgrowths of quartz. Difference from P.12 is the abundant fine cherty interstices in P.22. Possible ferruginous, tuffaceous, but altered rounded clasts occur as are seen in the Whyalla Sandstone at Mt. Gunson; few clasts present are clear.

3.5.7 P.25. Irregular quartz grain size and abundant cherts occur as large grains, many being ferruginous. Several medium-sized quartz grains were round but are now subangular with quartz overgrowths. No potash feldspar is seen, otherwise like P.18.

3.5.8 P.49A. Medium-sized, mainly equigranular quartz, shows some original very rounded forms now subangular with authigenic overgrowths and in this respect like P.12; rock is highly silicified. Large clasts occur scattered through the rock, these are round to subangular, contain fine silicified quartz mosaics and abundant fine magnetite and some limonite patchily. The clasts are similar to those seen in P.18 but are much larger here. There are similarities in quartz fabric and presence of rounded cherts to Elizabeth Creek Conglomerate specimens P.29.

3.5.9 P.50B. Abundant rounded and some subangular quartz mineral grains and rock fragments. The rounding

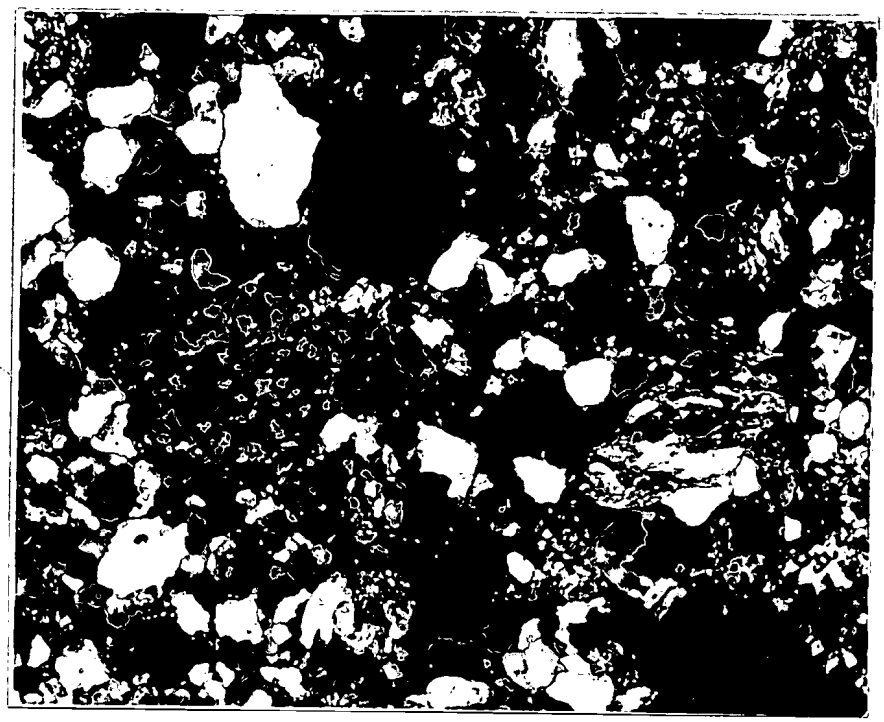


Figure 10 Pandurra Formation (Basal) P86

Quartz grains are rounded to angular and are distributed erratically. Pebbles of rounded chert (left of centre) and quartz grains (right of centre. Fine cherty quartz and clay mineral (some illite) constitutes the matrix.

Crossed nicols Magnification x 12

of the grains is due to absence of silicification overgrowths, there being abundant illite which constitutes the main matrix. There is rough sorting of grains into bands of irregular quartz as is seen in some Mt. Gunson Pandurra Formation specimens. Occasional ferruginous cherts are seen.

3.5.10 P.86. Very irregular grain sizes of quartz mineral grains and abundant rock fragments including large quartz gneiss grains. Many original quartz grains have authigenic overgrowths, ferruginous chert is abundant. Matrix is chert > clay mineral (some illite). Similar to P.25.

3.5.11 P.87. In appearance, between P.12 and P.22. Many rounded quartz grains of medium size show quartz overgrowth, some of the quartz are as spherical to those seen in Whyalla Sandstone at Mount Gunson. However, the grains are of irregular size and quartz rock fragments of rounded grains occur. Ferruginous cherts are fairly abundant and some micaceous cherts occur.

3.5.12 P.88B. Fairly regular quartz grains of medium size. Many rounded grains of quartz mineral and rock fragments but an abundance of subangular grains also occur. Ferruginous cherts are fairly abundant as are seen in Whyalla Sandstone at Mount Gunson. A moderate limonitic, illite matrix. Probably more like P.22 than any other specimen of the series.

3.5.13 P.89. A highly irregular quartzite of many rounded grains. A very rough banding of coarse and medium and of medium and fine grains is seen. Many ferruginous cherts occur; many rounded, some subangular. Something like specimen P.50B but here the matrix is more cherty. Groundmass is similar to P.86 and P.20A.

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3.5.14 EX31A. Fairly regular quartz grains, rounded and subangular with some potash feldspar grains. Abundant ferruginous chert grains. Similar to P.12 and P.11.

3.5.15 EX31B. Similar to some Yudnapinna specimens, fine regular grains, mainly subangular, includes quartz and potash feldspar; abundant ferruginous cherts and opaque mineral of similar size to cherts occurs. Abundant limonite and illite matrix are present.

The rocks have been divided into five groups :-

(a) Fairly regular grain size of largely quartz grains, many show rounded shapes (c.f. Whyalla Sandstone) before authigenesis. No banding. Usually with ferruginous cherts which are something like those seen in Whyalla Sandstone. Volcanic clasts are seen in some specimens. EX31A, P.11, P.12, P.22, P.87 and P.88B.

(b) Very irregular grain sizes and shapes of quartz grains, rock fragments (including quartz gneiss) also of abundant cherts including those seen in Whyalla Sandstone at Mount Gunson, ferruginous, micaceous and volcanic clasts; a little tourmaline may also occur. Potash feldspar is generally present. P.18, P.20A, P.20B, P.25 and P.86.

(c) Irregular sized quartz rock fragments and mineral grains commonly rounded, unsilicified with some banding of coarse/medium and medium/fine grains. Ferruginous cherts and some potash feldspar. Fairly clear rocks. P.50B and P.89.

(d) Rather like some Yudnapinna specimens, fairly regular grain size of subangular quartz, abundant potash feldspar and some opaques and ferruginous chert. Fine illitic matrix. EX31B.

(e) Like Elizabeth Conglomerate specimen P.29, equigranular, silicified quartzite with large chert rounded pebbles. P.49A.

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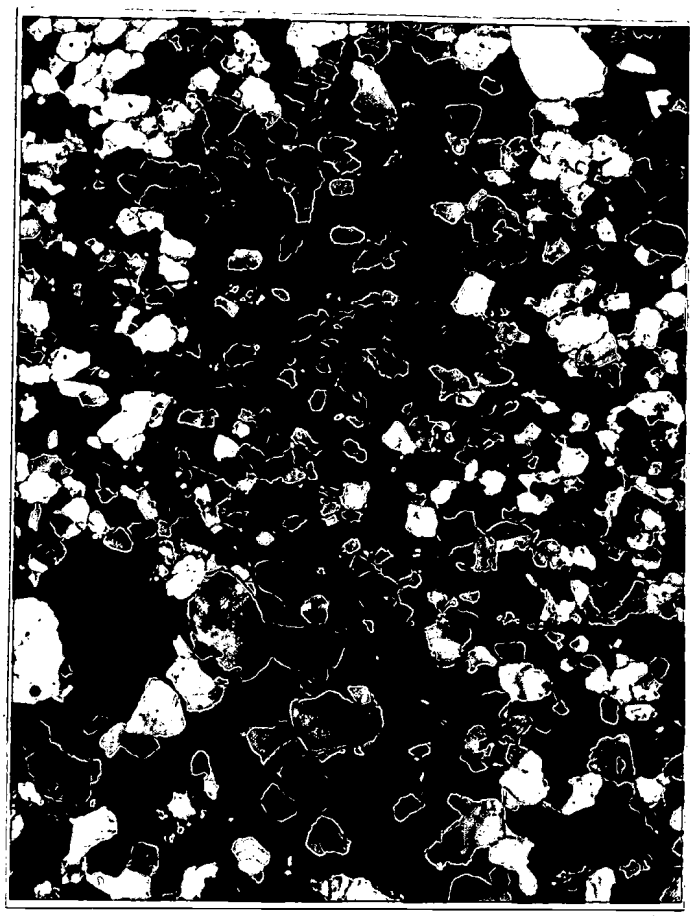


Figure 11 Pandurra Formation (Upper) P43

Coarse and fine bands of quartz are now mainly subangular partly through silicification. Occasional small chert grains (speckled) occur.

Crossed nicols Magnification x 15

3.6 Pandurra Formation - Upper Section (P.21, P.31, P.33, P.43, P.48, P.51B, P.53, P.58, P.67, P.83A, P.84B, - EX29-85584 and EX136-97217).

3.6.1 P.21. Like some Pandurra Formation specimens from Mount Gunson. A mainly regular, medium quartz grain size of round grains which have been enlarged by authigenic overgrowths. Sporadic quartz gneiss fragments and large quartz grains occur. A little zircon is seen.

3.6.2 P.31. Roughly banded of fine rounded quartz and cherts with coarse quartz (including rock fragments and gneiss), cherts (few ferruginous) and potash feldspar. The coarser grains are rounded.

3.6.3 P.33. Fairly even in grain size, rounded quartz mineral and quartz rock grains. Limonite as limited clayey interstitial mineral indicates some repetitive Liesegang banding.

3.6.4 P.43. A mixture of irregular (in size and shape) quartz mineral grains and rock fragments. Many grains are very round. There is a rough banding of mainly fine bands, but also of coarse, medium and fine quartz bands. Authigenesis has changed the shape of many round grains to subangular. Limonite occurs clearly at grain boundaries locally.

3.6.5 P.48. Like P.43 though the fine banding has fewer quartz erratics.

3.6.6 P.51B. Like P.43 and P.48 though less fine quartz and more large coarse quartz grains (and ferruginous chert as per Whyalla Sandstone) are intermixed with finer quartz.

3.6.7 P.53. A groundmass of medium-grained, rounded > subangular quartz, with authigenic overgrowths as seen

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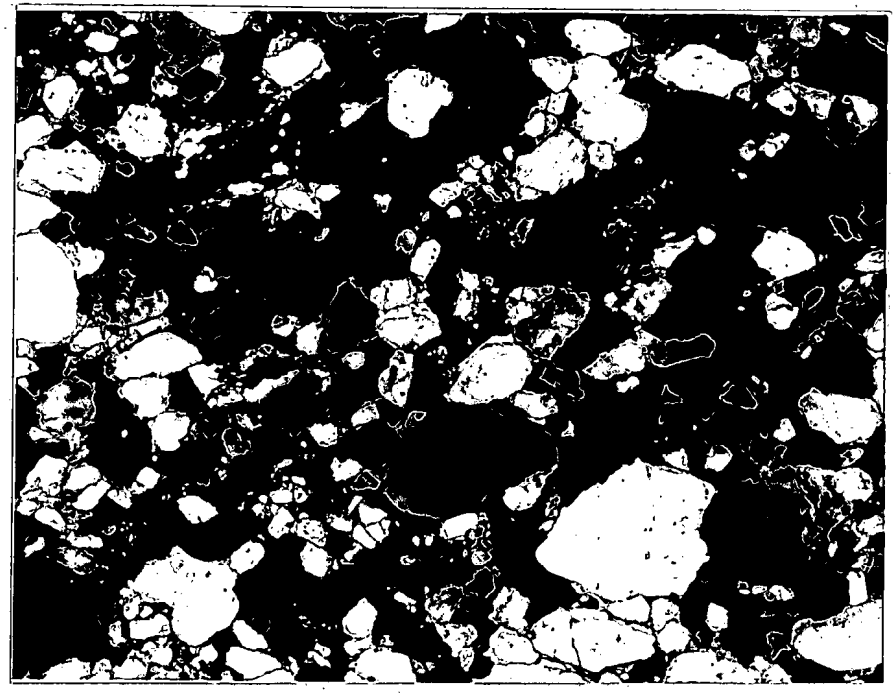


Figure 12 Pandurra Formation (Upper) P58

Grains of quartz are rather irregularly shaped and only vaguely banded. Many 'pebbles' occur. A little clay mineral occurs between quartz grains.

Crossed nicols Magnification x 16

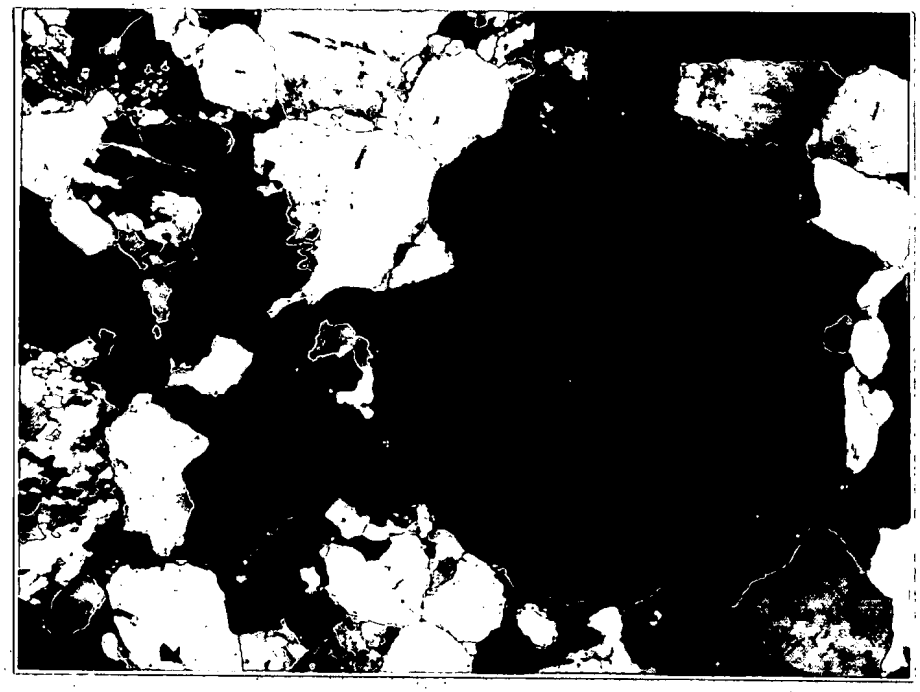


Figure 13 Pandurra Formation (Upper) P83 A

Very pebbly or conglomeratic with rounded quartz and chert grains (bottom, left corner).

Crossed nicols Magnification x 16

in P.51B, etc., but large and medium ferruginous cherts and volcanic clasts occur. These are somewhat similar to those seen in Whyalla Sandstone at Mount Gunson.

3.6.8 P.58. More like Pandurra Formation from the basal sequence (P.49A and P.18), unsorted, irregular, grain sizes and very round to subangular quartz, quartz gneiss, medium and large cherts including many ferruginous types; highly silicified.

3.6.9 P.67. Very similar to P.51B except that in P.67 there is more limonite between quartz grains. Quartz gneiss grains occur.

3.6.10 P.83A. Resembles the individual coarse bands of P.31. The coarse quartz is rounded and many smaller grains occur scattered within the 'band'. Quartz gneiss is seen.

3.6.11 P.84B. A very cherty rock but many of the original quartz grains and rock fragments are quite rounded and some rock fragments are large. The rock is quite similar to P.18 of the basal Pandurra Formation sequence except that the latter contains coarser chert and quartz grains.

3.6.12 EX29-85584. A fairly clean medium-grained unsorted quartzite containing many rounded quartz grains, a few rounded micaceous/ferruginous cherts and round to angular quartz gneiss grains. Somewhat similar to P.51B texturally.

3.6.13 EX136-97217. Variable drill fragments. Many fragments resemble the Pandurra Formation as seen in P.51B. However, a few have been ferruginised and are finer grained with larger quartz erratics scattered through the groundmass and others are mixed medium and

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fine angular quartz and round ferruginous chert and a ferruginous cement.

The upper Pandurra Formation specimens are divided into the following classification :-

(a) Coarse and fine bands of quartz mineral grains, rock fragments (including quartz gneiss). The bands are of coarse to fine and the finer bands are of medium to fine quartz. The rocks are mainly silicified and many coarse and fine grains are rounded, other grains are subangular and angular. P.31, P.43, P.48, P.51B, P.58, P.67, EX136-97217*.

P.31 and P.58 differ from this group in containing easily identifiable volcanic clasts.

(b) Similar to (a) but completely unsorted grains - no banding, faintly cherty in 85584. P.83A, 85584.

(c) Finer grains generally than (a) but 'clean' as in (a) and many grains were round before silification. Scattered quartz erratics (grains and rock fragments) occur in the finer grained 'matrix'. Some clay mineral in interstices - patchy. P.21 and P.33. P.21 is slightly ferruginous, cherty. P.33 has Liesegang rings of iron oxide.

(d) These specimens differ from those in groups above in being rather cherty, particularly with ferruginous chert and contain more than usual volcanic clasts.

However, P.53 contains coarse chert and volcanic material and P.84B contains more coarse quartz and less chert. Both rocks are unsorted.

Unfortunately the classification of Pandurra Formation is not easy. There are certain resemblances between the Upper and Lower Pandurra Formation Groups.

* contains mostly fragments of subdivision (a).

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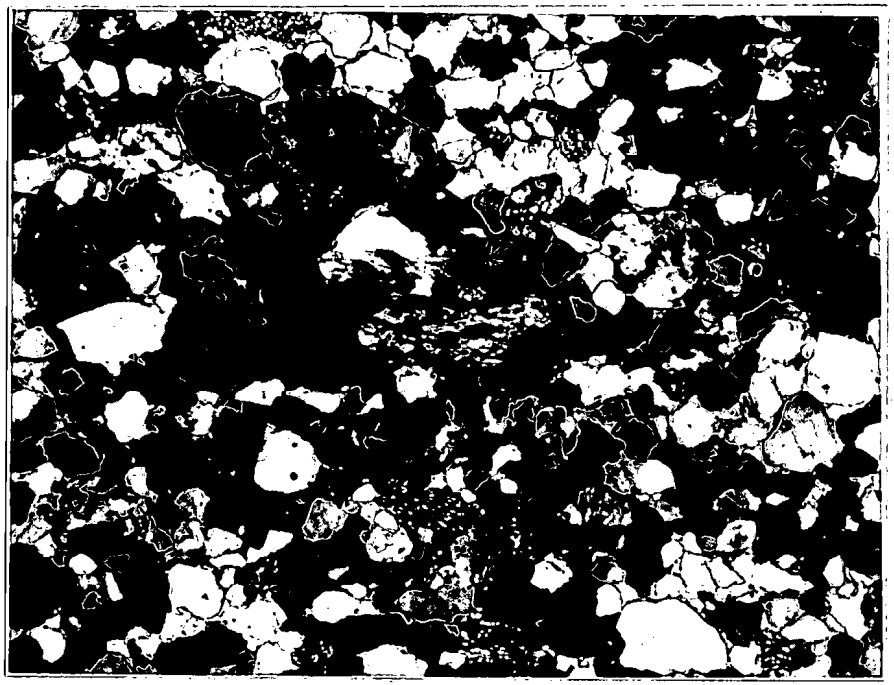


Figure 14 Elizabeth Creek Conglomerate P9

Rounded and subangular quartz mineral grains and rock fragments. Similar in fabric and mineralogy to Pandurra Formation (Basal)

Crossed nicols Magnification x 15

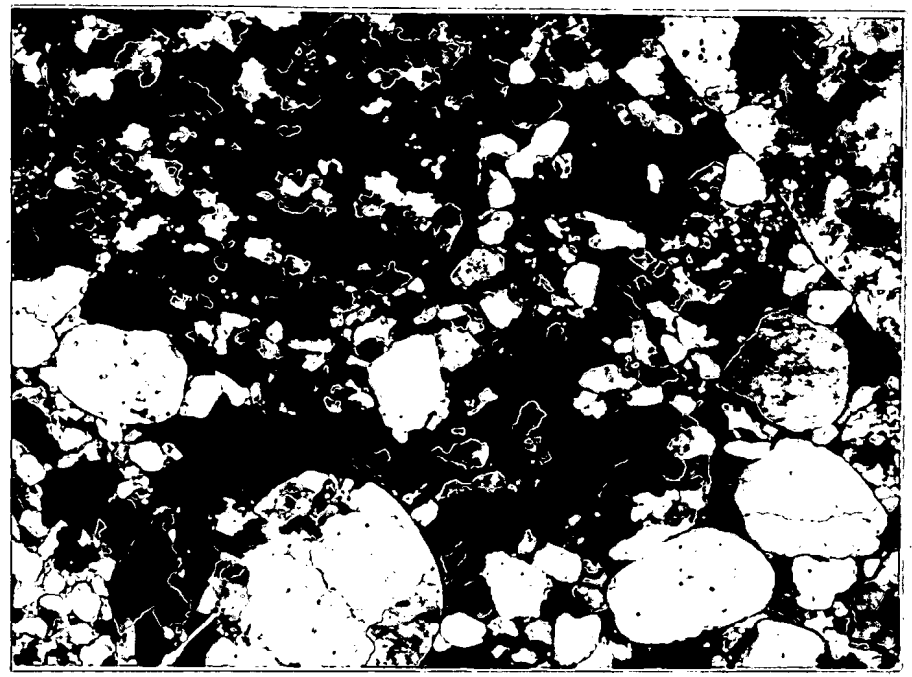


Figure 15 Elizabeth Creek Conglomerate P27

Coarse round conglomerate grains derived from Pandurra Formation (Upper).

Crossed nicols Magnification x 12

For example, between Pandurra Basal (b) and Upper (d) groups. Both are very cherty and unsorted; both contain ferruginous chert and volcanic clasts. Possibly the Upper (d) group is rather more quartzose and the less cherty of the two groups.

Generally, it may be said that the Upper group is more quartzose, possibly shows some semblance of sorting, mainly contains less volcanic material and ferruginous chert, contains fewer quartz gneiss fragments, contains no potash feldspar, and is generally (but not in all cases) more silicified.

3.7 Elizabeth Creek Conglomerate (P.2, P.3, P.9, P.27, P.29, P.57A and EX88-86545).

3.7.1 P.2. Coarse, somewhat rounded fragments of even-grained (Upper?) Pandurra Formation. An irregular quartz mineral grain and rock fragment matrix with fine quartz and limonite cement, with less clay mineral and carbonate cement.

3.7.2 P.3. In appearance a Pandurra Quartzite specimen rather like P.20A and P.12 (Basal) with a fairly even medium to fine grained quartz component and round ferruginous cherts and quartz gneiss fragments.

3.7.3 P.9. In appearance a Pandurra Quartzite specimen similar to P.20A and P.12 (Basal) as for P.3 except that in the section there is one large ferruginous chert erratic grain.

3.7.4 P.27. Coarse conglomerate grains of Upper Pandurra Formation, silicified equigranular quartz and some recrystallised quartzite pebbles showing abundant sutured grains. Other pebbles are of quartzite gneiss. A matrix of fine quartz and limonite occurs between the pebbles which are mainly of oblong shape with rounded corners.

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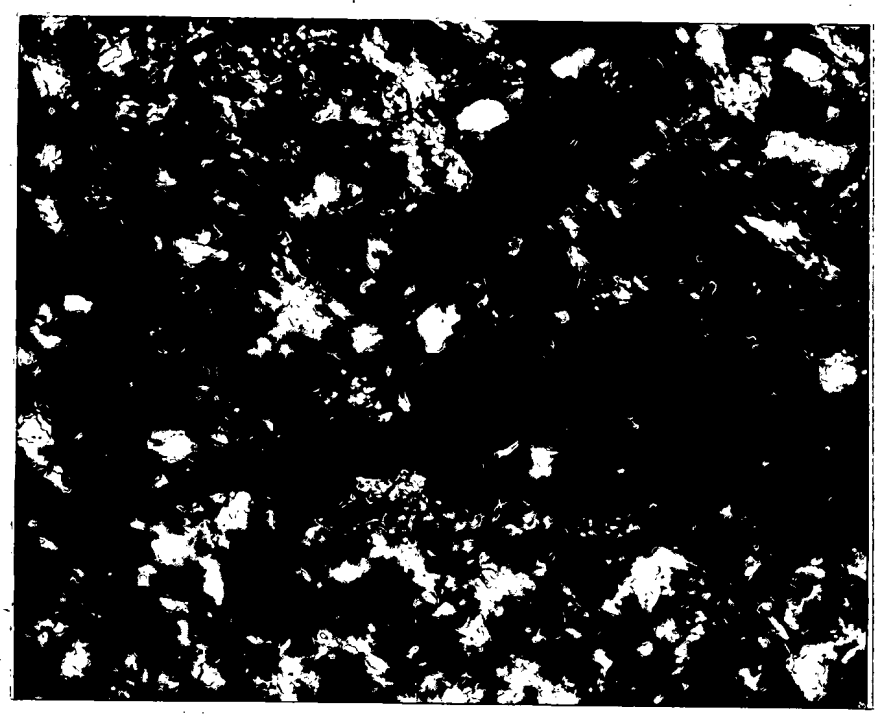


Figure 16 Woocalla Dolomite (shale) P28

Banded shale, of mainly dolomite (mottled white and grey), and kaolinite (black speckled with white); less quartz as granules (milky grey) and medium sized to small opaque minerals (black with sharp outlines) occur.

Crossed nicols Magnification x 400

3.7.5 P.29. Rather like the matrix of rounded quartz and ferruginous cherts of Pandurra Formation P.49A (Basal). Large rounded cherty clasts are seen in both.

3.7.6 P.57A. There are definite resemblances with P.31 of the Upper Pandurra Formation. This is shown by the silicified authigenic overgrowths, round quartz and large clasts of silicified quartzite and chert of rounded to rounded/oblong appearance which are of similar size to those seen in P.31.

3.7.7 EX88-86545. Various pebbles, of granite (adamellite), dolerite, basalt and one which looks curiously like one Yudnapinna Beds specimen (e.g. P.46), and also curiously like a Corraberra Sandstone specimen from Mt. Gunson (see Appendix) where many grains are curiously oblong, there is an abundance of opaque oxides and appreciable potash feldspar present in this fragment.

The Elizabeth Creek Conglomerate is subdivided according to the origin of large rudaceous fragments of Pandurra Formation in a matrix of weathered(?) Pandurra Formation which are seen in P.2, P.3, P.27, P.29 and P.57A. Otherwise and at the same time (e.g. P.29 and P.57A), the rocks have a fabric which resembles respectively the Basal or Upper Pandurra Formation rocks in the scheme or as in the specimen EX88-86545 the pebbles are of Roopena Volcanics and Granite? and could be a conglomerate resting on (formed from?) or transported from the Roopena Volcanics or elsewhere? See Summary, 2.6.

3.8 Woocalla Dolomite (P.28, P.34, P.35, P.52, EX50 (20 m), EX139-97275, EX143-97342, EX147-97404 and EX 149-97427).

3.8.1 P.28. A banded shale of fine kaolinite > carbonate granules > muscovite flakes > quartz granules. A little limonite (after pyrite) also occurs. Presumably Woocalla Shale.

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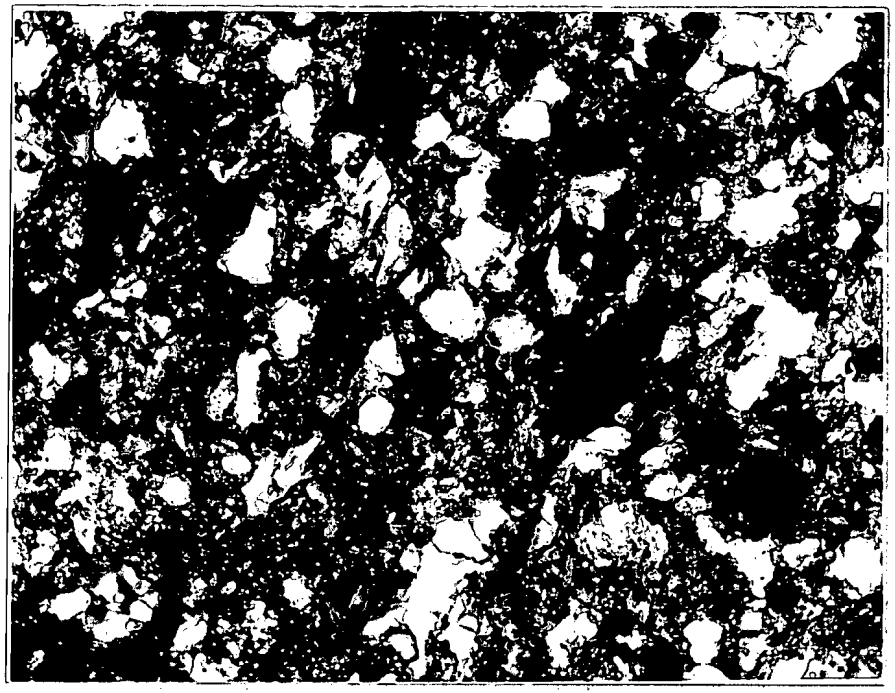


Figure 17 Woocalla Dolomite (siltstone) P35

Fairly even grained quartz in abundant sericite, chlorite and limonite matrix with a little granular carbonate.

Crossed nicols. Magnification x 105



Figure 18 Woocalla Dolomite (mainly dolomite) Ex 50 (20 m

Fine carbonate (grey-white stippled) with limonite laminae (dark grey). Aggregates of limonitised pyrite (black) and detrital quartz (white grains).

P.P.L. Magnification x 80

3.8.2 P.34. Mainly fine-grained, subangular quartz with patchy welded mosaics, potash and plagioclase feldspar grains of similar size occur, ragged green-brown chlorite, muscovite flakes, micaceous chert and patchy limonite. Appreciable transparent heavy minerals (zircon, sphene, etc.) occur. The mineral originally identified as biotite is probably chlorite. The rock is probably not Corraberra Sandstone as previously identified and could well be an arenaceous facies from the Woocalla Dolomite.

3.8.3 P.35. Is looked-at in conjunction with P.34; apart from the heavier oxidation the quartz grains though somewhat smaller are just as angular. There is a little carbonate here not seen in P.34 and the potash feldspar noted in P.34 is present in this specimen altered, as clots of sericite. May be related to P.34.

3.8.4 P.52. A weathered fine-grained dolomite which may now be partly calcite. Manganese has segregated from altering dolomite, and jointing contains manganese dioxide, limonite and cherty quartz. No baryte could be identified.

3.8.5 EX50. A black laminated shale in hand specimen. A sedimented fine carbonate rock with laminae defined by fine limonite (probably after syngenetic pyrite) laminae as fine spheres and aggregates which may well have been pyrite framboids originally, and some detrital quartz. Unlike P.28, lithologically more like P.52.

3.8.6 97275. This section consists of mounts of percussion drill fragments of several lithological types. Most fragments are of banded fine carbonate intermixed with fine kaolinite and fine and coarse detrital quartz. The banding is emphasised by limonite (once, thin syngenetic pyrite) horizons. Other mounts show almost

pure carbonate with Collenia(?) growths. This section shows similarities with and/or transitions between all types shown so far of the Woocalla Dolomite. One syenite grain as a rounded fragment (orthopyric) 2 mm in size, is seen.

3.8.7 97342. Dolomite and quartz fragments are set in dolomite and calcite cement. A little detrital quartz also occurs. Dolomite is specked by a little opaque mineral, including some angular opaque fragments. Dolomite breccia is cemented by carbonate.

3.8.8 97404. The rock consists of a crenulated, banded dolomitic shale with quartzose bands. Where dolomitic and kaolinitic, fine limonite (after pyrite) streaks of aggregated spheres indicate original bedding. The larger quartz grains in bands are oblong, angular and rounded and have a matrix continuous with the clayey bands. The quartz grains are highly irregular in size, varying to 0.6 mm.

3.8.9 97427. Quartz grains vary to 1.2 mm as rock fragments of mineral grains; fine clear cherts and ferruginous cherts (to 0.5 mm) occur in a fine carbonate or cherty cement. Shapes of the grains are mainly oblong to rounded and some mounted fragments are very like Pandurra Formation specimens examined in this report. Carbonate breccia (recemented 97342) and angular quartz set in carbonate matrix (see 97404). Large ferruginous cherts (1.2 mm) as seen in Whyalla Sandstone also occur.

The Woocalla Dolomite specimens may be classified into the following subdivisions :-

(a) the mainly fine dolomite, with or without much limonitised pyrite, and one brecciated specimen. P.52, 97342 and EX50.

(b) the quartzose, cherty, chloritic sandstones/ siltstones. P.34 and P.35.

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Figure 19 "Magazine Hill Clay" P85

Mobilised kaolinite with illite and less fine detrital quartz and chert. Limonite staining emphasises banding. Some microfaulting of bands is seen.

P.P.L. Magnification x 12

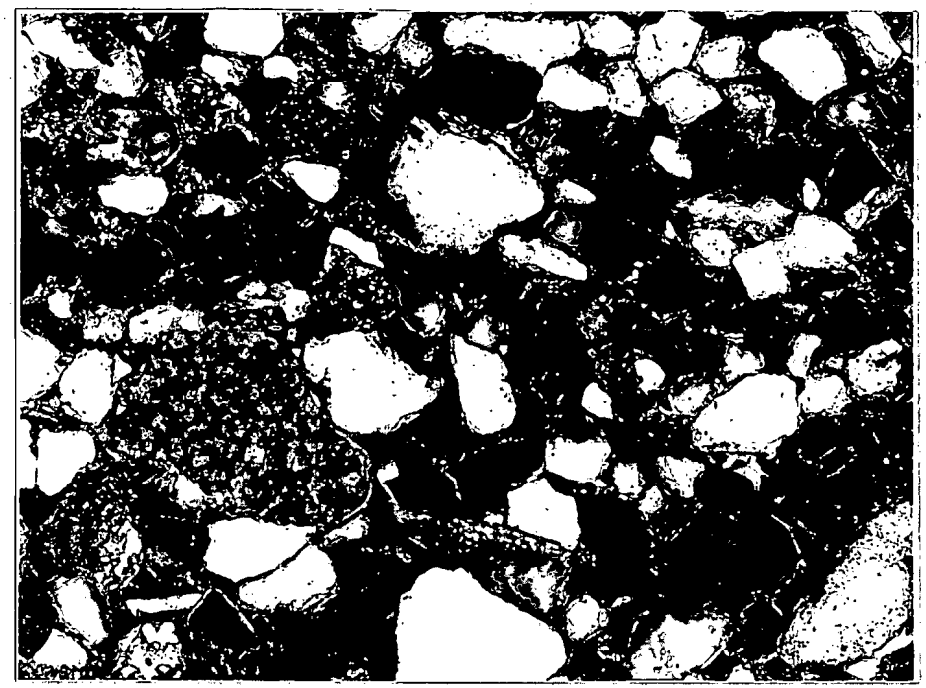


Figure 20 Yudnapinna Beds P65

Rounded to subangular grains of quartz occurs in a variable but mainly cherty and minimal kaolinite matrix (c.f. Appendix description). A volcanic cherty clast is seen left of centre.

Crossed nicols Magnification x 103

(c) quartzose bands, clay and/or carbonate matrix and bands, with altered volcanic (basaltic?) fragments (97427).
P.28, 97275, 97404 and 97427 (majority of mounted fragments).

3.9 Magazine Hill Clay (P.6A, P.6B, P.81 and P.85)

3.9.1 P.6A. This is very similar to the Woocalla Dolomite specimens P.34 and P.35 with angular quartz and chlorite and also is texturally similar. The groundmass has been partly chertified. Erosion of the quartz boundaries in the mosaic gives the grains an angular breccia appearance. Patchy clay mineral present may be altered feldspar.

Possibly this rock is Woocalla Dolomite?

3.9.2 P.6B. Except for absence of carbonate this clayey rock is very similar to P.28 of the Woocalla Dolomite (Shale) group. The curious looking fibrous chlorite/clay mineral present in some members of the Woocalla Shale (or Silt) group is also present. Silty quartz and chert are present.

Possibly Woocalla Dolomite?

3.9.3 P.81. Fine kaolinitic clay spotted with illite and quartz. No structures occur.

3.9.4 P.85. There is strong textural resemblance to P.28 except that the latter contains carbonate and the former shows mobilisation effects and is heavily oxidised. There is a similar content of detrital quartz and chert.

Possibly Woocalla Dolomite?

This leaves only P.81 as a definite(?) Magazine Hill Clay.

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3.10 Yudnapinna Beds (P.40, P.65, P.65A, P.41A, P.46, EX11-85235, EX11-85271, EX36-85713, EX37-85739, EX43-85846, EX44-85893, EX96-86645, EX142-97325 and EX146).

3.10.1 P.40. Mainly subangular quartz of marginal siltstone/sandstone grain sizes with scattered erratics of somewhat larger quartz grains and rock fragments which are generally round. Micaceous and ferruginous rounded cherts as seen in Whyalla Sandstone occur, appreciable rounded potash feldspar grains and a little plagioclase. A sprinkling of large rounded tourmaline, magnetite and zircon grains. A little illite as interstitial matrix occurs.

3.10.2 P.65. Similar mineralogically and texturally with P.40. Minimal kaolinitic matrix, no obvious feldspar, but volcanic clasts occur.

3.10.3 P.65A. Coarser, more rounded, more even quartz grains of sandstone sizes, round volcanic clasts, ferruginous cherts. Possibly more like basal Pandurra Formation?

3.10.4 P.41A. Quite like P.40, grains subangular > angular of borderline siltstone/sandstone size. Large erratics of sandstone quartz, subangular and rounded shapes occur. A scattering of rounded large opaques and some tourmaline and zircon. Potash feldspar and ferruginous chert (like Whyalla Sandstone type) occur as round erratics. Chert and clay occupy the interstices.

3.10.5 P.46. Like P.34 (Woocalla Dolomite facies) in heavy mineral abundance (P.46 - tourmaline and zircon as unworn large grains) and presence of appreciable fresh potash feldspar grains, a little plagioclase, also presence of orange-brown fibrous chlorite. The quite angular quartz is fairly equigranular but is surrounded by kaolinite and chloritic clay and some ferruginous

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chert. The abundance of potash feldspar shows some similarity with P.40. The rock thus shows similarities with Woocalla Dolomite and only vaguely shows similarities with some Yudnapinna Beds specimens. Siltstone/sandstone subangular to angular quartz grains, abundant potash feldspar (to 2 percent), abundant carbonate matrix; a little part rounded yellow-green pleochroic tourmaline. Other fragments show a similar quartz fabric except for rounded large quartz rock fragments erratics and limonite carbonate cement, small cherts are fairly common.

3.10.6 EX11-85235. A siltstone/sandstone of subangular to angular quartz grains, abundant potash feldspar (7 percent), abundant carbonate matrix. A little pleochroic part-rounded yellow-green tourmaline occurs. Other mounted fragments contain rounded quartz rock erratics and limonite/carbonate matrix. Small chert grains are fairly common.

3.10.7 EX12-85271. Very like EX11-85235 but some clear twinned oligoclase grains are also present, carbonate matrix. Some mounted fragments show large quartz erratics and have limonite/carbonate matrix.

3.10.8 EX36-85713 (Polished Section only). Apparently similar to 85235 with quartz mineral grain and rock fragment erratics scattered among silt-size quartz in abundant matrix.

3.10.9 EX37-85739 (Polished Section only). Mounted fragments of siltstone similar to 85235 with mainly hematite or limonite or cherty cement.

3.10.10 EX43-85846 (Polished Section only). Similar to 85235 with rounded quartz erratics in fine silty quartz matrix.

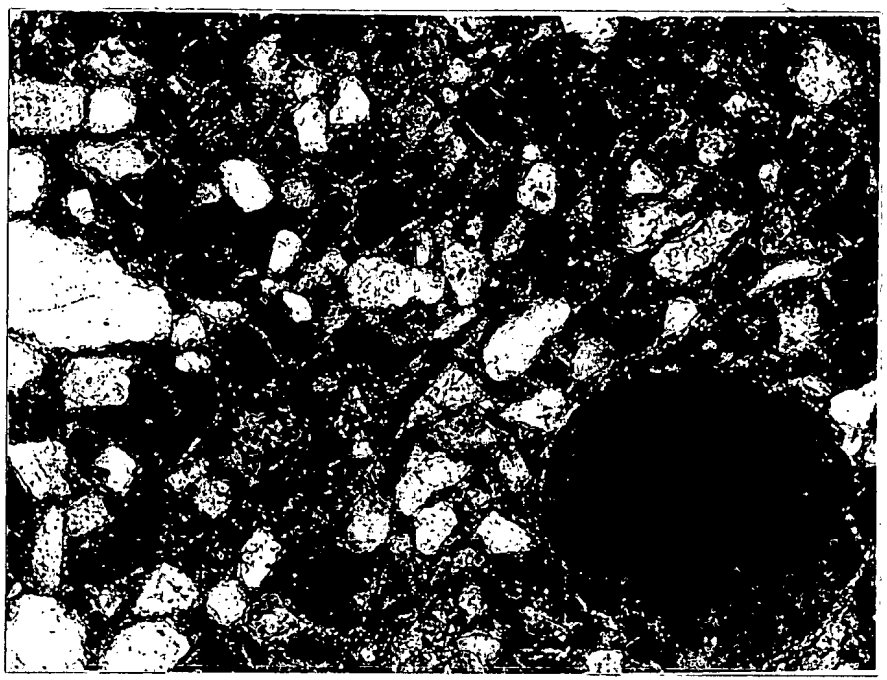


Figure 21 Yudnapinna Beds. Ex 96 - 86645
27 to 30 m.

Large round quartz grain (bottom) right corner. Silt size angular quartz and feldspar as smaller grains. Matrix is cherty rather than kaolinite. (See Appendix).

Crossed nicols. Magnification x 90

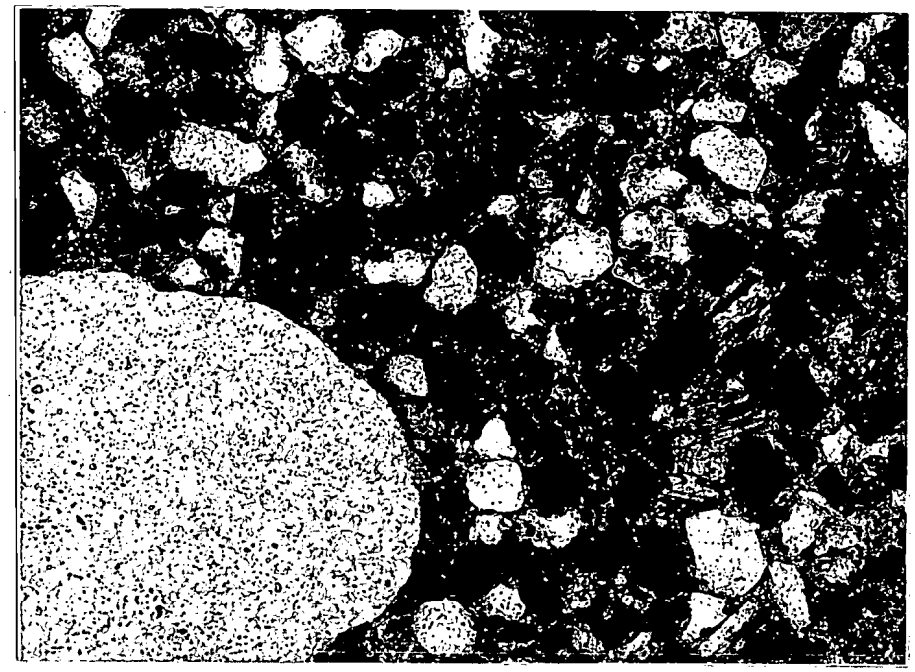


Figure 22 Yudnapinna Beds. Ex 142 - 97325
42 to 45 m.

Large round quartz grain (bottom, left). Rounded to subangular silt-sized quartz, potash feldspar (faintly stippled) and oligoclase (twinned). Fine matrix of illite and carbonate.

Crossed nicols. Magnification x 90

3.10.11 EX44-85893. Minimal carbonate in interstices; siltstone/sandstone grains are rounded, rounded oblong and subangular quartz grains; abundant potash feldspar and a little decomposed plagioclase, ferruginous cherts, volcanic clasts and spherical quartz large erratics. A sprinkling of round magnetite grains, amber pleochroic part rounded tourmaline and zircon of similar 'silt-size'. Broadly similar fabric to P.40 with minimal groundmass, but groundmass in 85893 is carbonate rather than illite as in P.40.

3.10.12 EX96-86645. Similar to 85271, but the matrix is cherty and limonitic rather than carbonate, fine silty subangular to angular quartz, potash feldspar and oligoclase, but opaques are abundant in 86645 as are ferruginous cherts.

3.10.13 EX142-97325. Very similar to 85271 and 85235 with silty, angular to rounded silt-size quartz, potash feldspar and oligoclase, rounded micaceous chert. Erratics are of spherical quartz, ferruginous cherts and altered possible basaltic grains. Lenticles of carbonate occur in one mounted fragment. Abundant rounded, silt-size magnetite and some amber-green pleochroic part-worn tourmaline, zircon and rutile grains occur. Interstitial mineral is carbonate > illite > limonite.

3.10.14 EX146. Probably more similar to 85893 in that quartz grains are slightly larger and more rounded than similar to the finer, dirtier 85235 group as stated in the original petrographic report on the thin-section. The large, rounded quartz erratics, abundance of fresh potash feldspar, ferruginous cherts and some volcanic clasts, tourmaline (part-worn, amber-green) and zircon occur. There is not very much worn silt-size magnetite present.

Yudnapinna Beds specimens are classified as follows :-

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(a) This section shows a broad group of specimens with silt-size quartz with or without large rounded erratics of quartz, feldspathic grains and some ferruginous chert. An abundance of heavy minerals (particularly magnetite) is also noted. A rock cement of illite, carbonate or limonite is present.

The section is split into two sub-groups :-

i) Fine angular to subangular quartz and abundant 'cement' matrix, normally large spherical quartz erratics and some subangular grains occur as large erratics. Occasionally ferruginous cherts of volcanic clasts occur as large (0.5 to 1 mm) erratics. 85235, 85271, 85713, 85739, 85846, 86645 and 97325.

ii) Coarser silt/sandstone, round to subangular, rounder quartz mineral grains than are seen in i). Less interstitial rock cement and rounded to subangular erratics (to 2 mm) of quartz grains, quartz rock fragments, ferruginous chert, clear cherts and commonly altered volcanic clasts. Coarser bands of round to subangular quartz (0.1 to 0.5 mm) may occur with little intermingling silt-size quartz (P.65 and 85893). These bands vary from 0.5 to 3 mm thick and grade into the mainly silty bands. The rock cement is mainly cherty or illitic and is sparse. P.40, P.41A, P.65, EX146 and 85893.

(b) Subangular, equigranular quartz with abundant cherts; some chlorite, and chert and clay mineral as abundant rock cement. Heavy mineral and feldspar abundance. May not be Yudnapinna Beds and resembles some specimens of Woocalla Dolomite facies. P.46.

(c) Rounded equigranular quartz, fewer subangular grains and a marked resemblance of quartz fabric and presence of ferruginous chert to Pandurra Formation rocks of basal (a) group (P.11, P.22 etc.). P.65A.

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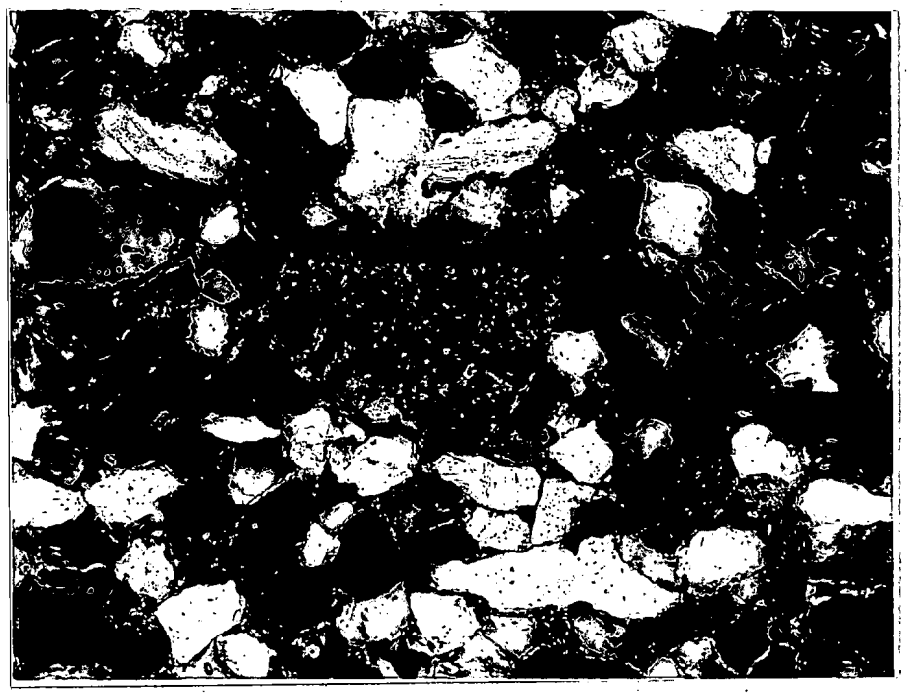


Figure 23 Whyalla Sandstone P51

Quartz grains are roughly bimodal (not seen too well at this high magnification) but many grains are rounded with projecting authigenic overgrowths. One large chert occurs in centre of photograph.

Crossed nicols Magnification x 96

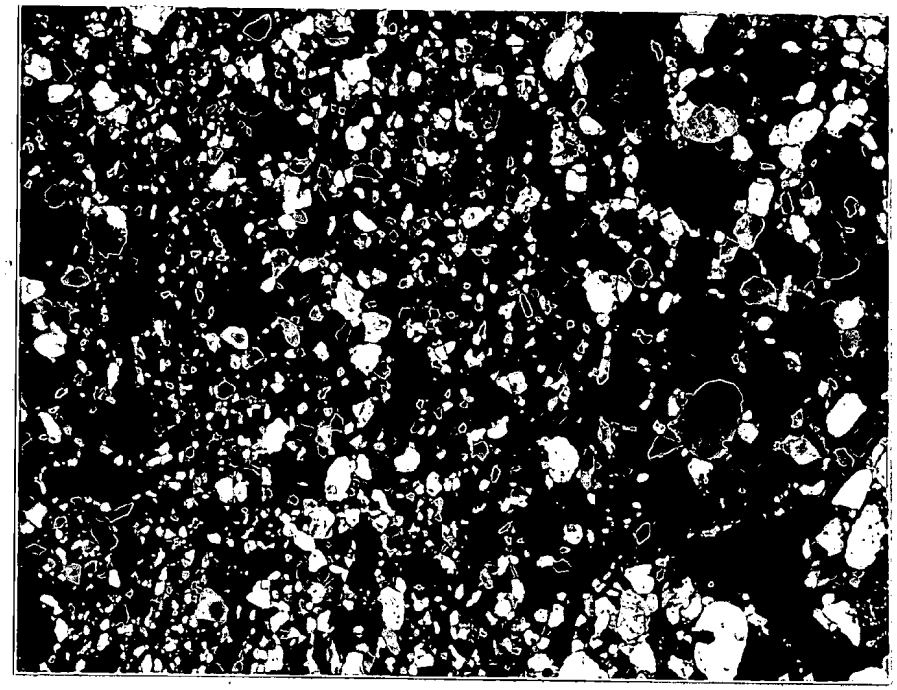


Figure 24 Whyalla Sandstone P60

Bands of mixed coarse and fine rounded quartz grains. Careful scrutiny will reveal speckled ferruginous chert grains.

Crossed nicols Magnification x 15

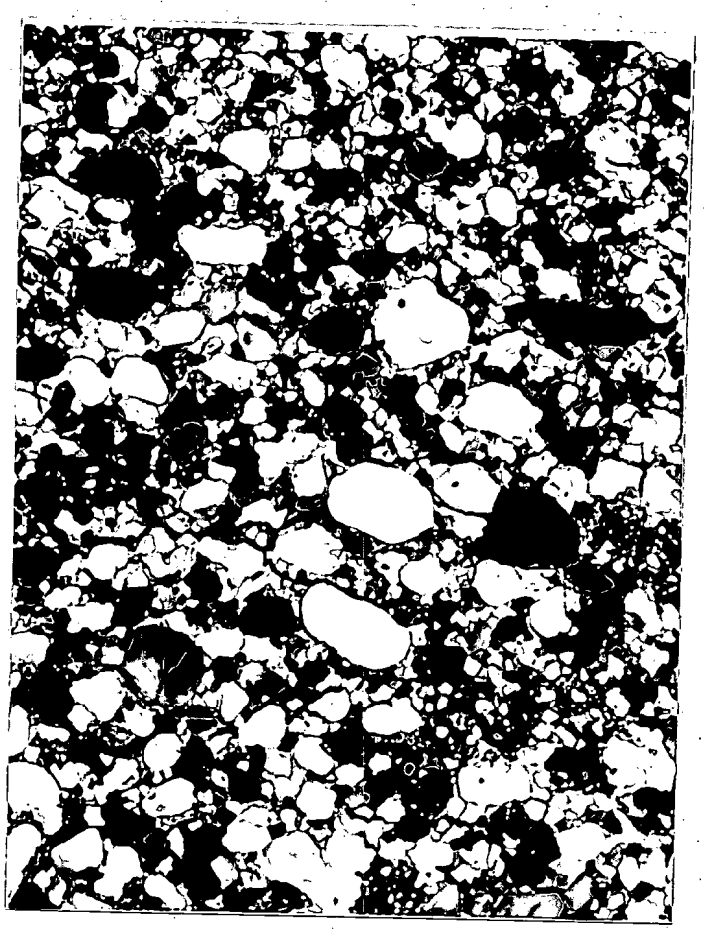


Figure 25 Whyalla Sandstone P66

Large round quartz grains tend to be spherical or flat-round. Silt-size quartz and clay mineral occur in the interstices.

Crossed nicols Magnification x 14

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3.11 Whyalla Sandstone (P.51, P.56, P.60, P.66, EX137-97229, (transitional to Yudnapinna Beds) and EX140-97292.

3.11.1 P.51. This is a quartz rock of subrounded to subangular quartz grains of sandstone size. There is a rough two modal distribution of few large subrounded quartz mineral grains and finer (approaching silt-size) more angular grains. A little fresh microcline occurs. Ferruginous cherts of variable size are common and are usually rounded. Magnetite and unworn zircons of silt-size occur. Interstitial clay mineral is appreciable. Fabric resembles group a(ii) of Yudnapinna Beds.

3.11.2 P.56. Larger quartz grains than for P.51 and more rounded (some appear spherical). A limited silt-size quartz and ferruginous chert matrix occurs of rounded grains but many grains were silicified into cherty masses. Ferruginous and micaceous cherts are common and some are undoubtedly altered volcanic (basaltic and tuffaceous) clasts. Rounded clear cherts also occur. Sporadic silt-size magnetite grains are seen and fairly unworn grains of zircon, tourmaline and a little sphene.

3.11.3 P.60.* In places very like P.51 with large, rounded quartz grains and a finer silt-size matrix of quartz and ferruginous chert (c.f. P.56). Large ferruginous cherts, cherty volcanic grains and clear cherts are evident. Scattered rounded green tourmaline and rather more magnetite are seen.

3.11.4 P.66. Very like P.60 with coarse bands and large round quartz grains and silt-size quartz matrix. Some ferruginous > clear cherts occur and silt-size rounded green tourmaline, topaz, zircon, rutile and abundant magnetite occurs. Abundant clay mineral occupies the interstices.

* Some banding of more silty and more sandy bands occurs - this is unusual.

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3.11.5 EX136-97229. As for P.51, large round quartz grains and small ferruginous cherts occur but here there is more abundant silt-size quartz, and magnetite of similar shape is abundant; a little topaz and green tourmaline (well rounded) occur and monazite and epidote, abundant zircon are all seen. Patchy kaolinite occurs, but the cement is largely secondary chert. Resembles group a(ii) of Yudnapinna Beds.

3.11.6 EX140-97292. Like P.51 in places but large quartz grains and silt-size grains show more angularity, though rounded grains in both modes occur. Abundant silt-size quartz is seen as in 97229 in patches. Potash feldspar of median quartz size occurs in moderate quantity. Rounded ferruginous cherts and cherty volcanics of both size modes are present. Angular and scoured zircons are seen but rounded magnetite grains are present in appreciable quantities. An inhomogeneous rock of pockets of fine silty quartz and a little carbonate and areas of abundant coarse clasts and minimal silt.

It is not easy to split the above specimens into distinct groups because of continuous wide variations. The sections show differences in roundness of grains, though most show abundant round grains; also there is a variable silt-size matrix; variable chert (including volcanic clasts) content and a variable heavy miheral component. Little potash feldspar is observed. Moderate clay mineral is seen in most of them.

In the Whyalla Sandstone the following characteristics are noted :-

(a) Presence of sand grains (mainly round) and silt quartz (mainly subangular) as two distinct population modes;

(b) Presence of appreciable silt-size magnetite and a variable heavy mineral suite.

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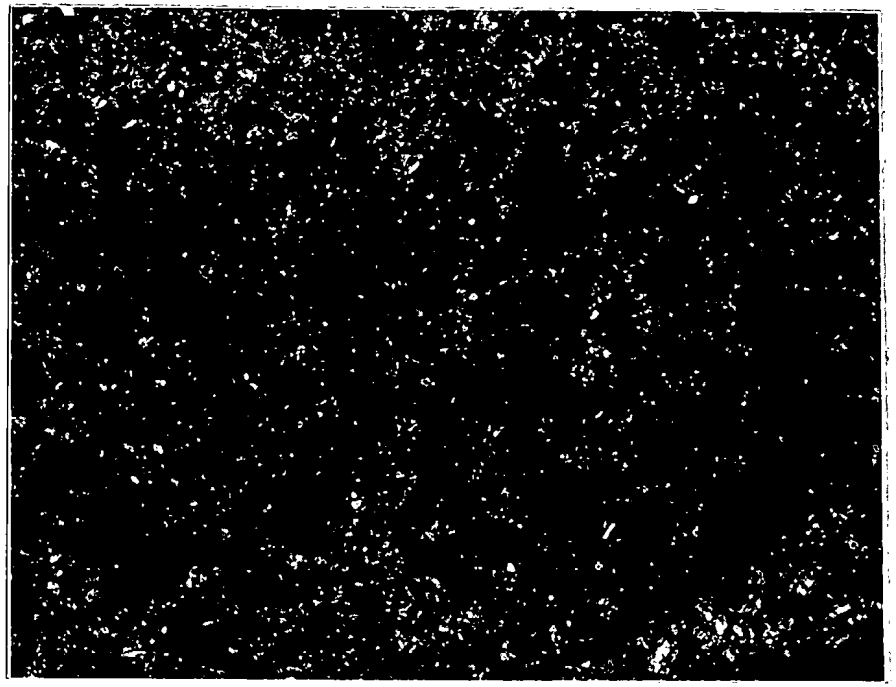


Figure 26 Tregolana Shale (clay) Ex 93 - 86587

A bedded clay rock of illite > kaolinite, cherty quartz and limonite. Limonite pseudomorphs of pyrite are seen.

P.P. Light Magnification x 90

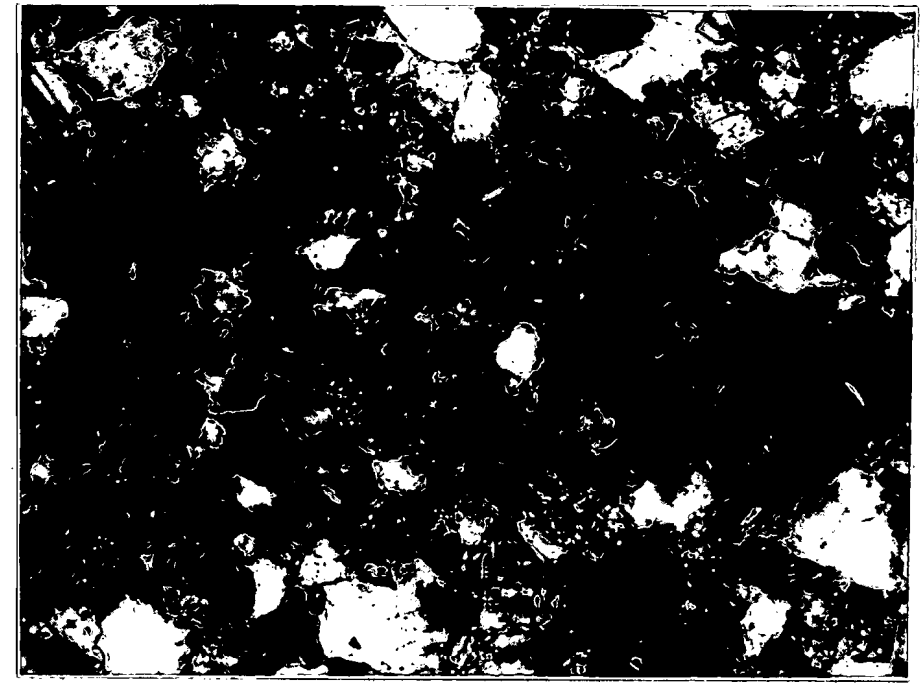


Figure 27 Tregolana Shale (silt) Ex 93 - 86587

A silty rock of roughly equigranular subangular quartz grains (flat white and grey), cross hatch twinned microcline and twinned plagioclase. Interstitial kaolinite occurs appreciably.

Crossed nicols Magnification x 90

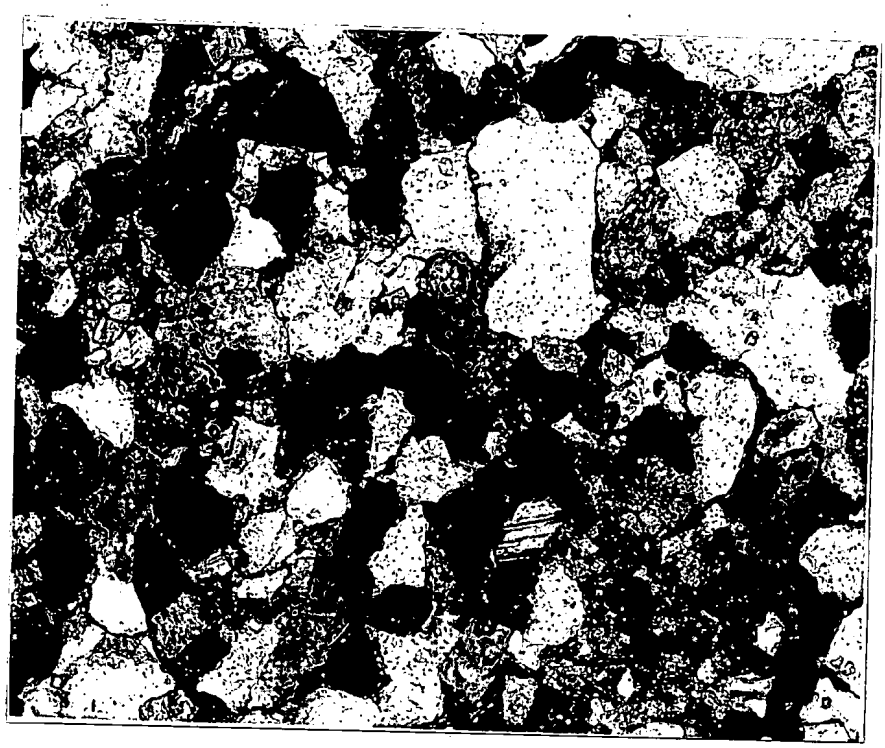


Figure 28 Tregolana Shale (sandy) Ex 93, 17 m. 86589

Subangular sand sized quartz grains (faintly stippled or plain white). Oligoclase present shows lamellar twins. Heavily stippled small grains are of dolomite. Two large composite ferruginous chert grains occur towards top left corner.

Crossed nicols Magnification x 90

In the Pandurra Formation the following characteristics are noted :-

(a) The quartz grains where round are more continuously variable in size although scattered large mainly angular clasts do occur and these are normally rock fragments of inequigranular quartz mosaics.

(b) Quartz gneiss grains occur commonly in the Pandurra Formation.

(c) Detrital heavy minerals occur less commonly in the Pandurra Formation.

(d) There are as many ferruginous cherts and cherty volcanic grains in some Pandurra Formation Basal specimens as in the Whyalla Sandstone. Similarly for potash feldspar which is appreciable in Basal Pandurra Formation specimens.

3.12 Tregolana Shale (EX93-86587 and EX93-86589)

3.12.1 EX93-86587 (mounted fragments).

(a) A bedded shale rock of illite > kaolinite, cherty quartz and hematitic limonite. Varying amounts of limonite in bedding give the rock a banded appearance. Opaque specks may be limonite pseudomorphs of syngenetic pyrite.

(b) One mounted fragment shows equigranular, subangular quartz (0.05 to 0.15 mm), abundant potash feldspar and less fresh plagioclase; and scattered possible biotite flakes, magnetite grains and appreciable kaolinite occur.

3.12.2 EX93-86589. As for the sandstone fragments discussed under 86587 with a fairly equigranular subangular quartz, 0.1 to 0.4 mm content, appreciable potash feldspar and fresh albite/oligoclase of similar grain size are present. However, there is about 5 percent carbonate of similar size to quartz grains and patchy kaolinite occurs where silicification has not taken place.

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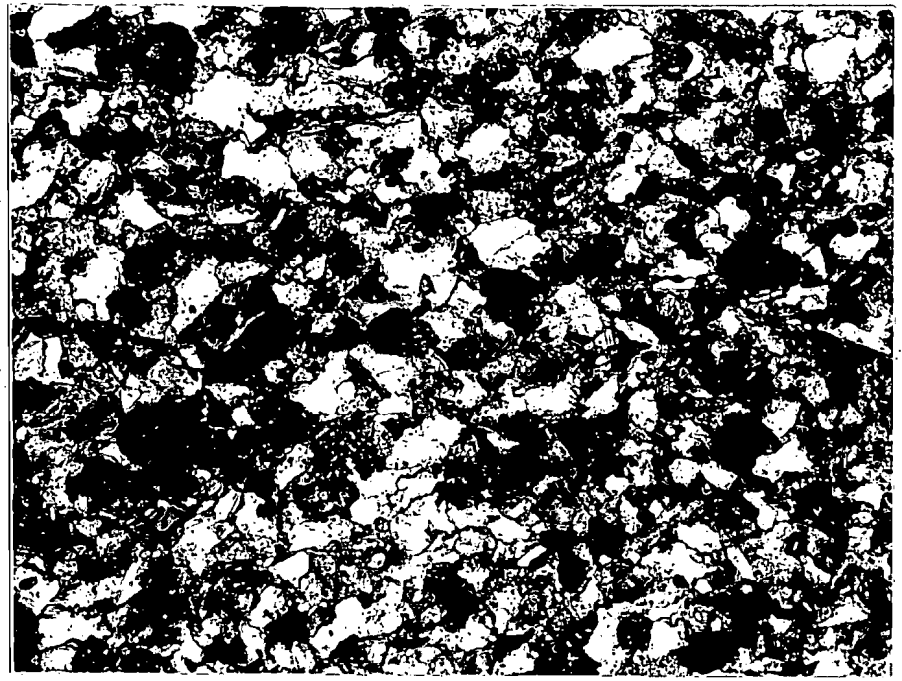


Figure 29 Corraberra Sandstone P79

Silt-sized subangular quartz, potash feldspar and twinned plagioclase occur. Biotite and illite (speckled) occur in the interstices.

Crossed nicols Magnification x 90

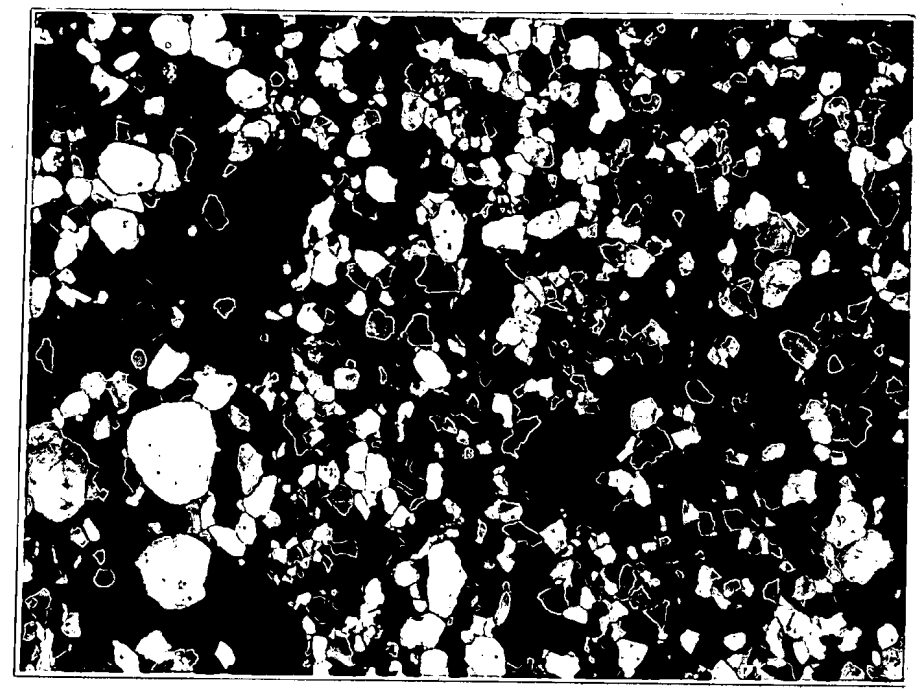


Figure 30 Corraberra Sandstone A4223 Mt. Gunson

Different from P79 in being cleaner, coarser grained and banded. Many quartz grains are quite round. Hematite-limonite cement is abundant.

Crossed nicols Magnification x 16

The bedded shale resembles the Tregolana Shale (Pernatty Lagoon/Mystery Area). The sandstone fragments are more like Corraberra Sandstone.

3.13 Corraberra Sandstone (P.79 and P.80)

3.13.1 P.79. An impure siltstone which consists largely of fairly equigranular subrounded quartz grains (median 0.05 mm). Of similar grain size are abundant potash feldspar and oligoclase grains. The rock is pocked by messy ferruginous chert. Scattered greenish biotite flakes and scarce elongate illite flakes are seen. The rock is largely silicified. Abundant finer magnetite (euhedra and rounded grains), greenish tourmaline and composite glauconite grains occur.

3.13.2 P.80. Similar to P.79 but quartz grains are slightly coarser and are coated with limonite. There are 3 volume percent irregular carbonate grains scattered around the section. Potash feldspar as clear grains are more abundant than oligoclase.

There is less magnetite present than in P.79. A little sphene and tourmaline are seen.

Coarser varieties of Corraberra Sandstone from Mt. Gunson have been described (see Appendix). The mineralogy and textures are similar to those of the two siltstones described above.

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4. REFERENCES

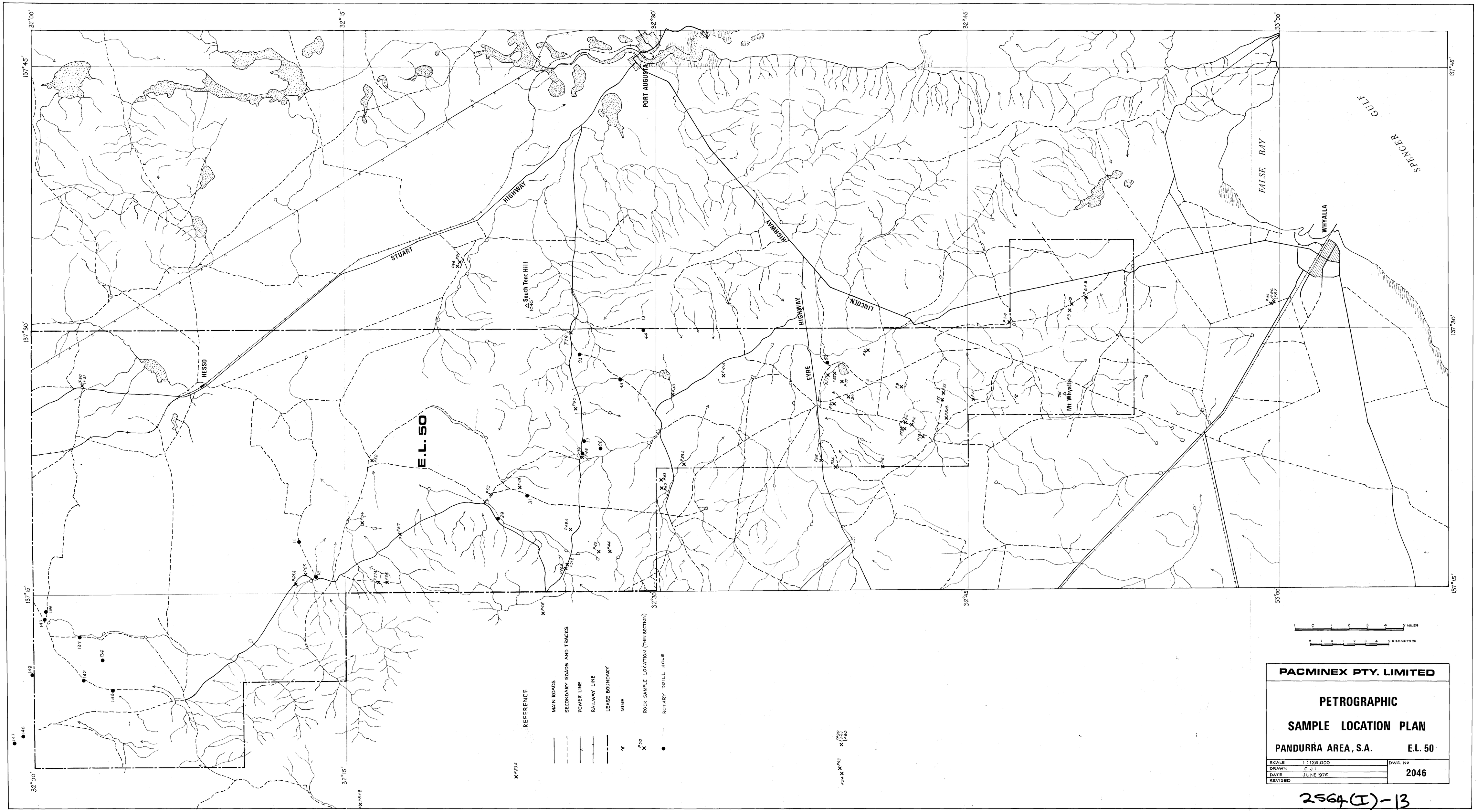
1. CAROZZI, A. : Petrography. John Wiley & Son Inc. N.Y., 1960.

2. PACMINEX PTY. LTD., : Petrography of Mount Gunson Sediments, PMR 195/72.

3. Memorandum from D.G. Tonkin to P.J. Curtis dated 27th November, 1974, and entitled "Pandurra Petrography". (See Appendix II).

All original petrographic descriptions are in Appendix I, in order of specimens in the main report.

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PACMINEX PTY. LIMITED

PETROGRAPHIC SAMPLE LOCATION PLAN

PANDURRA AREA, S.A. E.L. 50

SCALE	1:125,000	DWG. Nº 2046
DRAWN	C.J.L.	
DATE	JUNE 1975	
REVISED		

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APPENDIX I

PETROGRAPHIC NOTES MADE DURING PREVIOUS MAIN INVESTIGATIONS OF ROCK TYPES DISCUSSED IN THIS REPORT. NOTES ARE PLACED IN THE ORDER OF CLASSIFICATION IN THE PRESENT REPORT.

REPORTS FROM WHICH NOTES ARE TAKEN

1.	PETROGRAPHY OF MOUNT GUNSON SEDIMENTS	PMR 195/72
2.	MEMORANDUM ON PANDURRA THIN-SECTIONS FROM P.J. CURTIS TO D.G. TONKIN, DATED 4/9/73	
3.	PETROGRAPHY OF PANDURRA THIN-SECTIONS II	PMR 5/74
4.	PETROGRAPHIC/MINERAGRAPHIC STUDY OF SOME PANDURRA DISTRICT SPECIMENS	PMR 73/74
5.	PETROGRAPHIC REPORT - SUPPOSED VOLCANIC ROCK FROM THE BEDA-BORE DRILL CORE, S.A.	PMR 153/74
6.	PETROGRAPHY OF PANDURRA THIN-SECTIONS III	PMR 29/75

MOONABIE FORMATION

P.95 - Siliceous fine-grained quartzite from Mt. Laura, Whyalla.

A fine pink siltstone alternating with dark clay bands. A possible recumbent fold(?) is seen in the hand specimen. The fold is not seen in thin-section and may be a 'slump' characteristic.

A very fine-grained, mainly even-grained quartzite of mainly subangular but some angular and fewer rounded quartz grains (0.02 to 0.3 mm, median 0.08 mm). Up to 10 volume percent of fine angular mainly untwinned oligoclase* plagioclase occurs which shows only occasional lamellar twinning. Subangular pleochroic blue and greenish tourmaline (approx. 0.08 mm) to < 1 volume percent; opaque mineral, likely magnetite of very variable grain size (0.002 to 0.08 mm) occurs scattered as large grains or in groups of fine grains to 4 volume percent.

Some quartz grains are flattened or even spicular and fragmentary (tuffaceous?), (approx. 0.25 x 0.02 mm). Some of the long or flat quartz grains show a rough parallelity.

The presence of angular splintery quartzite suggests metamorphic origin of clasts as does the presence of blue pleochroic tourmaline.

Clay mineral (chloritic > illite) occupies areas between quartz grain boundaries and overall is present to about 7 volume percent of the rock. Vugs commonly contain fine opaques.

Some tuffaceous fragments and up to 10 volume percent of fine fragmentary oligoclase plagioclase and an abundance of opaques and chloritic clay show this rock

*confirmed by mineral stain

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to be a tuffaceous sandstone. Some of the quartz is fragmentary and is plainly tuffaceous. The rough banding indicates probable sedimentation under water.

P.96 - Dark grey quartzite, from Water Tank Hill, Whyalla.

A different rock from P.95. The hand specimen indicates a rock type very like the Pandurra Formation specimens P.86, P.87 and P.89. In thin-section, quartz mineral grains and some rock fragments around 1 mm in size are rounded-oblong in section. The remaining grains of largely quartz mineral grains (0.2 to 2.2 mm) show more than half of these to have a high degree of rounding. Cherts in the rock (0.6 to 2.5 mm) and corresponding to half the grains present are very like those seen in the Whyalla Sandstone. Most cherty grains are ferruginous and round. About 30 volume percent of the cherty grains are of devitrified volcanic glass and of opaques and mica showing original flow-banding. Other interstitial mineral is probably tuffaceous. The volcanic chert present is possibly a similar source bed to that for Whyalla Sandstone cherts(?). As in many sandstone/quartzite rock types in the area, no sorting of quartz grains is apparent. Opaque minerals (apart from tuffaceous grains) are likely magnetite (0.1 to 0.2 mm), present to 2 volume percent. Several grains of zircon, one attached to magnetite are seen in the interstices.

Feldspar staining shows a complete absence of potash feldspar but white etching of occasional grains indicates the presence of volcanic clasts containing plagioclase material.

CORUNNA CONGLOMERATE

P.90 - Silicified conglomerate from Tassie Creek reservoir, "Corunna" station.

In hand specimen the rock has the appearance of an irregular quartz conglomerate containing minimal matrix but possible greenish volcanic fragments.

Shows large rounded quartz rock fragments, several millimetres in size, with the individual quartz mineral grains (0.2 to 2 mm, median 1 mm) of sutured quartz grains. The fragments are quite clear and there is an absence of non-silica cement; also quartz mineral grains (approx. 1 mm) with alternate cherty grains of similar size occur. The interstices of large fragments are quartzite with grains (approx. 1 mm). Yellowish clay occupies some corners between interstitial quartz and chert; the clay occurs to 3 volume percent of interstitial quartz. Chert, overall occurs to 20 volume percent of the rock. Abundant (locally) cloudy zircon (approx. 0.08 mm) occurs in clots in the interstices, the grains contain near perfect forms with very little rounding and are present overall to <1 volume percent. Some limonite granules, also shapeless masses of the mineral occur in between some matrix quartz to 2 volume percent.

The large individual quartzite and quartzite chert fragments are characteristic. No volcanic element is seen in thin-section. A coarse quartzite conglomerate. It is hard to differentiate between this rock and Elizabeth Conglomerate P.27.

P.91 - Siltstone facies of Corunna Conglomerate, Tassie Creek reservoir.

A fine reddish coloured siltstone with sporadic large rounded clasts of mainly quartz rock and occasional

quartz mineral grains, all rather more than 1 mm in size. Some bands of larger grains of quartz are seen.

In thin-section a rough banding of coarser quartz grains (approx. 0.5 mm) are seen, several grains of just one grain thick. The larger quartz grains in bands may have silicified in situ as abundant clay pockets between quartz grains remain, i.e. silicification proceeded along selected planes parallel to 'bedding'. Grains on the whole are not graded and quartz grains, largely subangular (0.08 to 0.5 mm) with a fair abundance of illitic clay up to 20 volume percent of rock in pockets and between quartz grains are seen where not silicified.

An igneous clast (approx. 0.3 mm) of possible silicified dolerite shows decussate lath pattern (now of quartz outlined by limonite particles). Occasional rounded cherts (approx. 0.08 mm) occur to less than 1 volume percent of rock. Opaque laths of ilmenite(?) and magnetite euhedra occur to 4 volume percent of rock. Also a scattering of zircon and possible topaz are seen (< 1 volume percent). Under very low power reflected light microscopy other volcanic clasts (approx. 0.3 mm) are seen as feldspar fragments, chlorite and oxidised basaltic fragments to about 2 volume percent of the rock. No sulphides are seen.

The rock is a sandstone of lithic wacke composition characterised by mainly unsorted sand grains (quartz and lithic) but with some silicified larger quartz in bands. Characterised by abundance of opaque minerals and volcanic clasts.

Staining proves the absence of potash feldspar but some grains have etched powdery white with hydrofluoric acid (presence of plagioclase?).

P.92 - Crystal tuff? Tassie Creek reservoir.

Limonite stained rock fragments (approx. 1 mm) alternate with clear quartz.

In thin-section, subhedral cherts are seen (0.5 to 3.5 mm) several of which are similar to those seen in P.90. Apart from clear cherts there occur many others like the ferruginous cherts of Whyalla Sandstone and fragments of basic tuff and volcanic clasts. Tuffaceous cherts of cemented volcanic fragments are now largely silicified but contain some mica which indicates form of fragments of original constituent feldspar. One granophyric fragment now pseudomorphed by quartz and limonite is seen. Fragments of ferruginous trachyte(?) are now largely silicified. Elsewhere several crystal fragments, up to 2 mm of microcline are seen. Magnetite and a little zircon up to 0.2 mm occur.

Volume Percentage modal mineral composition of the rock :-

Quartz rock fragments	45
Quartz mineral grains	22
Clear cherts	10
Ferruginous volcanic cherts	12
Microcline	10
Interstitial clay	-
Magnetite (with a little zircon)	1

Microcline fragments and volcanic cherts stained well for potash. A quartzite containing mixed volcanic: lithic and crystal tuff fragments.

P.93 - Reputed tuff. From 2 km west of Tassie Creek reservoir. May contain pebbles of acid Gawler Range Volcanics.

Somewhat similar to P.92 in outward appearance.

In thin-section somewhat finer grained than P.92 with smaller volcanic clasts.

At one end of the section are coarse subangular quartz rock fragments (1 to 3 mm) in chaotic array, with coarse ferruginous (volcanic) cherts. The coarse cherts consist of :-

(a) a mass of angular quartz, fine opaque mineral and a little clay from a silicified tuffaceous rock;
(b) banded clear chert and quartz rock with opaques as in (a);
(c) ferruginous chert; and
(d) chert and finely disseminated clay mineral.

The finer grained part of the section shows variations in grain size of 0.1 to 1.2 mm, median 0.24 mm. A mixture of quartz mineral grains and generally a greater proportion of quartz rock fragments are present in the larger size range. Clay mineral, mainly illite occupies about 10 volume percent of the section. The quartz grains show little or no sorting. Volcanic cherts and fragments of opaque minerals, mica and chert (approx. 0.3 mm) occur to about 6 volume percent of the rock.

Opaque minerals (mainly magnetite) up to 0.15 mm, occur to about 2 volume percent of the rock, and occasional rounded grains of zircon with dark borders (0.08 mm). No feldspar is seen (as confirmed by staining procedure). A micaceous quartzite (lithic wacke) which contains tuffaceous and volcanic grains. Related to P.92.

P.94 - Conglomerate. From 2 km west of Tassie Creek reservoir. May contain pebbles of acid Gawler Range Volcanics.

A coarse lithic polymict conglomerate with pebbles, centimetres in size.

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In thin-section the interstices partly consists of a groundmass of very fine chert which appears to be encroaching on the contained pebbles, i.e. the pebbles are showing alteration to dark chert. The remaining groundmass is of small quartz grains, microcline and rock fragments (0.1 to 1.0 mm, median 0.25 mm), these are set in a mass of fine chert and a little illite.

Where unattacked by chertification, the quartz rock pebbles are seen to consist of very irregular quartz mosaics. Other pebbles (approx. 5 mm) are of lighter chert than groundmass and are round. One large (several millimetres) chert:mica pebble may be recrystallised volcanic rock (devitrified glass) with a little leucoxene and <1 volume percent magnetite. Another pebble of devitrified glass (now chert) contains a glassy micaceous fragment and an eroded quartz grain and is probably tuff. There are other pebbles similar to the latter, including large potash feldspar (approx. 1 mm) grains and pebbles (several millimetres in size).

This is a conglomerate which contains volcanic and/or tuffaceous pebbles. However, some pebbles are of clear feldspathic quartzite (approx. 7 volume percent microcline) where not seen converted to chert.

Silicified Elizabeth Creek Conglomerate is probably different from the Corunna Conglomerate in having more rounded quartz pebbles, few if any potash feldspar grains, volcanics or tuffaceous pebbles; the former rock type possibly also contains less chert(?).

GAWLER RANGE VOLCANICS

P.24 - A kaolinised then silicified porphyritic andesite showing perfect outlines of plagioclase phenocrysts now completely kaolinised and a minimal number of corroded rounded quartz grains of similar size range are present. Vesicles, (0.15 to 0.3 mm) contain radiate devitrified glassy matter and associated clay mineral, with centres filled with opaque mineral. The groundmass is of devitrified glass and clay mineral infilled with secondary quartz which also occupies fractures in the groundmass. Scattered limonite particles complete the mineral composition of the groundmass.

ROOPENA VOLCANICS

P.19 - A possible source of volcanic lithic grains in the Whyalla Sandstone.

An oxidised variolitic basalt with a groundmass of variolitic plagioclase, hematite (ex-magnetite) and some palagonite. Phenocrysts of mainly plagioclase but also of scattered altered clinopyroxene sections are seen. Vesicles containing altered zeolite(?) intergrowths are present. Some quartz is also present in the vesicles.

A9657 (Beda Bore Chip)

The rock is a hydrothermally altered dolerite with a framework of decussate plagioclase laths of variable grain size (0.1 x 0.02 mm to 0.8 x 0.1 mm, median 0.3 x 0.05 mm). The more basic plagioclase has been altered to albite and only simple twinning is seen. However, some plagioclase contains tiny colourless radiate laths which are length slow, have low birefringence and low R.I. and are assumed to be natrolite.

Most of the ferromagnesian minerals present in the interstices of plagioclase laths are uralitised where the uralite occurs as corona reaction rims, as cross fibres in outer even zones enclosing fine granular clinozoisite(?) or in some cases enclosing clear whole magnesite grains. Some grains with olivine shapes which are veined irregularly by limonite contain fine fibrous unoriented serpophite and fine clinozoisite(?). The olivine pseudomorphs are rare and vary up to 1 x 0.4 mm in size. No pyroxene shapes are seen.

Limonite or secondary hematite occurs in the mineral interstices pseudomorphing magnetite octahedra or as secondary irregular masses exsolved from altered pyroxene and olivine. All the iron oxides occur to 10 volume percent of the section.

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PANDURRA FORMATION - BASAL SECTION

EX31A - Core from between 42 and 43 metres. Purple shale. Whyalla Sandstone or Pandurra Formation? Cu 5 ppm, Pb < 20 ppm, Zn 10 ppm.

A sandstone of some round but mainly of angular grains are seen in hand specimen. The presence of chrysocolla is noted. A stylolite horizon is seen cutting across the bedding.

The quartz grains, which are mainly mineral grains are very variable in size, 0.1 to just over 1 mm in size with a possible median size of 0.5 mm. The grains, unlike most Whyalla Sandstone are subangular mainly, with some angular grains and in this way the rock resembles the Pandurra Formation specimens A4002 (West Lagoon), A4337 and A4347 (Cattlegrid), though some of the quartz grains in these rocks are round by comparison.

An abundance of ferruginous chert grains (approx. 3 to 5 volume percent) are noted and some of these are of devitrified volcanic glass, others show flow banding. There is also fresh feldspar (approx. 3 volume percent confirmed by stain technique), mainly microcline and granophyric material. Oblong tourmaline grains and some zircons are present to less than 1 percent. Fan-shaped sheafs of muscovite are common. The matrix of 5 to 7 volume percent is of illite with crops of magnetite grains in places.

P.11 - Whyalla Sandstone, with lithic grains and silicified, previously mapped as Pandurra Formation.

The section shows the rock to be somewhat similar to P.9 and with a similar content of lithic fragments.

Some rounding of many of the quartz grains before silicification is evident but lithic fragments and

quartz have been fused into a quartzite mosaic. Lithic fragments constitute about 5 volume percent of grains present and are variable in size from .15 to 1.5 mm but are quite rounded in shape. Quartz rock fragments of clear tiny quartz as regular mosaics and also of irregular mosaics occur probably to a further 5 volume percent of rock although because of complete silicification this is not easy to determine. Occasional fresh microcline and less, twinned albite feldspar prisms may be seen.

P.12 - Whyalla Sandstone? Stained purple and very silicified giving superficial likeness to Pandurra Formation, as which it was previously mapped. Same locality as P.11.

Very similar to P.11 but more original quartz as rounded shapes are obvious by the internal elliptical opaque particle trains. Lithic fragments of fine mica flakes, hematite and cherty particles tend to be ovoid or rounded-prismatic and are present to 3 volume percent. Quartz rock fragments are present to probably another 3 to 5 volume percent. A little (approx. 1 percent) prismatic microcline and rare twinned albite are also present.

P.22 - Whyalla Sandstone. Purple grains in white matrix. Looks very like Pandurra Formation, except for outcrop character, purple rather than red colour and lack of vitreousness on fresh fracture. Previously mapped as Pandurra Formation.

The quartz grains (median approx. 0.6 mm) are mainly subangular with a tendency to rounding for some and angularity for others. Evenness of grains is characteristic and the quartz has been silicified in patches of mosaics so that it is difficult to distinguish former quartz mineral grains from rock fragments. Rounded or rounded-angular chert grains of purplish hue (to 4 volume percent of rock) which are similar in grain size

to surrounding quartz grains contain the characteristic aggregates of cherty quartz and limonite particles. Interstitial kaolinite in vugs and channels between quartz grains occur up to 10 volume percent. No heavy minerals* are seen and minimal opaque minerals are present.

P.87 - Grit, Mt. Laura, Whyalla.

A roughly banded variety with alternate bands (several millimetres wide) indicating more coarse and more fine quartz grains. Rounded and subangular quartz grains occur ranging from 1 to 2.5 mm, median 0.6 mm.

The banding seen on sawn section at low power is not so obvious in thin-section and appears to indicate abundance of fine interstitial chert at alternate horizons. The larger quartz grains appear to have been somewhat more rounded at one stage but silicification has made the grains more angular. As in another specimen, P.86, the interstices are cherty/micaceous. Rounded cherts occur to 10 volume percent of the rock, no ferruginous cherts as per Whyalla Sandstone are seen. Grain size and textures compare with Pandurra Formation rocks from the Mount Gunson area such as A4009, 4226 and 4245.

No feldspar (potash or plagioclase) is present, as indicated by staining method.

P.88B - Sandstone, very dusky red with white patches and bands. From site overlying Moonabie Formation at Water Tank Hill, Whyalla.

Large quartz rock clasts, fairly evenly distributed in finer grained subangular quartz groundmass as seen in hand specimen.

* non-opaques

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Thin-section shows the 'clasts' seen in the rock under low power microscopy are not clasts at all but areas where the grain cement is quartz rather than limonitic chert. The rock is largely of fairly even-grained sub-rounded quartz grains (0.16 to 1.2 mm, median 0.3 mm) and some distinctly angular grains. Chert is present as limonitic chert and micaceous chert as rounded grains around 0.5 mm and is present to about 10 volume percent of the rock; also present as interstices with limonite and fine sericite to about 3 volume percent. Coarse micaceous interstitial areas of illite occur, but these are not common. No large quartzite clasts occur.

Chertification of margins of quartz grains has taken place. An even-grained ferruginous Pandurra Formation rock. No feldspars (potash or plagioclase) are present, as shown by staining method.

P.18 - Whyalla Sandstone overlying Roopena Volcanics. Stained purple and containing pebble-sized lithic fragments. Previously mapped as Pandurra Formation.

An inequigranular rock of mainly quartz rock fragments and lithic grains (of mainly chert and hematite). Some of the larger lithic fragments to maximum 5 mm, are subangular in shape. Quartz mineral grains (10 to 20 volume percent of rock) are commonly subangular with no inner train of opaque particles to show an original rounded grain. Vugs containing illitic clay are local, to 5 volume percent of all rock. Microcline prisms flecked with sericite are also present but are sparse ($<$ 1 volume percent). A lack of heavy minerals is apparent. No volcanic relicts are seen in lithic grains.

P.20A - Whyalla Sandstone. Stained purple except for pea-sized spots, where lithic grains can be distinguished. Previously mapped as Pandurra Formation.

Somewhat similar to P.9 and not resembling at all Whyalla Sandstone from the Gunson area if only the quartz fabric is considered. The rock is inequigranular and contains a high proportion of angular and subangular quartz grains. The rock is only patchily silicified and there is an abundance of clay mineral and silt-size quartz grains intermixed with and interstitial to the quartz rock fragments and mineral grains. Cherty lithic grains (to 5 volume percent of rock) of chert, mica and hematite, tend to be rounded or subangular and are occasionally welded to quartz grains. Rounded or oblong microcline grains, some twinned and fresh, others are altering to kaolinite and a chloritic clay mineral along cleavages (approx. 1 volume percent). It is hard to differentiate between quartz rock grains and areas of welded quartz mineral grains welded by secondary silicification. Opaque minerals of approximately similar grain size to quartz, lath-like or tending to octahedral shapes are present to about 3 volume percent of rock.

P.20B - Whyalla Sandstone overlying Moonabie Formation. Contains lithic and feldspathic fragments and is silicified. Previously mapped as Pandurra Formation.

Coarser grained than previously described rock, a typical member of this series. However, although many of the quartz mineral grains (median 1.2 mm) are now subangular, evidence of a more rounded nucleus of primary quartz is shown by trains of opaque particle inclusions. Microcline feldspar as prism euhedra or fragments (median 1.2 mm, but larger grains are seen) are present to about 2 volume percent. Lithic grains (to roughly 7 volume percent of the rock) are large (to 2.2 mm) and patchy chert and micaceous chert areas are seen within the grains. Only traces of interstitial clay are seen in narrow channels between quartz rock fragments (around 5 volume percent of quartzose grains)

and quartz mineral grains. Minimal quantity of opaque mineral grains are present which are now limonitised and no other heavy mineral grains are seen.

P.25 - Whyalla Sandstone, overlying Gawler Range Volcanics. Possibly fragments of the volcanic rock.

Unsorted sandstone. Very irregular grain size of quartz mineral grains and chert grains (lithic fragments) are seen varying between 0.1 and 3.0 mm, median 0.3 mm. The grains tend to be subangular with some angular grains, though the smaller quartz grains (to 0.7 mm) tend to be rounded. Lithic fragments - some quite large (approx. 2 mm) are more rounded than the larger quartz rock fragments.

Lithic grains	-	approx. 5 volume percent
Quartz rock fragments Quartz mineral grains	-	88 volume percent
Kaolinite	-	7 volume percent
Opaque minerals and zircon	-	<1 volume percent

As in previous sandstones from the area, silicification is patchy with kaolinite occupying channels between grains where silicification has not taken place, and kaolinite is present in some vugs. The secondary silicification and present angularity of the quartz grains makes it impossible to estimate the proportion of rounded grains present, if any, before silicification took place.

Lithic fragments are composed of chert, limonite and very little sericite. One grain of the lithic material shows feldspar shapes - now all kaolinite in a cherty matrix possibly where chert has replaced the devitrified glass of the volcanic rock matrix. Other brown lithic grains seen in the section are just chert plus limonite dust particles.

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No feldspar grains are seen apart from kaolinite pseudomorphs in lithic grains as reported above.

P.86 - Grit, overlying basal conglomerate, Mt. Laura, Whyalla.

Vaguely like the Pernatty Lagoon, Pandurra Formation section A4241, but large clasts are more round as in Elizabeth Creek Conglomerate P.27. Large (several millimetres) clasts of quartz rock and cherty quartzite occur (including a chert grain with a strong lineation of composite grains) in a fine quartz groundmass. The large clasts indicate the existence of a rough banding within the rock.

In thin-section quite like P.84B, but in this specimen (P.86) the cherts are present as abundant large clasts as well as smaller grains. Some of the smaller chert grains are quite ferruginous in P.84B. The cherts are thoroughly mixed up with the quartz grains and rock fragments, also chert is present as interstitial silica cement. Chert occurs to 40 volume percent of the rock. The larger quartz rock fragments and quartz mineral grains (approx. 2 mm) are commonly round and these are present to 25 volume percent of the rock. Smaller quartz grains and rock fragments (0.1 to 0.6 mm, median 0.5 mm) constitute most other rock not covered by chert and the larger quartz grains. Many of these are fairly round (approx. 0.15 mm) are embedded in quartz rock fragments and chert grains and occur to less than 1 volume percent, and a little massive sphene occurs with this.

Under high power, illite is seen to be intermixed with interstitial chert.

No feldspars (potash or plagioclase) are present, as indicated by staining method.

P.50B - Looks like Pandurra Formation, outcrops like Whyalla Sandstone.

In hand-specimen are seen very irregular quartz grains as subangular to angular grains, abundant clay matrix, local oxide copper (probably traces of malachite).

In thin-section the quartz grains are seen to be not so irregular in grain shapes or sizes. Many grains of quartz rock and quartz mineral are perfectly spherical to near spherical or flat/rounded; this comprises rather more than half the grains present, both small and large. Grain size variation is 0.2 to 3.5 mm. There are, as seen in Whyalla Sandstone, roughly two populations of quartz grains; small, evenly subangular and rounded varying between 0.2 and 0.5 mm, median 0.3 mm; large, 1 to 3.5 mm, some rounded but many rounded/subangular or flattened in shape with a ratio of 2:3 rock fragments to mineral grains and comprising about 5 percent of the rock. The larger grains do show a tendency to concentrate in some layers (bedding planes). Ferruginous cherts, and some clear chert grains, subangular to rounded occur to 1 to 2 volume percent of the rock averaging, 0.3 mm and are present interstitially with the finer quartz grains.

'Volcanic' (devitrified glass) sericitic cherts are present but are rare. Some replacement of quartz by opaque mineral is noted.

The matrix is of mainly fine illite with some coarse shreds and kaolinite patches overall to 25 volume percent of the rock. The kaolinite patches may be the result of clay mineral replacement of chert.

P.89 - Light coloured sandstone, heavy mineral bearing, from Ready Mix Concrete quarry, Whyalla.

A coarse and fine banded (several millimetres wide) quartzite with a number of red stained grains speckling the rock.

In thin-section are seen abundant large rounded quartz grains, appreciable subangular quartz grains and quartz rock fragments, also some angular grains. About one-third of quartz grains which are more than 0.2 mm in size are quite round, near spherical and this is uncommon in the Pandurra Formation. Coarse quartz bands, grains vary 0.10 to 1 mm, median 0.3 mm, some illite and chloritic clay occurs in pockets or thinly between quartz grains to 5 volume percent. Large cherty grains (approx. 1 mm) occur occasionally.

Fine, quartz bands where quartz is more subangular (0.05 to 0.5 mm, median 0.15 mm) with abundant illite and chloritic clay in pockets and between grains are seen, taking up about 20 volume percent of the rock. Again, cherty rounded quartz grains (approx. 0.3 mm) occur to about 2 volume percent, and more commonly so than the coarse quartz bands.

Opaque minerals, topaz and sphene occur to rather less than 1 volume percent, grain size approx. 0.03 mm.

Although as mentioned above there is an unusually high degree of rounding in the larger quartz grains, there is a large amount of quartz of all size ranges which is distinctly subangular or angular and this is typical of Pandurra Formation quartzite. The presence of abundant clay is also unusual for Pandurra Formation which in previous specimens examined was commonly silicified.

Ferruginous cherts (0.3 to 1 mm) occur, the smaller ones being quite round, the remainder are subrounded. Some contain a little mica and are possibly of volcanic origin. One other glassy volcanic fragment, somewhat

angular (approx. 0.2 mm) is seen. All cherty material occurs to 5 volume percent. A little worn tourmaline (approx. 0.05 mm), as pleochroic grain occurs.

No staining for potash feldspar is observed at all, but some grains (< 1 volume percent of grains present) etched easily with hydrofluoric acid, possible micaceous volcanic(?) clastic grains.

EX31B - Core from between 42 and 43 metres. Purple shale Whyalla Sandstone or Pandurra Formation. Cu 5 ppm, Pb < 20 ppm, Zn 10 ppm.

Fine-grained quartzite with many grains stained red. Large unstained porphyrotope of quartzite.

The general appearance under low power (X 12.5 magnification) is of a rock with similarities (in shape of grains) to both Whyalla Sandstone and Pandurra Formation selected rock types.

The quartz grains are mainly subangular but a proportion (10 to 15 volume percent) are quite angular and wedge-like. Several grains are flat with rounded ends. The grains vary from 0.05 to 0.3 mm with a median of 0.15 mm. About 3 volume percent of fresh rounded twinned and untwinned microcline grains of median quartz size are seen. Ferruginous and cloudy cherts, mainly sub-rounded but ranging in grain size with quartz grains are present to 7 to 10 volume percent of the rock and sheafs of muscovite, apparently diagenetic, growing from clay matrix are present to 1 volume percent. Clay matrix (illite and kaolinite to about equal proportions) occur to 20 volume percent of the rock and large subangular quartz rock fragments (to 1 mm) occur sparsely and are reminiscent of much of the Pandurra Formation. Limonite occurs as lenticles in the matrix, as clots and as pseudomorphs after magnetite (approx. 0.16 mm), overall

to 3 volume percent. Some (< 1 percent) of quartz-feldspar, granophyric fragments occur. Several of the ferruginous and clear cherts appear to be micaceous, are of devitrified glassy volcanic fragments and are chloritic. A fair amount of sphene is seen in the matrix.

P.49A - Whyalla Sandstone silicified and containing Pandurra pebbles.

A fine even-grained pink quartzite with large pebble erratics.

In thin-section the quartz grains are not so even-grained as they appear in hand-specimen. However, many grains show some internal rounding of a nucleus demarcated by limonite particle inclusions before marginal silicification set in. Grain size of mainly quartz mineral grains varies between 0.1 and 1.3 mm with median size around 0.4 mm. Overgrowths of quartz have produced an almost entirely quartz mosaic, the originally rounded nature of grains being shown by included fine particles as described above. The typical ferruginous cherts as seen in Whyalla Sandstone and some clear chert grains which are rounded to subangular and of median quartz grain size occur. Some recrystallisation of part of chert is noted in some cases. The cherts occur to about 2 percent of microscope field of view. Brownish, rounded tourmaline grains (approx. 0.048 mm) occur as inclusions in quartz overgrowths.

Large erratics of quartzite in the rock are rounded, patchily and faintly ferruginous recrystallised chert, 20 mm and 3 mm in size; also a more ferruginous fine chert grain is somewhat subangular and is 6 mm in size.

A silicified but sharp boundary between the erratics and main quartzite is noted.

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PANDURRA FORMATION - UPPER SECTION

P.31 - Pandurra Formation grit.

Characteristically a Pandurra Formation rock type showing a rough banding of quartz rock fragments and mineral grains varying from median 0.25 mm to maximum 1.5 mm. The coarser bands are really poorly sorted and contain occasional brownish, rounded cherts or rounded to subangular rock fragments. Cherts are present to less than 1 volume percent in the finer bands which are mostly subangular with some rounded quartz mineral grains, mainly welded by silicification into mosaics and with fewer quartz rock fragments present. Originally more rounded grains are shown to have been present by narrow trains of opaque particles which enclose the earlier quartz grains. Kaolinite is present in isolated vugs to about 1 volume percent of the rock composition.

Tourmaline, which is detrital is present to less than 1 volume percent. Opaque minerals, now limonite occur only as the fine opaque particles in quartz as mentioned above. About 1 volume percent of sphene and zircon are clustered as irregular lozenge shapes or prisms in the interstices now silicified, as somewhat scattered groups.

P.43 - Pandurra Formation Quartzite with regolith.

Under low power microscopy the rock appears to be an irregular Pandurra Quartzite with pinkish quartz, clay matrix and 'regolith' consisting of rounded quartz grains with limonite cement.

In thin-section is seen no distinct boundary contact between the 'regolith' of coarser rounded quartz mineral grains (to 2.5 mm but variable and median 0.6 mm) and rock fragments and chert (to 3 mm); with a finer grained zone of mainly quartz mineral grains (approx. 0.15 mm but up to 2 mm) surrounding the 'regolith'. Below the

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regolith in the main host rock, banding of fine quartz grains (approx. 0.2 mm) and unsorted (0.3 to 2 mm) bands are seen. The difference in cementing material is noted, that of the 'regolith' being mainly amorphous limonite and that of the host quartzite being largely silica but with occasional pockets of kaolinite platelets of similar size to the surrounding quartz grains. The quartz grains of the host quartzite are subangular and fit together as mosaics due to the normal formation of quartz overgrowths.

Within the 'regolith' the grains are also locally silicified and form mosaics, though blind channels and pockets of limonite occur and more than half of the grains show a degree of rounding. Where present the subangular grains were rounded before silicification as indicated by internal trains of fluid inclusions and limonite particles. Some small rounded cherts (< 1 volume percent of the 'regolith') - not ferruginous, are also seen.

No heavy minerals are seen.

Lack of distinct boundaries between the main rock and 'regolith' shows the latter to have been a possible unconsolidated aggregate of quartz held together by limonitic-mud, the resulting mud-ball being washed into the sedimentary environment by flood waters.

No regolith 'sensu stricto' is identifiable. The host rock is identified as Pandurra Quartzite.

P.48 - Pandurra Formation, from below the pre-Marinoan zone of silicification.

In hand-specimen, subangular grains of quartz are moderately sorted, with pebbles several millimetres in diameter forming the 'bottom' end of the specimen. Malachite is seen as traces in the interstices of finer sizes of quartz grains.

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Thin-section shows very little variation between mainly quartz mineral grains which are largely sub-angular to sub-rounded and form a mosaic. The variation in grain size is between 0.1 and 1.0 mm with a median grain size of 0.3 mm. At the coarser pebbly end of the section the grain size abruptly rises to 3.5 mm consisting of rounded and flattened grains. Those grains between 1.2 and 3.5 mm constitute about 30 volume percent of grains present at the pebbly end. The remainder of grains present are of similar size range to quartz grains at the finer end. Thus, the larger quartz grains may be considered as erratics.

The cement between the tightly fitting quartz grains was originally a very fine parting of limonite, (2→5 μ thick) which because of secondary silicification has been trapped behind later diagenetic quartz grain boundaries in many places. Fine subangular quartz grains (approx. 0.03 mm) as groups between the larger grains (0.1 mm and greater) only locally appear to be absorbed into the larger neighbouring quartz grains by encroaching silicification. No cherts are seen but only occasional quartz rock fragments, some of which contain trains of fluid inclusions.

P.51B - Pandurra Formation. Pink quartzite. Boulder in Whyalla Sandstone.

Pink irregular quartzite with some pale erratic grains. Patchy clay interstices but mainly silicified. Traces of oxide copper mineralisation.

In thin-section the rock is seen to be a poorly sorted quartzite of mainly quartz mineral grains, minor quartz rock fragments (including quartz gneiss fragments) and some clear cherts, the latter grains occurring to around 2 volume percent. Predominantly large subangular and with fewer rounded quartz mineral grains and rock fragments (approx. 2 mm in size) occur to about 3 volume percent of

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the rock. The remaining grains are mainly quartz mineral grains from 0.1 to 1.2 mm, median 0.3 mm and a poorly sorted banding of mainly fine grains with large erratics and alternatively mainly coarse with much interstitial fine quartz are seen. The rock consists largely of fused sutured quartz mosaics although cherty material in the interstices and in vugs and a little clay mineral in blind channels do occur.

Heavy minerals and feldspar are lacking.

P.58 - Pandurra Formation grit. Unsilicified.

A poorly sorted sandstone of mainly subangular quartz grains and rock fragments. Clay matrix.

Thin-section shows many of the larger quartz grains to be rounded and are commonly perfectly oval in section. These grains are mainly a single quartz mineral grain. The quartz mineral grains, quartz rock fragments and clear chert are of similar size (1.5 to 2 mm). Many of the larger quartz mineral grains have rounded primary nuclei and silicification has made the grain perimeters more angular.

The smaller grains in the rock vary mostly from 0.1 to 1.0 mm, are too variable to obtain median value; they are more rounded (some near spherical) than subangular.

Overall, the modal volume percent of mineral constituents are :-

Quartz mineral grains	90
Quartz rock fragments	5
Clear chert clasts (large grains)	2
Ferruginous rounded volcanic chert grains (small grains)	1
Kaolinite matrix	2

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The rock is mainly silicified into mosaics and clay mineral occurs only in vugs.

P.67 - Sandstone. An irregular sandstone of large subangular quartz grains in a fine subangular quartz grain matrix.

At one end of the section are the familiar (of Pandurra Quartzite) large angular to subangular erratics of quartz rock fragments which are more abundant than large mineral grains, (varying 0.5 to 4 mm) in fine quartz (approx. 0.1 mm). Further down the section are subangular to round quartz grains (0.3 to 0.8 mm, mostly around median 0.7 mm) which show peripheral trains of opaque inclusions indicating secondary silicification. Silicification has not altered the primary shapes of quartz grains very much. Where not silicified, and this is the case in areas all over the section, limonite fills in spaces between the quartz grains to about 2 volume percent of the rock. Clay mineral as kaolinite occupies sporadic vugs in the rock and is seen adjoining the limonite in the interstices; also elsewhere brownish cherty material is seen associated with kaolinite in the interstices. No chert grains, ferruginous or clear are seen and no heavy minerals apart from occasional almost fresh unworn zircon grains. Absence of feldspar, ferruginous cherts and near absence of heavy minerals are noted.

EX136-97217 - Pandurra Formation quartzite. 84-84.5 m. Green quartzite.

Variable drill fragments mounted in the one thin-section.

a) Rounded grains of quartz mineral grains with fewer rock fragments (0.15 to 1.8 mm, median 0.4 mm) are silicified into mosaics, but a little residual limonite occurs in the space now silicified, adjoining quartz grain boundaries. Clay mineral (kaolinite) occurs in pockets to 2 volume percent. One rounded

quartz gneiss grain is seen. There is about 2 volume percent of fine granules of limonite mostly interstitial but some occurs with clay in pockets. No potash feldspar is present. An unusual Pandurra Formation type in view of the roundness of most quartz grains.

b) As for a) but the grains roundness is accentuated by the absence of silicification, with the presence of interstitial chloritic clay > kaolinite which occurs to about 7 volume percent. One square, glassy-looking chert grain (0.55 mm) occurs and some round quartz gneiss pebbles.

c) More typically Pandurra Formation (as per Mt. Gunson) although most quartz grains are fairly rounded. Very large quartz rock grains (approx. 1.5 mm) but somewhat flattened, set in an unsorted groundmass of fairly round quartz mineral grains (0.1 to 0.7 mm). All quartz grains are fairly tightly fitting with minimal limonite cement between all grains.

d) Subangular to angular unsorted quartz grains (0.004 to 0.5 mm). Cemented with limonite which occurs as fine flecks. Limonitic chert similar to that seen in Whyalla Sandstone occurs.

Most pebbles present are similar to a) above. Some are similar to those of d) but have a very heavy limonite cement to about 25 volume percent of pebble. A few loose pebbles of quartz rock and mineral grains occur to 2 mm and one large quartz gneiss pebble (3 x 4 mm).

A very variable textured make-up for approx. 0.5 mm pebbles and the rounded quartz grains which are seen in many cuttings are not typical of Pandurra Formation.

P.83A - Grit, from 15 km west of 'Carriewerloo' Homestead.

Large quartz and quartzite clasts (several millimetres in size) occur in a groundmass of smaller quartz grains.

Large clasts (2.5 to 6 mm) of mainly quartz rock fragments, some quartz gneiss fragments and fine-grain quartzite (approx. 0.10 mm quartz grain size) are seen. Finer, round to subangular quartz grains (0.5 to 1.5 mm, median 0.6 mm) occupy the interstices and take up to 60 volume percent of the rock. Kaolinite in voids (0.5 to 2.0 x 1.0 mm) take up 10 volume percent of the rock. The rock grains are fused together by secondary quartz where pores are absent. Larger quartz grains contain inclusions of sericite flakes (approx. 0.008 x 0.008 mm) sparsely, and abundant fluid inclusions mainly around 0.003 mm contain gas bubbles and one inclusion appears to contain a cube of halite. Trapped fluids occur from circulating brines between quartz grains in an original quartz mosaic now secondary silicified to form one quartz grain with polarisation differences in extinction which indicate previously distinct separate grains.

There is an approach to two populations of quartz grains. Large quartz grains are in fact fused mosaics of originally smaller grains.

No heavy minerals are seen.

No potash or plagioclase feldspar occur, as indicated by staining procedure.

85584 - Hole EX29, 24 to 27 m. T.S. Either Whyalla Sandstone or Pandurra Formation. Cu 5 ppm, Pb <20 ppm, Zn 10 ppm.

In hand-specimen, a medium grain sandstone with minimal interstitial clay or silt. Many grains are quite round, but most grains are subangular.

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Comparing with Mt. Gunson Plateau sections Nos. A4234 and A4235 which also show an abundance of fine silty matrix :-

a) 85584 shows between 10 and 15 volume percent of quartz mineral grains which are rounded but are not spherical. Specimens from the 'Plateau' show mainly (at least 80 volume percent) of rounded, largely spherical grains (as nuclei, before authigenic quartz overgrowths).

b) Maximum grain sizes are a little more at 2.0 mm for 85584, otherwise the range in grain sizes for Plateau specimens and 85584 are similar.

c) Much less than 1 percent of ferruginous cherts occur in 85584.

d) Heavy minerals are rare in all specimens (88584, A4234 and A4235).

However, the grain shapes and ranges compare favourably with A4009 (Pandurra Formation from West Lagoon), the coarse layer of A4005 (Pandurra Formation, West Lagoon), and of A4245 and A4256 (Pandurra Formation, Main Open Cut).

Resemblances to A9843 (siliceous sandstone overlying Whyalla Sandstone, West Lagoon) and A9845 (siliceous sandstone from the Main Open Cut) are there but there is still a tendency for most grains to be round in the latter and there is an abundance of lithic cherts which is not apparent in 85584. Also there is the presence of quartz gneiss fragments in 85584 which are commonly seen in the Pandurra Formation rocks so far examined. Staining for potash feldspar indicated none to be present.

P.21 - Pandurra Formation - Reddish-pink vitreous quartzite.

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Typical of Pandurra Formation in this area. Similar to A4256 and A5257 (2.5 and 15.0 m respectively of DH 3-4-3D). Subangular to angular clear quartz grains which are fairly even-grained at median 0.2 mm size but rough banding is seen where median grain size increases to 0.5 mm with some intermixed grains of approximately 1 mm size. Much of the quartz occurs as fused mosaics of quartz mineral grains showing occasional pockets and channelways of kaolin in between the quartz. Some larger quartz grains contain myriads of fluid inclusions which criss-cross the grains as fine trains. Occasional large zircon grains are seen (approx. 0.08 mm).

Chert grains (somewhat rounded) are infrequent (approx. 1 volume percent) and feldspar grains are not seen.

P.33 - Pandurra Formation, red quartzite with Liesegang banding. Typical for the area.

A fairly even-grained quartzite of subangular and rounded quartz grains (0.1 to 1.0 mm, median 0.4 mm). Many of the smaller and larger grains are quite round and some of the larger quartz grains show an original rounded grain nucleus enclosed by a narrow margin of opaque matter.

The matrix of kaolinite/illite occurs patchily. Most quartz grains are welded into mosaics by secondary silicification.

The Liesegang hematite coloration is caused by an abundance of iron-rich opaque matter which formed in repeat zones at close even-spaced intervals in the kaolinitic interstices between quartz grains before silicification. Where clay mineral still remains unsilicified then some of the hematite/opaque matter occurs intermixed with the clay. In the clear, colourless quartzite areas only very fine internal opaque trains of particles are seen in the quartz grains and none appears in scarce clay mineral vugs or channels there. It is

obvious that the formation of intervals of greater density hematite particles took place before silicification. Sporadic worn zircon grains and tiny green tourmaline prisms (approx. 0.01 x 0.004 mm) occur within quartz overgrowths or the clay interstices to $<<$1 volume percent.

The quartz fabric is somewhat similar to the finer grained quartzite band of P.31, but cherts (lithic fragments) are not seen at all here. Quartz rock fragments are present (as far as can be seen after the masking effects of secondary silicification) to less than 5 volume percent. Kaolinite is present to 1 to 2 volume percent. There are similarities in rock fabric with finer bands in Pandurra Quartzite at the Main Open Cut. (A4256, DH 3-4-3D, 8.5 m).

P.53 - Whyalla Sandstone containing chips of Gawler Range Volcanics.

A spongy looking pinkish quartzite with irregular inclusions of limonitised fine-grained rock.

In thin-section the quartz grains are presently irregular in size and subangular due in some cases to quartz overgrowths on more rounded grains. The size variation is 0.1 to 1.3 mm, median 0.2 mm. Some large grains of quartz are quite subangular and this is fairly unusual for Whyalla Sandstone as seen by the writer. However, most grains ($>$ 80 volume percent of quartz grains present) which now have quartz overgrowths, show by internal narrow elliptical trains of hematite particles that they were to some extent rounded before silicification. The quartz grains which were originally mainly mineral grains constitute 85 volume percent of the rock and with associated volcanic clasts, form a tight silicified mosaic. The remaining 15 percent of the rock consists of variable size (to several millimetres) and variable shapes of ferruginous cherts, clear cherts, micaceous cherts and volcanic cherty grains with microlites

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(variolitic) texture and devitrified palagonite, always accompanied by abundant limonite. Other grains contain chertified feldspar phenocrysts in a devitrified glassy mass of porphyrite or andesite? The latter are derived fragments from the Gawler Range Volcanics. Less than 1 percent of rounded zircons (approx. 0.048 mm in size) are present.

A poorly sorted quartzite with some rounding shown by primary nuclei of quartz grains. However the quartzite fabric is somewhat similar to that seen in A4255 (DH 3-4-3D, 6.1 m), Whyalla Sandstone from the Main Open Cut area. This rock has been highly silicified but does not contain as much cherty material.

Abundant volcanic clasts occur.

P.84B - Grit, from Seven Miles Outstation, 21 km southwest of 'Yudnapinna'.

An irregular quartzite of variable subangular grains, unsorted and with appreciable chert grains.

In thin-section the grains vary between 0.2 and 3 x 3 mm with an approximate modal value of 0.6 mm. Most grains are quartzite grains of irregular included quartz grain sizes. However, a proportion of quartz grains where present (0.5 to 1 mm) are almost spherical but most grains are subangular. An abundance of ferruginous cherts, rounded and oval (0.5 to 1.5 mm) are seen such as commonly occur in the Whyalla Sandstone. Again, most cherts, of similar grain size are clear, are of irregular shape and are of fine composite grains. One very large irregular shape of chert clast, (several millimetres) occurs in one corner of the section. One large cherty volcanic clast, possibly porphyrite, is seen with a large plagioclase grain; no individual feldspar grains are seen. Careful examination of quartz grain boundaries

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indicates that progressive chertification of the rock has taken place as occurs during weathering oxidation.

No individual potash or plagioclase feldspar grains are present as indicated by staining method.

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ELIZABETH CREEK CONGLOMERATE

P.3 - Whyalla Sandstone containing lithic fragments.

A much silicified sandstone. Roundness of the quartz grains before secondary silica addition has given the grains a subangular outline common to the Pandurra Quartzite. Quartz grains (now median size of 0.3 mm) are cemented together by secondary quartz so that only small pockets of illitic or kaolinitic clay are left. However, cherty looking grains containing opaque hematite dust are present to about 3 volume percent and are of similar size to neighbouring quartz grains. The chert grains retain their roundness and are cemented by secondary quartz to their quartz grain neighbours. Quartz gneiss and other rock fragments lacking included opaque matter are also present to about 5 volume percent and are of generally larger maximum grain size (approx. 1.5 mm) than other rock grains present.

P.9 - Whyalla Sandstone with lithic grains and silicified.

Present are mainly subangular to rounded quartz grains (median 0.4 mm), fairly even grained with isolated sporadic exceptions. Many of the 'rounded' grains of quartz have become fused mosaics where silicification has cemented the grains together; included opaque particles as elliptical shaped trains indicate former roundness of the quartz grains. Lithic grains of hematite/chert are fairly common (approx. 5 volume percent) and these are mainly rounded and of similar grain size to quartz mineral grains. Quartz rock fragments are rather more angular and are present to about 3 volume percent; these are usually larger than quartz mineral grains present. Some flakey interstitial fine micaceous mineral occurs in the interstices which is likely to be illite and occurs patchily to about 3 volume percent of rock.

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P.29 - Silicified conglomerate with banded iron formation pebbles. From 5 km SSE of Pandurra.

A mainly silicified quartzite of somewhat rounded quartz grains (0.1 to 2.0 mm, median 0.7 mm). Secondary quartz cement occurs between the quartz grains. Ferruginous, somewhat rounded grains of chert with a little mica, occurs (0.2 to 2.0 mm, to 2 volume percent). Occasional zircon prisms (approx. 0.01 mm) are seen embedded in quartz grains. Large rounded clasts (approx. 10 mm or larger) occur with mosaics of very fine quartz, $<$ 0.05 mm, grain size as are seen in P.27. As for P.27, the specimen is very clean but on the other hand is coarser and with more abundant matrix compared with pebbles. With large, (fine constituent grain) clasts the rock is similar to many occurrences of Pandurra Quartzite Formation and with abundant round quartz grains and ferruginous chert but without the large chert clasts the rock is similar to the Pandurra Formation from the road metal quarry at Woocalla Sidings (A4229).

P.2 - Silcreted basal Whyalla Sandstone containing angular chips of red quartz from Pandurra Quartzite.

The chips, similar to Pandurra Quartzite contain mainly subangular grains of quartz, somewhat equigranular (approx. 0.3 mm and 0.5 mm) and a little chert of similar size ($<$ 1 volume percent) and all close packed so that very little interstitial mineral is present. Welding of quartz grains by secondary silica has taken place. Where interstitial minerals occur they are carbonate and carbonate ensheathing clay mineral or fine opaque matter to about 2 volume percent of field. The main rock material present besides the rock chips is round or subangular quartz grains (up to 3 mm) but very variable, larger than the individual grains forming the rock chips and sitting in fine particles or clay mineral and some fine opaque mineral as is common in Whyalla Sandstone at Mount Gunson.

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P.27 - Silicified quartz pebble conglomerate from 'Pandurra' copper prospect.

A number of large, round quartz grains (1.5 mm) and some quartz rock fragments (approx. 2.0 mm) of equigranular quartz grains (approx. 0.1 mm) occur which are similar to those common in Whyalla Sandstone. A matrix of smaller rounded quartz grains (approx. 0.2 mm) occur in the interstices and also occur in mosaics as fragments. Lenticular fragments and rounded grains of very variable quartz (0.002 to 0.1 mm) occur as silicified shale fragments of several millimetres in size.

All the large constituent grains show some rounding but are not spherical. These large grains are generally fragments of silicified quartzite. This rock is a very pure quartzite and the larger quartzite grains are derived from the Pandurra Formation.

Zircon (approx. 0.15 mm) and a little topaz (approx. 0.06 mm) occur interstitially or embedded in quartz and a scattering of cubic opaque mineral (0.02 to 0.04 mm) - all occur to <1 volume percent.

P.57A - Silicified conglomerate; overlies Pandurra Formation. Believed to have undergone pre-Marinoan silicification along with upper section of the Pandurra Formation.

A silicified conglomerate of large and small grains in two distinct population distributions.

Thin-section shows large round quartz rock fragments and chert from 1 to 7 mm (about 20 volume percent of the rock) in a more subangular matrix of smaller quartz grains with fewer rock fragments and clear chert grains (overall 0.05 to 0.6 mm, median 0.3 mm, many grains are of approx. median size). The small quartz grains show the usual elliptical trains of hematite particles just within the

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grain boundaries to indicate more rounded primary quartz. Secondary silicification has welded the whole mass of quartz grains into sutured quartz mosaics. Occasional (< 1 volume percent of rock) volcanic rock grains of devitrified glass containing decussate patterns of microlites are observed. The large round conglomerate fragments which are quartz rock fragments show a similar complete silicification of constituent grains into mosaics.

The rudaceous element is largely of water-worn quartz and some chert grains derived from the Pandurra Quartzite. Absence of heavy minerals, ferruginous chert and aeolian quartz would suggest a Pandurra Formation origin for much of the rock material. A pebbly sand type of conglomerate which was subsequently silicified.

EX88-86545 - Elizabeth Creek Conglomerate. 57 to 60 m. Acid volcanic and acid 'plutonic' pebbles. Carbonate matrix.

Different rock types are represented by various pebbles present in the samples, as :-

a) A slightly altered adamellite granite of medium grain size. Large irregular plates (approx. 1 mm) of microcline mainly clear of inclusions but intergrown with part sericitised plagioclase of similar grain size. Variable clear anhedral quartz and perfect prisms and some clusters of fibrous actinolite needles, containing exsolution opaques and with slight extinction occupy the interstices. Larger flakes of secondary muscovite have grown from locally formed sericite. Myrmekite patches have developed where microcline and altering plagioclase are intergrown. Apart from secondary iron oxides associated with actinolite, occasional interstitial primary magnetite octahedra occur.

Minerals Present	Vol %
Plagioclase (now much altered and includes muscovite and sericite)	40
Microcline	32
Quartz	20
Actinolite (after hornblende)	8
Opaque minerals (includes magnetite)	<1

b) A possible dolerite much sericitised and chloritised. The feldspar occurs as a decussate pink coloured framework of sericitised plagioclase of variable size (median 0.2 mm). Some relict lamellar twinning is seen in marginal areas of some grains. The interstices are now largely flakey ripidolite chlorite (anisotropic green to purple) and is commonly associated with local abundances of magnetite. Scattered areas of irregular secondary quartz occur and small calcite aggregates after plagioclase are seen.

c) An altered (metasomatised/hydrothermally altered) porphyritic basalt with oligoclase phenocrysts part-silicified but some fresh (approx. 0.7 mm) with a groundmass of fine feldspar prisms and irregular but rounded pockets (to 0.3 mm) of flakey green chlorite or augite phenocrysts shapes (approx. 1 mm) now chlorite and magnetite. Areas of groundmass are seen silicified by quartz but leaving feldspar phenocrysts intact or part or totally silicified or totally carbonatised. Fine scattered magnetite occurs throughout, though much of it is limonitised and appreciable amounts are associated with chlorite and are secondary after original ferromagnesian phenocrysts which are now altered. Ophitic textures of plagioclase shapes in large augite plates which are now mainly chlorite are seen locally as possible dolerite fragments in basalt.

d) A possible silicified and carbonatised basic tuff. Patchy albite mosaics, very variable as amygdules; some branching albite forms containing fine scattered carbonate grains are seen. The groundmass is of limonite stained carbonate and fine magnetite. Magnetite shows lenticular concentrations associated with lenticular carbonate possibly simulating original flow of glassy material. No other structures are perceptible.

e) Feldspathic quartzite or feldspathic arenite of Williams et al. An equigranular quartzite of subangular and flattened quartz grains (0.05 to 0.4 mm, median 0.16 mm) and abundant microcline (approx. 5 volume percent) as oblong grains. Illite occurs along grain margins and in pockets at about 7 volume percent; tourmaline as a rounded grain (0.08 mm) and abundant opaque mineral as fine grains (> 0.005 mm) occurs to roughly 5 volume percent with octahedral (0.02 to 0.08 mm) magnetite at about 1 volume percent. Much of the fine opaques with illite and a little carbonate may be much altered volcanic grains and would thus constitute about 3 percent of the section. The section resembles Corraberra Sandstone (A4224) from Mount Gunson, and also of Yudnapinna Beds (97325), all remarkably similar rocks.

WOOCALLA DOLOMITE

P.52 - Woocalla Dolomite? Manganiferous.

Fine cream-coloured rock with numerous small vugs. Manganese dioxide has apparently deposited(?) along subparallel fractures or joints in the rocks and has diffused along microfractures flanking the major joints.

Thin-section shows fine-grain dolomite with moderate (3 volume percent) goethite depositing largely as spheres (approx. 0.005 mm) within fine dolomite grains. Possibly some of the goethite is pseudomorphing original sygenetic pyrite(?). The dolomite which is seen as irregular grains of very variable size (to 0.026 mm) is fairly clear except where deposited manganese dioxide occurs in the dolomite as irregular lenticles and masses commonly intergrown with goethite, although as mentioned above, most goethite occurs separately scattered through the dolomite.

It would appear that both manganese dioxide and goethite were the product of weathering of dolomite containing appreciable iron and manganese in solid solution. Upon weathering both elements were leached and became oxidised, the iron precipitating first in the dolomite followed by manganese which precipitated in fractures. Thus the diffuse goethite seen beyond and around manganese in fractures is precipitated iron extracted from dolomite; but the goethite spheres which occur scattered throughout the rock may possibly be pyrite pseudomorphs.

No organic algal structures are seen.

Woocalla Dolomite where weathered, quite often shows oxidation of 'dolomite' manganese, although as previously seen by the writer it occurs more diffuse associated with goethite and seems to occur towards the bottom of the stratigraphic unit.

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97342 - Drill Hole EX 143, 39 to 42 m. Rotary drill cuttings. Large (5 cm) chip of greyish dolomite from thin probably brecciated lens between 'Yudnapinna Beds' and Pandurra Formation.

Fine cloudy dolomite in fragments with clear calcite/dolomite cement (approx. 0.03 mm width but variable), and in pockets. Fine limonitic opaques (approx. 0.02 mm to 2 volume percent overall) speckle the dolomite fragments. Prismatic gypsum (approx. 0.3 mm x 0.1 mm, 1 volume percent) and angular quartz and a minority of round detrital grains (0.03 to 0.3 mm at 1 volume percent of section) occur scattered through the section.

Possible solution breccia of Woocalla Dolomite.

EX50 - Core from 20 m. Black shale of Woocalla Dolomite.

In hand-specimens the rock is a creamy-white rock with fine blue-black parallel laminae.

Compared with the basal Woocalla Shale from Sweet Nell (A4233). EX50 is a laminated rock. Both EX50 (20 m) and A4233 contain an abundance of carbonate and opaque mineral. However, EX50 is strongly laminated and differentiated into fine carbonate bands and bands of a mixture of sericite (illite?) and fine subangular quartz (approx. 0.025 mm) with or without carbonate blebs and some chlorite laths and also bespattered with anhedral blebs of limonite. The carbonate and clay/quartz bands alternate to various thicknesses throughout the section depth with bands of clay becoming more common at one end of a rhythmic sequence and carbonate dominant at the other end. The cycles repeat throughout the thickness. Thin bands of chert and quartz/illite occur rhythmically through the carbonate layers. Porphyrotopes of quartz are also seen in dolomite bands.

Carbonate is by far the most abundant mineral component of this rock. No potash feldspar occurs (confirmed by stain technique).

The least hematite-rich bands of the Tregolana Shale are apparently coarser grained and with less carbonate than the specimen of Woocalla black shale, EX50. The Tregolana Shale is more quartzose and less carbonate rich even where finer grained.

Polished section shows scattered pyrite (median 0.005 mm, maximum 0.1 mm) mainly in the darker (clay/quartz) bands of laminated shale. The identity of pyrite is partly obscured by the poor polish though it appears in places mainly as anhedral masses and finer euhedra. Some nucleation (precipitation?) around greyish (magnetite) grains is seen, therefore the sulphide may be recrystallised melnikovite. Probably rather less than 1 volume percent of pyrite occurs in the rock, and with the very fine median grain size, it is almost certainly syngenetic with the shale.

P.34 (?) Dolomitic sandstone, possibly Whyalla Sandstone.

A very fine-grained and 'dirty' sandstone. The quartz grains are angular to subangular (approx. 0.005 to 0.30 mm). Many quartz grains are fused together as mosaics. As seen in Whyalla Sandstone elsewhere, rounded cherts (median 0.16 mm) are quite common but yellowish brown ragged biotite flakes (median 0.10 x 0.02 mm) are scattered through the section and less muscovite of similar size range. Limonitised magnetite grains, some octahedra, (approx. 0.05 mm) but much messy limonite surrounding quartz grains is abundant. Feldspars as subhedral to oblong, clear twinned plagioclase (approx. 0.06 mm) occurs with composition around Ab_{88}, also a little fresh microcline occurs. Kaolinite occurs in pockets and channels. Scattered zircon grains are present and a little sphene occurs associated with limonite

opaques. A little chlorite is seen attached to 'magnetite'. Banding is shown where a greater density of opaque minerals occurs.

Approximate modal composition :-

	Vol %
Quartz mineral grains Quartz rock fragments	81
Chert	3
Microcline	1
Plagioclase	2
Kaolinite	3
Biotite	1→2
Muscovite	1
Chlorite	<1
Magnetite (limonite pseudomorphs)	5
Zircon, sphene, etc.	<1

P.35 - Flaggy, micaceous siltstone; from 'Pandurra' ? Tregolana Shale.

A sericitic siltstone with banding emphasised by limonite staining. In thin-section the rock consists of long fibrous sericite laths as aggregates and short-staple laths in books which are unoriented parallel growths, alternating with anhedral quartz (approx. 0.08 mm) which is fairly even-grained, chlorite and patchy limonite as minute granules which are mainly intergrown with the micaceous minerals; and a little granular carbonate.

Diagenetic recrystallisation of quartz has resulted in angular to subangular grains and mosaic patches. Similarly, sericite occurs in pockets and is interstitial to patchy quartz mosaics. Patchy anhedral albite-twinned albite plagioclase grains of similar grain size to quartz mosaics are seen.

Modal mineral percent volume composition :-

	Vol %
Quartz	79
Sericite	10
Chlorite	1
Carbonate	2
Albite	1
Limonite	7

P.28 - Calcareous black shale. Drill hole cuttings. Possibly Woocalla Dolomite equivalent.

A fine-grain rock of mainly kaolinite with less rounded brown carbonate granules or aggregates of rounded granules (0.01 to 0.25 x 0.08 mm, approx. 10 volume percent) and about equal amounts of small angular quartz or chert grains (median 0.015 mm, but up to 0.06 x 0.02 mm). Also long laths of detrital muscovite (1 volume percent) and anhedral opaque minerals (median 0.01 mm, <1 volume percent) are present. Banding is indicated by lenticles of clay mineral and carbonate and also by the subparallel orientation of muscovite laths.

The specimen does not compare at all with the basal shale in the Woocalla Dolomite from Sweet Nell (A4233) which contains much more carbonate, a high proportion of opaques and is coarser grained. Except for median grain size the sections are not at all like the Tregolana Shale sections from the Pernatty Lagoon/Mystery drill cores. There is no resemblance with the 'Tregolana Shale' 6B specimen which is somewhat chloritic and lacks carbonate.

97275 - Drill hole EX 139, 48 to 51 m. Rotary drill cuttings. Cu 130 ppm, Pb 600 ppm, Zn 520 ppm. Grey shale and dolomite.

a) Angular dolomite fragments (0.04 to 0.3 mm) contain fine opaque dust with clear secondary dolomite/

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calcite cement between fragments.

b) Fine dolomite of grains approx. 0.008 mm contain bands of fine limonite dust and fine opaques (0.001 to 0.018 mm, median 0.005 mm, to 4 volume percent) and angular quartz (0.005 to 0.05 mm, very variable size to 10 volume percent). From a Collenia 'reef'.

c) Irregular dolomite fragments (0.001 to 0.3 mm, median 0.005 mm) and quartz grains of angular and subangular aspect (0.16 to 1 mm, to 25 volume percent) and fine limonitised opaque mineral, (0.004 to 0.03 mm, to 2 volume percent). Some of the larger dolomite fragments themselves contain quartz fragments. Lagoonal mud.

Fragments from b) are the most common. Some Pandurra Quartzite/spherical Whyalla Sandstone grains are also present. Facies of Collenia 'reef' and lagoonal carbonate mud.

97404 - Drill Hole EX 147, 69 to 72 metres. Rotary drill cuttings. Cu 1100 ppm, Pb 280 ppm, Zn 1000 ppm, Mn 70 ppm. Grey clay from contact between Whyalla Sandstone and Pandurra Formation. Thin and polished sections.

Various rock types are represented by fragments sectioned.

a) Whyalla Sandstone with Pandurra Formation fragments. Round quartz and quartz gneiss grains (approx. 1.5 mm); subhedral quartz grains and some rock fragments (0.2 to 1.5 mm); also smaller quartz grains, subhedral and round (0.1 to 0.3 mm); and a fine matrix of illitic clay occur. There is a trace of potash feldspar present as round grains.

b) Banded clay of fine illite and some kaolinite. Banding is shown by limonite particle concentrations (approx. 0.02 mm wide) bands close together (approx. 0.05 mm apart). Scattered subangular > angular

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quartz grains (0.025 mm) occur to 3 volume percent and concentrations of opaques (grain size to 0.05 mm) or scattered much finer opaque minerals also occur in some bands and total amount in section to 5 volume percent. Quartz bands of variable quartz, round to subangular (0.05 to 0.080 mm) occur in the clay. Quartz as large grains has collected around peripheries of clay particles in some chips from the process of 'drilling' to that of 'preparation of section'.

c) Particles of Pandurra Quartzite with subhedral quartz grains > quartz rock fragments > ferruginous cherts, (0.16 to 0.30 mm, median 0.24 mm). Some interstitial illite flakes to 5 volume percent but abundant silicification has occurred.

Largest number of particles constitute those of section b).

P.S. Massive (maximum 0.8 x 0.6 mm) framboids are seen which have irregular outlines and pyrite cement occurs between individual spheres or the spheres surround detrital quartz from the rock. Colour of aggregates is visually pale yellow or yellow although occasional 'framboids' are brown and isotropic as in the melnikovite variety of pyrite.

One massive chalcopyrite:sphalerite/galena exsolution composite grain (0.6 x 0.3 mm) which formed from a gel form is seen. Mutual boundaries between chalcopyrite, sphalerite and galena are observed. Elsewhere, chalcopyrite nucleates around pyrite, or occurs in massive form. Evidence of framboidal chalcopyrite is seen here. Abundance progression is chalcopyrite > pyrite > sphalerite > galena.

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97427 - Drill Hole EX 149, 48 to 49 m. Rotary drill cuttings. Cu 10 ppm, Pb 20 ppm, Zn 35 ppm. Light grey dolomite and red quartzite (Pandurra Formation).

a) Irregular clear dolomite fragments cemented by dolomite (0.005 to 0.05 mm) with angular > subangular and a little rounded quartz (0.024 to 0.2 mm, at 3 volume percent) and fine limonitised opaque mineral, (< .001 to 0.008 mm, to 1 volume percent). Lagoonal mud.

b) Rounded and subangular quartz grains (0.16 to 0.50 mm) in fused mosaics but pockets of kaolinite are present in the interstices and limonite flecks indicate the position of original interstitial minerals. About 20 volume percent of quartz grains are fused quartz rock fragments - Pandurra Quartzite.

c) Fine subangular quartz (0.016 to 0.08 mm, median 0.03 mm), with abundant illite > kaolinite cement (20 volume percent), one large oblong, part sericitised twinned plagioclase (approx. 0.7 x 0.4 mm) and a little irregular quartz to 0.30 mm altogether to 10 volume percent. Irregular opaque mineral blebs, now limonite (0.08 to 0.11 mm) to 1 volume percent.

d) Large quartz grains (approx. 2 mm) containing trains of limonite particles, attached finer quartz mineral grains and rock fragments (0.05 to 0.5 mm) some limonite cement, otherwise interstitial clay mineral - Pandurra Quartzite.

e) Angular to subangular quartz in carbonate cement - basal Woocalla Dolomite.

f) Lithic cherty and volcanic (basaltic?) clasts.

The fragments are Pandurra Quartzite > Woocalla Dolomite > volcanic/cherty clasts.

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MAGAZINE HILL CLAY

P.6A - Sandstone from type locality for Whyalla Sandstone, therefore by definition is Whyalla Sandstone. However, this rock bears no resemblance to Whyalla Sandstone as we know it and is suspected to be part of the Tregolana Shale.

An abundance of angular quartz grains (median, 0.16 mm) and fractured quartz lenticles together comprise 20 volume percent of rock. Also present are large filamentous looking muscovite flakes (median 0.19 x 0.08 mm, the maximum grain length being several times 0.19 mm) occurring up to 3 volume percent which appear to be forming from unoriented filamentous chloritic clay mineral. Both quartz and muscovite are set in a fine matrix of kaolinite flakes and chloritic clay in about equal proportions, and scattered, for the most part, amorphous, opaque grains with leucoxene, (of size mainly .016→ .096 mm), to 1 to 2 volume percent. Scattered rounded chert grains (all approx. 0.08 mm) occur sporadically. Brecciated quartz lenticles and muscovite show a disturbed parallel orientation. A little detrital zircon is seen. The rock does not look anything like the Tregolana Shale examined from the Mystery area, the latter is finer grained and contains more opaque matter and appreciable hematite/limonite and does not contain quartz breccia fragments. The rock has no affinity with any rock type seen in the Gunson area so far.

P.6B - Shale interbedded with P.6A. Suspected Tregolana Shale.

Angular to subangular quartz mineral grains (approx. 20 volume percent) varying in size from 0.008 to 0.20 mm, median 0.10 mm. Ragged muscovite flakes (median 0.10 mm) are scattered sporadically around the section to 2 volume percent. Scattered leucoxene aggregates

and fewer detrital zircon grains, are present together to <1 volume percent. Remainder of mineral content consists of fine kaolinitic clay and some chlorite.

For a description of Tregolana Shale from DH-3-6-2D, 5.0 m (A4239) see P.65 of PMR 195/72. It is seen that the two rocks are of quite different type if A4239 is typical of Tregolana Shale in the area. Only two samples of Tregolana Shale were taken at the time of sampling and both from drill holes in the Pernatty Lagoon/Mystery area. The latter contains appreciable hematite and some carbonate and is finer grained than P.6B.

P.85 - White and grey banded clay from Magazine Hill quarry.

A fine, white, banded clay but possibly more gypsiferous than P.81?

In thin-section the fine kaolinitic clay is patchily stained with goethite/limonite. Euhedral plates of gypsum up to 0.5 mm occur to about 1 volume percent. Rounded and angular quartz (to 0.15 mm) also occur to about 2 volume percent. A sprinkling of illite flakes (approx. 0.03 mm) to 3 percent or more is seen near limonite stained areas. Abundant holes in the section are filled with fine grinding media (< 0.03 mm particle size), occur patchily with more abundant goethite(?) to about 7 volume percent in stained areas; traces of glauconite(?) occur. Some very fine opaque matter is very fragmentary and could be organic carbon.

There are definite similarities to P.28 (Woocalla Shale). Some mobilisation of clay occurred during slumping; crenulation and micro-faulting follows grey bands.

The rock is probably weathered Woocalla Shale(?).

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It is thought that holes now filled with grinding media were occupied by halite before section preparation.

P.81 - White clay from Magazine Hill quarry.

A fine, white banded clay.

In thin-section the specimen is seen to consist of very fine kaolinite with a little rounded quartz (0.025 to 0.050 mm) distributed throughout to about 1 volume percent. Scattered very fine grinding medium (up to 0.008 mm) as single grains or aggregates also occur to about 3 to 4 volume percent and occasional opaque limonite masses (to 0.03 mm). Traces of gypsum may also be present and a little illite. It has been suggested that the grinding medium has filled in spaces occupied previously by halite before being solubilised by water in section preparation.

A possible leached shale rock, an almost pure kaolinite.

YUDNAPINNA BEDS

85235 - Drill Hole EX 11, 34 to 37 m. Rotary drill cuttings. Cu 5 ppm, Pb $<$20 ppm, Zn 26 ppm, Mn 1340 ppm. Greyish-green and greyish red siltstone. Effervescent in HCl.

Angular to subangular quartz grains with few rounded grains (0.016 to 0.24 mm, but mainly close to the median size of 0.064 mm). Grains of oligoclase occur ($<$ 1 volume percent) and potash feldspar (varies between 2 and 7 volume percent); detrital rounded rutile (approx. 0.05 mm, $\ll$1 volume percent); octahedral$<$ rounded magnetite grains (approx. 0.03 mm, approx. 1 volume percent); greenish, rounded glauconite(?) grains (approx. 0.1 mm, $<$ 1 volume percent), and red subangular chert grains (approx. 0.1 mm, $<$ 1 volume percent), muscovite flakes (approx. 0.1 x 0.03 mm, $<$1 volume percent) and granular, subangular, carbonate grains (0.05 to 0.06 mm, 2 volume percent). The interstices are of fine granular carbonate $>$ limonite $>$ clay mineral, overall around 15 volume percent. Size ranges are just within siltstone grain size.

All mounted fragments show varying amounts of potash feldspar as grains (K. Feldspar staining method). Volcanic clasts, cherty or glassy clasts are seen in section with potash feldspar phenocrysts in some fragments.

A quartz wacke (Williams et al) with a mainly carbonate matrix. Very much like the silt-size fraction consisting of the matrix of some Mt. Gunson, Whyalla Sandstone samples and elsewhere.

85271 - Drill Hole EX 12, 73 to 76 m. Rotary drill cuttings Cu 8 ppm, Pb $<$20 ppm, Zn 17 ppm. As previous sample.

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Very similar to 85235 except that the quartz grains are more subangular rather than angular and limonite becomes more dominant than carbonate in the matrix.

Subangular to round quartz and flat quartz fragments (0.03 to 0.16 mm, median 0.064 mm); oligoclase grains, similar in size to quartz grains, sharply albite twinned; <1 volume percent potash feldspar; clear cherty grains and some micaceous chert grains (0.03 to 0.16 mm, 2 volume percent); muscovite flakes (up to 0.1 x 0.03 mm, <1 volume percent); clear carbonate grains (approx. 0.05 mm, up to 3 volume percent in clear fragments, nil percent in limonitic cement fragments); rounded glauconite grains (approx. 0.05 mm, <1 volume percent). Rounded magnetite (approx. 0.05 mm, 1 volume percent. Magnetite is limonitised where limonite content is high. The matrix varies between carbonate and limonite-rich, 10 to 15 volume percent. No heavy minerals other than magnetite are seen.

Staining for potash feldspar indicated occasional clasts in 'white' mounted fragments of the rock, i.e. <1 volume percent of potash feldspar is present. Occasional sericitised but glassy clasts are volcanic and are present to <1 volume percent.

A quartz wacke as for 85235.

85713 - Hole EX 36, 30 to 34 m. Grey pyritic material, Cu 25 ppm, Pb <20 ppm, Zn 50 ppm.

Colloform pyrite fragments are seen, very fine-grained but with a slight bluish/yellow anisotropism which may indicate the presence of the melnikovite variety of pyrite of very fine marcasite and pyrite in rhythmic precipitation in layers. The colloform rosettes are approximately 0.03 mm in diameter with slight variations. The rosettes are aggregated.

Most rock fragments contain scattered tiny pyrite grains. Some contain a cement-film of pyrite between quartz grains. Few tiny (< 0.003 mm) grains of suspect chalcopyrite are seen. Other reflective minerals include goethite segregations in rock fragments.

85739 - Hole EX 37, 61 to 64 m. Grey pyritic material. Cu 170 ppm, Pb <20 ppm, Zn 50 ppm.

A miscellany of quartz grains, quartz rock fragments and cherts with some black shale fragments containing sulphides. One bright red grain (several millimetres in size) is of quartz grains with a hematitic/limonitic/chert cement. Some pyrite grains are recrystallised aggregates, (grains are approx. 0.03 mm but quite variable, aggregates approx. 0.5 x 0.3 mm or larger). At one end of an aggregate, zoning of pyrite suggests a recrystallised colloform structure of now completely pyrite.

Other mineral particles contain minute pyrite (< 0.003 mm) and possibly also some chalcopyrite. Scattered goethite grains occur with some larger grains pseudomorphing pyrite aggregates; lighter, lepidocrocite may also be present as laths.

There is around 2 percent pyrite in the mounted material.

85846 - Hole EX 43, 21 to 24 m. Whyalla Sandstone, fine-grained, pyritic. Cu 10 ppm, Pb <20 ppm, Zn 10 ppm.

Mainly fine subangular > angular quartz grains (approx. 0.05 mm) with scattered large subangular quartz mineral grains and rock fragments (approx. 1 mm). Sulphides are scarce ($\ll$1 volume percent). One large (approx. 0.15 mm) aggregate of recrystallised pyrite grains (0.012 to 0.030 mm) is seen. Other than that, very occasional

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pyrite grains (approx. 0.030 mm) are scattered through the mount.

86645 - Drill Hole EX 96, 27 to 30 m. Rotary drill cuttings. Dark grey clayey sandstone. Sulphide-bearing. Cu 10 ppm, Pb 40 ppm. Zn 70 ppm. Thin and polished sections.

Consists largely of subangular and some angular quartz grains (0.015 to 0.18 mm, but largely median size, 0.06 mm) in a groundmass of clay mineral (illite > kaolinite as mainly fine flakes but some diagenetically formed larger flakes to 0.16 mm length are seen; clay is present to 20 volume percent of rock). Large, more rounded grains of quartz (approx. 0.3 mm) and Pandurra Quartzite fragments occur to 3 volume percent of rock. Plagioclase (oligoclase) and potash feldspar are of similar grain size and shape to the population of small quartz grains and are of size (approx. 0.06 mm). Also seen is opaque (pyrite), euhedral and angular in larger sizes, rounded smaller sizes (0.008 to 0.08 mm, median 0.02 mm) occurs to 8 volume percent with clay in the interstices. Ferruginous, subangular cherts, largely around 0.10 mm are seen scattered in the section to 1 volume percent.

Staining for potash feldspar shows the content to be around 5 volume percent for most mounted rock fragments. Mainly small feldspar grains but some quite large grains are seen. Group intergrowths of potash feldspar grains are also seen to occur. The 5 volume percent of potash feldspar includes some glassy-looking volcanic clasts present.

P.S. Pyrite (up to 0.09 x 0.03 mm) occurs as recrystallised framboidal type with secondary pyrite filling spaces between recrystallised spheres which are now euhedral. Very fine pyrite (few microns in size) occurs adhering to margins of quartz clasts. A little goethite

(0.015 x 0.006 mm) occurs adhering to quartz. Fine framboids (0.003 to 0.018 mm), spheres (0.001 to 0.002 mm) occur associated with margins of the quartz clasts. Possible melnikovite pyrite as brown specks associated with normal pyrite in colloform zoned varieties are seen. Pyrite content is probably 2 volume percent of the section and scattered as fine growths.

97325 - Drill Hole EX 142, 42 to 45 m. Rotary drill cuttings. Cu 10 ppm, Pb 20 ppm, Zn 30 ppm. Greyish-red siltstone with orange lithic grains. Minor greyish-green siltstone. Weakly effervescent in HCl.

Similar to 85325 but a variety of grain shapes from angular to rounded quartz, abundant microcline and some oligoclase, and volcanic clasts (sericite, glass(?) and chert). Quartz varies between 0.02 and 0.22 mm, median 0.06 mm, similarly for microcline which occurs at 2 volume percent, and oligoclase, <1 volume percent. A large granophyric grain is seen. Chert is rounded, approx. 0.6 mm, many grains are micaceous, occurs to 3 volume percent; carbonate grains, approx. 0.06 mm, subangular occur to 1 volume percent and rounded to euhedral magnetite, approx. 0.06 mm at 3 volume percent; also several grains of glauconite(?) are seen, approx. 0.05 mm, <1 volume percent. Matrix between the larger grains is fine carbonate > illite > limonite, together to about 10 volume percent. One large zircon grain, (approx. 0.05 mm) is seen; minor rutile and coarse rounded tourmaline (greenish) occur as rounded grains.

There is a resemblance to Corraberra Sandstone particularly with 97325, albeit of finer grains, in grain shapes, presence of appreciable magnetite, limonite, varied heavy minerals and appreciable feldspar. The presence of a carbonate matrix may be unusual for the Corraberra Sandstone but the sedimentation and environmental characteristics may to some extent have been similar.

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All fragments contain between 2 and 7 volume percent potash feldspar. Occasional glassy volcanic clasts are seen; these are also probably potassic and occur to 2 volume percent.

P.40 - Sandstone, Whyalla or Corraberra? From Illeroo.

Bleached-looking sandstone with clay matrix(?) and traces of atacamite as greenish flakes which dissolve slowly in 1:1 hydrochloric acid.

There is a tendency for two generations of quartz grain-sizes to occur. The larger grains are mainly rounded and subangular with appreciable flat grains with rounded corners (overall variation 0.24 to 0.72 mm). These are nearly all quartz grains and there are few rock fragments. The smaller size mineral grain population is more subangular than round and varies mainly between 0.08 and 0.20 mm of quartz mineral grains, ferruginous cherts, volcanic 'cherts' and fresh feldspar (microcline > plagioclase). Illite occurs interstitially as a film between quartz grains and in some vugs.

The chert, (mainly micaceous/ferruginous) including silicified volcanic fragments, occurs to about 7 volume percent of the rock. Albite and microcline occur together at about 1 volume percent. Bundles of greenish biotite and squat blue-green tourmaline (approx. 0.1 x 0.05 mm) are present as minor quantities. Possible monazite is scattered around the section as squat yellow sections; also scattered magnetite euhedra, blue-green tourmaline and zircon. The heavy minerals total just over 1 volume percent.

P.41A - Sandstone similar to P.40, from Lincoln Gap.

Pale sandstone with a pebble band of spherical quartz grains.

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The main sandstone consists of near spherical to flat and subangular quartz grains 0.2 to 1.0 mm, coarser chert grains 1.0 to 3.0 mm, mainly ferruginous and micaceous (with limonite as homogeneous specks in chert and fine mica matrix). The larger grains occur in a fine subangular quartz (approx. 0.1 mm) matrix. The abundance of ferruginous/micaceous chert (5 volume percent of section), two populations of clastics and roundness of some of the larger quartz grains, (Whyalla Sandstone); and flatness of many quartz grains and appreciable detrital, rutile, zircon and tourmaline to about 1 percent (Corraberra Sandstone); suggest this rock to be Corraberra Sandstone with derived Whyalla Sandstone material. Narrow channels between all quartz grains contain kaolinite flakes with rather less illite totalling to about 10 volume percent.

A fine-grain sandstone with 10 volume percent quartz (largely mineral grains, some rock fragments) as coarse clastic material.

The pebble band is a sediment horizon in the rock consisting of large round quartz rock fragments and chert varying between 0.5 and 4.0 mm.

P.65 - Whyalla Sandstone(?) Clay-rich layers similar to P.40, P.41A. Fine white quartzite with round lithic fragments as inclusions.

Grains are rounded, flat with rounded corners and sub-angular grains (0.03 to 1 mm, median 0.08 mm) are poorly sorted and are mainly quartz mineral grains with appreciable ferruginous cherts. The flattened grains among both the smaller and larger grains are present to nearly half the total quartz grains in the section. Ferruginous cherts and minor granophyric grains which are similar in shape are together present to less than 1 volume percent. Clear cherts of all sizes are rounded and occur to less than 1 percent. Heavy minerals

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including leucoxene > magnetite > zircon > tourmaline > rutile are present, total between 1 and 2 percent.. Also scattered large clasts (0.3 to 1 mm) of spherical quartz rock fragments occur to 3 percent of grains present in most of section but grades up to 10 percent where present in a coarser band of quartz grains.

Clay mineral (kaolinite > illite) as fine flakes to 10 volume percent of the rock, some coarser muscovite also occurs to less than 1 percent of rock, also a little interstitial carbonate.

The rock is similar to P.40 in grain size and texture but contains no feldspar, less ferruginous chert, more clay and more heavy minerals.

EX146 - Panned concentrate. Yudnapinna Beds(?). 30 to 46 m. Carbonate-bearing. Black heavy mineral.

Similar to Yudnapinna sections 85235, 85271 and 97325 but very like basal Whyalla Sandstone in that the quartz grains present are more spherical (0.2 to 1 mm, to about 7 volume percent of the section). Pandurra Formation fragments (to 8 mm) with unsized angular to subangular quartz grains > rock fragments (0.1 to 0.6 mm) in a limonite cement occur; also grains of Woocalla Dolomite (approx. 0.5 mm). The 'silt-size' matrix is mainly of round grains (0.03 to 0.10 mm, median 0.08 mm) and are just slightly within the sand-sizes of Pettijohn. This includes ferruginous and micaceous:ferruginous chert grains quite rounded and rounded cherts of devitrified basalt (volcanic chert of Whyalla Sandstone) - total to 3 volume percent of the rock. Up to 3 volume percent potash feldspar (silt-size)* is present. Fine illitic clay and some clay mineral laths are seen to 3 volume percent. A little rounded grains of green tourmaline also occur and less rounded zircon at about 1 volume percent.

* checked by mineral staining procedure

Grain size of fine quartz and shapes of the grains are similar to Yudnapinna Beds. Silt-size Yudnapinna is similar to silt-size matrix of Whyalla Sandstone (A4007A). With the round (spherical) Yudnapinna quartz sand-size grains, differentiation is difficult and petrographically impossible with present state of sampling. It would be preferable to put the Yudnapinna Beds specimen, if EX 146 is a typical example of the type, at the base of the Whyalla Sandstone where in fact it occurs stratigraphically, but with no break. In other specimens the presence of appreciable plagioclase precludes this.

P.S. Shows rounded grains of specularite (0.02 to 0.08 mm) mainly free, though minor amounts are seen flecking quartz rock fragments. Specularite occurs to about 1 volume percent of section as scattered grains. One large pyrite grain (approx. 0.3 mm) which is a pyrite cemented agglomeration of spheres (framboid) shows some faint internal vein-like growths of specularite. Lamellar translation planes of specularite are easily seen and some grains contain titanhematite flecks distributed along lattice planes.

85893 - Drill Hole EX 44, 66 to 70 m. Sandy siltstone, grey and green, hard. Either Tregolana Shale of Whyalla Sandstone.

Low power binocular examination indicates a Whyalla Sandstone type rock of two generations of quartz, sand-size and silt-size grains, the latter forming the matrix.

In thin-section the round quartz grains of the sand-size grains and the abundance of silt-size quartz are remarkably similar to the grains in section A9864 (70827) or Tregolana Shale specimens from Penelope Inlet submitted by Dr. K.J. Maiden, and particularly the iron poor bands.

85893 specimen, sand-size grains vary between 0.3 and 0.8 mm, median 0.05 mm, are mostly round though some are fairly angular and there are about two percent ferruginous cherts, mainly round and of similar size range to the quartz grains. Also 2 volume percent of round to subangular fresh microcline grains (approx. 0.5 mm) are present and subangular fresh oligoclase and granophyre grains. The silt-size matrix is even-grained quartz but of mainly angular and subangular grains (0.03 to 0.19 mm, median 0.10 mm) and constitutes about 70 volume percent of the rock. Rounded magnetite, angular tourmaline and zircon are of silt-size and constitute about 1 volume percent of the rock. Thin carbonate segregations (approx. 3 volume percent) occur interstitially.

P.46 - Whyalla Sandstone, overlying Gawler Volcanics.

A very fine-grained sandstone with carbonate cement and containing patchy oxide-copper mineralisation.

In thin-section the quartz grains are more or less equigranular, subangular with an abundance of flat grains (0.05 to 0.24 mm, median 0.16 mm) and many show replacement of grain margins by the carbonate matrix. In fact the matrix is largely brownish chloritic clay with patchy illite and carbonate. The chloritic clay platelets commonly occupy the centres of vugs; illite and carbonate, mixed or separately occupy narrow or broad zones flanking the quartz grains; however, chloritic clay platelets also flank quartz grains locally. Chloritic clay is associated with leucoxene which occurs as granule aggregates. Occasional grains of fresh albite (one percent of rock) and a little limonitised magnetite are seen as scarce components; also large (0.3 x 0.8 mm) flakes of muscovite; less than one percent volume of rock of cherty tachylyte; and large (0.10 mm) chunky tourmaline (olive green) grains. The abundance of chloritic clay, scattered

leucoxene aggregates, and feldspar and tachylitic chert fragments may indicate derivation of matrix from an igneous rock source.

Modal composition of rock :-

	Vol %
Quartz	64
Chert (including much micaceous chert)	2
Volcanic fragments	1
Carbonate	3
Chloritic clay	20
Illite/muscovite	5
Leucoxene	2
Plagioclase feldspar	1
Microcline	2
Tourmaline, topaz, sphene	<1

P.65A - Whyalla Sandstone(?). Similar to P.65.

A fine-grain greenish equigranular sandstone specked with red lithic particles and white clay and black magnetite(?).

Overall, coarser grained than P.40, P.41A and P.65, (has many fewer fine grains and is more even-grained than the latter specimens).

Many quartz grains are round, near spherical, some are subangular and fewer are flattened with round corners. The grains vary between 0.16 and 0.80 mm, but most grains are around the median of 0.3 mm. Similarly quartz rock fragments, some being gneissose occur to 3 volume percent of the rock. Rounded ferruginous cherts, some containing silicified volcanic microlites and occasionally included mica flakes occur to 2 to 3 volume percent and also clear chert grains of similar size to 1 percent of rock. Clay mineral as mainly illite with less kaolinite occupies vugs and narrow channelways between quartz grains. Total clay mineral is about 3 volume percent in the rock.

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Occasional rounded greenish tourmaline grains to much less than 1 volume percent are the only heavy minerals seen. Some silicification of quartz grains into mosaics has taken place.

WHYALLA SANDSTONE

P.56 - Whyalla Sandstone, silicified.

Mainly rounded to near spherical quartz grains showing frosted and some grooved surfaces with a few large angular grains and many ferruginous cherty grains, all in a white fine-grained interstitial matrix.

The Whyalla Sandstone quartz grains in thin-section are mainly mineral grains (approx. only 1 percent quartz rock fragments are present) and are quite spherical, varying between 0.1 and 1.2 mm, median 0.4 mm, associated with subangular to rounded ferruginous volcanic chert grains of similar size range occurring to 10 volume percent of the rock. The interstices (5 volume percent of the rock) consists of fractured chert fragments cemented by secondary quartz (also chert) associated with some clay mineral to neighbouring quartz grains. Many of the ferruginous chert grains contain devitrified glassy matter, some variolitic structures and are possibly basaltic. One large round greenish tourmaline (0.4 mm) shows fractures and fill with chert. Opaque oxides occur as magnetite grains in groups inside the volcanic cherts and occasionally within quartz overgrowths on primary quartz grains.

P.51 - Sandstone, (Whyalla or Corraberra?) from Tent Hill Crater. Pale sandstone shows a sharp contact between fine and medium grained sandstone.

An even-grained sandstone of rounded (not spherical) subangular and flattened quartz grains varying between 0.048 to 0.5 mm, median 0.1 mm. Most grains are quartz mineral grains. Micaceous cherts are more common than ferruginous cherts, are of similar grain size to median quartz and are rounded to subangular to 5 volume percent of the rock. Clay mineral occurs up to 3 volume percent as interstitial mineral in narrow channels between grains, but the rock cement is to a great extent silicified,

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though sutured boundaries between quartz grains are rare. Traces of glauconite, i.e. clay, as rounded speckled green grains are seen, also occasional large (approx. 0.1 mm) rounded green tourmaline grains with yellow-green overgrowths. Aggregates of leucoxene and some magnetite are seen distributed throughout to a total of 3 volume percent.

Overgrowths on quartz grains appear to be slight, following evenly the original quartz grain margins. These are easily detectable by opaque particle inclusions which indicate original grain shape.

Some twinned fresh microcline grains are seen of oblong grain shape and size ranges are similar to those of the quartz grains.

P.60 - Whyalla Sandstone. Silicified lithic sandstone.

Many rounded quartz grains with frosted surfaces in a matrix of finer more angular grains and clay.

Thin-section shows banding by the larger quartz and chert (ferruginous and clear) grains which are rounded (near spherical in some grains) or are flattened grains with rounded corners (0.2 to 1.5 mm) with interstitial finer quartz grains (0.02 to 0.19 mm). These bands alternate with those of predominantly small subangular quartz grains (also 0.02 to 0.19 mm) with scattered large erratics of round larger quartz grains. Other bands of equigranular quartz (0.2 to 0.4 mm) many rounded, few subangular grains occur between the coarse and fine bands described. Some rough sorting of grains has therefore taken place. The overall percentage of oval to near spherical grains in the section is probably around 20 volume percent but is much higher among the bands of largest quartz grains. The overall percentage of ferruginous chert or volcanic rock grains is around 2 volume percent with some grains consisting of

devitrified palagonite glass. Some rounded topaz and less brownish and green tourmaline occur; both minerals are around 0.08 mm in size and with the occurrence of sporadic opaque minerals of similar size make up about 1 volume percent of the rock. The tourmaline is quite angular and appears to have suffered very little attrition. The rock has been largely silicified into mosaics but there are blind interstitial channels containing chert and kaolinite.

P.66 - Sandstone (Whyalla or Corraberra?).

Inequigranular, rounded or rounded-flat grains and abundant lithic particles. A white sandstone as per P.65.

A quartzite with two population distributions of larger near spherical grains and smaller round to subangular grains. Some of the larger grains do show a tendency to flatness but these are concave-convex and concave shapes as are commonly seen in some large Whyalla Sandstone quartz grains. Grain size of larger quartz grains is 0.3 to 1.0 mm, smaller grains vary between 0.03 to 0.15 mm, median 0.1 mm. Ferruginous chert varies from subangular to rounded/flat grains, vary between 0.05 and 0.5 mm and occur to 1 to 2 volume percent. Clear cherts are not seen. A brownish clay mineral occurs between 7 and 10 volume percent of the section (derived from volcanic material?) and is seen occasionally in small vugs but mainly as a film between the quartz and chert grains. Magnetite occurs to 1 volume percent; rounded zircon > rutile > tourmaline also makes up to 1 percent.

97229 - Drill Hole EX 137, 33 to 36 m. Rotary drill cuttings. Cu 10 ppm, Pb 20 ppm, Zn 30 ppm. Grey lithic sandstone with pyrite and black heavy mineral. Pan-concentrated specimen. Thin and polished sections.

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Somewhat similar to 97292 but a small proportion of large quartz grains are subangular. A greater proportion of quartz grains are of the fine variety which are more even-grained with most grains approaching the median of 0.05 mm. Lithic cherts here are all very small (approx. 0.08 mm) and contain speckled limonite through their groundmass. Abundant fine opaque minerals (0.02 to 0.13 mm) occur, some rounded but mainly subangular occur to 3 volume percent. This includes minor rounded suspected monazite and tourmaline of similar grain size but totalling < 1 volume percent of all grains present and some oblong and rounded zircon grains to approx. 1 volume percent. Some large (several millimetres) grains are made up of rounded and subangular quartz with a rich limonite cement. Secondary pyrite appears to replace margins of some quartz grains in the mosaics.

A heavy mineral concentrate in Whyalla Sandstone. Constituent fragments of Pandurra Quartzite show ferruginised quartz mosaics.

P.S. A minor brown melnikovite variety of pyrite is associated with the yellow variety. The former variety shows massive aggregates of tiny spheres cemented by the secondary yellow pyrite. The pyrite is interstitial to other mineral grains and varies 0.02 to 0.4 mm and is present to approx. 5 volume percent of grains present. The pyrite is syngenetic but detrital with sandstone formation (similar quartz/pyrite aggregate grain sizes and shapes).

97292 - Drill Hole EX 140, 39 to 42 m. Rotary drill cuttings. Cu 10 ppm, Pb < 20 ppm, Zn 20 ppm. Dirty lithic sandstone.

Typical Whyalla Sandstone textures. Two generations of quartz grains. Large rounded quartz grains (0.3 to 1.0 mm, median 0.7 mm) with finer silt-size subangular grains; also there are some mosaics of smaller quartz

grains as irregular intergrowths of ex-Pandurra Quartzite(?), (approx. 2.0 mm). Smaller angular to subangular quartz (up to 0.2 mm, median 0.08 mm) occupy the interstices with fine platelets of illite. Red with limonite, chert grains (lithic grains), subangular to rounded (0.2 to 2.0 mm) occur to 2 volume percent of the rock. Some of the latter grains are composed of fine chert, others are devitrified volcanics and contain capillary structures, devitrified glass and silicified feldspar(?) fragments. Occasional subangular grains of fine carbonate also occur.

In various fragments potash feldspar (confirmed by stain method) occurs as mainly clasts varying between median and larger quartz grains in size, to about 1 volume percent.

TREGOLANA SHALE

86587 - Drill Hole EX 93, 10 m. Rotary drill cuttings. Cu 10 ppm, Pb 40 ppm, Zn 60 ppm. Greyish red shale.

Several fragments are shown mounted in section.

a) Coarse quartzite of subangular quartz, plagioclase (oligoclase), perthite and clear microcline grains in that order of abundance. Feldspar grains constitute about one half of the larger grains (0.16 to 0.6 mm) present and form a distinct population of grains. Quartz grains, also subangular (0.03 to 0.08 mm) are more dominant with some clay mineral cement tinged with limonite. Flecks of chlorite also occur. A mixed rock of fragments derived from some underlying igneous source. Sandy bands in clayey Tregolana Shale?

b) As for a) with abundant feldspar but grains are nearly all 0.16 to 0.6 mm, very little interstitial clay occurs so that quartz grains are now mainly cemented by secondary quartz showing trails of limonite particles indicating original grain boundaries. A little zircon as rounded grains is present. The rock is rather like a feldspathic Pandurra Quartzite(?).

c) Distinctly Tregolana Shale (as per A4239, A4246). A very fine quartz groundmass of subangular grains (approx. 0.01 mm) and limonite-clay mineral mixture in about equal quantities. Grain size is fairly equigranular. Elsewhere are parallel bands (0.15 to 0.3 mm) of limonite/clay > quartz.

Abundance of type rocks in section are c) > b) > a).

86589 - Drill Hole EX 93, 17 m. Rotary drill cuttings. Cu 15 ppm, Pb 30 ppm, Zn 65 ppm. Fine greenish grey sandstone, interbedded with shale.

a) Similar to 86587 b). Almost equigranular (0.05 to 0.16 mm, median 0.10 mm) rounded to subangular quartz grains, abundant clear oligoclase, somewhat oblong grains similar to quartz size range at about 2 volume percent and clear microcline at about 1 percent. Large tourmaline grains (approx. 0.05 mm) occur as a trace. Minimal clay matrix and a coarse brown clay mineral and volcanic clasts, the latter two minerals occur to approx. 1 volume percent each. The grains of quartz are more rounded here than for 86597 b). Carbonate grains occur intermixed and are of similar size to the quartz grains or smaller and occur to 2 volume percent. Occasional ferruginous cherts and large pyrite(?) grains occur to 1 volume percent.

b) Similar to 86587 a). Large and small quartz grains (0.05 to 0.5 mm) but differentiation into two populations as for 86587 a), is not possible. Among the rounded larger grains are sericitised anti-perthite grains with potash feldspar as sericitised patches in oligoclase which is otherwise clear. Smaller oligoclase grains are twinned and clear and are elongate oblong in shape. Also among the large and small quartz grains are occasional ferruginous cherts. Rhombs of dolomite (0.05 to 0.11 mm) are also present to 2 volume percent. No previous rock types from the area seen are in anyway similar to this type except possibly some sections of Corraberra Sandstone.

Mineral grains are close fitting with very little clay matrix in both types a) and b). Types a) and b) are equally prolific in the section.

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A4239 - Drill Hole 3-6-2D, 5.0 m. Pernatty Lagoon/ Mystery Area.

A fine-grained intergrowth of cherty quartz (maximum 0.050 mm, average 0.015 mm), sericite flakes (average 0.04 x 0.015 mm) and fine opaques and hematite particles (range 0.003 to 0.050 mm, average 0.006 mm) in the interstices. Scattered carbonate granules (0.013 to 0.026 mm) occur.

Fine, parallel, linear concentrations of quartz grains, sericite and hematite particles gives a banded appearance to the rock.

The quartz is clear of inclusions and variable in shape from angular to rounded, and is similar to the fine matrix quartz - in its varied shapes in most Whyalla Sandstone samples.

Modal mineral composition as volume percent :-

	Vol %
Quartz	78
Sericite	17
Carbonate	1
Hematite	3
Opaque minerals	1

A4246 - Drill Hole 3-6-4D, 5.5 m. Pernatty Lagoon/ Mystery area.

Similar to A4239 in nature of minerals, sizes, shapes and banding but the proportions of sericite and quartz are different and with the additional presence of kaolinite this rock is more argillaceous.

Quartz grains, range 0.016 to 0.11 mm, average 0.017 mm.

Sericite flakes, range 0.03 to 0.10 mm, width approx. 0.03 mm.

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Hematite/opaque grains, 0.004 to 0.02 mm, average 0.006 mm.

Modal mineral composition as volume percent :-

	Vol %
Quartz	20
Sericite	72
Kaolinite	5
Carbonate	1
Hematite/opaques	2

Variations in mineral concentrations shown by banding indicate seasonal climatic variations, i.e. velocity of run-off water entering the depositional environment, since apart from fine bands or lenticles of carbonate and kaolinite rich bands, the nature of minerals present as shown by drill cores is fairly constant with depth in this stratigraphic unit in the Mystery area.

CORRABERRA SANDSTONE

P.79 - Purple siltstone. Possibly Corraberra Sandstone.

In hand specimen the rock appears a fine sandstone of quartz sand grains, whitish (feldspar?) and common black opaque grains.

An impure sandstone of subangular to angular quartz (0.016 to 0.15 mm, median 0.05 mm), mainly mineral grains, some larger grains of rock fragments; and messy ferruginous chert. Common fresh microcline and plagioclase grains, similarly mainly subangular and of about 0.05 mm; sericite flakes (approx. 0.05 mm); ragged green biotite (up to 0.10 mm); magnetite, rounded tourmaline and zircon grains are present. The grains are tightly welded together by mainly quartz cement, though suturing of quartz grains is not seen. The brown colour of the rock is provided by fine limonite inclusions which form narrow trains just within the quartz grain peripheries and probably helped form the primary cement of the rock before secondary silicification.

Modal mineral composition as volume percent :-

	Vol %
Quartz mineral	77
Quartz rock	2
Chert	3
Plagioclase	2
Microcline (confirmed by feldspar staining technique)	7
Kaolinite (pockets)	2
Sericite	<1
Biotite	1
Magnetite (limonite pseudomorphs?)	3
Interstitial powdery limonite	2
Tourmaline (bluish), zircon, topaz	<1

/....

In mineral composition the rock is similar to specimen A4222, chocolate brown and coarser-grained Corraberra Sandstone from Mount Gunson but P.79 is finer grained and more angular than any Corraberra Sandstone sampled from Mount Gunson outcrop.

P.80 - Silicified purple siltstone, from hilltop on 'Carriewerloo'. Presumed to be Corraberra Sandstone.

Low power magnification of hand specimens indicates a fine sandstone, orange stained as for P.79, but slightly coarser grained and with less interstitial limonite, clay etc.

Quartz mineral grains (0.05 to 0.16 mm, median 0.08 mm) clear except for internal trains of hematite inclusions close to periphery of the quartz grains. In most cases no change in shapes of grains after secondary silicification are seen and grains are mainly angular or subangular with some rounded grains. Most quartz grains are now fused into silicified mosaics with original limonite interstitial matter trapped in the authigenic quartz overgrowths. As has been remarked before in other suspect Corraberra Sandstone, a large number of 'flat' quartz grains are seen to be present. Clear rounded cherts with fewer ferruginous cherts and some igneous granophyre particles (all about 0.08 mm) occur. Fresh plagioclase is seen ranging with quartz grain sizes and more oblong and less flattened microcline grains are present. Some flat detrital muscovite laths (approx. 0.13 mm x 0.02 mm, maximum 0.5 mm length). Detrital carbonate (ex-ankerite or siderite?) as somewhat worn cleavage fragments also occurs, in size ranging with quartz grains and usually containing some limonitic matter.

Magnetite (approx. 0.04 mm) as rather rounded equigranular grains occur. Other heavy minerals present are tourmaline (yellowish brown centres, pale green over-

growths), sphene and topaz occur sparsely and are of similar grain size to magnetite except for some bluish tourmaline which occurs slightly larger (to approx. 0.08 mm).

Modal mineral composition as volume percent.

	Vol %
Quartz mineral Quartz rock*	83
Chert (clear, ferruginous and micaceous)	2
Carbonate	2
Plagioclase	2
Microcline (confirmed by potash feldspar staining technique)	7
Muscovite	1
Magnetite	1
Sphene, tourmaline, etc.	<1
Interstitial limonite	1

* Only traces of quartz rock are present as fragments.

The rock is similar to A4222 Corraberra Sandstone from Mount Gunson except for finer median mineral grains and for silicification of the former specimen (P.80).

CORRABERRA SANDSTONE - MOUNT GUNSON

Some variations in appearance were noted in the field and hand specimens of each of the varieties seen were collected and sectioned.

A4222 - Chocolate brown, coarse-grained.

Grain shapes of quartz are slab-like and angular to ovoid; many grains were originally ovoid as indicated by internal fine particle limonite trains but have been made angular by diagenetic silica overgrowths; now fairly equigranular. Many grains show strain shadows and some lath-like grains show Böhm lamellae and are

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apparently of metamorphic origin. Many grains are completely strain free. Quartz grains range from 0.05 to 0.24 mm, average 0.09 mm. Hematite/limonite particles form a cement where quartz growth due to diagenesis has not penetrated the interstices. The limonite cement is of fairly regular thickness (to 0.009 mm) and limonite also occurs densely in sporadic chert grains which themselves are similar in shape and size to quartz grains. Quartz rock fragments are also of similar size to quartz mineral grains and are of minor importance.

Microcline as fresh grains are detrital, subangular, and of similar grain size to neighbouring quartz grains (to 0.2 mm, average 0.08 mm) and cemented with hematite/limonite.

Heavy minerals are shown by scattered rounded barrel-shaped zircon grains (approximately 0.08 mm) clear of debris and yellowish-green detrital pleochroic tourmaline of similar grain size.

Clay mineral as kaolinite platelets occupies scattered pockets in the rock of up to 0.3 x 0.15 mm in size.

Muscovite, detrital, as long thin plates (to 0.3 mm) are present in trace amounts.

The tabular, quartz-muscovite, micaceous chert and some clay pockets give a very rudimentary bedding to the rock.

Modal mineral volume percent composition :-

	Vol %
Quartz mineral grains	84
Quartz rock fragments	1
Microcline	2
Chert grains	1

/....

	Vol %
Micaceous chert	3
Muscovite	1
Limonite pseudomorphs of magnetite(?)	5
Limonite/hematite, interstitial	2
Zircon	1
Tourmaline	<1

A fairly well-sorted sandstone which contains rather more heavy minerals but of still limited quartz grain size variation compared with the underlying Whyalla Sandstone. A moderate abundance of lamellar strained quartz shows a metamorphic source for much of this quartz.

A4223 - Red-brown and flaggy.

More coarse grained than A4222, more equigranular but marked by finer and coarser bands of quartz. This sample is cleaner, with less cementing matrix of hematite/limonite. The grains are rounded to subangular. Range of grain sizes in different bands 0.1 to 0.8 mm, average 0.3 mm; 0.05 to 0.4 mm, average 0.2 mm.

As in the previous section described, the quartz is present mainly as mineral grains. Few grains show strain-shadows, otherwise the grains are relatively strain-free. Similarly, many grains are joined one to another through diagenetic addition of quartz to the grains but many have retained a hematite/limonite cement of maximum 0.008 mm thickness.

The usual fine trains of hematite particles within quartz grain margins indicate a slightly more rounded grain before diagenesis, although in this rock silica diagenesis was very slight and the hematite particles are just within the quartz grain boundaries. Close packing of quartz grains before diagenesis occurred leaving minimal space for quartz growth, although isolated pockets of clay occur measuring from 0.06 to 0.65 mm square and some pockets

contain a high proportion of limonite.

A few large (approximately 0.1 mm) detrital zircon grains are seen but traces only of opaque mineral are present which are now pseudomorphed by limonite.

No feldspar is seen.

Modal mineral volume percent composition :-

	Vol %
Quartz mineral grains	92
Quartz rock fragments	1
Kaolinite	5
Hematite/limonite	2
Opaque minerals	<1
Zircon	<1

A4224 - Pale, leached, massive sandstone.

Similar in grain size to A4222 but less matrix and abundant magnetite. The quartz grains are subangular to rounded, range 0.03 to 0.50 mm, average 0.10 mm. Few quartz rock fragments of similar size are seen. However, many quartz grains show strain shadows, Böhm lamellae and other evidence of strain. However, since they are scattered among many grains which exhibit no strain effects it is assumed that many of them are derived from metamorphic rocks of distant provenance. Many quartz grains show fused, faintly curved boundaries and many show an inner more rounded grain outlined by hematite particles or fluid inclusions ($<$ 0.001 mm) adjoining grain boundaries.

Scattered oblong fresh microcline grains, average 0.1 mm, are present, also muscovite flakes as fine shreds to 0.3 x 0.1 mm, but commonly 0.1 x 0.04 mm and with frequent elongated yellowish clay (illite?) flakes in pockets give a banded appearance to the rock.

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A little clear wedge-shaped sphene, rounded zircon (0.08 mm) and tourmaline as detrital grains are seen.

Magnetite (or limonite pseudomorphs), interstitial, around 0.05 mm.

Some concentration of heavy minerals has taken place here yet the even-grained nature of quartz does not suggest turbulent current action.

Modal mineral volume percent composition :-

	Vol %
Quartz mineral grains	83
Quartz rock fragments	1
Microcline	1
Kaolinite/illite ?	8
Magnetite (mainly altered to limonite)	6
Sphene, zircon, tourmaline	1

PJC/SS
4/8/75

APPENDIX II

MEMORANDA DATED 26TH AND 27TH NOVEMBER, 1974 REQUESTING THE RE-EXAMINATION AND RE-CLASSIFICATION OF PANDURRA THIN SECTIONS

PACMINEX PTY. LIMITED

MEMORANDUM TO: Mr. P.J. Curtis OUR REF: DGT/SS

FROM: D.G. Tonkin DATE: 27th November, 1974
Typed - 10/12/74

PANDURRA PETROGRAPHY

Could you please re-examine all the Pandurra sections; in the groups shown on the attached sheet.

Now that basic stratigraphy of the Pandurra area has been completed, the samples submitted previously can be assigned to their appropriate stratigraphic unit with more certainty.

You will notice that the number of specimens considered to be Whyalla Sandstone has been reduced from 16 to 6, for example.

What I would like is a description of the general characteristics of each of the rock units, noting especially any diagnostic features.

Similarities between groups should be pointed out.

Subdivision of groups would be appreciated.

Note : The attached list includes the latest batch of samples and a further batch of 3 in preparation now. The earlier samples were reported on by you in :-

1. Petrogaphy of Pandurra Thin Sections I, PJC/IM dated 4/9/73.
2. PMR 5/74
3. PMR 73/74
4. PMR 87/74.

D.G. TONKIN

c.c. R.W. Gersteling

PANDURRA PETROGRAPHIC SAMPLES

Moonabie Formation (2)

P.95 and P.96

Corunna Conglomerate (5)

P.90, P.91, P.92, P.93 and P.94

Gawler Range Volcanics (1)

P.24

Roopena Volcanics (1)

P.19 Beda Bore Chip (A9657)

Pandurra Formation - Basal Section (15)

P.11, P.12, P.18, P.20A, P.20B, P.22, P.25, P.49A, P.50B, P.86, P.87, P.88B, P.89, EX31A and EX31B

Pandurra Formation - Upper Section (13)

P.21, P.31, P.33, P.43, P.48, P.51B, P.53, P.58, P.67, P.83A, P.84B, EX29-85584 and EX136-97217

"Elizabeth Creek Conglomerate" (7)

P.2, P.3, P.9, P.27, P.29, P.57A and EX88-86545

Woocalla Dolomite (9)

P.28, P.34, P.35, P.52, EX50 (20 m), EX139-97275, EX143-97342, EX147-97404 and EX149-97427

"Magazine Hill Clay" (4)

P.6A, P.6B, P.81 and P.85

"Yudnapinna Beds" (14)

P.40, P.41A, P.65, P.65A, P.46, EX11-85235, EX12-85271, EX36-85713, EX37-85739, EX43-85846, EX44-85893, EX96-86645, EX142-97325 and EX146 (Cont.).

Whyalla Sandstone (6)

P.51, P.56, P.60, P.66, EX137-97229 (transitional to "Yudnapinna Beds"?), and EX140-97292

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0239

Tregolana Shale (2)

EX93-86587 and EX93-86589

Corraberra Sandstone (2)

P.79 and P.80

DGT/SS

PACMINEX PTY. LIMITED

0240

MEMORANDUM TO: Mr. P.J. Curtis

OUR REF: DGT/SS

FROM: D.G. Tonkin

DATE: 26th November, 1974
Typed - 10/12/74.

3 Pandurra Samples for Thin & Polished Section

Three drill cuttings samples as per the attached sheet were sent to I.R. Pontifex & Associates.

The samples are :-

EX 88-86545 : "Elizabeth Creek Conglomerate", 57-60 m. Acid volcanic and acid "plutonic" pebbles. Carbonate matrix.

EX 136-97217 : Pandurra Formation quartzite. 84-84.5 m. Green quartzite.

EX 146-Panned Concentrate
: "Yudnapinna Beds"?, 30-46 m. Carbonate-bearing. Black heavy mineral.

D.G. TONKIN

RECEIVED
10 NOV 1975
DEPT. OF MINES
SECURITY

Second Quarterly Report on Exploration Licence 186, Pandurra Area, for the Period Ending 7th October, 1975

1. General

Work during the quarterly period consisted of :-

1.1 Preparation and submission by Geoterrex Ltd., of data obtained from the airborne E.M. INPUT survey over the Yudnapinna area (see Figure 1).

1.2 Preliminary interpretation of the INPUT data for the Yudnapinna area.

1.3 A petrological review of rock specimens common in the E.L.

1.4 Preparation of a follow-up drilling programme on targets previously outlined by stratigraphic drilling.

1.5 Preparation of preliminary geological cross sections.

2. Geophysics

A report on the airborne E.M. INPUT survey carried out in February, 1975 was received from Geoterrex Ltd. The portion pertinent to E.L. 186, Pandurra (PMR 170/75) is appended to this report.

Some preliminary geological interpretation of the fourth channel contoured data has been made. It is intended that certain aspects be tested by several stratigraphic drill holes before a more realistic interpretation is attempted.

3. Petrology

Pacminex petrologist P.J. Curtis made a review study of all samples so far sectioned for the Pandurra area. The purpose of this study was to re-examine rock specimens in the light of knowledge gained during geological mapping and stratigraphic drilling programmes. The aim was to provide descriptions of the general characteristics of each rock unit in the Pandurra area.

A report by P.J. Curtis (PMR 127/75) is appended to this report.

4. Drilling

A programme of 31 drill holes was prepared to investigate further the target areas indicated by our previous work. These areas of interest were reported on in our 'Progress Report on Exploration in the Pandurra Area, E.L. 50, South Australia from March, 1973 to December, 1974' (PMR 160/74) submitted to the S.A. Department of Mines in January, 1975. The intended locations of the proposed holes are shown on Figure 2.

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This drilling has now been started and the results will be presented in the next technical report.

5. Geology

Working geological cross sections based on stratigraphic drilling were prepared, but these can now be up dated upon receipt of some 70 surveyed borehole collar elevations kindly supplied by the South Australian Department of Mines.

On completion of the fill-in drilling programme and further collar elevation levels still being determined, the revised sections will be submitted.

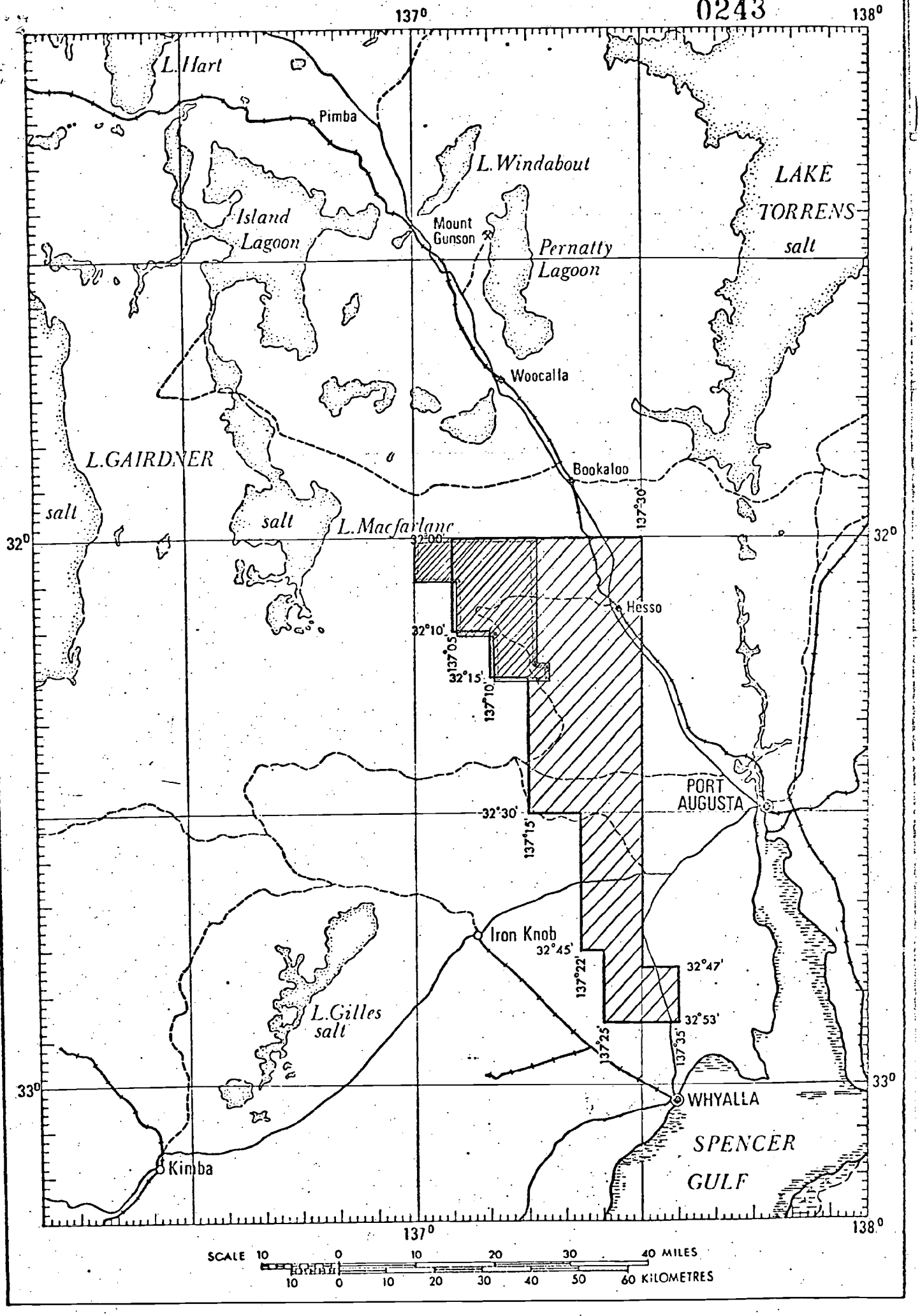
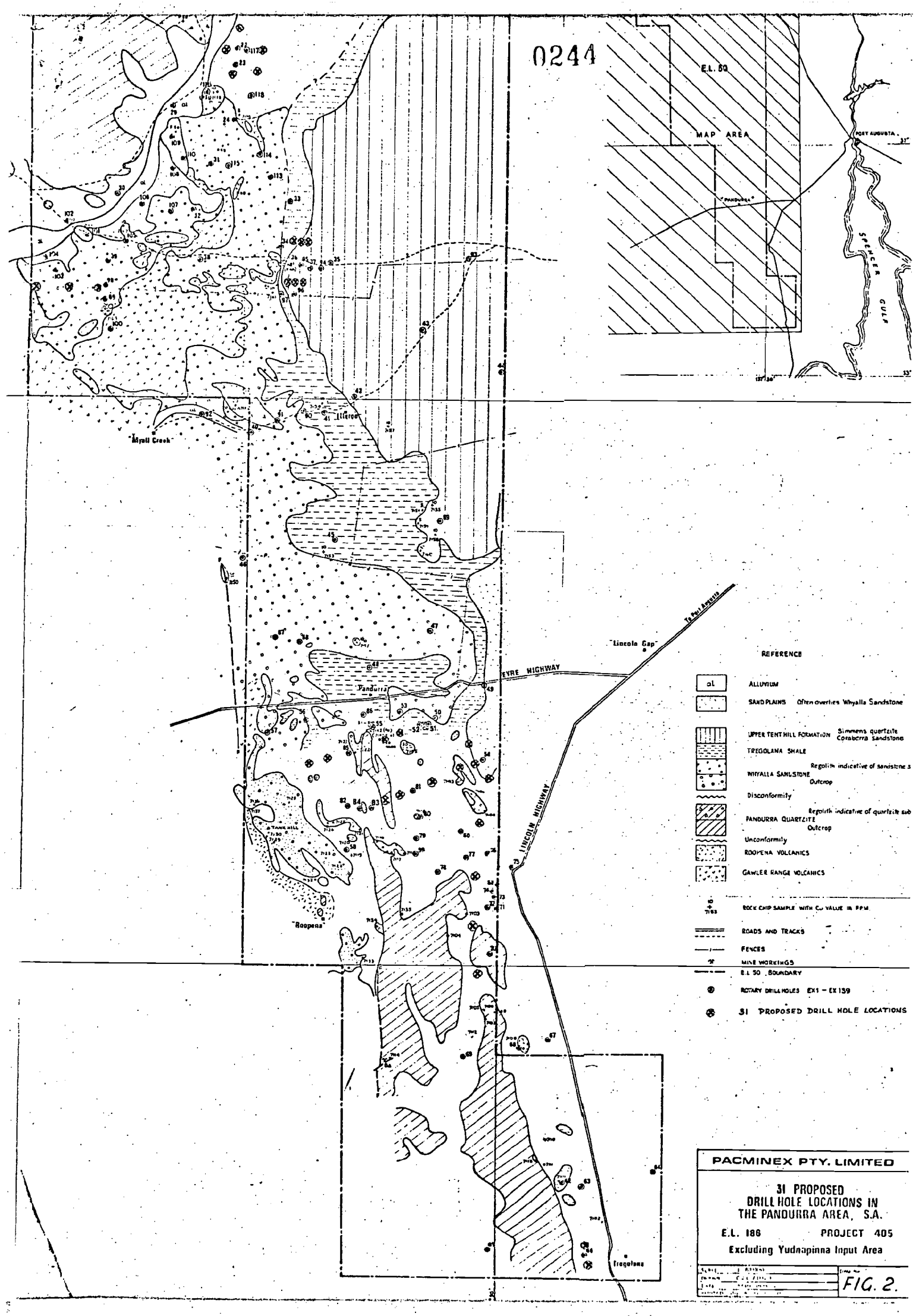


FIG. 1. YUDNAPINNA INPUT SURVEY AREA E.L. 186 PANDURRA, S.A.


0244
E.L. 50
MAP AREA
PORT AUGUSTA
"PANDURRA"
SPENCER GULF
137°30'
33°
Myall Creek
Illeroo
Lincoln Gap
To Port Augusta
EYRE HIGHWAY
Pandurra
LINCOLN HIGHWAY
Roopena
Tregolana
REFERENCE
al ALLUVIUM
SAND PLAINS Often overlies Whyalla Sandstone
UPPER TENT HILL FORMATION Simmens quartzite Corraberra Sandstone
TREGOLANA SHALE
Regolith indicative of sandstone s
WHYALLA SANDSTONE
Outcrop
Disconformity
Regolith indicative of quartzite sub
PANDURRA QUARTZITE
Outcrop
Unconformity
ROOPENA VOLCANICS
GAWLER RANGE VOLCANICS
ROCK CHIP SAMPLE WITH Cu VALUE IN PPM
ROADS AND TRACKS
FENCES
MINE WORKINGS
E.L. 50 BOUNDARY
ROTARY DRILL HOLES EX1 – EX 139
31 PROPOSED DRILL HOLE LOCATIONS
PACMINEX PTY. LIMITED
31 PROPOSED DRILL HOLE LOCATIONS IN THE PANDURRA AREA, S.A.
E.L. 186 PROJECT 405
Excluding Yudnapinna Input Area
FIG. 2.

EXPLORATION LICENCE 186 (PANDURRA)
SUMMARY OF EXPENDITURE
FOR THE THREE MONTH PERIOD ENDING 30TH SEPTEMBER, 1975

Expenditure for the period was $20,282. To this should be added an expenditure of $34,464 erroneously omitted from the previous quarterly report. An overall total of $57,830 was spent since the E.L. was granted.

The quarterly expenditure was incurred as follows :-

Geological and Geophysical	3,456
Drilling Costs	Nil
Logistics (including salaries and wages)	16,498
Administration	328
Other Costs	Nil
Total	$ 20,282

The expenditure of $34,464 not previously reported was incurred as follows :-

Geological and Geophysical	30,150
Drilling Costs	Nil
Logistics (including salaries and wages)	2,738
Administration	1,576
Other Costs	Nil
Total	$ 34,464

DMC-2

E.L. 186

0246 Sheet 1 of 9

Date of Survey Apr. - Nov. 75
Datum M.S.L.(1)
Surveyor N. EDWARDS

DEPARTMENT OF MINES - SOUTH AUSTRALIA
BOREHOLE LEVEL SURVEY

AREA Stuart Shelf Pacminex D.H.

Copy to	Date
C.S.D.	

Hundred Name	Hundred No. / State Number	Sec. No	Bore No.	Field Survey No.	Obs. Bore No.	R.L. Peg m	R.L. Ground m	R.L. Reference m	Casing above Ground m	Level Book No.	Level Book Page	Remarks	C.S.D. Ledger	C.S.D. O.B.S.	C.S.D. B.R.C.
				2				107.617		482	32				
				3+3A				86.622		"	29				
				4				103.767		"	49				
				5				124.693		"	39				
				6				102.197		"	41				
				7				111.645		"	40				
				10				96.285		"	53				
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				12				113.432		"	53				
				14				119.778		"	18				
				15				113.292		"	53				
				16				98.355		"	52				
				17				110.940		"	51				
				18				78.129		464	18				
				19				75.664		"	19				

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Sheet 2 of 9

Date of Survey Apr.-Nov. 75
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Surveyor A. EDWARDS

DEPARTMENT OF MINES - SOUTH AUSTRALIA
BOREHOLE LEVEL SURVEY

AREA Stuart Shelf Pacminex D.H.

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Hundred Name	Hundred No. / State Number	Sec. No	Bore No.	Field Survey No.	Obs. Bore No.	R.L. Peg m	R.L. Ground m	R.L. Reference m	Casing above Ground m	Level Book No.	Level Book Page	Remarks	C.S.D. Ledger	C.S.D. O.R.S.	C.S.D. B.R.C.
				20				67.967		464	21				
				22				98.253		"	15				
				23				98.847		"	15				
				24				—		—	—				
				25				91.043		"	17				
				26				109.245		432	16				
				28				93.463		"	16				
				31				126.819		"	13				
				32				121.962		"	12				
				33				121.214		464	12				
				34				105.752		"	12				
				35				118.374		"	10				
				36				105.196		"	11				
				37				110.885		"	11				
				38				119.145		432	9				

0248 Sheet 3 of 9

Date of Survey Apr.-Nov 75
Datum M.S.G (1)
Surveyor N. EDWARDS

DEPARTMENT OF MINES - SOUTH AUSTRALIA
BOREHOLE LEVEL SURVEY

AREA Stuart Shelf Pacminex D.H.

Copy to	Date
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Hundred Name	Hundred No.	Sec. No	Bore No.	Field Survey No.	Obs. Bore No.	R.L. Peg m	R.L. Ground m	R.L. Reference m	Casing above Ground m	Level Book No.	Level Book Page	Remarks	C.S.D. Ledger	C.S.D. O.B.S.	C.S.D. B.R.C.
	State Number														
				39				179.228		432	12				
				40				95.176		"	5				
				41				82.973		"	6				
				42				21.953		"	7				
				43				25.902		164	28				
				44				92.015		"	30				
				45				76.748		"	53				
				46				97.316		"	52				
				48				74.036		"	50				
				49				65.959		"	48	Top of casing			
				50				59.422		"	45				
				51				60.570		"	45				
				52				57.145		"	45				
				53				60.297		"	46				
				55				72.669		"	49				

0249

Sheet 4 of 9

Date of Survey Apr - Nov 75
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BOREHOLE LEVEL SURVEY

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Hundred Name	Hundred No.	Sec. No	Bore No.	Field Survey No.	Obs. Bore No.	R.L. Peg m	R.L. Ground m	R.L. Reference m	Casing above Ground m	Level Book No.	Level Book Page	Remarks	C.S.D. Ledger	C.S.D. O.B.S.	C.S.D. B.R.C.
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				61				58.804		"	41				
				62				35.166		"	33				
				63				38.173		"	33				
				64				21.859		"	33				
				66				32.735		"	32				
				67				51.547		"	39				
				68				43.364		"	40				
				72				50.679		"	40				
				73				59.005		"	40				
				74				55.255		"	41				
				75				45.631		"	42				
				76				55.838		"	42				
				77				57.773		"	42				
				78				61.189		"	43				

Sheet 5 of 9

Date of Survey Apr-Nov 75
Datum M.S.L.(1)
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DEPARTMENT OF MINES - SOUTH AUSTRALIA
BOREHOLE LEVEL SURVEY

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Hundred Name	Hundred No.	Sec. No	Bore No.	Field Survey No.	Obs. Bore No.	R.L. Peg m	R.L. Ground m	R.L. Reference m	Casing above Ground m	Level Book No.	Level Book Page	Remarks	C.S.D. Ledger	C.S.D. O.B.S.	C.S.D. B.R.C.
	State Number														
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				81				61.260		"	44				
				82				99.321		"	49				
				83				92.247		"	49				
				84				100.207		"	49				
				85				84.430		"	49				
				86				69.330		"	50				
				88				78.485		"	51				
				90				87.762		482	6				
				91				90.563		"	6				
				93				82.949		464	27				
				94				114.236		"	11				
				95				106.082		"	11				
				97				93.945		482	11				

Sheet 6 of 9

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BOREHOLE LEVEL SURVEY

AREA Stuart Shelf Pacminex DH.

Hundred Name	Hundred No.	Sec. No	Bore No.	Field Survey No.	Obs. Bore No.	R.L. Peg m	R.L. Ground m	R.L. Reference m	Casing above Ground m	Level Book No.	Level Book Page	Remarks	C.S.D. Ledger	C.S.D. O.R.S.	C.S.D. B.R.C.
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				99				139.551		"	11				
				101				129.988		"	10				
				102				—		—	—				
				105				139.109		"	10				
				107				127.790		"	54				
				108				114.170		"	54				
				111				47.653		464	24				
				112				113.364		"	24				
				113				119.141		"	31				
				114				104.237		"	13				
				116				107.887		"	31				
				117				97.384		"	15				
				118				96.251		"	31				
				119				113.833		482	17				

0252 Sheet 7 of 9

Date of Survey Apr – Nov 75.
Datum . . M.S.L. (1) . . . . .
Surveyor . N. EDWARDS. . .

DEPARTMENT OF MINES - SOUTH AUSTRALIA
BOREHOLE LEVEL SURVEY

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Hundred Name	Hundred No.	Sec. No	Bore No.	Field Survey No.	Obs. Bore No.	R.L. Peg m	R.L. Ground m	R.L. Reference m	Casing above Ground m	Level Book No.	Level Book Page	Remarks	C.S.D. Ledger	C.S.D. O.B.S.	C.S.D. B.R.C.
	State Number														
				120				106.122		132	52				
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				122				113.324		"	18				
				123				115.083		"	20				
				124				141.482		"	22				
				125				140.739		"	22				
				126				138.713		"	23				
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				130				110.289		"	39				
				131				125.227		"	40				
				132				107.611		"	40				
				133				116.633		"	39				
				134				107.185		"	37				

0253 Sheet 8 of 9

Date of Survey Apr - Nov 75
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Surveyor N. EDWARDS

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BOREHOLE LEVEL SURVEY

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Hundred Name	Hundred No.	Sec. No	Bore No.	Field Survey No.	Obs. Bore No.	R.L. Peg m	R.L. Ground m	R.L. Reference m	Casing above Ground m	Level Book No.	Level Book Page	Remarks	C.S.D. Ledger	C.S.D. O.B.S.	C.S.D. B.R.C.
	State Number														
				135				97.685		482	36				
				137				91.184		"	36				
				138				91.114		"	30				
				139				89.590		"	29				
				140				86.014		"	29				
				141				89.351		"	28				
				142				95.571		"	27				
				143				100.122		"	27				
				144				109.526		"	26				
				145				97.198		"	48				
				146				129.574		"	48				
				147				120.827		"	47				
				148				85.578		"	46				
				149				89.506		"	45				
				150				116.718		"	50				

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Sheet 9 of 9

Date of Survey Apr.-Nov. 75

Datum M.S.L. (1)

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DEPARTMENT OF MINES - SOUTH AUSTRALIA
BOREHOLE LEVEL SURVEY

AREA Stuart Shelf Pacminex D.H.

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Hundred Name	Hundred No.	Sec. No	Bore No.	Field Survey No.	Obs. Bore No.	R.L. Peg m	R.L. Ground m	R.L. Reference m	Casing above Ground m	Level Book No.	Level Book Page	Remarks	C.S.D. Ledger	C.S.D. O.B.S.	C.S.D. B.R.C.
	State Number														
				152				111.245		182	38				
				C.D.7.				114.500		"	47				

3

Prospect 405

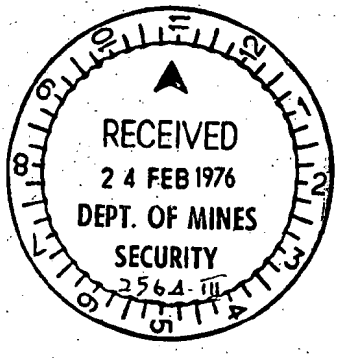
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PACMINEX PTY. LIMITED

PANDURRA AREA, S.A.

THIRD QUARTERLY REPORT ON EXPLORATION FOR EXPLORATION LICENCE 186 PERIOD ENDING 7TH JANUARY, 1976

PMR 16/76



SYDNEY

January, 1976.

D.G. TONKIN

EXPLORATION LICENCE 186 (PANDURRA)

SUMMARY OF EXPENDITURE

FOR THE THREE MONTH PERIOD ENDING 31ST DECEMBER, 1975

Actual expenditure for the period was $42,589 incurred as follows :-

	$
Geological and Geophysical	190
Drilling Costs	20,334
Logistics (including salaries and wages)	20,513
Administration	1,084
Other Costs	468
Total	$42,589

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CONTENTS

		PAGE NO.
1.	INTRODUCTION	1
2.	SUMMARY	2
3.	DRILLING	3
	3.1 Programme Completed	3
	3.2 Summary of Results	3
4.	GEOPHYSICS	6
	4.1 February 1975 INPUT Survey Interpretation	6
	4.2 Proposed INPUT Orientation Studies	6
5.	IGNEOUS PETROLOGY	7
6.	REGIONAL GEOLOGY	8
	6.1 Geological Sections	8
	6.2 Stratigraphic Observations and Revisions	8
7.	DRILL HOLE NUMBERING SYSTEM	12

APPENDIX

I 32 DRILL HOLE FIELD LOGS

LIST OF ILLUSTRATIONS

FIGURES		FACING PAGE NO.
1	LOCALITY PLAN, PANDURRA AREA, E.L. 186, S.A., SHOWING E.L. BOUNDARIES AND YUDNAPINNA INPUT SURVEY AREA	1
2	32 DRILL HOLE LOCATIONS IN THE PANDURRA AREA, S.A.	3

PLANS (IN POCKET)

PMX DRG NO.	
2037A	STRATIGRAPHIC DRILL HOLE AND GEOLOGICAL SECTION LOCATION PLAN, SCALE 1:125,000
I534-1	GEOLOGICAL SECTIONS AA' TO JJ'

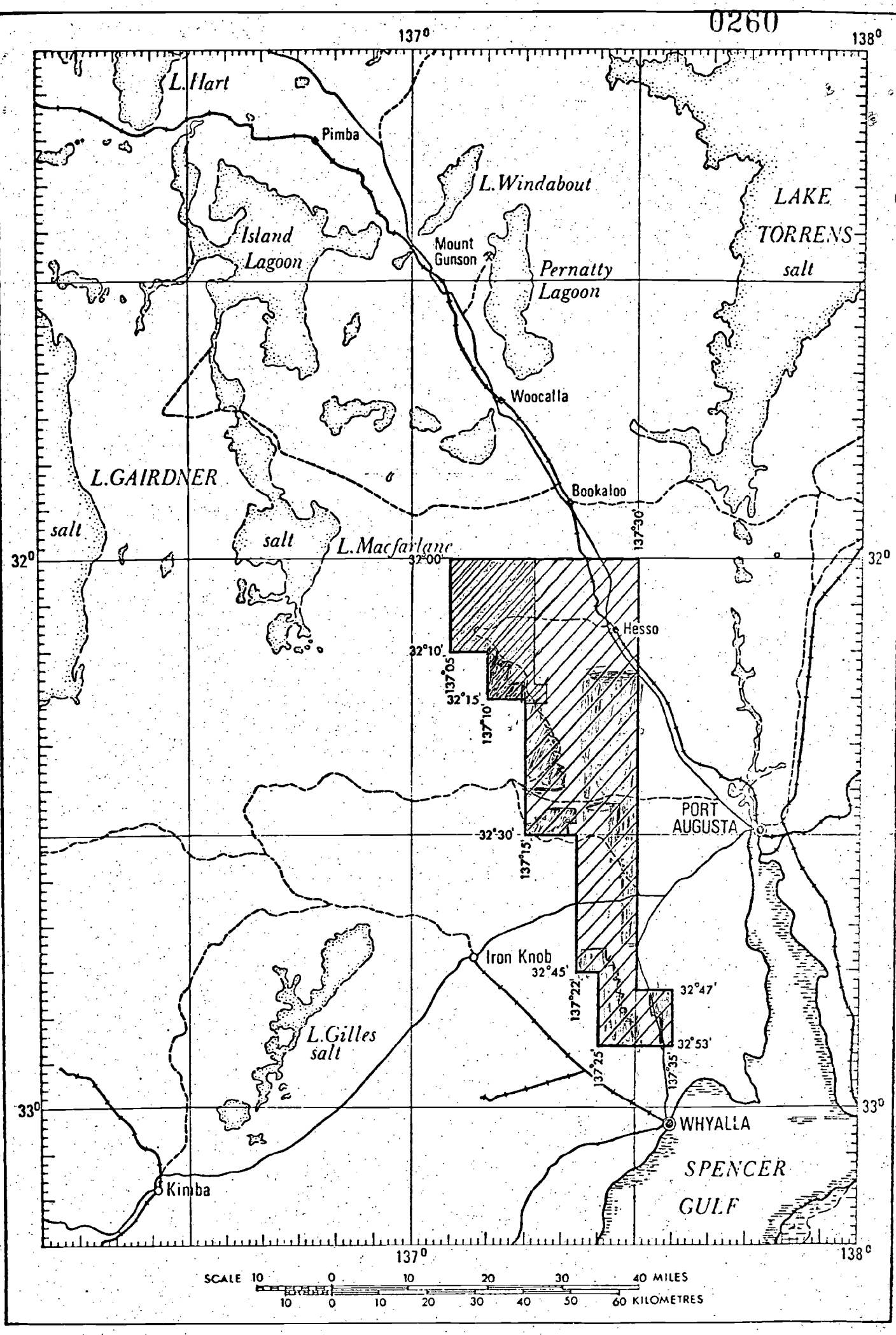


FIG. 1. YUDNAPINNA INPUT SURVEY AREA E.L. 186 PANDURRA, S.A.
LOCATION PLAN

1. INTRODUCTION

This report summarises exploration activities carried out in Exploration Licence 186 (E.L. 186) Pandurra Area, South Australia, during the quarter 7th October, 1975, to 7th January, 1976. It is the third quarterly report submitted to the South Australian Department of Mines for E.L. 186.

In addition to describing the previous quarter's activities, this report details changes in stratigraphic interpretation which have occurred in the twelve months since the submission of our last comprehensive report, PMR 160/74. That report was a 1973/1974 progress report for the Pandurra Area, then designated E.L. 50.

2. SUMMARY

Work during the quarterly period consisted of :-

2.1 Drilling of 32 rotary/percussion drill holes.

2.2 Interpretation of data from the Yudnapinna INPUT survey.

2.3 Planning of drill holes to test the Yudnapinna INPUT interpretation.

2.4 Planning of INPUT orientation lines, to be flown in February 1976, over two areas of interest.

2.5 Initiation of igneous petrology studies to differentiate between Gawler Range Volcanics, Roopena Volcanics and younger mafic dykes.

2.6 Preparation of geological sections of the Pandurra Area, using topographic survey data supplied by the S.A. Department of Mines.

2.7 Review of stratigraphic relationships on the Stuart Shelf, incorporating current interpretations.

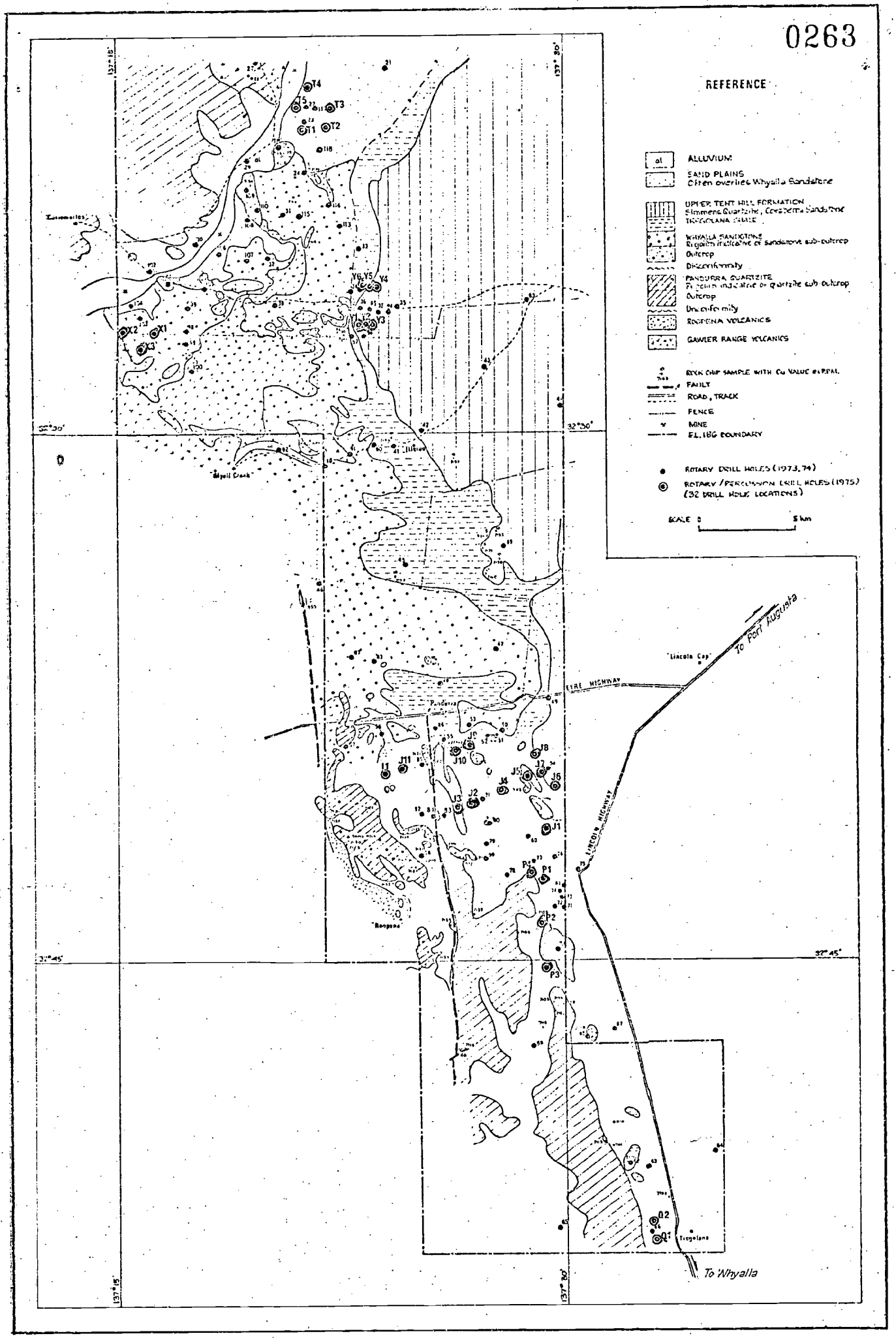


FIG. 2. 32 DRILL HOLE LOCATIONS - DRILLED DURING THE QUARTER ENDED 7TH JANUARY 1976 - PANDURRA AREA E.L. 186

3. DRILLING

3.1 Programme Completed

During the quarter a programme of 32 rotary/percussion drill holes was completed. A Mayhew 1000 drilling rig was employed under a contract with W.L. Sides & Son Pty Ltd. This programme tested all geologically interesting areas outlined by previous work, with the exception of the area covered by the Yudnapinna INPUT survey. A total of 1,404 m was drilled. Drill hole locations are shown on Figure 2 and on Drawing No. 2037A. Copies of the field drill logs, which include Cu, Pb and Zn geochemical assay results, are appended to this report.

3.2 Summary of Results

3.2.1 "Roopena" Target (Drill Holes 6332 P-1 to 6332 P-4)

The sediments overlying the Pandurra Formation in this target were previously thought to be Whyalla Sandstone Member. They are now believed to be recent stream deposits. No anomalous base metal content was detected.

3.2.2 "Tregolana" Target (Drill Holes 6432 Q-1 and 6432 Q-2)

Here black shale facies rocks of the Woocalla Dolomite were found overlying Pandurra Formation. Geochemical assays revealed no anomalous base metal content. It was concluded that an anomalous copper concentration in drill hole EX 66 was due to local residual enrichment by weathering.

3.2.3 "Pandurra" Target (Drill Holes 6332 J-1 to 6332 J-11 and 6332 I-1)

Anomalous copper concentrations (> 2000 ppm) were detected in Woocalla Dolomite black shales in holes 6332 J-1, 6332 J-2, 6332 J-9 and 6332 J-10.

/....

Above average lead and zinc contents (up to 2800 ppm Pb and 1100 ppm Zn) were found in many places within Woocalla Dolomite sediments.

In holes 6332 J-9 and 6332 J-10, pebbly sandstone equated with the "McLeay Beds" at Mt. Gunson was penetrated beneath Woocalla Dolomite. This pebbly sandstone was extremely pyritic in hole 6332 J-10.

Holes 6332 J-4 and 6332 J-7 bottomed in fine grained igneous rocks beneath Woocalla Dolomite. These igneous rocks have been studied petrographically and described as microdolerites. They are believed to be mafic dykes of the kind encountered beneath the MG 14 area at Mt. Gunson. ?Rida. volcs (TI)

3.2.4 Horseshoe Dam Target (Drill Holes 6333 Y-1 to 6333 Y-6)

This target was of interest because of the association of fine pyrite with high copper content in "Yudnapinna Beds" in holes EX 36 and EX 96 and because the basal sample of the Woocalla Dolomite in hole EX 96 contained 2000 ppm copper.

Above average copper contents (1100 ppm and 1500 ppm) were found in the basal Woocalla Dolomite in holes Y-5 and Y-6. Pyritic "Yudnapinna Beds" was intersected in Y-3 and Y-4, but there was no associated copper concentration.

3.2.5 Gunter Dam Target (Drill Holes 6333 T-1 to 6333 T-5)

In this area the Whyalla Sandstone Member was thought to be directly on Pandurra Formation, overlapping the edge of the concealed Woocalla Dolomite. It is now believed that the sediments

/....

previously equated with the Whyalla Sandstone Member are really recent stream deposits.

Holes T-2 and T-3 intersected Woocalla Dolomite. In each hole, black laminated shale was underlain by 1 to 2 m of massive pyritic dolomite. In hole T-2, above average copper contents were recorded in this dolomite and in the underlying pink quartzite (650 ppm and 180 ppm) whilst anomalous lead and zinc contents were found in black shale higher up in the hole (2800 ppm Pb and 3600 ppm Zn). In hole T-3, base metal contents anomalous for sandstones were found in 'McLeay Beds" or Pandurra Formation at the bottom of the hole. Maximum assay values were Cu 270 ppm, Pb 780 ppm and Zn 1400 ppm.

3.2.6 "Cariewerloo" Target (Drill Holes 6333 X-1 to 6333 X-3)

These holes intersected thicknesses of between 40 m and 60 m of black shale, indicating an outlying basin of Woocalla Dolomite of considerable depth. Although such a basin could be expected to have provided a reducing palaeo-environment, no anomalous base metal concentrations were found.

4. GEOPHYSICS

4.1 February 1975 INPUT Survey Interpretation

A geological interpretation of the Yudnapinna area was made, using contoured fourth channel E.M. data from the INPUT survey. Locations were nominated for an initial 7 to 10 rotary/percussion drill holes, designed to test this interpretation before closer definition of possible targets is attempted. Tentative plans are for this drilling to begin in March 1976.

4.2 Proposed INPUT Orientation Studies

Geoterrex Ltd has agreed to perform limited INPUT testing over other target areas in E.L. 186. The work planned will involve flying of several profile lines across two areas where sub-outcropping Woocalla Dolomite is too deeply weathered for identification by surface mapping.

The areas to be tested are two recently drilled at "Cariewerloo" and "Pandurra". The work is scheduled for early February, 1976. If successful in delineating features of interest, further INPUT surveying would be considered for these areas.

5. IGNEOUS PETROLOGY

Recent microscopic studies of fine grained igneous rocks have cast doubt on some earlier macroscopic identifications. Cuttings from drill holes in the Horseshoe Dam target were previously identified as Gawler Range Volcanics. However some of these are microscopically indistinguishable from mafic dyke rocks in the "Pandurra" target area. Although the Gawler Range Volcanics are supposed to be dominantly rhyolitic, only andesitic and basaltic rocks have been identified so far.

Consequently, a study has begun which will attempt to differentiate between Gawler Range Volcanics, Roopena Volcanics and mafic intrusives in samples collected so far.

6. REGIONAL GEOLOGY

6.1 Geological Sections

Ten geological cross sections of the Pandurra Area, E.L. 186, are included with this report. The geology is based mainly on information gained from rotary/percussion drilling. Where they were available, drill hole collar levels relative to Mean Sea Level were used. These were generously supplied by the survey section of the S.A. Department of Mines.

The geological sections illustrate the regional geology as it is understood to date. The location of each section is shown on Drawing No. 2037A.

6.2 Stratigraphic Observations and Revisions

6.2.1 Gawler Range Volcanics

Petrographic studies so far have failed to identify any acid volcanic rocks in the Horseshoe Dam to "Cariewerloo" Homestead area. Mafic and intermediate rocks have been identified. Further studies are underway, to determine whether igneous sub-outcrop in this vicinity is Gawler Range Volcanics or Roopena Volcanics.

6.2.2 Pandurra Formation

A pre-Woocalla Dolomite fault running due south from near "Pandurra" homestead has been inferred from geological mapping. This inference is supported by low level aeromagnetic data obtained by B.H.P. on SML 204 in 1970. The western block is upthrown and here gritty sandstone of the basal Pandurra Formation is exposed. On the eastern side of the fault, red quartzite of the upper silicified portion of the Pandurra Formation is exposed. This quartzite is very similar to that of the Pandurra Formation cropping out in the Mt. Gunson area.

The fault is depicted on the geological sections which accompany this report.

6.2.3 Mafic Dykes

Drill holes 6332 J-4 and 6332 J-7 bottomed in igneous rocks petrographically identified as microdolerites. Rocks of essentially the same composition were intersected in the Mt. Gunson area, in drill holes OK 68 and LY 3. These rocks appear to form mafic dykes. At LY 3, the dyke is less than 50 m wide and strikes north-west. Hole 6332 J-7, in the "Pandurra" target, coincides with a north-west trending dyke/fault whose presence was interpreted from low level aeromagnetic data by B.H.P. in their SML 204 in 1970. (Beda equiv.)

6.2.4 "McLeay Beds" Equivalent

In some places, a loosely consolidated pebbly sandstone lies disconformably on the palaeosurface of the Pandurra Formation. This unit was referred to in past reports as the "Elizabeth Creek Conglomerate". It has been decided to discontinue use of this name, as it appears to be inappropriate.

Maximum measured thickness of this "McLeay Beds" equivalent was in excess of 54 m, intersected in drill hole EX 80. The unit consists of subangular pebbles of banded iron formation (b.i.f.) and red quartzite plus rounded milky quartz pebbles, in a clayey sand matrix. It occupies the same stratigraphic position as the "McLeay Beds" of the Mt. Gunson area. The sediments are thought to represent epiglacial outwash deposited on a possibly glaciated terrain. The palaeosurface of the Pandurra Formation has steep-sided topographic features and internally draining basins which suggest glacial erosion.

/....

6.2.5 Woocalla Dolomite

This term is used in Pacminex reports in the sense applied by R.K. Johns in "Report of Investigations No. 42", Geological Survey of S.A., published in 1974. As used in that publication, the term Woocalla Dolomite is taken to refer to a stratigraphic formation comprising massive dolomite and black shale members and the facies variations between.

It is evident from study of the geological sections that the contact with the underlying "McLeay Beds" equivalent is disconformable (see section II').

6.2.6 "Yudnapinna Beds"

These are fine grained sandstones and siltstones, red-brown, green or grey in colour and typically having a carbonate bearing matrix. They overlie the Woocalla Dolomite or the Pandurra Formation and are overlain, at Horseshoe Dam locality, by Tregolana Shale Member. Thus they occupy the stratigraphic position defined for the Whyalla Sandstone Member of the Tent Hill Formation and must be time-equivalent to that unit. The white silty claystone defining the type locality for Whyalla Sandstone Member of White Cliffs Dam is interpreted as being a leached outlier of carbonate-bearing siltstone of the "Yudnapinna Beds" type.

6.2.7 Whyalla Sandstone Member

At Mt. Gunson, the rock known as Whyalla Sandstone is a distinctive, friable, lithic sandstone, composed predominantly of extremely well rounded quartz grains. This lithology has not been encountered south of an east-west line running through about Hesso, in the northern part of E.L. 186.

In the area between Oakden Hills and Hesso, lithic sandstone of the typical Mt. Gunson character grades downwards into siltstone of the "Yudnapinna Beds" type. Therefore it seems likely that the friable lithic sandstone of the Mt. Gunson region is a shallow water facies of the Whyalla Sandstone Member, this facies being restricted to an area north of Hesso. Thus what has to date been called "Yudnapinna Beds" probably represents "typical" Whyalla Sandstone Member.

The conformation of the contact of the Whyalla Sandstone and the "Yudnapinna Beds" with the underlying Woocalla Dolomite suggests that there is at least partial disconformity between the Woocalla Dolomite and succeeding sediments - see geological sections AA', BB' and CC'. Where observed, the change of rock type at the contact is usually abrupt.

7. DRILL HOLE NUMBERING SYSTEM

A new bore hole numbering system has recently been adopted which will simplify the rapid locating of bore holes drilled by Pacminex throughout Australia.

The numbering is based essentially on the nomenclature of the 1:50,000 topographical maps adopted by the Division of National Mapping, Department of Minerals and Energy. These sheets are further broken down into 25 areas of approximately 10 km x 11 km each which have been codified by all the letters of the alphabet except the letter O, with A in the north-west corner and Z in the south-east corner.

The recent drilling programme has therefore been confined to the Roopena 6332, Cariewerloo 6333 and Cultana 6432 sheets.

D.G. TONKIN
(EMP)

137°15′ 137°30′ 137°45′ 32°00′ 32°15′ 32°30′ 32°45′ 33°00′

A A1 B B1 C C1 D D1 E E1 F F1 G G1 H H1 I I1 J J1

Yudnapinna H.S.
HESSO
E.L. 186
△ North Tent Hill
• Horseshoe Hill
Gunter Dam
■ Cariewerloo H.S.
• Sugarloaf Hill
△ South Tent Hill 1045′
Horseshoe Dam
■ Illeroo H.S.
■ Myall Creek H.S.
Pandurra H.S.
■ Roopena H.S.
761′ △ Mt. Whyalla
■ Tregolana H.S.
WHYALLA
PORT AUGUSTA
STUART HIGHWAY
EYRE HIGHWAY
LINCOLN HIGHWAY
FALSE BAY
SPENCER GULF

REFERENCE

- MAIN ROADS
- SECONDARY ROADS AND TRACKS
- POWER LINE
- RAILWAY LINE
- LEASE BOUNDARY
- MINE
- ROTARY DRILL HOLE (1973 & 1974)
- ROTARY / PERCUSSION DRILL HOLE (1975)
- A — A1 SECTION LINE

1 0 1 2 3 4 5 MILES

2 1 0 1 2 3 4 5 KILOMETRES

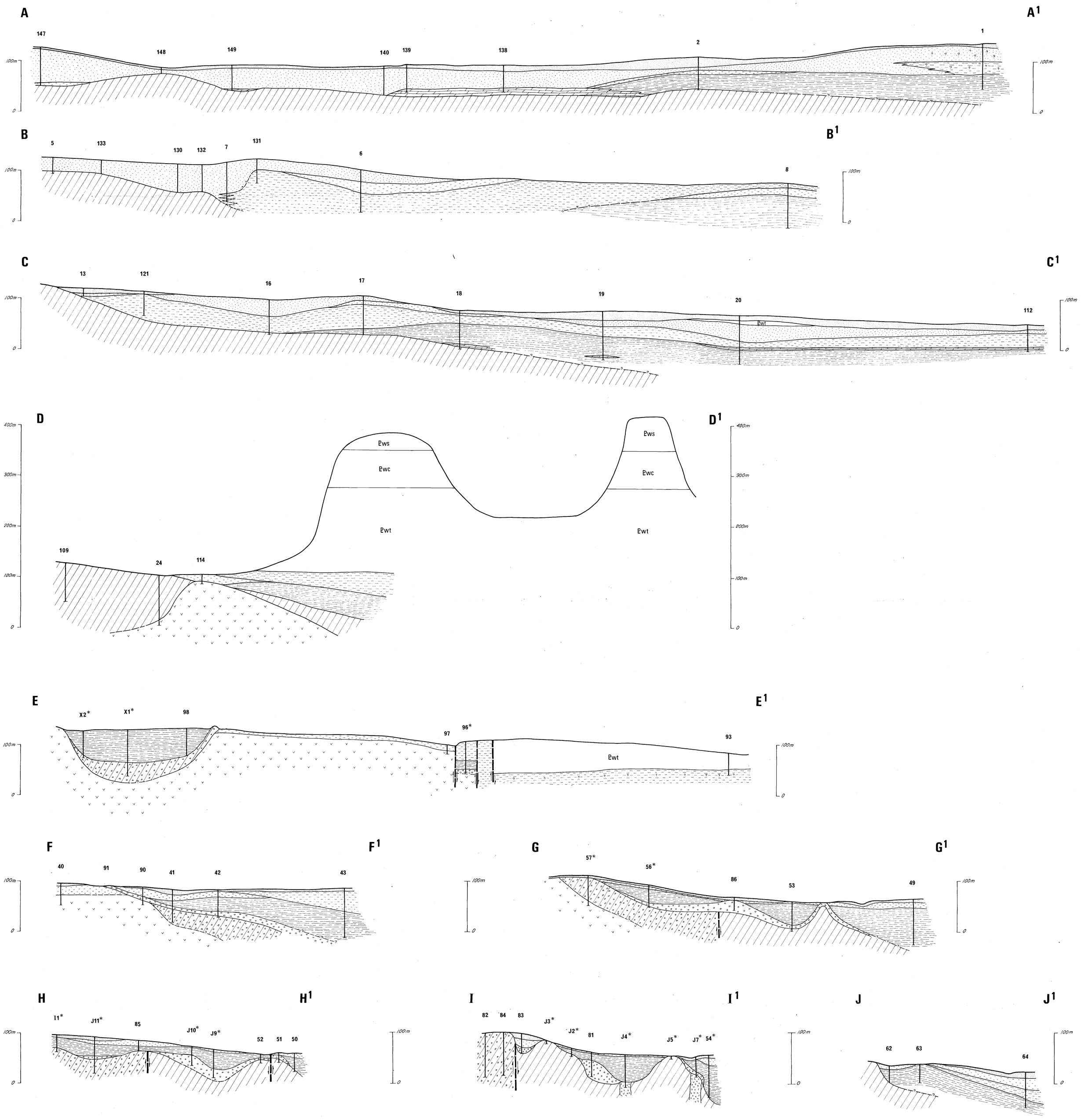
PACMINEX PTY. LIMITED

STRATIGRAPHIC DRILL HOLE & GEOLOGICAL SECTION LOCATION PLAN

PANDURRA AREA, S.A. **E.L. 186**

SCALE	1 : 125.000	DWG. Nº
DRAWN	C.J.L. / P.R.	2037A
DATE	FEB. 1973	
REVISED	DEC. 1974 / FEB. 1976	

2564(III)-1



NOTE : COLLAR ELEVATION NOT SURVEYED SHOWN BY *
PREFIX X DRILL HOLE SERIES 6333, I AND J SERIES 6332

PACMINEX PTY. LIMITED

E.L.186 PANDURRA AREA S.A.

GEOLOGICAL SECTIONS

SCALE : HORIZONTAL 1:50,000 VERTICAL 1:3000	DWG. No.
DRAWN : D.G.T. / P.R.	1534-1
DATE : JANUARY 1976	
REVISED :	

2564(III)-2

APPENDIX I

32 DRILL HOLE FIELD LOGS

Roopena	6332	P-1 to P-4 J-1 to J-11 I-1
Cultana	6432	Q-1 to Q-2
Cariewerloo	6333	Y-1 to Y-6 T-1 to T-5 X-1 to X-3

PACMINEX PTY. LTD.—FIELD DRILL LOG

0275

HOLE No. 6332 P-1

PAGE 1 OF 2

PROJECT: PANURRA 405 | DATE STARTED: 20/12/75 | TYPE OF DRILL: MAYHEW 1000

AREA: ROOPENA 6332 | COORDINATES: | HOLE SIZE:

LOCATION: ROOPENA | CONTRACTOR: W.L. SIDES

STARTED: 9.15 am | ELEVATION: | DRILLER: K. TERLINGTON

COMPLETED: 12.30 pm | DEPTH: 35.0m | LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
0	Red sandy clay, gypsum, calcrete. Blade bit.		45716		20	60	140
3.0	3" Casing. Red sandy clay and orange sand; minor calcrete.		45717		20	50	130
6.0	Red clay, sand, cherty & silic. ss gravels.		45718		15	40	250
9.0	Red clay, sand, beige sandy clay; coarse gravel band 2 ~ 11m - well worn pebbles of chert & silic. ferruginous ss.		45719		20	40	110
12.0	Beige to yellow clay sand, minor sandy clay, minor red clay sand. Coarse red & yellow ferruginous silcrete gravels, pebbles red, white chert - well worn.		45720		10	40	140
15.0	Beige a buff clay sand - sand poorly sorted ranging degrees of rounding, many yellow red pink to reddish chert grains & small pebbles.		45721		10	20	45
18.0	Beige a buff sandy clay & black carbonaceous ? ex Mallee ? material, minor clay sand.	Sediments	45722		10	40	95
21.0	Beige clay sand - v. fine grained, some larger rounded pink & brown cherty lithics up to 1-2 mm.	Unconsolidated.	45723		10	20	25
24.0	Buff & beige clay sand - coarse clear, white qtz pebbles 2-5 mm, many smaller pinkish qtz grains poorly sorted.		45724		10	20	200
27.0	Purple-pink clay, irregular qtz grains and rounded qtz pebbles ~ 5mm. Very clayey.		45725		80	20	75

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PACMINEX PTY. LTD.—FIELD DRILL LOG

0276

HOLE No. 6332 P-1

PAGE 2 OF 2

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: .... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 35.0m LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
30.0	Grey clay & v. fine sand and					
	excess. qtz gravels to 1cm.	45726		95	40	190
33.0	Dark grey sandy clay - sticky - using					
	water injection — highly contaminated sample.					
	Hard at ~ 35m - Sand caving in - sample	45727		530	60	120
	indistinguishable - Abandon Hole.					
36.0	Possibly top of Wessalia black shale					
	END OF HOLE AT 35m.					
39.0						

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

HOLE No. 6332RC

PAGE | OF |

PROJECT: PANDORA 405 DATE STARTED: 20/10/75 TYPE OF DRILL: MAYHEW 1000

AREA: ROOPENA 6332 COORDINATES: HOLE SIZE:

LOCATION: CONTRACTOR: W.L. SIDES

STARTED: 2 p.m. ELEVATION: DRILLER: K. TERRINGTON

COMPLETED: 4.15 p.m. DEPTH: 19.5m LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
0	Dune sand, clay, silic. ss pebbles.	Unconsolidated Sediments	45728		20	60	450
3.0	Orange sand & clay; stiff green sandy clay ± pink qtz grains, often calcareous, calcrete nodules.		45729		50	60	80
6.0	Pale green sandy clay, calcareous, and calcrete - pink qtz grains prominent. 8.m Casing.		45730		20	80	220
9.0	Grey-green sandy clay and clay sand, minor yellow limonite, coarse calcified sandy clay		45731		15	40	120
12.0	Buff & grey-green clay sand, minor clay. Poorly sorted & rounded qtz sand constituent; lg. pebble calcified ss ± pink qtz grains		45732		10	40	140
15.0	Clay sand as above to 16m.						
	Hammer from 16m - Smack water ~ 50 g/hr. Orange grade to minor orange-brown clayey cheesy to bright red. A few chips thin brown patchoid oxide?	PANDORA FM	45733		10	40	250
18.0	Massive very hard red oxide, minor red clay. NO apparent mineralisation.		45734	1.5	30	40	140
19.5	END OF HOLE AT 19.5m						

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0278

HOLE No. 6332 F-3

PAGE 1 OF 1

PROJECT: PANDURRA 405 | DATE STARTED: 20/10/75 | TYPE OF DRILL: MAYHEW 1000

AREA: ROEBENA 6332 | COORDINATES: | HOLE SIZE:

LOCATION: | | CONTRACTOR: W.L. SIDES

STARTED: 4.45pm | ELEVATION: | DRILLER: K. TERRINGTON

COMPLETED: 9:40 am 21/10/75 | DEPTH: 21.0m | LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
0	Reddish brown sandy clay, calcrete.	Unconsolidated Sediments	45735		20	70	130			
3.0	Grey-green sandy clay, some red mottling		45736		10	40	90			
	6m Casing									
6.0	Hard grey-green sandy clay & abundant pink qtz. grains.		45737		10	40	160			
9.0	Hammer 6 - 12 m.									
	Hard grey-green sandy clay as above to ~ 11m, then soft red & yellow clay sand; possibly weathered Pandurra - contains soft chips red & yellow fine grained qtzite?		45738		10	40	45			
12.0	Red & yellow clay sand - using blade bit. Chips red & yellow weathered qtzite?		45739		10	30	120			
15.0	Hard at 15m - Struck water ~ 50 g/hr. Chips red & yellow weathered qtzite, minor yellow silcrete. Alternating yellow & orange-red qtzite. Hammer from 15m.	PANDURRA FM	45740		15	30	140			
18.0	Fine grained massive qtzite - color alternating red & yellow. Minor soft bands 18 - 19.5m.		45741		10	20	490			
21.0	END OF HOLE AT 21.0m									

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PACMINEX PTY. LTD.—FIELD DRILL LOG

0279

HOLE No. 6332 P-4

PAGE 1 OF 1

PROJECT: PANDORRA 405 DATE STARTED: 21/10/75 TYPE OF DRILL: DIAMOND (SCD

AREA: ROCKENA 6332 COORDINATES: HOLE SIZE:

LOCATION: CONTRACTOR: W.L. SIDES

STARTED: 10.30 am ELEVATION: DRILLER: K. TERRINGTON

COMPLETED: 11.45 am DEPTH: 6.0 m LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
0	0 - 2 m - Orange sand, smooth rounded qtz + chert pebbles, yellow silicass or qtzite and red qtzite pebbles.	Scree	45742		35	60	280
	2 - 3 m Hammer - hard limonitic qtzite						
3.0	Limonitic qtzite, changing to pink qtzite. Pale grey-green sandy clay near 6m.	Pandurra Fm	45743		5	40	140
6.0	END OF HOLE AT 6.0m.						

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PACMINEX PTY. LTD.—FIELD DRILL LOG

0280

HOLE No. 6332 J-1

PAGE 1 OF 2

PROJECT: PANDURRA 405 | DATE STARTED: 21/10/75 | TYPE OF DRILL: MAYHEW 1000

AREA: Roopena 6332 | COORDINATES: | HOLE SIZE:

LOCATION: Roopena | CONTRACTOR: W.L. SIDES

STARTED: 1pm | ELEVATION: | DRILLER: K. TERRINGTON

COMPLETED: 8:15 am 22/10/75 | DEPTH: 48.0 m | LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
0	Red sand, clay and gravels	Recent	45744		15	40	120
3.0	Red sand, clay and gravel, clamp at 6m.		45745		20	60	100
6.0	Wet yellow and red unconsolidated grit.		45746		15	40	110
9.0	Yellow sand and grit - several hundred gallons water / hour. Khaki and grey clay at ~ 10m. 11m Casing - water flow sealed.		45747		35	60	320
c	Light khaki-green clay		45748		40	80	440
15.0	Dark khaki-green clay - weathered shale?	Dolomite	45749		35	90	320
18.0	Khaki clay to 19.5m. Blue-grey to black calcareous shale (hammering).		45750		40	90	420
21.0	Black calcareous shale	Woocalla	45751		30	100	440
24.0	Black calcareous shale - khaki clay contamination.		45752		40	140	500
27.0	Black calc. shale + minor interbedded dolomite. Wet at 28.5 m - 50-100 g/l.		45753		30	220	920

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PACMINEX PTY. LTD.—FIELD DRILL LOG

0281

HOLE No. 6352 J-1

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: .... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 48.0 m ..... LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
30.0	Black and grey laminated shale and minor interbedded dolomite.	Dolomite	45754		40	540	1100			
33.0	Black and grey shale, minor dol. as above, minor yellow clay contam^{n}.		45755		30	880	1300			
36.0	Black laminated shale, minor yellow clay & weathered shale, minor dolomite.		45756		190	1200	740			
37.0	Black laminated shale, abundant interbedded light grey pyritic dolomite.	Woodcallo	45757		2300	200	660			
42.0	Light-grey, minor creamy pyritic dolomite, minor pyritic black shale. A few chips of pinkish white qtzite at 45m.		45758		2900	220	530			
45.0	White, pink, minor red f'grained qtzite - very hard, massive, ē abundant blebs h.m. in part. Minor pebbles pyritic banded ironstone. Water flow at end of hole 200-250 g/hr.	McLeay Beds? or P-p.	45759		110	60	140			
48.0	END OF HOLE AT 48.0m.									

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PACMINEX PTY. LTD.—FIELD DRILL LOG

0282

HOLE No. 6332J-2

PAGE 1 OF 1

PROJECT: PANDURRA 405 | DATE STARTED: 22/10/75 | TYPE OF DRILL: MAYHEW 1000

AREA: ROOPENA 6332 | COORDINATES: | HOLE SIZE:

LOCATION: Pandurra | CONTRACTOR: W.L. STOKES

STARTED: 9.45 | ELEVATION: | DRILLER: K. TERRINGTON

COMPLETED: 10.45 | DEPTH: 15.0m | LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
0	Surface scree of silic congl, white qtz pebbles, silicified Pargeroo SS or qtzite, banded chert pebbles, minor orange sand & clay.	Recent	45760		720	140	260
	2-3m - Soft grey-green clay - (weathered shale?)						
3.0	Grey-green, minor red, yellow clay; minor gypsum & black Manganese? or carbon? nodules.	N. Woocalla Weathered	45761		2100	180	220
	6m Casing.						
6.0	Yellow weathered shale?, minor pale green clay as above. Black Mn-siliceous or carbonaceous nodules at 9m.		45762		2000	200	1000
9.0	Black, Yellow, red shales.						
	Hard at 10.5m - Hammering - Pink qtzite		45763		2100	380	720
12.0	Pink qtzite & soft or yellow bands to 13.5. Hard silic qtzite bands and softer non-silic layers - yellow & red clay bands. Some brown chert pebbles, possibly from conglomeratic layer.	L.P.	45764		270	40	160
15.0	END OF HOLE AT 15.0m						

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PACMINEX PTY. LTD.—FIELD DRILL LOG

0283

HOLE No. 6332 J - 3

PAGE 1 OF 1

PROJECT: Pandurra 405 | DATE STARTED: 22/10/75 | TYPE OF DRILL: MAYHEW 1000

AREA: Reserve 6332 | HOLE SIZE:

LOCATION: Pandurra | COORDINATES: | CONTRACTOR: W.L. SIDES

STARTED: 11:15 am | ELEVATION: | DRILLER: K. TERRINGTON

COMPLETED: 12.00 | DEPTH: 5.0m | LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
0	Surface scree silic. cengl, granite ords, white qtz pebbles, orange sand & clay, calcrete.	Recent	45765	3.0	70	80	460			
	Hard at 1.5m. Hammering - Orange & brown weathered mafic. fragmented									
3.0	Orange-brown granite, changing to red f'spathic granite - mildly, becoming massive. Hard white clay bands, Pebble failback jammed hammer.	P-p	45766	2.0	30	40	40			
5.0	END OF HOLE AT 5.0m.									

CSR/0035

HOLE No. 6332-4

PACMINEX PTY. LTD.—FIELD DRILL LOG

0284 PAGE 1 OF 3

PROJECT: PANDURRA 405 DATE STARTED: 22/10/75 TYPE OF DRILL: MAYHEW 1000

AREA: Regional 6332 COORDINATES: HOLE SIZE:

LOCATION: Pandurra CONTRACTOR: W. L. SIDES

STARTED: 2.45 ELEVATION: DRILLER: K. TERRINGTON

COMPLETED: 1.15 27/10/75 DEPTH: 64.0m LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
0	Minor orange sand ; pebbles reddish-purple foreigneous shale - surface scree. Soft pale grey-green clay ; minor gypsum.	Recent	45767		30	80	70			
3.0	Red, reddish-purple shale, pale grey-green clay.	Weathered Woocalla	45768		40	80	120			
6.0	Hammer from 6m - 7m - Hard. foreigneous red shale ; soft pale green & red mottled clay. Green and yellow shale		45769		60	80	260			
9.0	Boring 7-10m. Blue-green, minor black-yellow calc. shales, deep maroon shale near 12m. Minor black calc. shale.		45770		45	70	320			
10	Hammer from 10m Minor red and black shale at top of sample, changing to black calc. shale.		45771		40	80	190			
15.0	Black calc. shale, some coarse muscovite or sericite flakes	Dolomite	45772		35	80	220			
18.0	Wet at 18m. 50-100 g/hr. Black calc. shale - ~~some~~ coarse muscovite ~~or sericite flakes~~ Minor interbedded dolomite ; tr. pyrite.		45773		35	70	200			
21.0	Black calc. shale, minor interbedded dolomite ; tr. pyrite.		45774		110	90	180			
24.0	Black calc. shale, minor dol., pyritic	Woocalla	45775		40	80	200			
27.0	Black calc. shale, greenish dolomite? ; grey dolomite. Sudden water flow increase 1000-1500 g/hr near 30m.		45776		35	80	150			

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PACMINEX PTY. LTD.—FIELD DRILL LOG

0285

HOLE No. 6332.5-4

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: ..... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 64.5m LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
30.0	Black shale, grey calc-arenite? or dolomite - micaceous.		45777		60	90	140
33.0	Black shale and grey dolomite		45778		40	100	150
36.0	Black shale & dolomite as above.		45779		40	140	540
37.0	Black shale & pyritic dolomite.	Dolomite	45780		40	360	1100
	Black shale & pyritic dolomite		45781		40	260	880
45.0	Black shale & pyritic dolomite.	Wooleeana	45782		30	200	860
48.0	Laminated black shale and light grey banded dolomite - dolomite ± micro-vugs - pyritic		45783		40	220	1200
51.0	Black shale and minor red/green mottled calc-arenite? highly calcareous, - ± recrystd white calcite blebs) - latter rock is crystalline (marble like texture); green mixed non-calcareous; rock ± fine stringers of red Fe-oxide; calcite bands up to 1mm.		45784		120	240	340
54.0	Red & green calcareous "dolostone" (or a calc-arenite) as above - ± tr. chalcopyrite; fractured. Becoming purplish - ± phenocrysts qtz, calcite, apple-green chlorite? (soft talc-like mineral); phenocrysts often bordered with beige red Fe-oxide; tr. py.		45785		110	90	380
57.0	Purple volcanic? ± abundant green chlorite, calcite, red Fe-oxide, tr. py.	Dolerite	45786		80	100	400

PACMINEX PTY. LTD.—FIELD DRILL LOG

0280 HOLE No. 6332T-4

PAGE 3 OF 3

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: .... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 64.0m LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
60.0	Purple porphyritic volcanic? as above,						
	Fractured (or blocky, 61.5 - 63.0m)		45787		40	100	380
63.0	Purple volcanic, ± blue-grey siltstone?			1.0			
64.0	Hammer malfunction.		45788		15	100	380
	END OF HOLE AT 64.0 m.	Dolerite					
64.0							

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

HOLE No. 6332 J-S

0287

PAGE 1 OF 1

PROJECT: PANDURRA 405 DATE STARTED: 27/10/75 TYPE OF DRILL: MATHEW 1000

AREA: Ropana 6332 COORDINATES: HOLE SIZE:

LOCATION: West of Myall Creek, Pandurra CONTRACTOR: W.G. STOCKS

STARTED: 2:15 ELEVATION: DRILLER: K. TERRINGTON

COMPLETED: 3 p.m. DEPTH: 6.0m LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Orange clay & sand, yellow & red grade rubble to c. 2m; Hematite from 2m. Orange azurite, pebbly.	Scree	45787		30	80	180
3.0							
	Orange azurite, two white sandy clay bands near top of sample, pink fine grained fluorite azurite rest of sample; minor clear gypsum band. Sample a many angular quartz pebbles, possibly	PANDURRA Fm	45790		10	40	65
6.0	fallback.						
	END OF HOLE AT 6.0m						

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PACMINEX PTY. LTD.—FIELD DRILL LOG

0288

HOLE No. 6332 J-6

PAGE 1 OF 2

PROJECT: PANDURRA 405 | DATE STARTED: 27/10/75 | TYPE OF DRILL: MANNEX 1000

AREA: Reserve 6332 | COORDINATES: | HOLE SIZE:

LOCATION: East of Myall Creek, Pandurra | CONTRACTOR: W.L. GILES

STARTED: 3:45 pm | ELEVATION: | DRILLER: K. TERRINGTON

COMPLETED: 9am 28/10/75 | DEPTH: 42.0m | LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
3.0	Orange clay sand, gypsum.	Unconsolidated Sediments	45791		20	60	95
6.0	Clay sand, gypsum ; wet sand & gravel		45792		10	40	40
9.0	Wet sand, clay, gravel. 9m Casing.		45793		20	40	120
12.0	Dry pale khaki weathered shale.	WOOLNAMA SHALE	45794		40	60	560
15.0	Blue-green, khaki & red weathered shales		45795		30	80	230
18.0	Khaki weathered shale. Hammer from 16.5m — Black shale, laminated.		45796		35	80	310
21.0	Black laminated shale — casing lifted — sample wet, highly contaminated, low recovery.		45797		40	80	520
24.0	Dry black laminated shale.		45798		30	100	150
27.0	Black shale and interbedded dolomite - damp - hole made water overnight. - flow ~100 g/hr.		45799		30	300	240
30.0	Black shale and dolomite - dolomite more abundant than above - tr. fyz.		45800		160	160	140

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0289

HOLE No. 6332 J-6

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: .... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 42.0m. ..... LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Interbedded laminated shale and pyritic dolomite.						
33.0		WOODCARRA DOL.	45801		1200	200	350
	Minor black shale; massive grey and pink pyritic dolomite.						
36.0			45502		1300	160	240
	Minor grey dolomite; banded iron formation cream's and sand in ~ 37.5 - banded chert and silicified hematite/magnetite? pebbles, often pyritic. Pink fine grained gritty 37.5 - 39m - massive.	mickeay	45803		280	100	95
39.0	Water flow increase in gravels to ~ 500 g/hr.	PAMURRA FM? MCLEAY?					
	Pink fine grained gritty, minor pyrite. Sample 2 abundant gravel fallback; abundant black hem (probably from banded iron pebbles). Minor semi-silicified? sandy clay (hard, khaki-coloured, slightly calcareous).		45804		95	60	50
42.0							
	END OF HOLE AT 42.0m						

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0290

HOLE No. 6532 J-1

PAGE 1 OF 2

PROJECT: PANDURRA 405 | DATE STARTED: 23/10/75 | TYPE OF DRILL: MAYHEW 1000

AREA: Reserve 6732 | COORDINATES: | HOLE SIZE:

LOCATION: East of Myall Creek, Pandurra | CONTRACTOR: W.G. SIDES

STARTED: 9.45 am | ELEVATION: | DRILLER: K. TERRINGTON

COMPLETED: 2.30 pm | DEPTH: 31.0m | LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
	Red sandy clay, colluvial.	Unconsolidated Seds	45805		25	60	150			
3.0										
	Yellow limonitic clay, very damp brown clayey sand & grit.		45806		25	60	110			
6.0										
	Yellow and khaki weathered shale.		45807		40	280	620			
9.0	8m Casing.									
	Khaki weathered shale		45808		40	320	780			
12.0										
	Khaki weathered shale		45809		35	460	640			
15.0										
	Khaki weathered shale.		45810		110	540	800			
	Hole making some water; using water injection; Remains firm. — Black shale.	DOLOMITE								
18.0										
	Laminated black shale - very damp & sticky.		45811		35	800	1100			
21.0										
	Laminated black shale — wet at 24m — flow ≈ 100-200 g/hr.	WOODCARRA	45812		75	1200	1200			
24.0										
	Laminated black shale + minor interbedded pyritic dolomite.		45813		530	620	940			
27.0										
	Massive grey dolomite, minor black shale; abundant pyrite at bottom of sample — coarse veiling pink & white calcite near 30m; qtz, chert, brecciated iron pebble gravels at 30m — sudden water flow increase to ≈ 500 g/hr.		45814		1400	180	360			
30.0										

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG 0291

HOLE No. 6332J-7

PAGE 2 OF 2

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: ..... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 39.0 m. LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Chert, grey qtzite, pink qtzite, banded iron gravels, often pyrite coated; v fine sand. Pink qtzite is similar to that in 6332J-6, which may have been stepped sheet of purple volcanic.	MCLEAY ?	45815		65	80	180
33.0							
	Gravels, sand; brown shale and clay at ~ 35m; irregular nodules calcite, becoming rich in apple-green chlorite?; purple volcanic by 36 m (same as in 6332 J-4).		45816		40	100	130
36.0							
	Purple volcanic & abundant calcite/chlorite and red Fe-oxide.	DOLERITE	45817		25	120	210
39.0							
	END OF HOLE AT 39.0 m						

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

HOLE No. 6532 J-8

PAGE 1 OF 2

PROJECT: PANDORA 425 DATE STARTED: 28/10/75 0292 TYPE OF DRILL: MAYHEW 1000

AREA: Roopena 6332 COORDINATES: HOLE SIZE:

LOCATION: East of Myall Ck, Pandora CONTRACTOR: W.L. SIMES

STARTED: 4 pm ELEVATION: DRILLER: K. FERGUSON

COMPLETED: 1-30pm 29/10/75 DEPTH: 45.0m LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Sand, clay, abundant gypsum	Unconsolidated Seds.	45818		20	60	110
3.0							
	Gypsum, minor sand & clay. Very damp grit.		45819		15	40	70
6.0	6m Casing.						
	Wet gravel and grit; yellow clay sand, stiff khaki clay near 9m.		45820		20	70	170
9.0	9m Casing.						
	khaki clay - wet sand & grit contamd.	DUCHESS. TE.	45821		25	60	130
12.0							
	Minor khaki & limonitic weathered shale; Soft black weathered shale.		45822		40	70	280
15.0							
	Black laminated shale, becoming harder.		45823		35	100	350
	Hammer from 17m.						
18.0							
	Black & grey laminated shale, soft dark grey clay.		45824		40	100	300
21.0							
	laminated black shale.	WOOCALLA	45825		35	80	200
24.0							
	Damp grey clay and shale.		45826		40	120	480
27.0							
	laminated black shale.		45827		40	260	680
30.0							

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

HOLE No. 0332 J-8

PROJECT: ..... DATE STARTED: 0298 TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: .... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 45.0m LOGGED BY: A.L.G

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
	Damp shale, making some water by 31.5 m. Wet sample.	DOL.	45828		40	600	580			
33.0										
	Black laminated shale + interbedded dolomite; fr. py.	WOOCARRA	45829		480	360	340			
36.0										
	Minor black shale; light-grey dolomite, pyritic; fractured pink & red dolomite, 38-39 m.		45830		1500	260	360			
39.0										
	Minor grey clay (& weathered shale) band & apple-green chlorite? at 39 m; Orange, changing to pinky red qzite - f'sparkle, & abundant pyrite throughout. Thin band of white qzite.	PANDANUS FM	45831		40	60	95			
42.0										
	Red qzite, pyritic throughout. Fractured zone → increased water flow to ~ 100 - 150 g/hr.		45832		80	80	130			
45.0										
	END OF HOLE AT 45.0m									

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0294

HDLE No. 6332J-9

PROJECT: PANDURRA 405 | DATE STARTED: 29/10/75 | TYPE OF DRILL: MAYHEW 1000

AREA: Reopara 6332 | COORDINATES: | HOLE SIZE:

LOCATION: Pandurra | CONTRACTOR: W.L. SIDES

STARTED: 2.30 pm | ELEVATION: | DRILLER: K. TERRINGTON

COMPLETED: 6.15 p.m. | DEPTH: 57.0m | LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
3.0	Surface gravel ; khaki weathered shale. Minor calcrete.		45833		45	80	240
6.0	Khaki and brown shale, gypsiferous, a few rounded gravel pebbles. Rm Casing. Hummer from 5m.		45834		35	60	240
9.0	Khaki yellow, grey shales, minor gypsum.		45835		15	70	230
12.0	Khaki grey, minor yellow shales - colour often changes rapidly within a few mm. - finely laminated.	DOLOMITE	45836		40	70	220
15.0	Khaki shale & minor yellow & grey laminations.		45837		40	80	190
18.0	Minor khaki & grey laminated shale ; Black & light-grey laminated shale.		45838		45	90	180
21.0	Black & grey shale as above.	WOOCALLA	45839		40	180	180
24.0	Black & grey shale		45840		50	100	130
27.0	Black & grey shale		45841		85	120	190
30.0	Black & grey shale.		45842		50	140	170

PACMINEX PTY. LTD.—FIELD DRILL LOG

0295

HOLE No. 6332 J-9

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: ..... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 57.0 m ..... LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
	Black & grey shale - interbedded dolomite bands.	WOOCIALLA DOL.	45843		220	120	220			
33.0										
	Black shale & considerable interbedded dolomite, pyritic.		45844		45	120	230			
36.0										
	Grey pyritic dolomite.									
	Banded iron pebbles, chert, qtzite. sand, at 37.5m.		45845		2400	200	620			
	Wet at 39m - Red clay? band - water flow									
39.0	red to reddish brown, flow ~ 100-200 g/h.p.									
	Coarse gravels as above - abundant pyrite coating; reddish-purple clay matrix? White clay.		45846		40	40	40			
42.0										
	Purple sand and gravels - hard, some soft bands; white clay particles... contam? Conglomerate?	EQUIVALENT	45847		70	40	35			
	Probably hard sandstone or qtzite									
45.0										
	Purple sand & gravels as above; chips fine grained purple qtzite. Bulk of sample is sub-rounded grit size purple stained qtz grains.		45848		20	30	40			
48.0										
	Purple sand & gravel - minor chips purple P'spathic volcanic - gravel?	BEDS	45849		20	40	40			
	Bright red clay band.									
	Gritty sand.									
51.0										
	Purple sand - pulverised qtzite ? - grit size. White clay, gravel contam^{s}.	MCLEAY	45850		10	30	20			
54.0										
	Purple qtzite ? - sub rounded qtz grains - poorly sorted as are most of the samples from 42m.		45851		10	40	30			
	Gravel & white clay contam^{s}.									
57.0										
	END OF HOLE AT 57.0m.									
					Cu ppb	Zn	TDS g/l			
	WATER SAMPLE		633259		<5	0.4 ppm	37.2			

PACMINEX PTY. LTD.—FIELD DRILL LOG

0296

HOLE No. 6332J-10

PAGE 1 OF 2

PROJECT: PANDURRA 405 | DATE STARTED: 30/10/75 | TYPE OF DRILL: MAYHEW 1000

AREA: Roopena 6332 | HOLE SIZE:

LOCATION: Pandurra | COORDINATES: | CONTRACTOR: W.L. SIDES

STARTED: 7 am | ELEVATION: | DRILLER: K. TERRINGTON

COMPLETED: 9·30 am | DEPTH: 37·5 m | LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
	Predominantly orange sand & clay, surface ironstone & qtz pebbles; minor khaki weathered shale.	RECENT	45852		40	200	110			
3·0										
	Weathered laminated khaki shale.	DOLOMITE	45853		40	540	390			
	Hammer from 4m – 4m Casing.									
6·0										
	Khaki shale, minor grey shale.		45854		20	300	280			
9·0										
	Khaki, minor grey shale.		45855		40	1400	200			
12·0										
	Predominantly khaki shale. Fresh dark & light-grey laminated shale.	WOOCALLA	45856		70	2800	120			
15·0										
	Laminated black & grey shale, becoming increasingly dolomitic – ti. py.		45857		2500	400	300			
	A few banded jaspilite, qtz & chert pebbles (pyritic).									
16·0										
	Coarse gritty sand – clear & white qtz; jaspilite, sandstone, brown qtzite gravels, often centred with pyrite. Much black h.m. Hard white clay band.	EQUIVALENT	45858		90	130	50			
21·0										
	Coarse jaspilite, white qtz, orange, purple & brown qtzite gravels, pyrite centred, gritty sand, red clay; abundant black h.m. Wet – water flow ~ 100–200 g/hr.		45859		40	60	50			
24·0										
	Coarse gravels and sand as above – qtz sand varies from v. fine to grit size; coarse pyrite, abundant black h.m. & red clay.	BEDS	45860		20	40	40			
27·0										
	Very coarse gravels – jaspilites generally v. angular, some rounded brown qtzite and chert pebbles. Gritty sand, coarse pyrite, black h.m., red clay. White clay fallback.	McLEAY	45861		20	80	30			
30.0										

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0297

HOLE No. 6332J-10

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... HOLE SIZE: .....

LOCATION: ..... COORDINATES: ..... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 37.5 m ..... LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
	Predominantly purplish-brown gritty sand, lesser gravels. Abundant pyrite, black hm., red clay.	McLEAY BEDS EQUIVALENT	45862		40	100	30			
33.0										
	Purplish-brown sand, scattered jaspilite & white qtz gravel; coarse massive pyrite fragments; black hm., red clay.		45863		10	60	20			
36.0										
	Purplish-brown sand, gravels, purple fine grained ss or qtzite chips; pyritic, black hm. red clay.		45864	1.5	30	70	30			
37.5										
	6m fallback in hole at change of rod — hole abandoned.									
	END OF HOLE AT 37.5 m									
					Cu ppb	Zn ppb	TDS g/l			
	WATER SAMPLE		6332J10		<5	420	35.7			

CSR/0035

HOLE No. 6332 J-11

PACMINEX PTY. LTD.—FIELD DRILL LOG

0298

PAGE 1 OF 3

PROJECT: PANDURRA 405 DATE STARTED: 30/10/75 TYPE OF DRILL: MAYHEW 1000

AREA: Roopena 6332 HOLE SIZE:

LOCATION: Pandurra COORDINATES: CONTRACTOR: W.L. SIDES

STARTED: 10.45 am ELEVATION: DRILLER: K. TERRINGTON

COMPLETED: 8am 31/10/75 DEPTH: 69.5m LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Orange sand, red clay, silcrete & ironstone pebbles, minor calcrete & gypsum.	45865		30	60	30
3.0	3m Casing					
	White and pale green chert; silicified feldspathic sandstone, reddish (Fe-oxide). Hard white clay° near 6m. Minor gypsum Hammer from 3m.	45866		10	40	20
6.0						
	Hard white clay; Pink and minor v. pale green siltstone – shale. Sample predominantly v. fine powder.	45867		10	40	30
9.0						
	Very pale green clay & weathered shale. Finely powdered samples.	45868		20	40	20
12.0						
	Khaki-green, pink, minor yellow clays – weathered shale	45869		30	40	60
15.0						
	Yellow limonitic weathered shale - fine grey, pink laminations.	45870		60	120	120
18.0				60	100	120
	Yellow, fawn weathered shale; chips dark grey shale near 21m.	45871		90	80	110
21.0						
	Dark grey to black shales, minor light grey silty shale.	45872		30	60	80
24.0						
	Black laminated shale and light grey silty shale; both types micaceous, the latter very calcareous.	45873		10	40	50
27.0						
	Light grey silty shale as above, minor black shale.	45874		20	40	50
30.0						

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0299

HOLE No. 6332 J-11

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: .... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 69.5m LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Black and grey laminated shales, minor grey clay.	45875		100	2700	190
33.0						
	Grey shale and clay.	45876		210	120	140
36.0						
	Minor shale, abundant grey clay, and gravels – jaspilite and reddish brown qtzite. Damp.	45877		190	120	100
39.0						
	Red-brown clay and gravel, damp at top; reddish-brown shale and clay. & blocks of grey-green shale & clay.	45878		40	60	40
42.0						
	Red-brown shale, sandy in part, minor green siltstone? Sticky red clay contam^n	45879		30	40	30
45.0						
	Red sandy shale – clay contam^n;	45880		20	40	40
48.0						
	Red shale – clay contam^n; shale micaceous; qtz grit near 51m.	45881		10	40	40
51.0						
	Minor grit; purplish sandstone – fine grained in part; some chips white sandstone.	45882		10	30	10
	Hole making water – wet sample.					
54.0						
	Purple sandstone – siltstone, sometimes mottled white. Red-brown micaceous shale; minor white ss. Water flow < 50 g/hr.	45883		10	40	20
57.0						
	Purple siltstone, white ss, purple and red-brown micaceous shale.	45884		20	40	30
60.0						

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

HDLE No. 6332 J-11

0300

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: ..... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 69.5 m ..... LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
	Purple sandstone - siltstone, sometimes with white mottling ; white ss ; red-brown & purple micaceous shale; black h.m.	45885		20	40	10			
63.0									
	Red-brown, green micaceous shales, purple siltstone - ss, mottled white in part, white ss, black h.m.	45886		20	40	40			
66.0									
	Purple-white ss - siltstone, minor green micaceous shale, black h.m.	45887		20	40	20			
69.0									
	Purple-white fine grained ss, green micaceous shale	45888	0.5	20	40	30			
69.5	Abundant black h.m.								
	END OF HOLE AT 69.5m.								
				Cu ppb	Zn	TDS g/l			
	WATER SAMPLE	6332511		7	0.3 ppm	29.3			

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0301

HOLE No. 6332 I-1

PAGE 1 OF 2

PROJECT: PANDURRA 405 | DATE STARTED: 31/10/75 | TYPE OF DRILL: MAYHEW 1000

AREA: Roepena 6332 | COORDINATES: | HOLE SIZE:

LOCATION: Pandurra | CONTRACTOR: W.L. SIMES

STARTED: 9 am | ELEVATION: | DRILLER: K. TERRINGTON

COMPLETED: 11:45 am | DEPTH: 33.0m | LOGGED BY: J.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
3.0	Surface ironstone pebbles, orange sand & clay, gypsum, minor calcrete.	45889		20	60	40
6.0	Red clay, ferricrete band, pale grey chert (silcrete?) at 6m. Hammer from 3m.	45890		20	60	40
9.0	Pale grey chert (silicified clay?) becoming soft near 9m - weathered shale.	45891		10	240	50
12.0	Light grey, khaki, yellow, minor red weathered shale. Minor fawn "greasy" shale - soft, having the feel of serpentine.	45892		60	860	120
15.0	Khaki or yellow weathered shale.	45893		70	300	610
18.0	Khaki & yellow shale to ~16m; Hard grey shale.	45894		40	260	690
21.0	Grey laminated shale.	45895		30	380	70
24.0	Black and grey laminated shales, & occasional scattered sand grains.	45896		40	120	70
27.0	Black & grey shale, soft grey clay at ~ 26m; Pale pink grzite, limonitic at top, softer sandy bands.	45897		190	80	140
30.0	Pink grzite & red & green shale bands & pyrite.	45898		60	40	40

CSR/0035

HOLE No. 6332 I-1

PACMINEX PTY. LTD.—FIELD DRILL LOG

0302

PAGE 2 OF 2

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: .... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 33.0m ..... LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
	Pink + white qtzite, f'spathic, red micaceous shale bands.		45899		30	40	60			
33.0	END OF HOLE AT 33.0m.									

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0303

HOLE No. 6432 Q-1

PAGE 1 OF 2

PROJECT: PANDURRA 405 | DATE STARTED: 31/10/75 | TYPE OF DRILL: MAYHEW 1000

AREA: Cultana 6432 | COORDINATES: | HOLE SIZE:

LOCATION: Tregalana | CONTRACTOR: W.L. SIDES

STARTED: 3pm | ELEVATION: | DRILLER: K. TERRENSTON

COMPLETED: 5.30pm | DEPTH: 31.5m | LOGGED BY: ALG

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
3.0	Orange sand & clay, abundant gypsum.	45900		20	30	40
				20	40	40
6.0	Sand, clay & gypsum to 4m. Hard pale green & pink sandy clay; minor gypsum. 4m Casing; Hammer from 4m.	45901		30	20	20
9.0	Hard green & pink sandy clay, white fibrous gypsum.	45902		40	20	20
12.0	Minor hard sandy clay; soft green clay with some limonite staining, minor red clay, minor silicified ironstone gravel, possibly within red clay band.	45903		240	80	70
15.0	Green, red, yellow clay - weathered shale.	45904		450	120	120
18.0	Yellow & khaki weathered shale.	45905		220	220	190
				210	220	200
21.0	Khaki and grey clay & weathered shale	45906		100	240	190
24.0	Soft grey and black shale & clay.	45907		40	360	260
27.0	Damp grey shale & clay.	45908		460	140	70
30.0	Soft damp grey shale; Red qtzite near 30m.	45909		830	120	180

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0304

HOLE No. 6432 Q-1

PAGE 2 OF 2

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: ..... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 31.5 m LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
30.0	Red oxide – fractured – wet ~ 50 g/hr.	45910	1.5	140	140	140			
	Some pale brown oxide.								
31.5	END OF HOLE AT 31.5m								
				Cu ppb	Zn	TDS g/l			
	WATER SAMPLE	6432Q1		<5	1.0 ppm	30.6			

CSR/0035

0305

PACMINEX PTY. LTD.—FIELD DRILL LOG

HOLE No. 6432Q-2

PAGE 1 OF 2

PROJECT: PANDURRA 405 DATE STARTED: 1/11/75 TYPE OF DRILL: MAYHEW 1000

AREA: CULTANA 6432 HOLE SIZE:

LOCATION: "Tregulana" COORDINATES: CONTRACTOR: W.L. SIDES

STARTED: 7 am ELEVATION: DRILLER: K. TERRINGTON

COMPLETED: 11.15 am DEPTH: 48.0 m LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
3.0	Orange sand, clay, qtzite pebbles, gypsum, calcrete.	"AGENT"	45911		10	40	20			
6.0	Red and green sandy clay - sample contaminated with surface sand + gravel when casing lifted. Hammer from 3m.		45912		40	50	50			
9.0	Red and green sandy clay Hard grey clay		45913		30	40	10			
12.0	Soft grey and grey-green clay	CLAY	45914		20	1600	20			
15.0	Pale grey-green clay Red and yellow clay.		45915		50	360	40			
12.0	Yellow clay and weathered shale.		45916		400	140	110			
21.0	Khaki-brown shale, ± silicified shale band.		45917		60	60	140			
24.0	Khaki - dark brown shale ; ± gravel band - rounded pebbles.		45918		120	70	110			
27.0	Brown siliceous shale. Grey micaceous shale at 27m.	WOOMERA DOLOMITE	45919		50	40	65			
30.0	Grey & brown shales at top of sample, Grey micaceous shale. Hard sandy shale at 30m - Wet ; flow = 50g/hr. -Micaceous, some CO_3^{2-}.		45920		35	40	65			

CSR/0035

HOLE No. 6432Q-2

PAGE 2 OF 2

PACMINEX PTY. LTD.—FIELD DRILL LOG

PROJECT: ..... DATE STARTED: 03.06 TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: .... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 48.0m LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
	Interbedded black laminated shale and fine grained grey micaceous sandstone. Grey clay & gravel fallback.		45921		30	40	80			
36.0	Black shale & light grey ss as above		45922		95	60	90			
39.0	Black shale, grey ss, minor dolomite, pyrite.	DOLOMITE	45923		290 270	80 80	50 50			
42.0	Black shale, minor dolomite, grey clay, pyrite	LYNOTT CREEK A	45924		340	50	50			
45.0	Black shale, dolomite (pyritic), grey clay. Light grey clay, gypsum fallback. Low sample recovery.		45925		280	80	110			
48.0	Red and pink f'spathic qtzite - no apparent mineralisation. Water flow ~ 150 g/hr.	PANDURRA FM	45926		480	80	150			
	END OF HOLE AT 48.0m									
					Cu ppb	Zn	TDS			
	WATER SAMPLE		6432Q2		<5	1.5 ppm	27.5			

CSR/0035

HOLE No. 6333 Y-1

PACMINEX PTY. LTD.—FIELD DRILL LOG

0307

PAGE 1 OF 1

PROJECT: PANDURRA 405 DATE STARTED: 3/11/75 TYPE OF DRILL: MAYHEW 1000

AREA: CARTWERLOO 6333 COORDINATES: HOLE SIZE:

LOCATION: Nine Mile Dam CONTRACTOR: W.L. SIDES

STARTED: 3pm ELEVATION: DRILLER: K. TERRINGTON

COMPLETED: 4.30 pm DEPTH: 24.0m LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	0-1m Orange sand & clay. White clay, occasional white remnant f'spar grains; coarse irregular qtz fragments	SAND					
3.0			45927	3m	20	60	90
	Fawn clay & weathered white f'spar; minor green clay, irregular qtz.	WEATHERED VOLCANIC (Clay)	45928	6m	10	60	25
6.0							
	Fawn clay & scattered white f'spar xtls, white kaolin; coarse irregular qtz & minor green staining.		45929	9m	10	30	25
9.0							
	Fawn, mauve, yellow clay, white f'spar xtls, green clay, coarse qtz.		45930	12m	55	40	40
12.0							
	Yellow weathered volcanic, some reddish mottling Manmar from 14m.	VOLCANIC	45931	15m	540 550	40 40	310 330
15.0							
	Yellow volcanic, abundant irregular qtz		45932	18m	480	40	260
18.0							
	Yellow & brown weathered volcanic.		45933	21m	380	30	320
21.0							
	Hard orange-brown volcanic & abundant amygdaloidal? qtz - often seems banded; abundant green staining; coarse clear muscovite		45934	24m	130	40	340
24.0							
	END OF HOLE AT 24.0m.						

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0308

HOLE No. 6333Y – 2

PAGE 1 OF 1

PROJECT: PANDURRA 405 | DATE STARTED: 3/11/75 | TYPE OF DRILL: MATHEW 1000

AREA: CARNEWERLOO 6333 | COORDINATES: | HOLE SIZE:

LOCATION: Nine Mile Dam | CONTRACTOR: W.L. SIDES

STARTED: 5pm | ELEVATION: | DRILLER: K. TERRINGTON

COMPLETED: 7.30 am 4/11/75 | DEPTH: 24.0m | LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
	Red clay and gypsum Rounded ferricrete pebbles.	TERTIARY	45935		25	40	60			
3.0	Pale grey-white silcrete at 3m – Hammering.									
	Pale grey-white silcrete – some red Fe-oxide mottling	SILCRETE	45936		5	20	35			
6.0										
	White and pale yellow fine grained ss – well rounded clear qtz grains.	YUDNAMUTANA BEDS	45937		5	20	180			
9.0										
	Pale Yellow and red-orange fine grained ss – well rounded qtz grains – predominately with red Fe staining		45938		10	30	50			
12.0										
	Red-orange fine g. ss as above, minor red clay ; Abundant grey-green to fawn clay.		45939		25	300	95			
15.0										
	Orange porphyritic volcanic & abundant white kaolinitic clay – some black Fe-oxide on fracture faces	VOLCANIC	45940		20	80	50			
18.0										
	Orange brown volcanic as above, less white clay than above.		45941		15	40	50			
21.0										
	Orange brown volcanic, minor porphyritic white weathered f'spar.		45942		20	30	25			
24.0										
	END OF HOLE AT 24.0m									

CSR/0035

0309

PACMINEX PTY. LTD.—FIELD DRILL LOG

HOLE No. 6333Y-3

PAGE 1 OF 3

PROJECT: PANDORRA 405 | DATE STARTED: 4/11/75 | TYPE OF DRILL: MAYHEW 1000

AREA: CARLEWERLOO 6333 | COORDINATES: | HOLE SIZE:

LOCATION: Nine mile Dam | CONTRACTOR: W.L. SIDES

STARTED: 10am | ELEVATION: | DRILLER: K. TERRINGTON

COMPLETED: 9am 5/11/75 | DEPTH: 81.0m | LOGGED BY: A.L.G.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
	Orange sand & clay, calcrete, gypsum, gravel - ironstone; red clay	RECENT?	45943		10	40	35			
3.0										
	Red, yellow, white silcrete & ferricrete; minor red clay	SILCRETE	45944		10	20	40			
	3-6m Hammer.									
6.0										
	Soft white v. fine sand & clay	UNCONSOLIDATED SAND MINERALS	45945		5	20	40			
	Rotary 6-8m									
	Hard white siltstone or chalcedony at 8m - Hammering									
9.0										
	Soft damp orange sand		45946		<2	20	35			
12.0										
	Orange sand to 13.5; Green clay.		45947		<2	30	45			
15.0										
	Green clay.		45948		<2	30	25			
	Soft friable v. fine white clay									
18.0	Green clay									
	Green clay		45949		<2	20	95			
	Friable v. fine white, pale green, yellow clay.	CLAY								
21.0										
	Limonitic green clay and pale green & yellow v. fine friable clay as above.		45950		5	40	35			
24.0										
	Green & yellow clays, brown clay & weathered shale.		45951		<2	30	65			
27.0										
	Brown, yellow & green weathered shales.	WEATHERED SHALE?	45952		<2	30	50			
30.0										

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

HOLE No. 63334-3

0310

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: .... HOLE SIZE: .....

LOCATION: ..... COORDINATES: ..... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 81.0m ..... LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
35.0	Brown, minor yellow & green shales; - v. fine sandy clay	45953		5	20	45
36.0	Brown, minor yellow shales; v. fine sand & clay	45954		5	40	35
39.0	Brown, minor yellow shales; v. fine sand & clay	45955		<2	30	40
42.0	Brown, minor yellow shales, minor white kaolin, blue-green silty shale; v. fine sand & clay	45956		5 10	30 20	40 40
45.0	Brown, minor blue-green shales; v. fine sand & clay.	45957		<2	40	70
48.0	Brown, blue-green shales, blue-green silty shale.	45958		5	40	90
51.0	Brown shale, blue-green siltstone	45959		5	30	80
54.0	Brown shale, minor blue-green siltst, the latter slightly calcareous Damp sample	45960		10	40	85
57.0	Brown and grey shales; v. fine khaki sand & clay; shales calcareous.	45961		75	120	80
60.0	Brown, minor grey-green shales, calcareous	45962		10	60	75

CSR/0035

BIRRIMA

YUDNAPINNA

PACMINEX PTY. LTD.—FIELD DRILL LOG

0311

HOLE No. 6333Y - 3

PAGE 3 OF 3

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: ..... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 81.0 m ..... LOGGED BY: A.L.S.

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
	Brown shale & clay, minor grey-green siltstone, calcareous		45963		10	70	150			
63.0										
	Damp grey-green calcareous siltstone — brown shale & clay contam^{n}		45964		10	60	120			
66.0										
	Wet grey-green and grey siltstone & abundant pyrite - coarse fragments up to 2mm. Minor brown siltstone; brown clay & silcrete contam^{n}. Siltstones calcareous		45965		10	70	45			
69.0	Water flow ~ 100-200 g/hr									
	Grey, grey-green siltstone predominantly, minor green, brown siltstones; occasional fine orange lithic grains; brown shale & yellow/orange silcrete contam^{s}. Abundant fine pyrite, occas. coarser fragments	BIDDS	45966		15	60	50			
72.0	Siltstones calcareous									
	Grey, grey-green, green, minor brown siltstones; occas. coarser sandy grains & orange lithics; abundant contam^{s} from washed out casing - silcrete, sand, brown shale fallback. Siltstones calcareous.		45967		20	50	30			
75.0	Fine pyrite.									
	Grey, grey-green, abundant brown siltstone, fine pyrite; white clay & silcrete contam^{s}. Siltstones calcareous	YUDNAPINNA	45968		10	40	20			
78.0										
	Predominantly brown, lesser grey-green calc. siltstones. Fine pyrite, occasional coarser fragments. Abundant orange sand contams.		45969		10	40	45			
81.0										
	END OF HOLE AT 81.0 m									
					Cu ppb	Zn ppb	T.D.S. g/litre			
	WATER SAMPLE		6333Y3		<5	250	31.7			

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG 0312

HOLE No. 6333Y-4

PROJECT: PANDURRA 405 DATE STARTED: 5/11/75 TYPE OF DRILL: MAYHEW 1000

AREA: CARNEWERLOO 6333 COORDINATES: HOLE SIZE:

LOCATION: Nine Mile Bank CONTRACTOR: W.L. SIDES

STARTED: 10am ELEVATION: DRILLER: K. TERRINGTON

COMPLETED: 5pm DEPTH: 69.0m LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
3.0	Minor orange sand & clay; pale grey silcrete gravels with dark-grey & black Fe-oxide or manganese oxide.	45970		20	90	30
6.0	Hard grey-green clay & purplish-red hematitic weathered shale.	45971		20	90	30
9.0	Hard grey-green clay & red hematitic shale & clay as above. Hammer from 6m.	45972		35	40	60
12.0	Soft green & yellow weathered shales	45973		15	70	160
15.0	Yellow, brown, minor green weathered shales	45974		30	60	85
18.0	Yellow, brown, minor grey-green weathered shales	45975		20	70	55
21.0	Yellow, brown, grey-green shales.	45976		20	60	150
24.0	Brown, yellow, grey-green shales.	45977		15	40	95
27.0	Brown, yellow, grey-green shales.	45978		20	70	800
30.0	Brown, yellow, grey-green shales.	45979		20	70	120

PACMINEX PTY. LTD.—FIELD DRILL LOG

0313

HOLE No. 6333Y-4

PAGE 2 OF 3

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: ..... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 60.0m ..... LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
33.0	Dark & light brown, minor yellow & grey-green shales	45980		20	60	180
36.0	Chocolate brown, light-brown, minor khaki-yellow shales.	45981		15	60	100
39.0	Chocolate brown, minor grey shales, green clay bands	45982		10	60	75
42.0	Chocolate brown, minor grey, khaki shales	45983		10	60	70
45.0	Chocolate brown, light brown, minor grey shales	45984		10	60	130
48.0	Choc. brown, minor grey & blue-green shales	45995		10	60	65
51.0	Choc. brown, minor grey shales.	45986		10	60	140
54.0	Choc. brown shale, grey-green micaceous siltstone	45987		10	80	95
57.0	Grey, grey-green, green micaceous siltstone, cr. v. fine py; lesser choc. brown shale.	45988		10	90	180
60.0	Blue-green, brown, grey siltstones.	45989		10	70	95

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0314

HOLE No. 63334-4

PAGE 3 OF 3

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: ..... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 69.0m LOGGED BY: A.h.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Green and brown micaceous siltstones, pyritic. Wet sample	45990		10	60	150
63.0						
	Green and chocolate brown siltstones ; v. fine pyrite.	45991		10	80	90
66.0						
	Green siltstone, choc. brown siltstone & shale, v. fine pyrite. Abundant white & yellow clay fallback	45992		10	90	70
69.0	Water flow ≈ 100-200 g/Lr.					
	END OF HOLE AT 69.0m					
				Cu PPb	Zn PPb	T.D.S. g/litre
	WATER SAMPLE	63337-4		<5	320	26.7

CSR/0035

HOLE No. 6333 Y-S

PACMINEX PTY. LTD.—FIELD DRILL LOG

0315

PROJECT: PANDURRA 405 | DATE STARTED: 5/11/75 | TYPE OF DRILL: MAYHEW 1000

AREA: CARLEWARLOO 6333 | COORDINATES: | HOLE SIZE:

LOCATION: Nine Mile Bank | CONTRACTOR: W.L. SIDES

STARTED: 5.30 pm | ELEVATION: | DRILLER: K. TERRINGTON

COMPLETED: 12.45 pm 6/11/75 | DEPTH: 69.0 m | LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
3.0	Red sandy clay, coarse gypsum. Hard grey-white silcrete at 3m.	45993		20	70	65
6.0	White silcrete Soft white & pale green clay, coarse fibrous white gypsum near 6m. 3½" Hammer.	45994		15	20	45
9.0	White clay ± scattered sand grains, fibrous gypsum	45995		5	40	30
12.0	Pale green stiff clay. 6–12 m Rotary.	45996		10	40	30
15.0	Pale green stiff clay; minor white friable clay Hamm from 12m.	45997		15	60	40
18.0	V. fine friable white to v. pale yellow clay & sand.	45998		10	30	75
21.0	Friable v. fine clay as above and stiff beige to v. pale yellow clay ± scattered sand grains.	45999		5	40	70
24.0	Beige and yellow clay ± abundant rounded clear qtz pebbles and sub-rounded orange porphyrite Bowler Range volcanic pebbles. Coarse fibrous gypsum probably fallback.	46000		10	60	35
27.0	Yellow & white sandy clay ± abundant orange & brown volcanic pebbles (sub-angular), well rounded clear & white qtz, black chert pebbles, minor reddish granite pebbles.	46001		10	60	55
30.0	Small rounded pebbles of volcanic & qtz as above in clay matrix. Dark grey clay and shale.	46002		160	80	90

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

HOLE No. 0316

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: ..... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 69.0 m LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
33.0	Dark grey clay - weathered shale.	46003		440	140	210
36.0	Dark grey laminated shale.	46004		20	60	55
39.0	Black and grey shale, laminated.	46005		60	120	220
42.0	Black & grey laminated shale	46006		70	90	140
45.0	Black & grey laminated shale, v. minor hard grey dolomite.	46007		55	120	140
48.0	Black shale, v. minor dolomite.	46008		45	100	100
51.0	Black shale, v. minor dolomite.	46009		50	120	140
54.0	Black shale, increased amount of dolomite.	46010		60	600	560
57.0	Black shale, abundant dolomite, tr. py.	46011		210	1200	100
60.0	Minor black shale, massive pyritic dolomite to ~ 59 m ; minor grey siltstone & abundant red vole? clips ; minor pisolitic? (hand in dolomite?) ; Brick red volcanic? - cryptocrystalline matrix, rare white micro-phenocrysts.	46012		1300	180	100

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0317

HOLE No. 6333Y-5

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: .... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 69.0 m LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Brick red volcanic as above ; creamy pink and dark brown mottled rhyolite? – cryptocrystalline					
	Damp purple clay ; apple-green and purplish-brown mottled volcanic? ± occasional	46013		30	80	70
63.0	white f'spathic ? microphenocrysts .					
	Apple-green and chocolate-brown mottled volcanic? as above – damp – abundant					
	clay content.	46014		20	80	85
66.0						
	Green and purplish-brown volc? as above. Some of green material has a					
	serpentine-like appearance; purple chy ± sericered remnant phenocrysts? of green mineral – fallback?	46015		25	100	130
69.0	Damp.					
	END OF HOLE AT 69.0 m.					

PACMINEX PTY. LTD.—FIELD DRILL LOG

HOLE No. 6333Y-6

PAGE 1 OF 3

0318

PROJECT: PANDURRA 405 DATE STARTED: 6/11/75 TYPE OF DRILL: MAYHEW 1000

AREA: CARNEGIE 6333 COORDINATES: HOLE SIZE:

LOCATION: Nine Mile Bank CONTRACTOR: W.A. SIDES

STARTED: 1:15 ELEVATION: DRILLER: K. TERRINGTON

COMPLETED: 10.30 pm 7/11/75 DEPTH: 76.0m LOGGED BY: A.L.E.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
	0-2 m - Red clay, sandy, orange gypsum. 2-3 m - White silcrete, minor yellow silcrete. Hammer from 2m.	46016		25	60	60			
3.0									
	White silcrete to ~ 5m; Unconsolidated white sands - well rounded but poorly sorted clear qtz grains, scattered reddish qtzite pebbles.	46017		10	20	15			
6.0									
	White & v pale yellow sands - v fine, scattered rounded qtz & chert pebbles. Rotary from 7.5 m.	46018		10	20	20			
9.0									
	Fine sands, qtz & chert pebbles, orange volcanic fragments, pink & grey sandy clays.	46019		25	40	30			
12.0									
	Pink & grey-green clay, fine sand, qtz, chert, volcanic pebbles. 1-2 cm.	46020		20	50	35			
15.0									
	Pale grey-green clay, less sand than above, scattered qtz pebbles 1-2 cm.	46021		30	90	30			
18.0									
	Pale grey-green clay.	46022		30	80	35			
21.0									
	Grey-green clay, minor yellow-orange clay & v. fine friable clay.	46023		75	80	30			
24.0									
	Yellow-orange, mauve weathered shales. Khaki-grey weathered shales. Hammer from 26m.	46024		300	100	150			
27.0									
	Black shale, minor interbedded dolomite.	46025		50	100	130			
30.0									

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

HOLE No. 6333Y-6

PROJECT: ..... DATE STARTED: 0319 TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: ..... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 76.0m LOGGED BY: A.C.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
33.0	Black shale, minor interbedded dolomite.	46026		40	90	140
36.0	Black shale, interbedded dolomite & tr. py.	46027		75	140	70
37.0	Black shale, abundant pyritic dolomite.	46028		1500	150	120
42.0	Minor black shale, abundant pyritic dolomite, minor brown siltstone, red pyritic volcanic? breccia? of blue-grey claystone and brown powder volcanics? - fragments of latter coated with blue-grey film; some breccia chips have carbonate fracture filling.	46029		1100	200	310
45.0	Purple & green mottled claystone? - chips vary in hardness; purple phase often with "phenocrysts" of the green phase. V. fine grained; V. similar to formation under black shale in 6333Y-5	46030		55	60	85
48.0	Purple siltstone mottled with green claystone?	46031		10	40	40
51.0	Purple & green siltstone - claystone? as above.	46032		10	40	50
54.0	Purple & green mottled siltstone?	46033		5	40	35
57.0	Purple & green mottled siltstone - claystone. Purple phase silty - green phase v. fine grained.	46034		10	60	55
60.0	Purple siltstone, green claystone.	46035		10	60	40

PACMINEX PTY. LTD.—FIELD DRILL LOG

0320

HOLE No. 6333Y-6

PAGE 3 OF 3

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: ..... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 76.0m ..... LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
	Purple & green silts./c claystone	46036		20	60	70			
63.0	Hole made water overnight - wet								
	Purple & green silts/c claystone	46037		10	40	300			
66.0									
	Purple weathered volcanic? and abundant soft green mineral intermixed	46038		10	60	400			
69.0									
	Purple & green weathered volcanic? as above; Orange-brown rhyolite (?) ± abundant qtz as fine veinlets, cavity fillings (agate); also ± abundant soft green mineral as above - blebs & fracture or vein fillings. Water flow ~ 500 g/hr.	46039		10	40	90			
72.0									
	Brown & orange rhyolite ± abundant qtz ± chalcedony; green mineral still abundant; pyrite coating some volcanic fragments.	46040		10	60	55			
75.0									
76.0	Brown rhyolite as above - abundant chlorite?. Considerable fallback in sample. One highly fractured zone. V. hard drilling.	46041	1.0	10	40	55			
	END OF HOLE AT 76.0m								
76.0									
				Cu ppb.	Zn ppb.	T.D.S g/litre			
	WATER SAMPLE	6333Y-6		<5	400	32.9			

CSR/0035

HOLE No. 6333T-1

PACMINEX PTY. LTD.—FIELD DRILL LOG

0321

PAGE 1 OF 2

PROJECT: PANDURRA 405 DATE STARTED: 7/11/75 TYPE OF DRILL: MAYHEW 1000

AREA: CARNEGIE 6333 COORDINATES: HOLE SIZE:

LOCATION: North of Jacky Dam CONTRACTOR: W.L. SIDES

STARTED: 11:15 ELEVATION: DRILLER: K TERRINGTON

COMPLETED: 4:15 DEPTH: 34.5 m LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Dune sand + clay, calcrete.	46042		15	40	60
3.0	Sand					
	Hard at 5.5 m - gravel band - Hammer 5.5 m	46043		15	50	75
	Red sandy clay.					
6.0	Red sandy clay + dune sand.	46044		10	40	60
9.0	Red qtzite and yellow silic ss gravel at 9.0m					
	Red qtzite, clear, fowler volcanic pebbles. Khaki-green sandy clay. + red sand, orange clay.	46045		20	40	35
12.0	Hammer from 9m.					
	Red qtzite + Red volcanic pebbles, sand, orange + grey sandy clay.	46046		5	40	45
15.0						
	Grey sandy clay, orange sand, coarse clear qtz grains, well rounded up to 2mm, abundant red-brown volc. pebbles	46047		10	80	30
18.0	Rotary from 16.5					
	Semi-consolidated red, yellow, grey, grey-brown sandy clay + high proportion of sand grains.	46048		10	40	40
21.0						
	Semi-consolidated grey clayey sandstone - siltstone.	46049		10	40	30
24.0	Hammer from 23.5					
	White and yellow silcrete, pink fine grained silicified ss clasts; extremely hard.	46050		<2	40	380
27.0						
	Pinkish-brown f'spathic qtzite.	46051		5	30	20
30.0						

CSR/0035

HOLE No. 6333T-1

PACMINEX PTY. LTD.—FIELD DRILL LOG

0322

PAGE 2 OF 2

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: .... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 34.5m LOGGED BY: A.L.G

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Pinkish-brown f'spathic qtzite.	46052		10	40	50
33.0						
	Purple f'spathic qtzite.	46053	1.5	5	40	180
34.5	END OF HOLE AT 34.5m.					

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0323

HOLE No. 6333T-2

PAGE 1 OF 2

PROJECT: PANDURRA 405 | DATE STARTED: 7/11/75 | TYPE OF DRILL: MAYHEW 1000

AREA: CRIEWERLOO 6333 | COORDINATES: | HOLE SIZE:

LOCATION: | | CONTRACTOR: W.L. SIDES

STARTED: 5pm | ELEVATION: | DRILLER: K. TERRINGTON

COMPLETED: 10.15 am 8/11/75 | DEPTH: 49.5m | LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No:	Assay Length	ASSAYS Cu	Pb	Zn
3.0	Orange sand & sandy clay, calcrete, gravel.	46054		20	70	65
6.0	Orange sand & clay - coarse gritty qtz, coarse gravels at 6m. - abundant qtz, orange volc's; some large rounded qtz pebbles 0-6m Rotary Casing	46055		10	50	40
9.0	Gravel; Orange sand, grey-green & sandy clay. 6-9m Hammer.	46056		20	60	40
12.0	Grey-green & red mottled sandy clay - high sand percentage - gritty. 9-21m Rotary	46057		10	40	20
15.0	Grey-green & red mottled sandy clay - gritty sand.	46058		15	40	30
18.0	Grey-green, minor red sandy clay.	46059		10	60	20
21.0	Soft grey-green sandy clay predominantly. Hard red & grey mottled sandy clay, minor chips yellow silcrete, red qtzite, orange volc's, Hard grey clay.	46060		10	60	20
24.0	Yellow & white silcrete, rounded qtz pebbles, mina red qtzite; Hard grey clay Hammer from 21m.	46061		20	100	55
27.0	Hard and soft grey clay	46062		25	1800	45
30.0	Grey and grey-green clay.	46063		30	1600	50

CSR/0035

HOLE No. 6333T-2

PACMINEX PTY. LTD.—FIELD DRILL LOG

0324

PAGE 2 OF 2

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: ..... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 49.5 m LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Grey-green & fawn clays.	46064		40	500	75
33.0						
	Grey-green, yellow, grey clays.	46065		160	140	440
36.0						
	Khaki weathered shale, minor grey shale at 39m.	46066		100	220	1100
39.0						
	Black shale & minor interbedded dolomite dark grey clay.	46067		50	620	1800
42.0						
	Black shale, dump grey clay ; dolomite near 45m.	46068		120	2800	3600
45.0						
	Massive dolomite @ top of sample, ± v. minor fine black laminae, pyritic. Dark grey, pyritic grnite - coarse chips vapour silicified ; gradually becoming pink Minor soft dark-grey siltstone possibly from beneath dolomite.	46069		650	400	420
48.0						
	Massive pink grnite, ± disseminated? pyrite. V. hard - sample finely pulverised.	46070	1.5	180	120	140
49.5	DRY HOLE					
	END OF HOLE AT 49.5 m.					

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0325

HOLE No. 6333T-3

PAGE 1 OF 3

PROJECT: PANDURRA 405 | DATE STARTED: 5/11/75 | TYPE OF DRILL: MAYHEW 1000

AREA: CARLEWILLOO 6333 | COORDINATES: | HOLE SIZE:

LOCATION: | | CONTRACTOR: W.L. SIDES

STARTED: 11.45 am | ELEVATION: | DRILLER: K. TERRINGTON

COMPLETED: 11 am 9/11/75 | DEPTH: 69.0m | LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Dune sand, red sandy clay, calcrete.					
		46071		30	60	50
3.0						
	Orange sand & clay ; qtzite gravel.					
		46072		10	40	30
6.0						
	Orange sand, minor clay, gravel.					
		46073		20	40	45
9.0						
	Sand, red sandy clay, v. coarse gravel.					
		46074		10	30	40
12.0						
	Red and grey mottled sandy clay, gravel bands.					
		46075		20	40	40
15.0						
	Red & grey sandy clay ; friable orange sand.					
		46076		10	30	25
18.0						
	Red & grey sandy clay & clay gravel; Stiff grey sandy clay.					
		46077		20	40	85
21.0						
	Hard red & grey sandy clay – clay sand – semi-consolidated					
		46078		10	40	30
	Ilmenite from 23m					
24.0						
	Red & grey clay - sand as above.					
		46079		15	40	45
27.0						
	Red & grey clay - sand as above					
	Friable yellow clay sand, – unconsolidated.					
		46080		20	40	45
30.0						

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0326 HOLE No. 6333T-3

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: .... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 69.0m. LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
33.0	Friable white & yellow clayey sand; & coarse grzite pebbles.	46081		5	20	40
36.0	Yellow friable clay sand; & abundant irregular qtz grains, yellow & white sikrete, pink volcanic grains.	46082		10	20	60
39.0	Damp fawn sandy clay.	46083		20	340	220
42.0	Damp fawn, yellow, grey clay	46084		20	860	150
45.0	Grey clay - very sticky - using water injection - wet sample - highly contaminated with fawn clay & sand.	46085		30	430	280
48.0	Grey clay and weathered black laminated shale - contaminated sample.	46086		120	320	740
51.0	Black laminated shale - highly contaminated.	46087		45	400	150
54.0	Black laminated shale, minor interbedded dolomite.	46088		70 60	400 400	270 280
57.0	Black shale and dolomite, tr. py.	46089		50	460	480
60.0	Black shale and pyritic dolomite.	46090		60	820	870

HOLE No. 6333T-3

RACMINEX PTY. LTD.—FIELD DRILL LOG

0327 PAGE 3 OF 3

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: .... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 69.0m LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
	Dolomite & py. + galena, minor shale; Dark grey sandstone – siltstone, color lightening down the sample – minor interbedded black shale.	46091		190	780	1400			
63.0									
	Light grey fine grained ss – siltstone & minor black shale	46092		270	260	310			
66.0	Gritty pink qtzite chips @ 66m. Pink f'spathic qtzite – fine pyrite. Much black shale & clay contam'n.	46093		120	300	680			
	Water flow ~ 50-100 g/hr.								
69.0	END OF HOLE AT 69.0m								
				Cu ppb	Zn ppb	T.D.S. g/litre			
	WATER SAMPLE	6333T3		<5	360	16.5			

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0328

HOLE No. 6333 T4

PROJECT: PANDORRA 405 DATE STARTED: 9/11/75 TYPE OF DRILL: MAYHEW 1000

AREA: CARTEWER-GO 6333 COORDINATES: HOLE SIZE:

LOCATION: CONTRACTOR: W.C. SIDES

STARTED: 11.45 am ELEVATION: DRILLER: KTERRINGTON

COMPLETED: 4.30 pm DEPTH: 45.0m LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Orange sand & clay, calcrete	46094		30	<20	30
3.0						
	Orange clay, gritty sand & large gravel pebbles up to 2cm - mostly red grzite, orange volcanics	46095		5	40	30
6.0	0-6m Rotary.					
	Gravels, orange & khaki sandy clay	46096		10	30	30
9.0	6-7.5 Hammer.					
	Orange & khaki clay sands, scattered grzite gravel.	46097		5	<20	20
12.0						
	Orange & khaki clay sands, coarse gritty sands, large grzite & conglomerate gravel pebbles.	46098		10	30	170
15.0	7.5-13.5 Rotary					
	Grey-green sandy clay, orange sand, grzite and volcanic gravels.	46099		<2	<20	60
16.0						
	Orange coarse qtz sand, rounded white qtz grains & pebbles, red & yellow silcrete fragments, reddish-brown, yellow & pink grzite gravel pebbles (angular).	46100		5	<20	30
21.0						
	Grey sandy clay; abundant coarse qtz grains & pink volcanics; yellow & red brittle clay	46101		5	<20	20
24.0						
	Grey mixed orange sandy clay; stiff red/yellow sandy clay;	46102		15	<20	20
27.0						
	Unconsolidated yellow clayey gritty sand - clear & white qtz grains, minor orange coated qtz grains. Damp.	46103		<2	<20	30
30.0						
	Rotary 27-33m/41.6m					

RACMINEX PTY. LTD.—FIELD DRILL LOG

0329

HOLE No. 6333T-4

PAGE 2 OF 2

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: ..... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 45.0m ..... LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Unconsolidated orange clayey sand as above. Damp.	46104		20	40	40
33.0						
	Unconsolidated khaki clayey gritty sand. Damp.	46105		20	<20	20
36.0						
	Unconsolidated khaki clayey gritty sand. Damp.	46106		10	30	30
39.0						
	Unconsolidated olive-green clayey gritty sand. Damp.	46107		10	40	80
42.0	Hammer from 41.6m					
	Gritty sand as above to 42.5. Dark feldspathic arzite - fractured at top, massive lower down. Dry; no apparent mineralisation.	46108		10	60	150
45.0						
	END OF HOLE AT 45.0m.					

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0330 HOLE No. 6333T-5

PAGE 1 OF 2

PROJECT: PANDURRA 405 DATE STARTED: 10/8/75 TYPE OF DRILL: MAYHEW 1000

AREA: CARBINEELOO 6333 COORDINATES: HOLE SIZE:

LOCATION: North of Jacky Dam CONTRACTOR: W.L. SIDES

STARTED: 6.30 am ELEVATION: DRILLER: K. TERRINGTON

COMPLETED: 12:15pm DEPTH: 49.5m LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
3.0	Orange dune sand, red qtzite gravel, angular orange volcanic fragments, coarse angular to sub-rounded clear qtz grains & pebbles	46109		10	30	30
6.0	Sand, red sandy clay, abundant qtz and reddy orange volcanics as above. 6in Casing.	46110		20	20	20
9.0	Red sandy clay, red dune sand, qtz & volcanics, finer grained than above.	46111		<2	40	50
12.0	Red & grey sandy clay, orange sand, qtz, orange, pink & red volcanics, minor maroon red qtzite chips. Hammer from 9m	46112		<2	20	40
15.0	Grey, minor red sandy clay, abundant qtz sand grains - orange, red & yellow Fe-oxide coating.	46113		<2	<20	100
18.0	Minor grey sandy clay, abundant gritty clear & white qtz grains — many vc sub-rounded white qtzite fragments ; abundant fine orange sand. Minor brown qtzite fragments.	46114		<2	<20	30
21.0	Grey sandy clay and abundant fine clear, white & orange qtz sand ; minor red qtzite fragments.	46115		10	<20	20
24.0	Grey sandy clay ; abundant coarse gritty clear qtz grains - many pink, pinkish from weathering of red qtzite ; minor fine rounded pink volc. grains. Sandy clay has minor orange mottling.	46116		10	<20	60
27.0	Hard grey sandy clay ; lesser red & yellow sandy clay.	46117		10	20	80
30.0	Grey clay sand & bright yellow limonitic clay sand — gritty — yellow, clear & pink qtz grains. Small % clay.	46118		10	<20	20

CSR/0035

RACMINEX PTY. LTD.—FIELD DRILL LOG

0331

HOLE No. 6333T-5

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: .... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 49.5m LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
33.0	Yellow limonite coated gritty qtz — poorly sorted & rounded	46119		15	30	60			
36.0	Grey clayey semi-consolidated sand — sand grains are poorly sorted, sub-rounded pink stained qtz, probably derived from weathering of pink qtzite. Minor yellow qtz sands.	46120		15	20	30			
34.0	Dirty yellow gritty qtz sands & pink qtz grains. Yellow, orange-brown, & v.dark chocolate brown fine grained silcrete.	46121		5 5	<20 <20	640 600			
42.0	Yellow-orange & dark brown silcrete; v dark brown-black, & reddish fine grained ss - hard - weathered qtzite surface? Abundant yellow gritty qtz grains - probably contam.ᵉ	46122		10	50	150			
45.0	V dark brown fine grained ss - qtzite? & v fine white pulverised qtz grains. Struck water ~1000 g/hr. Contaminated sample.	46123		10	40	340			
48.0	Fine-grained pink massive qtzite? - abundant fine qtz grains, slightly pink stained. Much contamination	46124		<2	30	180			
49.5	Fine-grained pink massive qtzite? as above. Hole ᵒ/ₒ fallbacks - hole caving — Abandoned.	46125	1.5	10	30	40			
	END OF HOLE AT 49.5m								
				Cu ppb	Zn ppb	T.D.S. g/litre			
	WATER SAMPLE	6333T5		12	100	14.4			

CSR/0035

RACMINEX PTY. LTD.—FIELD DRILL LOG

0332

HOLE No. 6333 X-1

PAGE 1 OF 3

PROJECT: PANDURRA LEASE | DATE STARTED: 10/11/75 | TYPE OF DRILL: MAYHEW 1000

AREA: CARLEWEE 6333 | COORDINATES: | HOLE SIZE:

LOCATION: Myall Creek, Boundary Fence | CONTRACTOR: W.L. SIDES

STARTED: 2.15 p.m. | ELEVATION: | DRILLER: K. TERRINGTON

COMPLETED: 3 p.m. 10/11/75 | DEPTH: 90.0m | LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Au	Pb	Zn
	Minor red sandy clay, ironstone pebbles, qtz pebbles, yellow volcanic pebbles (all surface zone). Gypsum. White, minor yellow & brown weathered shale.	46126		20	<20	30
3.0	3 – Casing.					
	Yellow & white weathered shale.	46127		60	<20	30
6.0	0-6 Rotary.					
	Yellow & pale green weathered shale.	46128		300	30	90
9.0	6-9m Hammer					
	Yellow weathered shale	46129		100	40	100
12.0	9-12 Rotary.					
	Yellow weathered shale.	46130		100	40	190
15.0	12 – Hammer.					
	Yellow & red weathered shales.	46131		60	<20	150
18.0						
	Red, brown & grey shale – silty and micaceous.	46132		50	60	100
21.0						
	Interbedded black shale & grey silty micaceous shale. Stratiform pyrite band in black shale, 1mm thick.	46133		60	60	90
24.0						
	Laminated pink & dark grey shales interbedded with grey silty shales. Pink bands very calcareous, light grey shale bands also calcareous.	46134		30	30	90
27.0						
	Interbedded grey shale, silty shale, micaceous siltstone.	46135		20	50	50
30.0						

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0333

HOLE No. 6333X-1

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: ..... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 90.0 m LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
	Light grey laminated shales ± v. fine black intercalations.	46136		30	60	200			
33.0									
	Laminated light grey & v. fine black shales.	46137		40	<20	60			
36.0									
	Laminated light grey and abundant black micaceous shales.	46138		100	170	90			
39.0									
	Very hard black shale and very hard crystalline brown pyritic silicified? shale. Neither calcareous. Wet sample.	46139		220	50	40			
42.0									
	Hard brown pyritic silicified? shale as above, ~~soft grey silty shale~~.	46140		120	<20	60			
	Flow ~ 200 g/hr.			120	<20	70			
45.0									
	Brown pyritic silic. shale and soft light grey silty shale.	46141		100	<20	80			
48.0									
	M.por brown silicified shale; Soft grey micaceous shale, silty, & minor grey siltstone.	46142		60	80	70			
51.0									
	Grey shale, silty shale, v. light grey siltstone or fine grained ss, minor brown silic. shale.	46143		50	20	70			
54.0									
	Grey shale, silty shale, brown silic. shale, siltstone. Pyritic.	46144		50	20	150			
57.0									
	Grey silty shale; v. hard grey fine grained ss. or siltstone, ± pink Fe-stained qtz grains, calcareous. Abundant contam's due to high water flow.	46145		80	40	80			
60.0	Sudden increase in water flow to ~ 1500 g/hr.			Cu	Zn	TDS.			

PACMINEX PTY. LTD.—FIELD DRILL LOG

0334

HOLE No. 6333X-1

PAGE 3 OF 3

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: .... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 90.0m LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn			
	Grey shale, minor grey siltstone; Gravel layer? of red & orange fine-medium volcanics. Abundant yellow shale & white clay fallback.	46146		200	<20	60			
63.0									
	Minor grey shale, possibly fallback. Red sandstone band at 64.5. Abundant red volcanic fragments (fallback?). Predominantly a green lithic-rich ss & volcanic grains, clear sub-rounded qtz grains, soft green weathered f'spar?; over clay & yellow shale at base.	46147		70	<20	40			
66.0									
	Green sandstone as above, becoming v. fine grained; Purplish-brown v. fine grained ss or siltstone & minor green blebs - probably interbedded with green ss.	46148		60	<20	70			
69.0									
	Purplish-red hematitic ss & minor green ss - both types have same lithology - clear qtz, orange volcanic grains, white f'spar, minor black h.m.	46149		70	<20	30			
72.0									
	Reddish-purple & green mottled sandstone as above.	46150		110	<20	40			
75.0									
	Reddish-purple & green sandstones.	46151		70	<20	30			
78.0									
	Reddish-purple & green sandstones	46152		80	<20	40			
81.0									
	Green and reddish sandstones - reddish phase has appearance of unsilicified Pandurra Quartzite.	46153		90	<20	20			
84.0									
	Red and green sandstone; lg. fractured? pebble coated with pyrite - fallback?	46154		60	30	50			
87.0									
	Red fine grained sandstone; abundant yellow & white weathered shale/clay fallback, as in all the above wet samples.	46155		30	<20	30			
90.0									
	END OF HOLE AT 90.0m			Cu	Zn	T.D.S.			

CSR/2035

PACMINEX PTY. LTD.—FIELD DRILL LOG

HOLE No. 6333X-2

0335 PAGE 1 OF 2

PROJECT: PANDURRA 405 DATE STARTED: 11/11/75 TYPE OF DRILL: MAYHEW 1000

AREA: CADEWARROO 6333 COORDINATES: HOLE SIZE:

LOCATION: "MYALL CREEK", Waterhole Dam CONTRACTOR: W.L. SIDES

STARTED: 3.45 pm ELEVATION: DRILLER: K TERRINGTON

COMPLETED: 11.45 am 12/11/75 DEPTH: 54.0 m LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Surface scree of round white qtz pebbles, red gyrite, jasper.					
	White, yellow-brown, red weathered shales	46156		110	<20	20
3.0						
	White, yellow-brown, mauve-pink weathered shales	46157		150	40	30
6.0	Rotary 0-7.5m ; 6.0m Casing.					
	Red, brown, yellows weathered sandy shales	46158		360	50	110
9.0	Hammer from 7.5m					
	Khaki weathered shale.	46159		70	<20	130
12.0						
	Khaki weathered shale ; laminated white + light grey shale & interbedded pink dolomitic bands.	46160		80	40	90
15.0						
	Khaki, yellow, pink-red, light grey shales & siltstone.	46161		20	<20	70
18.0						
	Major khaki pink silty shales ; light grey silty micaceous shale	46162		10	<20	60
21.0						
	Light grey micaceous shale, pyritic.	46163		10	40	80
24.0						
	Light grey shale, grey calcareous siltstone bands.	46164		50	<20	70
27.0						
	Light grey laminated shale & fine black shale laminae ; Black micaceous laminated shale ; pyritic.	46165		90	100	90
30.0						

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

HOLE No. 6333 X-2

0336 PAGE 2 OF 2

PROJECT: ..... DATE STARTED: ..... TYPE OF DRILL: .....

AREA: ..... COORDINATES: ..... HOLE SIZE: .....

LOCATION: .... CONTRACTOR: .....

STARTED: ..... ELEVATION: ..... DRILLER: .....

COMPLETED: ..... DEPTH: 54.0 m. LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Black shale & brown pyritic silicified shale. Damp at 33.0m.	46166		120	70	110
33.0				130	80	110
	Brown & black silicified shale & disseminated and apparently stratiform bands of pyrite. Wet at 35.0m - flow ≈ 200 g/hr.	46167		170	<20	110
36.0						
	Minor brown pyritic silicified shale. Light grey shale and abundant light grey siltstone.	46168		110	<20	150
39.0						
	Minor grey shale, predominantly light grey siltstone - fine grained ss.	46169		50	40	80
42.0						
	Grey shaly shale.	46170		50	<20	90
45.0						
	Grey shale and siltstone	46171		140	<20	90
48.0						
	Black and grey shale; Green lithic ss & abundant orange volc. grains (to 3mm), clear qtz. Fragments of angular red granite - possibly gravel on ss surface or pebbles in green ss matrix.	46172		380	120	120
51.0	Pyritic. Yellow weathered shale fallback.					
	Green and reddish ss & abundant fine orange volc lithic grains, fine disseminated? pyrite.	46173		190	30	20
54.0	Water flow ≈ 500 — 1000 g/hr.					
	END OF HOLE AT 54.0m					
				Cu ppb	Zn ppm.	TDS g/litre
	WATER SAMPLE	6333X2		6	1.6 ppm.	42.5

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

HOLE No. 6333X-3

0337 PAGE 1 OF 2

PROJECT: PANDURRA 405 DATE STARTED: 12/11/75 TYPE OF DRILL: MAYHEW 1000

AREA: CARLEWIRELOO 6333 HOLE SIZE:

LOCATION: "IDYALL CREEK" COORDINATES: CONTRACTOR: W.L. SIDES

STARTED: 1pm ELEVATION: DRILLER: K.TERRINGTON

COMPLETED: 5.45pm DEPTH: 46.0m LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
3.0	Red grzite, white qtz, client gravels, orange sand & clay, gypsum, calcareous red sandy clay.	46174		40	50	50
6.0	Gravels as above, red sandy clay, hard white clay. 4m Casing; Hammer from 4m.	46175		20	40	40
9.0	White, yellow & minor pink weathered shale	46176		40	40	70
				40	40	70
12.0	Yellow, white brown weathered shale.	46177		90	20	150
15.0	Yellow weathered shale, minor brown siltstone.	46178		50	<20	80
18.0	Yellow & white weathered shale, brown siltstone.	46179		80	<20	80
21.0	Yellow, white, minor mauve-pink weathered shale, brown siltstone.	46180		150	60	150
24.0	Yellow, white, mauve, dark grey weathered shales.	46181		150	110	70
27.0	Hard black silicified? shale - band c abundant fine grained disseminated pyrite.	46182		80	80	90
30.0	Black and pyritic brown silicified shales.	46183		140	30	40

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

HOLE No. 6333 X-3

0338 PAGE 2 OF 2

PROJECT: DATE STARTED: TYPE OF DRILL:

AREA: COORDINATES: HOLE SIZE:

LOCATION: CONTRACTOR:

STARTED: ELEVATION: DRILLER:

COMPLETED: DEPTH: 48.0m LOGGED BY: A.L.G.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Light grey soft shale and siltstone.	46184		130	60	130
33.0						
	Grey siltstone, lesser grey shale.	46185		20	<20	80
36.0						
	Grey shale, lesser grey siltstone.	46186		40	60	160
39.0						
	Grey + black laminated shale, minor siltstone to ~41m. Chips pyritic red qtzite + red pyritic volcanics, abundant qtz grains — ss?	46187		370	110	120
42.0						
	Abundant red pyritic volcanic - many waterworn pebbles, minor red pyritic qtzite, clear + white qtz grains. Grey siltstone band. Fine grained red ferruginous ss at 45m.	46188		150	<20	60
45.0				140	<20	60
	Alternating red fine grained ss + coarse white ss. — lithic, ± many fine orange volcanic grains.	46189		10	<20	40
48.0						
	END OF HOLE AT 48.0m					

CSR/0035

3

0339

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6 MAY 1976
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SECURITY
2564-III

FOURTH QUARTERLY REPORT ON EXPLORATION LICENCE 186, PANDURRA AREA, FOR THE PERIOD ENDED 7TH APRIL, 1976

1. 33% RELINQUISHMENT

Approval was granted by the Minister to an application made in October, 1975 to surrender about 738 square kilometres of Exploration Licence 186. The area of the licence was reduced from 2,215 square kilometres to 1,477 square kilometres. The new boundaries of the licence are shown on Figure 1. A relinquishment report (PMR 73/76) describing exploration work done in the surrendered area, has been submitted to the Department of Mines.

Not yet rcd. 6/5

2. EXPLORATION ACTIVITIES SUMMARY

Work during the quarterly period consisted of:

2.1 Airborne INPUT orientation survey flying over areas near "Cariewerloo" and "Pandurra" homesteads (Figure 2)

2.2 Siting of 14 drill holes to test the Yudnapinna INPUT interpretation (Figure 3).

2.3 Reinterpretation of sandy sediments near "Yudnapinna" homestead as Tertiary and Quaternary alluvia.

3. INPUT ORIENTATION LINES

Six test lines were flown by Geoterrex in February, 1976. Four lines near "Cariewerloo" homestead were flown on a grid pattern, over an outlier of Woocalla Dolomite black shales. Two profile lines were flown across the area just south of "Pandurra" homestead (see Figure 2).

The object was to test the capacity of the INPUT system to differentiate between the conductive Woocalla Dolomite black shales which are known to be present in both areas and less conductive "basement" rocks.

The results were received at the end of the quarterly report period and await evaluation. A preliminary impression is that the system worked well over the "Cariewerloo" target, but was less successful over the "Pandurra" target.

4. PROPOSED YUDNAPINNA DRILLING

Fourteen drilling sites were chosen to test the Yudnapinna INPUT survey results. The sites are shown on Figure 3.

/....

Drilling began on 8th April, 1975. A Mayhew 1000 rotary/percussion rig is being used.

5. STRATIGRAPHY

Sandy sediments intersected in drill holes near "Yudnapinna" homestead and previously indentified as Whyalla Sandstone are now re-interpreted as Quaternary and/or Tertiary alluvia. The sediments involved are immature, poorly consolidated and difficult to drill. They form an aquifer in many places and an area of potable underground water reported previously (PMR 160/74, submitted January 1975) lies within them.

6. IGNEOUS PETROLOGY

A comparative petrographic study of drill cuttings identified as Gawler Range Volcanics, Roopena Volcanics or mafic dyke rocks is still in progress. Macroscopic differentiation between these three rock types proved difficult. Microscopic study has been undertaken to ensure correct diagnosis. It is believed possible that the extent of sub-outcropping Roopena Volcanics may be greater than has been indicated by current mapping.

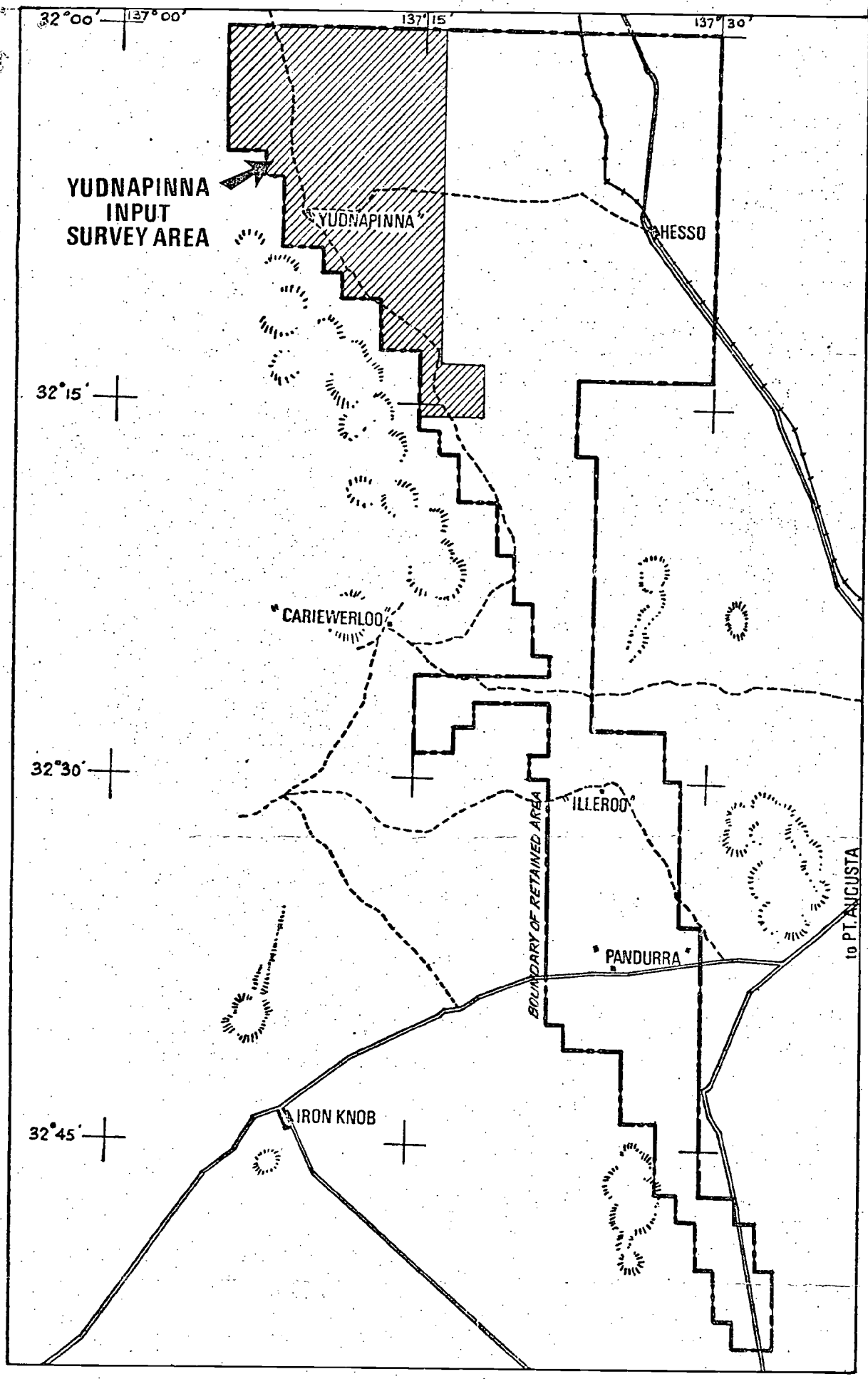


FIGURE 1 : LOCALITY PLAN E.L. 186 PANDURRA AREA, S.A.

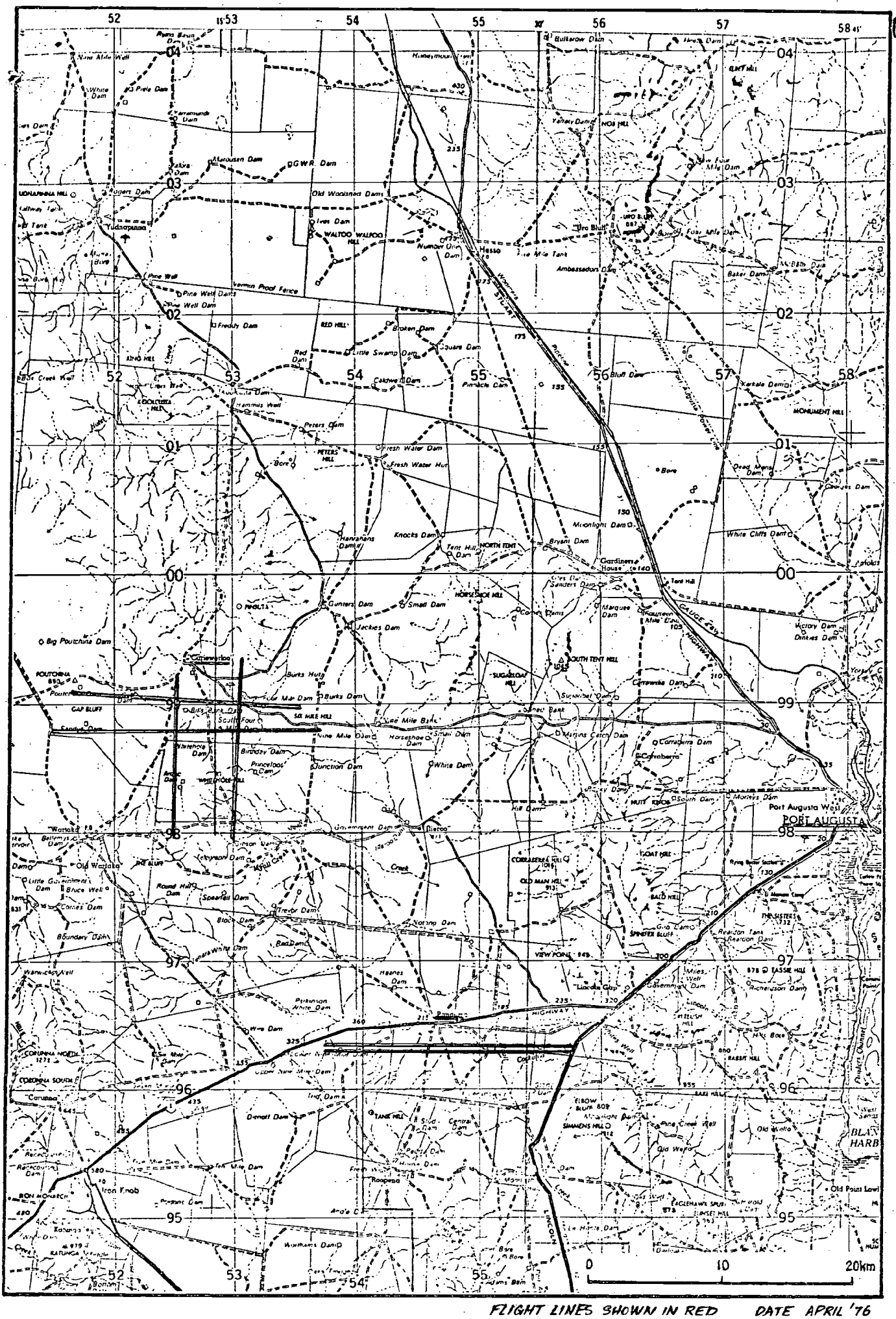


FIGURE 2 : AIRBORNE INPUT ORIENTATION SURVEY FLIGHT LINES, CARIEWERLOO AND PANDURRA AREAS

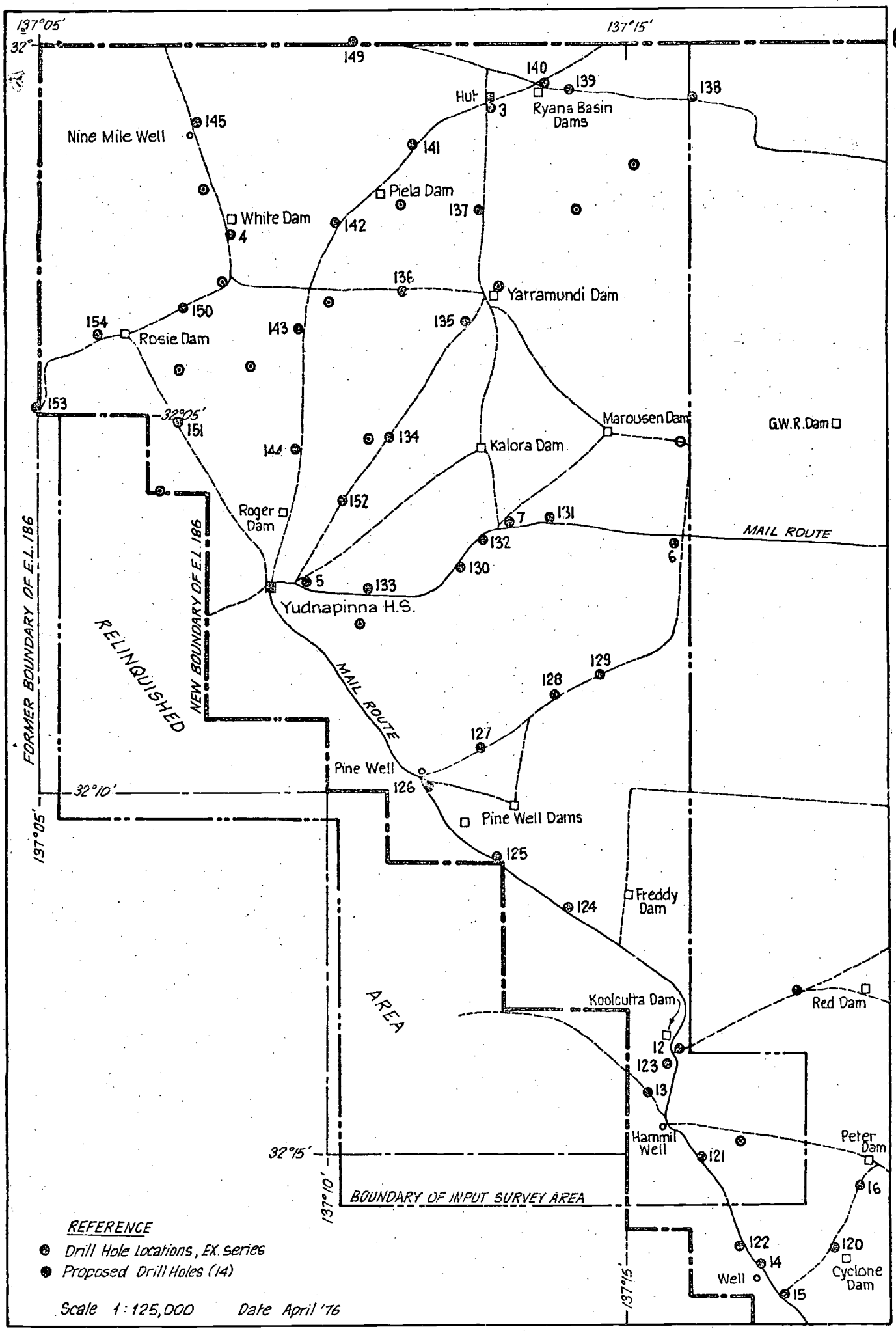


FIGURE 3 : PROPOSED DRILL SITES, YUDNAPINNA INPUT SURVEY AREA

EXPLORATION LICENCE 186 (PANDURRA)
SUMMARY OF EXPENDITURE
FOR THE THREE MONTH PERIOD ENDING 31ST MARCH, 1976

Actual expenditure for the 4th Quarterly period was $23,425. An overall total of $123,844 was spent since the E.L. was granted.

The quarterly expenditure was incurred as follows:

Geological and Geophysical	$1,215
Drilling Costs	$1,465
Logistics (including salaries and wages)	$20,495
Depreciation	nil
Administration	250
Other Costs	nil
Total	$23,425

0345

Pacminex Pty Ltd

A CSR COMPANY
15 BENT STREET
SYDNEY AUSTRALIA
BOX R221 ROYAL EXCHANGE PO
SYDNEY AUSTRALIA 2000
TELEPHONE (02) 2 0515
TELEX AA26175
CABLE 'PACMINEX' SYDNEY

Ref: WAH/SS:401/405/411

13th July, 1976.

The Director of Mines,
P.O. Box 151,
EASTWOOD, S.A. 5063.

Dear Sir,

EXPENDITURE ON EXPLORATION TO JUNE 30TH, 1976

In reply to your letter of June 29th, we wish to advise that our estimate of expenditure on our tenements in South Australia for the 3 months ended June 30th, 1976, is as follows :-

E.L. 199	Gunson	$ 69,000
E.L. 186	Pandurra	$ 31,000
E.L. 158	Terowie	$ 10,500
E.L. 227	Crockers Well	figures to be supplied by Minad/Teton.

Yours faithfully,

pro P.C. THOMAS,
Manager.

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26 JUL 1976
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DEPARTMENT OF MINES-SOUTH AUSTRALIA

0346

WATER SAMPLE ANALYSIS ADVICE

Bore Reference. . PUB 18. . . . Analysis No W2832/76

Hundred . . . . . — Section . . —

Sample collected by . M.G. MASON. Date . 25. 5. 76. .

Depth sample taken 62.00 Name AUST. SELECTION PTY. LTD.

Dept. Mines Results Address 32. MAIN ST. . .

Conductivity 64100.0 µS at 25°C . . PT. AUGUSTA.

Salinity. 38700 APPROX mg/l To AMDEL for analysis

pH . . . 7.0. . . AMDEL No. .

Remarks .SEE REPORT EL 186. . .

. 16-6-76

. . . . . .

Unit No. . . . . . Bore Folder No. . .

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SECURITY
2564

BORE DATA SHEET – WATER

0347 Reference No W2832/76

Owner / Occupier Name AUSTRALIAN SELECTION PTY LTD Address 32 MAIN ST PORT AUGUSTA

01 UNIT NO. (1 2) (3–16) Hundred OUT OF Hund. No. (17 19) Section (20 23) Bore (24 25) Bore Name PUB 18 (26–37)

Latitude or East (40–46) Longitude or North (47–54) Card Type (55) Zone (56 57) Accur. (58) Elevation (59–65) To (66) Datum (67) Accur. (68) Unit (69)

Basin (70) 1 (71) Situation of Bore

QUALITY OF WATER

Owner advised of analysis result 16-6-76

Water is required for

Water has been used for: sheep horses cattle poultry others (specify)

washing drinking domestic hot water service boilers others (specify)

Water has been used on: lucerne pastures vegetables fruit trees others (specify)

REFERENCES

02 UNIT NO. (1 2) Bore Folder No. (18–23) Common Property No. (24–33) Security Rating (35)

Departmental References (37–66)

Aerial Photograph No. (67 71 74) Reference No. (75–80) Driller's Name R. CRAWFORD

BORE DETAILS

03 UNIT NO. (1 2) Date Drilling Completed (21–28) Core Lab. No. (30–35) Logged (37) Status (39 40) Purpose (42 43) Rig Oper. by (45 46) Method Drilled (48–51) Total Depth (52–57) Unit (58)

Angle (59) Overall Casing: From (60–65) To (66–71) Unit (72) Smallest Diameter (73–76) Unit (77) Screen / Slotted Casing (78)

MOST RECENT DATA

07 UNIT NO. (1 2) Total Depth (17–21) Unit (22) Date (23–30) S.W.L. (31–35) Unit (36) Date (37–44)

Conductivity / Salinity 9870 APPROX (45–50) Code M (51) pH 7.0 (52 54) Date 9/6/76 (55–62) Supply (63–67) Unit (68)

Supply Method (69) Duration (hrs) (70 72) Drawdown Date Tested (73–80)

PUMP DETAILS: Type Diameter Depth Pump Set Pump Test Carried Out

Conductivity (field) µs at °C A.M.D.E.L. Analysis No. Deptl. Analysis No.

Remarks

Compiled

CONFIDENTIAL

SEE REPORT EL. 186

BORE PUB 18

SAMPLE TAKEN.

62.00 M

ACCURATE LOCALITY PLAN

BORE DETAILS

04 (1 2) UNIT NO. Samples Obtained (21 24) Technical Logs Available (27 52) Analyses Available (55 64)

LITHOLOGIC LOG

05 (1 2) UNIT NO. From (18 22) Unit (23) To (24 28) Description (29 32) Formation (33 35)

(37 41) (42) (43 47) (48 51) (52 54)

(56 60) (61) (62 66) (67 70) (71 73)

05 (1 2) UNIT NO. From (18 22) Unit (23) To (24 28) Description (29 32) Formation (33 35)

(37 41) (42) (43 47) (48 51) (52 54)

(56 60) (61) (62 66) (67 70) (71 73)

AQUIFER DETAILS

06 (1 2) UNIT NO. Supply Method (18) Hrs (19 21)

Water Cut (23 28 33)	Unit (34)	Water Level (39 45)	Drawdown (47 50)	Supply (51 56 61)	Unit (62)	Conductiv'y or Salinity (67 73)	Dev. Code (75)	pH (78)
06 (1 2)								
06 (1 2)								

COMMENTS

DEPARTMENT OF MINES-SOUTH AUSTRALIA

3

WATER SAMPLE ANALYSIS ADVICE

0348

Bore Reference . PUB 19. . . . . Analysis No W2833/76 .

Hundred. . . . . Section . . . . . .

Sample collected by. M.G.MASON. . . Date . 7.6.76 . .

Depth sample taken 51.00 Name AUST SELECTION PTY LTD

Dept. Mines Results Address 32 MAIN ST. . . .

Conductivity 26000 µS at 25°C . . . PT. AUGUSTA

Salinity 19000 ± . mg/l To AMDEL for analysis.

pH . . 7.4 . . . AMDEL No. . . . . .

Remarks SEE REPORT EL 186.

. . . . . 16-6-76 . . .

Unit No. . . . . Bore Folder No. . . .

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25 JUN 1976
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SECURITY
2564-III

BORE DATA SHEET – WATER

0349
Reference No W2833/76

Owner / Occupier Name AUSTRALIAN SELECTION PTY LTD. Address 32 MAIN ST PORT AUGUSTA.

0,1 UNIT NO. (1 2) (3 – 16)
Hundred OUT OF
Hund. No. (17 19)
Section (20 23)
Bore (24 25)
Bore Name PUB 19. (26 – 37)

Latitude or East (40 – 46)
Longitude or North (47 – 54)
Card Type (55)
Zone (56 57)
Accur. (58)
Elevation (59 – 65)
To (66)
Datum (67)
Accur. (68)
Unit (69)

Basin (70) 1 (71)
Situation of Bore

QUALITY OF WATER

Owner advised of analysis result 16-6-76

Water is required for
Water has been used for: sheep horses cattle poultry others (specify)
washing drinking domestic hot water service boilers others (specify)
Water has been used on: lucerne pastures vegetables fruit trees others (specify)

REFERENCES

0,2 UNIT NO. (1 2)
Bore Folder No. (18 – 23)
Common Property No. (24 – 33)
Security Rating (35)
Departmental References (37 – 66)
Aerial Photograph No. (67 71 74)
Reference No. (75 – 80)
Driller's Name R. CRAWFORD.

BORE DETAILS

0,3 UNIT NO. (1 2)
Date Drilling Completed 4/JUN/76 (21 – 28)
Core Lab. No. (30 – 35)
Logged (37)
Status (39 40)
Purpose (42 43)
Rig Oper. by (45 46)
Method Drilled (48 – 51)
Total Depth (52 – 57)
Unit (58)
Angle (59)
Overall Casing: From (60 – 65)
To (66 – 71)
Unit (72)
Smallest Diameter (73 – 76)
Unit (77)
Screen / Slotted Casing (78)

MOST RECENT DATA

0,7 UNIT NO. (1 2)
Total Depth (17 – 21)
Unit (22)
Date (23 – 30)
S.W.L. (31 – 35)
Unit (36)
Date (37 – 44)
Conductivity / Salinity 19000 < (45 – 50)
Code 4 (51)
pH 7.4 (52 54)
Date 9/JUN/76 (55 – 62)
Supply 15000 (63 – 67)
Unit G. (68)
Supply Method (69)
Duration (hrs) (70 72)
Drawdown
Date Tested (73 – 80)

PUMP DETAILS: Type Diameter Depth Pump Set Pump Test Carried Out
Conductivity (field) µs at °C A.M.D.E.L. Analysis No. Deptl. Analysis No.
Remarks
Compiled

CONFIDENTIAL.
SEE REPORT EL 186
BORE PUB 19.
SAMPLE TAKEN.
51.00 M.

ACCURATE LOCALITY PLAN

BORE DETAILS

04 (1 2) UNIT NO. Samples Obtained (21 24) Technical Logs Available (27 52) Analyses Available (55 64)

LITHOLOGIC LOG

05 (1 2) UNIT NO. From (18 22) Unit (23) To (24 28) Description (29 32) Formation (33 35)

(37 41) (42) (43 47) (48 51) (52 54)

(56 60) (61) (62 66) (67 70) (71 73)

05 (1 2) UNIT NO. From (18 22) Unit (23) To (24 28) Description (29 32) Formation (33 35)

(37 41) (42) (43 47) (48 51) (52 54)

(56 60) (61) (62 66) (67 70) (71 73)

AQUIFER DETAILS

06 (1 2) UNIT NO. Supply Method (18) Hrs (19 21)

06 (1 2)

06 (1 2)

Water Cut (23 28)	Unit (33)	Water Level (34 39)	Drawdown (45)	Supply (47 50)	Conductiv'y or Salinity (51 56)	Dev. Code (61)	pH (62 67)	Water Cut (73 75)	Unit (78)	Water Level	Drawdown	Supply	Conductiv'y or Salinity	Dev. Code	pH

COMMENTS

Prospect 405

0350

PACMINEX PTY. LIMITED

FIFTH QUARTERLY REPORT

ON EXPLORATION LICENCE 186

PANDURRA AREA,

FOR PERIOD ENDED 7TH JULY, 1976.

PMR 165/76

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23 AUG 1976
DEPT. OF MINES
SECURITY
2564-IN

SYDNEY
July, 1976

D.G. TONKIN

EXPLORATION LICENCE 186 (PANDURRA)

SUMMARY OF EXPENDITURE

FOR THE THREE MONTH PERIOD ENDING 30TH JUNE, 1976

Actual expenditure for the 5th Quarterly period was $31,735. An overall total of $155,579 was spent since the E.L. was granted.

The quarterly expenditure was incurred as follows:

Geological and Geophysical	$ 2,649
Drilling Costs	$13,351
Logistics (including salaries and wages)	$14,752
Depreciation	nil
Administration	$ 983
Other Costs	nil
Total	$31,735

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0352

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MOUNT GUNSON MINES	4

KEYWORDS

SOUTH AUSTRALIA
INTERPRETATION
EXPLORATION
9E L 186
AERIAL
PETROLOGY
DRILLING
INPUT
IGNEOUS ROCKS
9PANDURRA
PERCUSSION
MAGNETIC
SURVEY
8SI 53-04
COPPER
1976

CONTENTS

		PAGE NO.
1.	EXPLORATION	1
2.	YUDNAPINNA DRILLING	2
3.	IGNEOUS PETROLOGY	3
4.	AEROMAGNETIC INTERPRETATION	4
5.	ECONOMIC POTENTIAL	5

0354

APPENDICES

I	FIELD DRILL LOGS YD 1 TO YD 15
II	CLASSIFICATION OF IGNEOUS ROCKS, PANDURRA AREA

LIST OF ILLUSTRATIONS

FIGURES		FACING PAGE NO.
1	LOCALITY PLAN, E.L. 186, PANDURRA AREA, S.A.	1
2	1976 DRILL SITES, YUDNAPINNA INPUT SURVEY AREA	2

1. EXPLORATION

Work during the quarterly period included :-

1.1 Drilling of 16 rotary/percussion holes in the Yudnapinna district.

1.2 Petrographic examination of fine-grained igneous rocks from surface material and drill cuttings throughout the Licence area.

1.3 Commissioning of an interpretative study of low level aeromagnetic data from the Yudnapinna INPUT survey.

/....

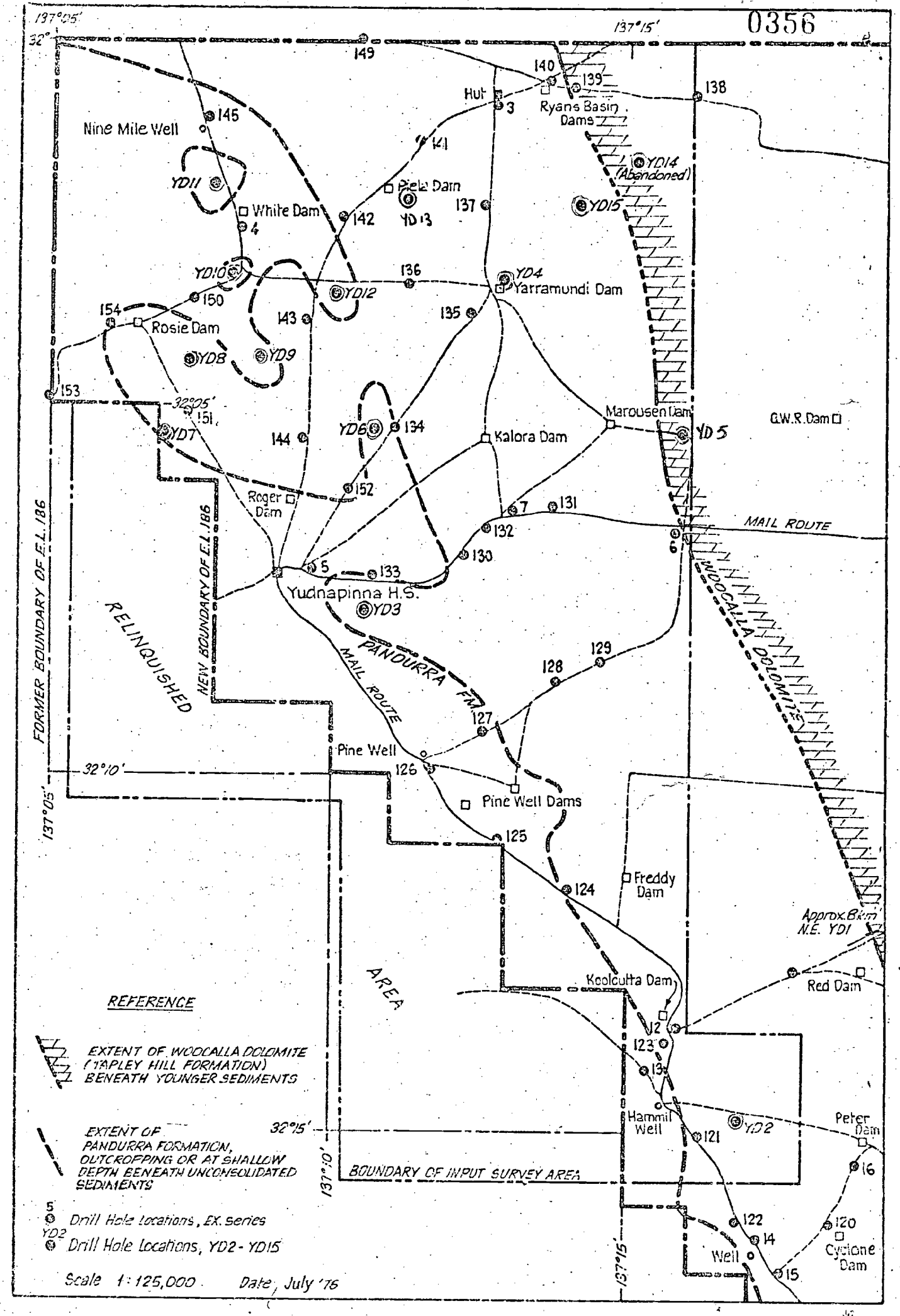


FIGURE 2 : 1976 DRILL SITES, YUDNAPINNA INPUT SURVEY AREA

2. YUDNAPINNA DRILLING

A Mayhew 1000 rig was used to drill 15 holes in the Yudnapinna district. The holes were numbered YD 1 to YD 15. Hole YD 1 was sited 7 km south-west from Hesso (see Figure 1). Holes YD 2 to YD 15 were sited on INPUT selected targets in the Yudnapinna INPUT survey area (see Figure 2). A total of 682 metres was drilled. Copies of the field drill logs are appended.

Drilling generally substantiated the interpreted conformation of the Pandurra Formation surface based on INPUT 4th channel contours (see Figure 2). INPUT seems to be a reliable indicator of resistive Pandurra Formation at shallow depth of beneath unconsolidated sediments.

Only one hole, YD 5, intersected black dolomitic shales of the Tapley Hill Formation (previously referred to as the "Woocalla Dolomite"). Dolomitic siltstones of the Yudnapinna Beds overlay both Tapley Hill Formation and Pandurra Formation. Both Tapley Hill Formation and Yudnapinna Beds had what seemed to be erosion channels on their upper surfaces. These channels were filled by poorly sorted, unconsolidated, clayey, sand deposits which are believed to be much younger than Pre-Cambrian, perhaps Tertiary, in age. In places, channels cut right through Yudnapinna Beds to the underlying Pandurra Formation. The Tertiary(?) deposits seem to be good acquifer, containing reasonable quality stock water in many places.

Drill cuttings were collected in samples representing 3 metre intervals. Each sample was geochemically assayed for Cu, Pb and Zn content. There were no indications of economic mineralisation. As with earlier drilling programmes in this district, only background base metal values were found.

3. IGNEOUS PETROLOGY

P.J. Curtis completed a petrographic study of fine-grained igneous rocks from E.L. 186. This study was requested in order to differentiate between Gawler Range Volcanics, Roopena Volcanics and mafic dyke rocks collected on surface and as drill cuttings. It was believed that Roopena Volcanics might be cropping out to the east of "Cariewerloo" Homestead, in an area mapped as Gawler Range Volcanics. Thin sections representing both volcanic suites were lent by the Mines Department and these assisted greatly. The study has just been completed and results have yet to be interpreted. A copy of Mr. Curtis's report is appended (PMR 81/76).

4. AEROMAGNETIC INTERPRETATION

A consultant, Mr. R.J. Smith, began an interpretation of the low-level aeromagnetic data from the Yudnapinna INPUT survey. Information about tectonic features and mafic intrusions is expected to emerge. Such data will assist in structural interpretations.

0360

5. ECONOMIC POTENTIAL

The area of the Yudnapinna INPUT survey was believed to be one which might potentially contain a mineral deposit of the Cattlegrid type. It was thought that over a large part of the area Whyalla Sandstone directly overlay Pandurra Formation in a stratigraphic situation similar to that at the Cattlegrid deposit. However, a previously unknown unit, the Yudnapinna Beds, has been found to overlie the Pandurra Formation in most places. Moreover, the sediments originally identified as Whyalla Sandstone are now thought to be much younger, perhaps Tertiary deposits.

The Yudnapinna section of E.L. 186 is no longer regarded as having potential for the discovery of a Cattlegrid type deposit. It was the only section of E.L. 186 remaining from those originally thought to have potential for that type of deposit. Future exploration in E.L. 186 will concentrate on the search for other styles of mineralisation.

DGT/SS
July, 1976

APPENDIX I

FIELD DRILL LOGS YD 1 TO YD 15

PACMINEX PTY. LTD.—FIELD DRILL LOG

0362 HOLE No. YD 1

PAGE 1 OF 3

PROJECT: Pandurra - 405. DATE STARTED: 8th April 1976. TYPE OF DRILL: Mayhew 1000

AREA: "Illeroo" HOLE SIZE: 115 mm

LOCATION: 6333 I -1 COORDINATES: CONTRACTOR: W.L. Sides

STARTED: 1720 ELEVATION: DRILLER: O. Vinecombe

COMPLETED: 1200, 11/04/76 DEPTH: 86.0 metres. LOGGED BY: R.E.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Sandy clay, orange-brown. Minor gypsum, cream.	51001		35	20	45
3.0						
	Sandy clay, orange-brown. rounded translucent qtz grains	51002		20	20	75
6.0						
	Clayey sand, orange-brown-cream. Minor silcrete bands.	51003		10	<20	95
9.0						
	Soft silty qtz sandstone, partly silicified. Cream to orange, minor purple & yellow. Most qtz grains well rounded. Minor silcrete.	51004		5	<20	65
12.0	Hammer from 12.0 m.					
	Silty qtz sandstone, fine to medium grained, cream. minor silicification.	51005		<2	<20	170
15.0	Rotary from 15.0 m.					
	Soft clayey qtz sandstone, fine grained. Cream with pink tinge. Well rounded qtz. HCl - v. weak effervesence	51006		5	<20	45
18.0						
	Soft fine sandy siltstone, well rounded qtz grains. cream with yellow tinge	51007		5	20	65
21.0						
	Soft fine sandy siltstone. cream with yellow-green tinge	51008		5	<20	55
24.0						
	Soft clayey siltstone, grey-green. Damp. HCl - v. weak effervesence.	51009		5	<20	40
27.0						
	Clayey siltstone, grey-green as 24.0 to 27.0 m.	51010		5	<20	70
30.0						

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0363 HOLE No. YD 1

PROJECT: Pandurra - 405 | DATE STARTED: 8th April 1976 | TYPE OF DRILL: Mayhew 1000

AREA: "Illeroo" | COORDINATES: | HOLE SIZE: 115 mm

LOCATION: 6333 I - 1 | | CONTRACTOR: W.L. Sides

STARTED: 1220 | ELEVATION: | DRILLER: D. Vinecombe

COMPLETED: 1200, 11/04/76. | DEPTH: 86.0 metres | LOGGED BY: R.E.J

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Clayey siltstone, green-grey. Damp.					
		51011		<2	<20	140
	HCl - weak effervesence					
33.0						
	Siltstone, dark green.					
		51012		10	<20	60
	HCl - weak effervesence.					
36.0	Water Table approx 35 metres					
	Siltstone, dark green & some grey chips.					
		51013		<2	<20	55
	HCl - mod - weak effervesence.					
39.0						
	Sandy siltstone, dark green, fine grained qtz sand. 50% contamination; mainly orange brown clayey-sand.	51014		5	<20	70
42.0	Hammer from 41.0 metres					
	Siltstone, grey-green & Silty qtz sandstone, medium grained, dark green 40% contamination by cream s.s.	51015		390	<20	80
45.0	HCl - weak effervesence					
	Shale, silty, fissile Dark grey. minor contamination by cream ss.	51016		190	120	120
48.0	HCl - strong effervesence					
	As 45.0 to 48.0 metres.	51017		60	340	620
51.0						
	As 45.0 to 48.0 metres.	51018		50	320	860
54.0						
	As 45.0 to 48.0 metres.	51019		35	180	600
57.0						
	Shale, fissile. Dark grey - black minor pyrite, v. fine in thin bands (< 2 mm).	51020		30	40	210
60.0						

PACMINEX PTY. LTD.—FIELD DRILL LOG

HOLE No. YD 1
0364 PAGE 3 OF 3

PROJECT: Pandurra - 405
AREA: "Illeroo"
LOCATION: 6333 I-1
STARTED: 1720
COMPLETED: 1200 11/04/76
DATE STARTED: 8th April 1976
COORDINATES:
ELEVATION:
DEPTH: 86·0 metres.
TYPE OF DRILL: Mayhem 1000
HOLE SIZE: 115 mm
CONTRACTOR: W.L. Sides
DRILLER: D. Vincombe
LOGGED BY: R.E.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn		
	Shale, silty. Dark grey. Minor contamination by cream s.s.	51021		35	70	180		
63·0	HCl - moderate to strong effervesence							
	Shale, dark grey. Minor contamination by cream s.s.	51022		30	40	190		
66·0	HCl - mod. to strong effervesence							
	As 63·0 to 66·0 m.	51023		25	30	130		
69·0								
	As 63·0 to 66·0 m.	51024		50	30	140		
72·0								
	As 63·0 to 66·0 m.	51025		30	40	85		
75·0								
	As 63·0 to 66·0 m.	51026		30	40	85		
78·0								
	Shale, dark grey & Siltstone, light to dark grey. Minor fine pyrite HCl - Strong effervesence	51027		30	30	90		
81·0								
	Shale, dark grey - 50% & Siltstone, light to dark grey Minor fine pyrite. HCl - strong effervesence esp.	51028		35	30	95		
84·0	with light grey siltstone							
	Siltstone, cream to dark grey Shale, dark grey. Minor fine pyrite HCl - stong effervesence.	51029		20	30	75		
86·0	30% Contamination							
	Hole Abandoned at 86 metres due to lost air return & cavitation to approx. 27m (Cusing to 10·5 m).	WATER SAMPLE		ppb 20		ppb <50	TDS 3·17%	

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0365 HOLE No. YD 2

PAGE 1 OF 2

PROJECT: Pandurra - 405. DATE STARTED: 11th April 1976 TYPE OF DRILL: Mayhew 1000

AREA: "Cariewerloo" COORDINATES: HOLE SIZE: 115 mm

LOCATION: 6333 M-1 CONTRACTOR: W.L. Sides

STARTED: 1555 ELEVATION: DRILLER: O. Vinecombe

COMPLETED: 1545 12/04/76 DEPTH: 42.0 metres LOGGED BY: R.E.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Clayey sand, calcareous; with gravel, qtz s.s. / qtzte. Calcrete bands. Moderate orange pink	51030		15	<20	45
3.0						
	Clayey sand, calcareous. with gravel, qtz s.s. / qtzte; & calcrete Very pale orange.	51031		10	<20	40
6.0						
	Clayey sand & Gravel, rounded qtz s.s. / qtzte. Pinkish grey.	51032		10	<20	120
9.0	Wet from approx. 8 metres					
	Sandy clay, sticky. Qtz sand, fine to medium grained. Yellowish grey to reddish brown.	51033		35	<20	75
12.0						
	Clayey sand, angular qtz - medium to fine grained approx 50%. Minor pockets of black material (to 4mm) Light grey to dark yellowish orange.	51034		30	<20	50
15.0	HCl - moderate effervescence.					
	Clayey sand, angular qtz - medium to fine grained, 50%. Mottled, light grey & reddish brown HCl - moderate effervescence.	51035		30	<20	35
18.0	Water Flow from 18 metres. Salty.					
	Clayey sand (soft s.s.?). Angular & rounded qtz, medium to fine grained, poorly sorted. Light grey to reddish brown.	51036		20	<20	20
21.0	HCl - no effervescence.					
	As 18.0 to 21.0 metres.	51037		20	<20	20
24.0						
	Clayey soft sandstone. Yellowish grey.	51038		15	<20	30
27.0						
	Clayey soft sandstone, some hard fragments. qtz is rounded & subrounded, medium to fine grained	51039		10	<20	20
30.0	Greyish orange.					

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

HOLE No. YD 2
0366 PAGE 2 OF 2

PROJECT: Pandurra – 405
AREA: "Cariewerloo"
LOCATION: 6333 M-1
STARTED: 1555
COMPLETED: 1545 12/04/76

DATE STARTED: 11th April 1976
COORDINATES:
ELEVATION:
DEPTH: 42.0 metres

TYPE OF DRILL: Mayhew 1000
HOLE SIZE: 115 mm
CONTRACTOR: W.L. Sides
DRILLER: O. Vinecombe
LOGGED BY: R.E.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn		
	Qtz sand & minor clay. (Friable sandstone) Qtz fine to coarse grained (max 4 mm), rounded to sub round.	51040		10	<20	15		
33.0	Yellowish - orange - grey.							
	As 30.0 to 33.0 m Qtz fine to medium grained.	51041		10	<20	15		
36.0								
	Qtz sand. Fine to coarse grained, rounded & sub rounded. Yellowish grey.	51042		5	<20	15		
39.0	Hammer from 39 metres.							
	Very Fine Sandy Siltstone. Greenish - grey; hand picked sample; 95% contamination by	51043		5	<20	55		
42.0	caving sand. HCl - no effervescence.							
	Hole Abandoned at 42.0 m Because of sand caving in strong water flow.							
		WATER SAMPLE		<10 ppb		120 ppb	TDS 1.029	

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0367

HOLE No. Y0-3

PAGE 1 OF 2

PROJECT: Pandurra - 405 DATE STARTED: 13th April 1976 TYPE OF DRILL: Mayhew 1000

AREA: "Yudnapinna" HOLE SIZE: 115 mm

LOCATION: 6333G - 1. COORDINATES: CONTRACTOR: W.L. Sides

STARTED: 0915 ELEVATION: DRILLER: D. Winecombe/S. Murra

COMPLETED: 1530, 14/04/76. DEPTH: 60.0 metres LOGGED BY: D.W.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
3.0	Gritty clay, red and Calcrete.	51044		10	<20	40
6.0	Gritty clay, red, with Calcrete and Silcrete.	51045		10	<20	25
9.0	Gritty clay, pale green.	51046		10	<20	110
12.0	Gritty clay, greenish orange. Occasional subrounded to rounded white & clear qtz grains.	51047		5	<20	20
15.0	Siltstone, pale green. Contains scatterred well rounded qtz grains to 1mm diameter.	51048		5	<20	25
18.0	Shaley siltstone, green. Ferruginous layers	51049		5	<20	50
21.0	Shaley siltstone, green. Scatterred rounded qtz grains, 1mm diameter.	51050		10	<20	20
24.0	Shale, pink & pale green Slightly gritty. Damp.	51051		5	<20	35
27.0	Gritty Shale, pink & green	51052		10	<20	40
30.0	Gritty shale; pink, yellow and green. Some thin dark grey layers.	51053		5	<20	40

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

HOLE No. YO-3

PAGE 2 OF 2

PROJECT: Pandurra -405 | DATE STARTED: 13th April. | TYPE OF DRILL: Mayhew 1000

AREA: "Yudnapinna" | COORDINATES: | HOLE SIZE: 115 mm

LOCATION: 6333 G-1. | CONTRACTOR: W.L. Sides

STARTED: 0915 | ELEVATION: | DRILLER:

COMPLETED: 1530, 14/04/76 | DEPTH: 60.0 metres. | LOGGED BY: D.W.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Sandy shale, yellow & green	S1054		5	<20	35
33.0						
	Sandy shale, yellow & green Scattered rounded pebbles & grains (to 1mm diameter) of red quartzite.	S1055		5	<20	30
36.0						
	Sandy shale, laminated. Yellow & green.	S1056		5	<20	45
39.0						
	Shale; brown, green & yellow.	S1057		10	<20	50
42.0						
	Shale, khaki & grey.	S1058		10	<20	110
45.0						
	Clay, khaki	S1059		10	<20	120
48.0	Water injection					
	Clay, khaki	S1060		10	<20	120
51.0						
	Clay, khaki & yellow.	S1061		5	<20	75
54.0	Hammer from 51.0 m.					
	Quartzite, Red, tough, poorly sorted. Contains angular blue qtz grains, chips of black chert?, white qtzite.	S1062		10	<20	50
57.0	Probably rubble on top of Pandurra-					
	Quartzite, Red.	S1063		5	<20	55
60.0						
	END of Hole, 60 metres.					

CSR/0035

WATER SAMPLE <10 ppb <50 ppb TDS 1.56%

0369 HOLE No. YD-4

PACMINEX PTY. LTD.—FIELD DRILL LOG

PAGE 1 OF 3

PROJECT: Pandurra -405 | DATE STARTED: 15th April 1976. | TYPE OF DRILL: Mayhew 1000

AREA: "Yudnapinna". | COORDINATES: | HOLE SIZE: 115 mm

LOCATION: 6333C-1 | | CONTRACTOR: W.L. Sides

STARTED: 0830 | ELEVATION: | DRILLER: D. Vinecombe/S. Murray

COMPLETED: 1530 | DEPTH: 64·0 metres. | LOGGED BY: D.W.J + R.E.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Clayey sand + calcrete, light brown.	51064		15	20	45
3·0						
	Gritty clay + calcrete, moderate reddish brown.	51065		10	<20	45
6·0	Slightly damp.					
	Gritty clay + calcrete, light brown.	51066		5	<20	40
9·0	Damp					
	Clayey siltstone, soft. Pale orange green.	51067		10	<20	30
12·0						
	Clayey siltstone, soft. Orange green.	51068		5	<20	45
15·0	HCl - moderate effervescence					
	Silty clay. Grecnish grey.	51069		5	<20	30
18·0						
	Silty clay Greenish grey.	51070		5	<20	95
21·0						
	Silty clay Greenish grey	51071		10	20	60
24·0	Water in hole at ~24 m.					
	Silty clay. Pale greenish grey some rounded qtz sand.	51072		5	<20	25
27·0	Contamination by reddish sand.					
	Sandy + silty clay. Very light grey, greenish tinge. Rounded translucent qtz grains, usually	51073		5	<20	45
30·0	less than 0.5 mm diameter.					

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0370 HOLE No. YD-4

PAGE 2 OF 3

PROJECT: Pandurra -405 | DATE STARTED: 15th April 1976 | TYPE OF DRILL: Mayhew 1000

AREA: "Yudnapinna" | COORDINATES: | HOLE SIZE: 115 mm

LOCATION: 6333C-1 | CONTRACTOR: W.L. Sides

STARTED: 0830 | ELEVATION: | DRILLER: S. Murray

COMPLETED: 1530 | DEPTH: 64.0 metres | LOGGED BY: R.E.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Very fine sandy & clayey siltstone, Soft. Olive grey.	51074		<2	<20	50
→	Contamination by reddish sand					
33.0	HCl – no effervesence					
	As 30.0 to 33.0 metres	51075		5	<20	45
36.0						
	As 30.0 to 33.0 metres	51076		<2	<20	150
39.0						
	Clayey siltstone & very fine sand. Minor hard bands. Soft. Light olive grey	51077		5	<20	55
42.0						
	Very fine sandy siltstone, clayey. Soft with thin hard bands. Minor sub rounded qtz grains to 1mm diameter. Light olive-grey & hard dark olive grey chips.	51078		<2	<20	65
45.0						
	Fine sandy siltstone, light olive grey; with minor dark green grains & sub rounded qtz to 1mm diameter.	51079		5	<20	65
8.0						
	Fine sandy siltstone, clayey. Olive grey with dark grey patches to 4mm. Minor rounded qtz & dark green grains to 1mm diameter	51080		<2	<20	40
51.0	Hammer from 50 metres.					
	Fractured Quartzite, hard. Greyish red to to very pale grey. Qtz grains to 5mm, angular & rounded. Pale yellow clayey pockets to 2mm.	51081		10	<20	65
54.0	Minor greenish grey pyrite.					
	As 51.0 to 54.0 metres	51082		10	<20	30
57.0						
	Quartzite Hard greyish red to pale grey. Clayey material in fractures, moderate red.	51083		5	<20	30
60.0	Pyrite chips.					

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0371

HOLE No. YD-4

PAGE 3 OF 3

PROJECT: Panclurra - 405

DATE STARTED: 15th April 1976

TYPE OF DRILL: Mayhew 1000

AREA: "Yudnapinna"

COORDINATES:

HOLE SIZE: 115 mm

LOCATION: 6333 C - 1

CONTRACTOR: W.L. Sides

STARTED: 0830

ELEVATION:

DRILLER: S. Murray

COMPLETED: 1530

DEPTH: 64.0 metres

LOGGED BY: R.E.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Qtzte pale brown to greyish red . pale yellow intergranular clay in some chips . Reddish clayey bands or fracture fillings . minor pyrite on fractures . intergranular.	51084		5	<20	30
63.0	As 60.0 to 63.0 metres.	51085		5	<20	35
64.0	END of Hole 64.0 metres in hard Qtzte.					

CSR/0035

0372

HOLE No. YD-5

PAGE 1 OF 4

PACMINEX PTY. LTD.—FIELD DRILL LOG

PROJECT: Pandurra - 405 DATE STARTED: 20th April 1976 TYPE OF DRILL: Mayhew 1000

AREA: "Yudnapinna" HOLE SIZE: 115 mm

LOCATION: 6333C - 2 COORDINATES: CONTRACTOR: W.L. Sides

STARTED: 1020 ELEVATION: DRILLER: D. Vinecombe

COMPLETED: 1000 22/04/76 DEPTH: 94.0 metres LOGGED BY: R.E.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
3.0	Clayey sand, gypsiferous. Greyish orange pink. Minor calcrete bands.	51086		10	40	65
6.0	Clayey sand, minor gypsum, calcareous. Light brown.	51087		15	<20	55
9.0	Clayey sand calcareous - 50% with silcrete / silicified sand. Yellow grey to light brown.	51088		10	<20	65
12.0	Silcrete / silicified sand and calcareous sandy clay. Qtz grains average diameter less than 0.5 mm, maximum 4mm. Light brown to yellowish grey.	51089		10	<20	50
15.0	Silcrete / silicified sandstone and clayey sand. Pinkish grey HCl - moderate effervesence.	51090		5	<20	65
18.0	Clayey sand with soft sandstone and hard silcrete bands. Qtz grains rounded to subangular, fine to medium grained. Light greenish yellow grey	51091		<2	<20	90
21.0	Clayey sand and soft sandstone with silcrete bands. Light grey with pale yellow and green patches. Minor black inter granular material. Wet from 20 m.	51092		<2	<20	130
24.0	Clayey sand and silicified sand / silcrete. Qtz grains medium to fine grained, rounded to subangular. Very light grey and pinkish grey. HCl, -ve	51093		<2	<20	25
27.0	Clay with minor silcrete & very fine qtz sand grains. Very light grey. HCl - no effervesence.	51094		<2	<20	60
30.0	Clay with minor very fine grained qtz sand. Very light grey.	51095		<2	<20	30

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0373

HOLE No. YD-5

PROJECT: Pandurra - 405 DATE STARTED: 20th April 1976 TYPE OF DRILL: Mayhew 1000

AREA: "Yudnapinna" COORDINATES: HOLE SIZE: 115 mm

LOCATION: 6333 C-2 CONTRACTOR: W.L. Sides

STARTED: 1020 ELEVATION: DRILLER: D. Vinecombe

COMPLETED: 1000 22/04/76 DEPTH: 94.0 metres LOGGED BY: R.E.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Clay: very light grey with moderate yellow patches. Minor fine qtz sand grains.	51096		<2	<20	50
33.0						
	Clay, very light grey with yellow & green bands. Minor medium to fine grained qtz grains. Minor greenish grey fine sandy	51097		<2	<20	50
36.0	siltstone chips.					
	Clay with minor qtz grains, fine to medium grained, and fine sandy siltstone, greenish grey. HCl - weak effervescence.	51098		<2	<20	85
39.0	Contamination with near surface sand					
	Silty fine grained qtz sandstone. Greenish-grey with minor red-brown qtzte grains.	51099		5	<20	45
42.0	Contaminated with near surface sand					
	Silty fine qtz sandstone. Greenish grey with minor red brown 'qtzte' grains.	51100		5	<20	45
45.0	Contaminated with near surface sand					
	Silty fine sandstone, greenish grey with scattered well rounded red brown grains to 2mm diameter.	51101		<2	<20	40
48.0						
	As 45.0 to 48.0 metres	51102		5	<20	50
	Contaminated with near surface					
51.0	sand.					
	As 45.0 to 48.0 metres.	51103		5	<20	65
	Contaminated.					
54.0						
	As 45.0 to 48.0 metres.	51104		5	20	60
57.0						
	As 45.0 to 48.0 metres.	51105		5	20	40
60.0						

PACMINEX PTY. LTD.—FIELD DRILL LOG

HOLE No. YD-5

0374 PAGE 3 OF 4.

PROJECT: Pandurra - 405. DATE STARTED: 20th April 1976 TYPE OF DRILL: Mayhew 1000

AREA: "Yudnapinna" COORDINATES: HOLE SIZE: 115 mm

LOCATION: 6333C-Z CONTRACTOR: W.L. Sides

STARTED: 1020 ELEVATION: DRILLER: D. Vinecombe

COMPLETED: 1000 22/04/76 DEPTH: 94.0 metres LOGGED BY: R.E.J./D.W.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
63.0	Silty fine sandstone, greenish grey, with scattered well rounded red brown grains to 1mm diameter. HCl - weak effervescence	S1106		5	<20	50
66.0	Silty fine sandstone, greenish grey to olive grey, with scattered well rounded red brown grains. Dark grey siltstone chips from 65 metres. Contaminated.	S1107		5	40	50
69.0	As 63.0 to 66.0, Dark grey siltstone is less than 10%.	S1108		70	60	90
72.0	Shaley Siltstone. Dark grey.	S1109		90	180	320
75.0	Shale, dark grey Contamination with silty clay, white.	S1110		45	300	310
78.0	As 72.0 to 75.0 m.	S1111		35	360	1100
81.0	As 72.0 to 75.0 m.	S1112		35	540	470
84.0	Shale, fissile, black	S1113		110	720	680
87.0	Shale, black	S1114		100	460	200
90.0	Shale, black to approximately 88m. Quartzite, red yellow and white. 95% of sample is shale.	S1115		70	150	100

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0375

HOLE No. YD-5

PAGE 4 OF 4

PROJECT: Pandurra - 405 | DATE STARTED: 20th April 1976 | TYPE OF DRILL: Mayhem 1000

AREA: "Yudnapinna" | COORDINATES: | HOLE SIZE: 115 mm

LOCATION: 6333C - 2 | CONTRACTOR: W. L. Sides

STARTED: 1020 | ELEVATION: | DRILLER: D. Vincombe

COMPLETED: 1000 22/04/76 | DEPTH: 94.0 metres | LOGGED BY: D.W.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn		
	Quartzite, yellow and red							
	Sample is 90% black shale contamination	S1116		40	100	85		
94.0								
	END of HOLE 94.0 metres.							
		WATER SAMPLE		<10 ppb		110 ppb	TDS 3.48 %	

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0376

HOLE No. YD-6

PAGE 1 OF 2

PROJECT: Pandurra 405 | DATE STARTED: 22/4/76 | TYPE OF DRILL: Mayhew 1000

AREA: Yudnapinna | COORDINATES: | HOLE SIZE: 115 mm

LOCATION: 6333 B-1 | CONTRACTOR: W.L. Sides

STARTED: | ELEVATION: | DRILLER: D. Vivecombe.

COMPLETED: | DEPTH: 31.0 metres | LOGGED BY: D. Jones.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
0	Brown clay & sand Calcrete	51117		20	30	45
3	Brown sandy clay Calcrete	118		15	20	50
6	Brown clay	119		10	20	30
9	Greenish orange clayey sand	120		5	20	20
12	Orange clay & sand	121		10	<20	40
15	Beige clay containing scattered sand grains	122		5	20	20
18	Dark yellowish orange silty clay Damp.	123		5	20	30
21	Greenish yellow clayey siltstone. Scattered rounded quartz grains up to 1mm.	124		<2	<20	20
24	White to pale grey quartzite — pulverised. Very clayey. Occasional sand size quartz grains	125		5	<20	20
27	Red quartzite. White clay matrix Occasional pebbles of colourless quartz.	51126		5	20	30

CSR/0035

30

HOLE No. YD-6

PACMINEX PTY. LTD.—FIELD DRILL LOG

0377

PROJECT: Pandora - 405 DATE STARTED: 23/04/86 TYPE OF DRILL: Mayhew 10

AREA: Xiahoupinna HOLE SIZE:

LOCATION: 6333 B-1 COORDINATES: CONTRACTOR:

STARTED: ELEVATION: DRILLER: D Vincombe

COMPLETED: DEPTH: 36.0 metres LOGGED BY: D.W.T

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
30	Red quartzite. Yellowish white clay matrix.	51127		10	20	25
33	Red quartzite White clay matrix.	51128		5	<20	20
36	END OF HOLE					

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0378

HOLE No. YD-7

PAGE 1 OF 1

PROJECT: Pandurra - 405 | DATE STARTED: 22nd April 1976 | TYPE OF DRILL: Mayhew 1000

AREA: "Yudnapinna" | COORDINATES: | HOLE SIZE: 115 mm

LOCATION: 6333 B-2 | CONTRACTOR: W. L. Sides

STARTED: 1605 | ELEVATION: | DRILLER: D. Vinecombe

COMPLETED: 1200 23/04/76 | DEPTH: 30.0 metres | LOGGED BY: D. W. J & R. E. J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
3.0	Clay and Sand with calcrete Light brown	51129		15	40	45
6.0	Silty clay very light grey. HCl - strong effervesence	51130		5	20	40
	Hammer from 6 metres					
9.0	Siltstone, very light grey and reddish grey. Scattered well rounded qtz grains to 0.5 mm diameter.	51131		5	30	40
12.0	Siltstone, very light grey and reddish grey. Scattered well rounded qtz grains to 0.5 mm diameter.	51132		5	20	40
15.0	As 9.0 to 12.0 metres.	51133		5	<20	55
18.0	Siltstone, greenish grey to moderate brown. Scattered rounded qtz grains to 0.5 mm diameter. HCl - mod. to weak.	51134		5	30	35
21.0	Siltstone, light grey with bluish green tinge. Well rounded qtz grains & qtzite grains to 3 mm diameter are common.	51135		5	30	80
24.0	Siltstone, light grey with bluish green tinge. Quartzite, red-brown with greyish blue green clayey? pockets and intergranular filling in last metre.	51136		5	50	150
27.0	Quartzite, reddish-brown to light brown. Minor greyish green blue intergranular material. Salty water from 25 metres	51137		50	130	130
30.0	Quartzite, pale to dark reddish brown. Minor clayey intergranular material. Hard.	51138		40	90	55
CSR/0035	END of HOLE 30.0 metres.					
		WATER SAMPLE		ppb 20		ppb 170 TDS 1.31%

PACMINEX PTY. LTD.—FIELD DRILL LOG

0379

HOLE No. YO-8

PAGE 1 OF 2

PROJECT: Pandurra -405

DATE STARTED: 23rd April 1976

TYPE OF DRILL: Mayhew 1000

AREA: "Yudnapinna"

HOLE SIZE: 115 mm

LOCATION: 6333 B-3

COORDINATES:

CONTRACTOR: W.L. Sides

STARTED: 1310

ELEVATION:

DRILLER: D. Vinecombe

COMPLETED: 1200 26/04/76

DEPTH: 42·0 metres

LOGGED BY: R.E.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Clayey sand, calcrete and minor silcrete with silicified sandstone / qtzte gravel. Greyish pink.	51139		15	40	40
3·0						
	Fine sandy siltstone, clayey. Numerous qtz grains, well rounded and sub rounded maximum diameter 1 mm. Very light grey with pinkish yellow tinge.	51140		10	20	30
6·0						
	Clayey siltstone and minor sandstone. Minor gypsum. Very - light grey	51141		5	<20	40
9·0	HCl - moderate effervescence					
	Fine sandy siltstone with minor sandstone. Numerous well rounded qtz grains, maximum diameter 1 mm. Light grey with yellowish	51142		5	20	35
12·0	green tinge.					
	As 9·0 to 12·0 metres.	51143		5	<20	45
15·0						
	Silty claystone. Minor qtz grains, well rounded, very fine to 1 mm diameter. Olive grey.	51144		30	20	65
18·0	HCl - no effervesence					
	Silty clay with minor qtz grains, well rounded, very fine to 1 mm diameter. Greenish olive grey.	51145		5	20	120
21·0						
	Silty clay with very minor qtz grains, fine. Greenish olive grey. Hammer from 24·0m	51146		5	20	140
24·0	HCl - no effervesence					
Water 24m.	Qtzte. Qtz grains angular and subrounded, maximum 3 mm diameter. Pale red brown to light yellowish grey. Pyrite	51147		5	<20	110
27·0	common - greyish green					
	Qtzte, hard. Qtz grains angular and subrounded. Pyrite as pockets und qtzte matrix. Pale yellowish grey to reddish	51148		10	30	110
30·0	brown.					

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0380 HOLE No. YO-8

PAGE 2 OF 2

PROJECT: Pandurra -405 | DATE STARTED: 23rd April 1976 | TYPE OF DRILL: Mayhew 1000

AREA: "Yudnapinna" | COORDINATES: | HOLE SIZE: 115 mm

LOCATION: 6333 B-3 | CONTRACTOR: W.L. Sides

STARTED: 1310 | ELEVATION: | DRILLER: S. Murray

COMPLETED: 1200 26/04/76 | DEPTH: 42.0 metres | LOGGED BY: R.E.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn		
	Qtzite, hard; Qtz grains angular and subrounded, maximum 2mm diameter. Pale yellowish grey, pale greenish grey minor reddish	51149		10	40	70		
33.0	brown. Pyrite common, matrix & pockets							
	Qtzite, hard; Qtz grains to 2mm diameter. Pale yellowish grey to reddish brown. Pyrite, minor, greyish green.	51150		10	20	30		
36.0								
	Qtzite, hard. Pale yellowish grey to pale reddish brown. Minor pyrite.	51151		10	40	80		
39.0								
	Qtzite, hard Light grey to pinkish grey & reddish brown. Very minor Pyrite.	51152		5	<20	25		
42.0								
	END OF HOLE at 42.0m.							
		WATER SAMPLE		15 ppb		<50 ppb	TDS 1.16 %	

0381

HOLE No. YA-9

PAGE 1 OF 1

PACMINEX PTY. LTD.—FIELD DRILL LOG

PROJECT: Pandurra - 405.
AREA: "Yudnapinna"
LOCATION: 6333 B-4
STARTED: 1330
COMPLETED: 1505

DATE STARTED: 26th April 1976
COORDINATES:
ELEVATION:
DEPTH: 6.0 metres.

TYPE OF DRILL: Mayhew 1000
HOLE SIZE: 115 mm
CONTRACTOR: W.L. Sides
DRILLER: S. Murray
LOGGED BY: R.E.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Clayey Sand, calcareous, light brown. Light Brown. Qtzte, hard, pale reddish brown. Minor silcrete, light grey to pale yellow.	S1153		10	40	90
3.0	Qtzte, hard. Pale reddish brown. Sub rounded and angular qtz grains to 2mm diameter.	S1154		5	20	30
6.0	END of HOLE at 6.0m.					

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0382

HOLE No. YA-10

PAGE 1 OF 1

PROJECT: Pandurra -405.
AREA: "Yudnapinna"
LOCATION: 6333 B-5
STARTED: 1615
COMPLETED: 1505

DATE STARTED: 26th April 1976
COORDINATES:
ELEVATION:
DEPTH: 20.0 metres.

TYPE OF DRILL: Mayhew 1000
HOLE SIZE: 115 mm
CONTRACTOR: W.A. SIDES
DRILLER: S. Murray
LOGGED BY: R.E.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Clayey sand to 1 metre. Calcareous, reddish brown Silty sandstone, pinkish grey	51155		10	30	35
3.0	HCl - weak effervesence (ss.). Silty sandstone and sandy siltstone. Minor gypsum pockets. Qtz grains well rounded to sub angular, maximum diameter	51156		5	<20	35
6.0	3mm. Very light grey. Silty claystone, soft. Light grey. Minor qtz grains well rounded to sub angular	51157		5	<20	50
9.0	Light grey with pinkish tinge Moist. HCl - no effervesence	51158		10	<20	60
	As for 6.0 to 9.0 metres	51159		5	60	90
12.0	Silty claystone, as 6.0 to 9.0 metres, to 13.5 metres. & Clayey sand. Grey brown to greyish black. Qtz grains	51160		10	40	200
15.0	rounded to sub angular, to 4mm. Qtzite, hard, pale reddish brown and light grey. Qtz grains, angular and sub rounded. Maximum diameter 3mm.	51161		5	20	140
18.0	Grey sandy clay in fractures. Qtzite, hard, pale reddish brown & yellowish grey.	WATER SAMPLE		<10 ppb		1260 ppb
	Water at 19.5 metres.					TDS 2.22%
20.0	END of HOLE at 20.0 m.					

CSR/0035

RACMINEX PTY. LTD.—FIELD DRILL LOG

0383

HOLE No. YD-11

PAGE 1 OF 2

PROJECT: Tanderra 405 | DATE STARTED: 27-4-76 | TYPE OF DRILL: Mayhew 1000

AREA: Yudnapinna | COORDINATES: | HOLE SIZE:

LOCATION: 6333 B-6 | CONTRACTOR: U.L. Sides

STARTED: 0800 | ELEVATION: | DRILLER: S. Murray

COMPLETED: 1150 | DEPTH: 33.0 metres | LOGGED BY: D. Jones

Metres	DESCRIPTION		SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
0	Brown sand & clay Calcrete		51162		15	<20	45
3	Brown sandy clay Gypsum, calcrete		163		10	20	40
6	Brown clay & sand; green gritty clay. Silcrete		164		10	<20	60
9	Silty clay with scattered well rounded quartz grains. Pale pink & pale green		165		10	<20	25
12	Greyish orange gritty clay. Abundant rounded quartz grains, and abundant pebbles of quartz up to 5mm. Occasional pebbles of red quartzite. Damp		166		10	<20	30
15	Light olive grey sandy clay. Pebbles of quartz and red quartzite up to 5mm. Occasional well rounded dark lithic grains.		167		10	<20	50
18	Dark olive grey silty clay. Occasional pebbles of quartz		168		<2	20	120
21	Dark grey silty clay	H_2O	169		<2	<20	110
24	Dark grey silty clay.		170		10	20	280
27	Pebbles, up to 10cm, of red quartzite, grey quartzite & silcrete. Regolith surface		51170		30	30	230

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0384

HOLE No. Y1-11

PAGE 2 OF 2

PROJECT: Pandurra - 405 DATE STARTED: 27-4-76 TYPE OF DRILL: Mayhew 1000

AREA: COORDINATES: HOLE SIZE:

LOCATION: 6333 B-6 CONTRACTOR:

STARTED: 0800 ELEVATION: DRILLER: S. Murray

COMPLETED: 1150 DEPTH: 33.0 LOGGED BY: O.W.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn		
30	Red quartzite, grey quartzite, silcrete pebbles & fragments. Red fissile siltstone. Lapilli.	51172		10	120	60		
33	END OF HOLE							
	Water sample.	WATER SAMPLE		<10 ppb		1200 ppb	TDS 2.90%	

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0385

HOLE No. YD-12

PAGE 1 OF 1

PROJECT: PANDURRA 405

AREA: "Yudnapinna"

LOCATION: 6533 E-7

STARTED: 1310

COMPLETED: 1510

DATE STARTED: 27th April 1976

COORDINATES:

ELEVATION:

DEPTH: 18.0 metres

TYPE OF DRILL: Mayhew 1000

HOLE SIZE:

CONTRACTOR: W.L. SIDES

DRILLER: S. Murray

LOGGED BY: D. Jones

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
0	Brown clay & sand Calcrete.	51173		15	<20	45
3	Brown clay. Gypsum, calcrete.	174		10	20	45
6	Pale green & brown gritty clay. Calcrete.	175		10	20	150
9	Silcrete, red & white quartzite fragments. Probably a regolith.	176		5	<20	35
12	Silcrete & quartzite fragments.	177		<2	<20	85
15	Massive red quartzite.	51178		<2	<20	45
18	END OF HOLE					

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0386

HOLE No. YD-13

PAGE 1 OF 3

PROJECT: Pandurra - 405

DATE STARTED: 27th April 1976

TYPE OF DRILL: Mayhew 1000

AREA: "Yudnapinna"

COORDINATES:

HOLE SIZE: 115 mm

LOCATION: 6333 B-8

CONTRACTOR: W.L. Sides

STARTED: 1510

ELEVATION:

DRILLER: S. Murray / D. Vinecombe

COMPLETED: 1700 28/04/76

DEPTH: 59.0 metres

LOGGED BY: D.W.J. & R.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Sand, clay and calcrete. Brown.	51179		20	<20	55
3.0						
	Clay and calcrete, brown overlying: Silty clay, light greenish grey. Gypsiferous	51180		10	<20	40
6.0						
	Clay with rounded qtz grains maximum diameter 3 mm. Very light greenish grey. and Silcrete, brown.	51181		10	<20	45
9.0	Gypsiferous. HCl - no gas.					
	Silty clay, light yellowish green grey and Silcrete, reddish brown and	51182		5	<20	15
12.0	yellow grey.					
	Silty clay, very light grey and pinkish grey.	51183		5	<20	75
15.0						
	Silty clay, light greenish grey and pinkish grey	51184		<2	<20	55
18.0						
	Silty clay, light greenish grey and brown grey.	51185		5	<20	50
21.0						
	Clay, banded grey, light gray and greyish yellow.	51186		<2	<20	35
24.0	HCl - no effervesence.					
	Sandy clay, brownish to medium grey. Rounded qtz grains maximum diameter 3 mm, Minor silcrete and qtzite, subrounded pebbles	51187		10	<20	60
27.0	and angular. reddish brown					
	Silty and clayey sandstone, greenish grey. Qtz grains well rounded, maximum diameter 2 mm.	51188		5	<20	60
30.0	Fine pyritic matrix in some chips.					

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0387 HOLE No. YD-13

PROJECT: Pandurra - 405. DATE STARTED: 27th April 1976 TYPE OF DRILL: Mayhew 1000

AREA: "Yudnapinna" HOLE SIZE:

LOCATION: 6333 B-8 COORDINATES: CONTRACTOR: W. L. Sides

STARTED: 1510 ELEVATION: DRILLER: D. Vinecombe

COMPLETED: 1700 28/04/76 DEPTH 69.0 metres LOGGED BY: R.E.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
33.0	Siltstone and silty sandstone, greenish grey and brownish grey. Qtz grains, well rounded, maximum diameter 1mm, reddish brown to translucent. Minor Silcrete pebbles. HCl, very weak react.	51189		5	<20	80
36.0	Siltstone and silty sandstone, hard. Brownish grey and greenish grey. Qtz grains fine to coarse, maximum diameter 3mm. Minor well rounded reddish brown grains.	51190		<2	<20	75
39.0	As 33.0 m to 36.0 m	51191		5	<20	130
42.0	Siltstone and silty sandstone, hard Brownish grey and greenish grey. Qtz grains, well rounded, maximum diameter 2mm. Well rounded reddish brown grains, maximum diameter 2mm	51192		<2	<20	60
45.0	As 39.0 to 42.0 m	51193		10	<20	75
48.0	Siltstone and silty sandstone, hard Light brownish grey and greenish grey. Well rounded qtz grains, well rounded lithic grains (greenish grey siltstone) and reddish brown grains all with maximum diameter 2mm.	51194		<2	<20	70
51.0	As 45.0m to 48.0m	51195		5	<20	100
54.0	Siltstone and sandstone, hard. Light brownish grey and greenish grey. Well rounded: qtz grains, maximum diameter 2mm, lithic grains and reddish brown grains, merimum 4mm.	51196		<2	<20	45
57.0	Siltstone with thin sandy beds. Very hard. Pale brown with pinkish tinge. Sand is well rounded, qtz, siltstone (greenish grey) and reddish brown grains. HCl - moderate to weak effervesence	51197		5	<20	90
60.0	Siltstone, very hard. Greyish red brown. Minor well rounded qtz grains, siltstone grains and reddish brown grains. WATER from 60m? HCl - moderate to weak effervesence.	51198		<2	20	60

HOLE No. YD-13

PACMINEX PTY. LTD.—FIELD DRILL LOG

0388 PAGE 3 OF 3

PROJECT: Pandurra - 405 DATE STARTED: 27th April 1976 TYPE OF DRILL: Mayhew 1000

AREA: "Yudnapinna" HOLE SIZE:

LOCATION: 6333B-8 COORDINATES: CONTRACTOR: W.L. Sides

STARTED: 1510 ELEVATION: DRILLER: D. Vinecombe

COMPLETED: 1700, 25/4/76 DEPTH: 69.0 metres. LOGGED BY: R.E.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn		
	Siltstone, greyish red, hard. Minor well rounded reddish brown grains, maximum diameter 3mm.	51199		10	<20	65		
63.0	HCl - moderate to weak effervescence							
	Qtzte, hard. Greyish red. Qtz grains average diameter less than .5mm, maximum 2mm. Thin bed of grey	51200		10	40	120		
66.0	dolomitic? siltstone? overlying qtzte.							
	Qtzte, hard Greyish red Minor clayey matrix.	51201		10	<20	60		
69.0								
	END of HOLE 69.0 metres.							
		WATER SAMPLE		<10 ppb		550 ppb	TDS 2.55 %	

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

HOLE No. YD-14

0389 PAGE 1 OF 2

PROJECT: Pandurra - 405 DATE STARTED: 29th April 1976 TYPE OF DRILL: Mayhew 1000

AREA: "Yudnapinna" HOLE SIZE: 115 mm

LOCATION: 6333C-3 COORDINATES: CONTRACTOR: W.L. Sides

STARTED: 0830 ELEVATION: DRILLER: D. Vinecombe

COMPLETED: 1700 DEPTH: 42.0 metres LOGGED BY: R.E.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Sand, Minor clay. Reddish brown	51202		10	<20	40
3.0	HCl - no effervesence					
	Clayey and silty sand. Qtz grains well rounded, maximum diameter 1 mm. Very light grey	51203		5	<20	25
6.0	pinkish-green tinge. Damp					
	silty and sandy clay. Qtz grains rounded, maximum diameter 1mm. Light yellowish-	51204		5	<20	40
9.0	greenish grey. Minor siderite, dark reddish brown. Contaminated.					
	As 6.0 to 9.0 metres. Heavy contamination by sand.	51205		10	<20	35
12.0						
	Sandy clay Minor rounded qtz grains of maximum diameter 1mm. Light yellowish-green grey.	51206		10	<20	40
15.0	wet at approximately 15 metres					
	Claystone, tenacious. Very minor fine qtz. Light yellowish-green grey.	51207		10	<20	25
18.0						
	Sandy claystone Qtz grains rounded maximum diameter .5 mm. Very light grey with medium grey and	51208		10	<20	25
21.0	yellow pockets.					
	As 18.0 to 21.0 metres	51209		5	<20	25
24.0						
	Sandy siltstone and claystone. Qtz grains well rounded, maximum diameter 1mm. Very light grey with minor	51210		10	<20	30
27.0	light brown and yellowish pockets					
	Clayey siltstone and sandstone Qtz grains well rounded, maximum diameter 4mm. Minor silicified bands. Very light grey with	51211		<2	<20	10
30.0	pinkish tinge.					

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0390

HOLE No. YD-14

PAGE 2 OF 2

PROJECT: Pandurra - 405

AREA: "Yudnapinna"

LOCATION: 6333C-3

STARTED: 0830

COMPLETED: 1700

DATE STARTED: 29th April 1976

COORDINATES:

ELEVATION:

DEPTH: 42.0

TYPE OF DRILL: Mayhew 1000

HOLE SIZE:

CONTRACTOR: W. L. Sides

DRILLER: D. Vinecombe

LOGGED BY: R.E.J.

Metres	DESCRIPTION
	Siltstone and sandstone with minor clayey matrix. Qtz grains well rounded, fine to maximum diameter 3 mm. Pinkish grey.
33.0	Difficult drilling - Caving.
	As 30.0 m to 33.0 m
36.0	
	Clayey siltstone, dark grey Sample is almost pure sand due to caving.
39.0	
	As 39.0 to 42.0 metres
	Casing to 40 metres; unsuccessful.
42.0	HOLE ABANDONED at 42 metres in greyish black clayey siltstone.

SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn		
51212		5	<20	10		
51213		<2	<20	10		
51214		10	<20	15		
51215		5	<20	10		
WATER SAMPLE		100 ppb		1500 ppb	TDS 3.29 %	

CSR/0035

PACMINEX PTY. LTD.—FIELD DRILL LOG

0391

HOLE No. YD-15

PAGE 1 OF 2

PROJECT: Pandurra - 405
AREA: "Yudnapinna"
LOCATION: 6333C-4
STARTED: 1000
COMPLETED: 1630 2/05/76

DATE STARTED: 30th April 1976
COORDINATES:
ELEVATION:
DEPTH: 40.0 metres

TYPE OF DRILL: Mayhew 1000
HOLE SIZE: 115 mm
CONTRACTOR: W.L. Sides.
DRILLER: D. Vinecombe
LOGGED BY: R.E.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Sand - minor clay. calcareous. Light brown.	51216		10	<20	40
3.0						
	Sand and clay with calcrete. Qtz grains rounded to angular, mostly smaller than 1mm diameter. Light brown.	51217		10	20	30
6.0						
	Clayey sand. Moderate to light brown. Rounded qtzite gravel near base, maximum dimension 5cm, reddish brown to pale grey.	51218		10	20	30
9.0						
	Sandy and silty clay. Qtz grains very fine to 1mm maximum diameter, rounded to angular. Pale greenish yellow.	51219		5	<20	40
12.0	HCl - no effervesence.					
	Clayey and silty sand. Pale greenish yellow and yellowish grey. Minor gypsum	51220		15	<20	50
15.0	Moist					
	Sandy and silty claystone. Qtz grains maximum diameter .5mm. Yellowish grey	51221		10	<20	35
18.0	HCl - no effervesence. WET.					
	Claystone with minor fine qtz sand. Yellowish grey with moderate yellow pockets	51222		10	40	50
21.0						
	Silty claystone with sandy beds Light yellowish grey with dusky red pockets. Qtz grains well rounded to sub angular,	51223		5	20	40
24.0	maximum diameter 1 mm.					
	Silty claystone with sandy beds Light yellowish grey with dusky red and moderate yellow pockets.	51224		10	20	40
27.0						
	Silty claystone with sandy beds Light yellowish grey and light olive grey, minor dusky red and moderate yellow pockets.	51225		10	20	25
30.0	HCl - no effervesence.					

CSR/0035

0392 HOLE No. YD-15

PAGE 2 OF 2

PACMINEX PTY. LTD.—FIELD DRILL LOG

PROJECT: Pandurra - 405. DATE STARTED: 30th April 1976 TYPE OF DRILL: Mayhew 1000

AREA: "Yudnapinna" HOLE SIZE: 115 mm

LOCATION: 6333C - 4 COORDINATES: CONTRACTOR: W.L. Sides.

STARTED: 1000 ELEVATION: DRILLER: O. Vinecombe.

COMPLETED: 1630 2/05/76 DEPTH: 40.0 metres LOGGED BY: R.E.J.

Metres	DESCRIPTION	SAMPLE No.	Assay Length	ASSAYS Cu	Pb	Zn
	Silty claystone with sandy beds. Yellowish grey with dusky red pockets. well rounded grains of qtz and olive green material to					
33.0	3mm maximum diameter.					
	Sandy Siltstone. Sand very fine to coarse and consists of well rounded qtz and siltstone, reddish brown to olive grey. Qtzite	51226		15	20	25
36.0	pebbles, well rounded from 35 m.					
	Qtzite gravel - Qtzite, pale red to dark reddish brown, local greenish and yellowish tinges. minor	51227		70	60	60
39.0	pyrite golden to greenish grey. Qtz grains rounded and angular.					
	Qtzite, greyish red. Qtz grains maximum diameter 4 mm. Very minor pyrite.	51228		25	50	50
40.0						
	Hole stopped due to caving through broken casing below 30 metres. Rotary bit unable to penetrate solid qtzite.	51229		35	60	130

CSR/0035

APPENDIX II

CLASSIFICATION OF IGNEOUS ROCKS, PANDURRA AREA

Prospect 405

0394

PACMINEX PTY. LIMITED

CLASSIFICATION OF IGNEOUS ROCKS FROM THE PANDURRA AREA

PMR 81/76

SYDNEY

P.J. CURTIS

July, 1976.

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0395

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CONTENTS

		PAGE NO.
1.	INTRODUCTION	1
2.	SUMMARY	2
3.	PETROGRAPHIC INVESTIGATION	4
4.	REFERENCES	24

APPENDICES

I MEMORANDUM FROM D.G. TONKIN TO P.J. CURTIS DATED 16TH FEBRUARY, 1976. ENTITLED "PANDURRA IGNEOUS PETROLOGY".

II LOCATION MAP OF DRILL HOLES IN THE PANDURRA DISTRICT, E.L. 186. (IN POCKET)

III LOCATION MAP OF OK 68 DRILL HOLE, OAKDEN HILLS.

IV LETTER AND INSERT FROM DIRECTOR OF S.A. DEPARTMENT OF MINES TO THE MANAGER, PACMINEX PTY. LIMITED, DATED 10TH JUNE, 1976.

V SOUTH AUSTRALIA DEPARTMENT OF MINES, THIN SECTIONS ON LOAN TO PACMINEX PTY. LIMITED. FIGURES 16 TO 25.

LIST OF ILLUSTRATIONS

FIGURES				FOLLOWING PAGE NO.
	D.G. TONKIN SERIES Extrusive Rocks			
1	6333Y-1	(45934)	COARSE TRACHYTE	4
2	6333Y-2	(45942)	COARSE ANDESITE WITH INTERMIXED RHYOLITE	5
3	EX 36	(85718)	COARSE BASALT	9
4	EX 38	(?)	ANDESITE INTERMIXED WITH RHYOLITE	10
5	EX 40	(85798)	TRACHYANDESITE	10
6	EX 57)	(86138	ANDESITE (FINE GRAINED)	12
	)	TO		
7	EX 57)	86139)	ANDESITE (COARSE GRAINED)	12
8	EX 97	(86661)	BASALT (COARSER GRAINED)	14
9	EX 97	(86661)	BASALT (FINER GRAINED AMYGDALOIDAL)	14
10	EX 100	(86703)	PORPHYRITIC ANDESITE	15
11	EX 105	(86951)	ALTERED PORPHYRITIC RHYOLITE	16
12	EX 106	(86757)	PORPHYRITIC RHYODACITE	17

FIGURES				FOLLOWING PAGE NO.
13	EX 107	(86768)	ASSOCIATED RHYOLITE AND ANDESITE.	17
14	EX 114	(86878)	PORPHYRITIC RHYODACITE	19
				19
	Basic Intrusive Rock			
15	OK 68	(45236)	DOLERITE.	21
	SOUTH AUSTRALIAN DEPARTMENT OF MINES SECTIONS ON LOAN TO PACMINEX PTY. LIMITED			
16	TS 19839		ROOPENA DDH 1, 51.2'-51.6'.	APPENDIX V
17	TS 19858		VESICULAR TRACHYTE (ROOPENA AREA).	APPENDIX V
18	TS 19883		ROOPENA DDH 1, 100'.	APPENDIX V
19	TS 19884		ROOPENA DDH 1, 105.5'.	APPENDIX V
20	TS 19963		ROOPENA DDH 1, 307'.	APPENDIX V
21	TS 19964		ROOPENA DDH 1, 355'.	APPENDIX V
	Gawler Range Volcanics			
22	TS 29693		BASALT.	APPENDIX V
23	TS 30997		PORPHYRITIC RHYOLITE.	APPENDIX V
24	TS 30129		RHYODACITE.	APPENDIX V
25	TS 30998		ANDESITE.	APPENDIX V

KEYWORDS

SOUTH AUSTRALIA
PETROLOGY
8SI 53-04
9PANDURRA
IGNEOUS ROCKS
1976

1. INTRODUCTION

Twenty eight volcanic rock and basic intrusive specimens were thin-sectioned, the sections consisting mostly of mounted percussion drill chips. The problem was to sort the specimens into the various igneous categories of Roopena Volcanics, Gawler Range Volcanics and basic intrusives. Further thin sections were prepared, uncovered, for feldspar staining, which apart from indicating relict feldspar showed up igneous textures in fine detail. All rock specimens showed some alteration; some (particularly most basalts and andesites) showed advanced hydrothermal alteration, and yet others showed potash feldspar metasomatism.

Apart from the dolerite intrusive rocks and some sediments, all rocks from their intimate relationships and some affinities with rock types from Roopena D.D.H. 1 (S.A. Mines Department) are thought to be part of a Roopena Volcanic assemblage of mainly coarse grained tholeiitic (?) extrusives.

2. DISCUSSION/SUMMARY

Apart from the dolerite intrusive rocks of OK 68 (remote from the Roopena area), J 4 (6332) and J 7 (45817) the remaining rocks are a "mixed bag" of basalts, andesites, rhyodacites and rhyolites with some trachyandesites (?). (EX 34 and EX 40) both of which resemble somewhat TS 19858 (the trachyte specimen from isotopic age sample site, GA 369). Some specimens (6333Y-2, EX 38, EX 107 and EX 114) appear to be from a rhyolite:andesite contact and contain intermixed rhyolite and andesite fragments. Other specimens show quartz wacke containing rhyolite fragments (EX 33), quartz arenite with rhyodacite (EX 95). One suspected rhyolite tuff (6333Y-5), also occurs.

From the relationships above it is seen that coarse grained andesites and basalts are present in the Pandurra suite and these are somewhat similar to those seen in Roopena DDH 1 (South Australian Mines Department). These andesites and basalts show a contact with a rhyolite of the same assemblage which although very similar texturally and mineralogically to Gawler Range Volcanics, rhyolite and rhyodacite sections submitted by the South Australian Mines Department are likely from their association with Roopena andesites to be Roopena Volcanics of late stage differentiation. The modal trachytes are probably potash feldspathised andesites. Potash metasomatism of the more basic volcanic rocks present has taken place as have the hydrothermal processes of argillisation, phyllitisation and silicification.

Classification of sections into rock types:

Basalts	:	EX 32, EX 36, EX 97, P 19, A 9657 (Beda Bore)
Andesites	:	EX 57, EX 90, EX 100, P 24
Trachyandesites	:	EX 34, EX 40
Trachyte	:	6333Y-1
Rhyodacites	:	EX 92, EX 106, EX 108
Rhyolite	:	6333Y-6, EX 24, EX 31, EX 105, EX 113
Tuffaceous rhyolite	:	6333Y-5

Mixed rhyolite and andesite : 6333Y-2, EX 38, EX 107, EX 114.

Rhyolite or rhyodacite and sediment : EX 33.

Sediment : EX 46, EX 95.

Dolerites : OK 68, J4 6332, J7 45817.

3. PETROGRAPHIC INVESTIGATION

6333Y-1 (45934) (Figure 1)

Stained thin-section shows an abundance of fine sanidine laths with or without an etched unstained white mineral (quartz) as groundmass. Orthoclase phenocrysts occur.

Covered thin-sectioned percussion-drill chips :-

1) Carlsbad twinned laths (approximately 0.1 mm), unoriented, with limonite stained kaolinite between laths. Fractured orthoclase (?) phenocrysts present show alteration to sericite along fractures. Sericite lined unoriented veins of a low B.R. colourless mineral, occur.

ii) As for i) but greater alteration to sericite, more limonitised, i.e. more weathered. Interstitial chloritised oblong sections of pyroxene occur.

iii) As for i).

iv) As for i), but more phenocrysts of orthoclase and some amygdules occur which contain illite clay.

A trachyte which is unlike TS 19858 (Roopena D.D.H. 1, Figure 17) in having a less regular feldspar matrix, in containing phenocrysts of orthoclase and in not containing large amygdules of quartz mosaics. No quartz is present in sections of 6333Y-1.

Probably an intersertal, textured coarse grained trachyte.

Figure 1: Coarse grained trachyte. 6333Y-1 (45934).

Fine sanidine laths (clear, red-brown tinged and show cleavage) but no flow (see Fander, Ref. 5). One orthoclase phenocryst occurs (right bottom).

Plain polarised light Magnification X 96

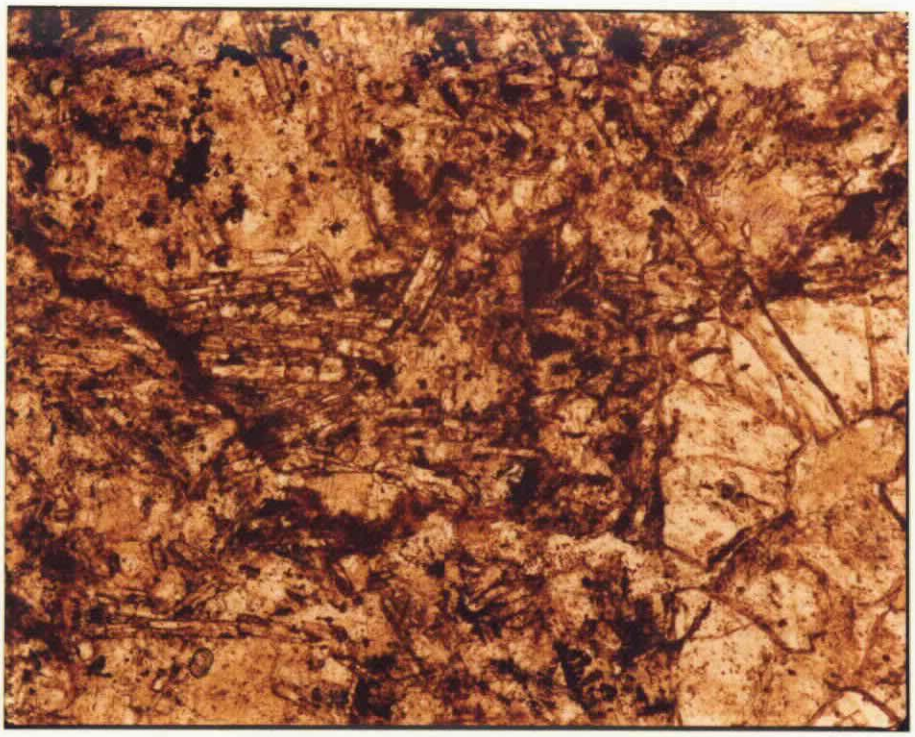


Figure 1

6333Y-2 (45942) (Figure 2)

Stained thin-section has the appearance of rhyolite as glassy intergrowths intermixed with pilotaxitic basalt. Potash feldspar is replacing plagioclase laths.

Microspherulites of rhyolite alternate with an unoriented pilotaxitic groundmass of squat laths in clear potash feldspar and water clear albite (?). Some myrmekitic growths occur.

An abundance of limonitised magnetite euhedra are present mainly in areas adjoining those of largely rhyolite spherulites. In those adjoining areas coarse plagioclase phenocrysts have been entirely sericitised. Patchy quartz of silicification has replaced glassy matrix around "ghost-like" decussate small plagioclase laths of andesite.

No sharp contact is seen between coarse grained andesite and rhyolite areas which show a narrow hybridised zone between the two phases.

6333Y-5 (46015)

Stained thin-section - "dacite" breccia fragments.

In covered thin section are seen glassy trachyte fragments in an andesite matrix.

Common fragments present are glassy rhyolite which shows flow patterns around an abundance of vesicles now containing clay mineral. Other fragments are of glassy rhyolite without vugs but with some ferruginised fragments. The latter contain fine relict sanidine laths, part altered to clay mineral, stained by reddish dust.

Many ferruginised fragments are seen. The matrix consists of limonitised and argillized fine rock fragments in sericite. Sedimentary quartz also

Figure 2: Coarse andesite with intermixed rhyolite. 6333Y-2 (45942).

Rhyolite veins (brownish tinge) intermixed with coarse andesite of decussate lath patterns associated with iron oxides, devitrified glass and chloritic clay.

Crossed nicols Magnification X 92

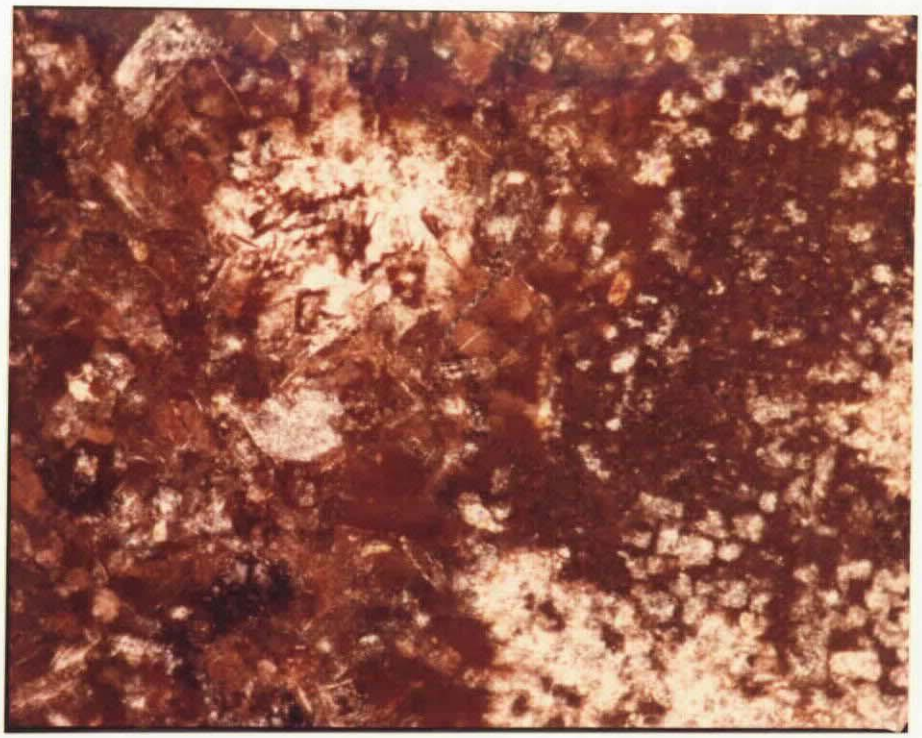


Figure 2

occurs in some "rhyolite" fragments.

Possible rhyolite tuff in vitroclastic and welded rhyolite substance. Part ferruginised and argillized.

6333Y-6 (46041)

Thin section stained for potash feldspar, stains a bright yellow with spherulite forms as per rhyolite.

Mostly an aggregate of microspherulites with radiating fibrous structures of tridymite laths (?) and potash feldspar, mostly iron oxide stained. Parts of section where not iron oxide stained show perlitic cracking and patchy alteration to amorphous clay mineral. Vesicles present contain quartz > carbonate. One large and some smaller orthoclase phenocrysts occur. The ferruginous sections of argillized glassy masses showing perlitic cracking resemble Roopena Volcanic sections P 478/67 (TS 19969) - basalt and P 502/67 (TS 19889) - andesite but no resemblance to "trachyte" of P 446/67 (TS 19858, Figure 17).

A resemblance to spherulitic iron oxide stained sections of Gawler Range Volcanics, porphyritic rhyolite (TS 30997) and rhyodacite (TS 30129) of S.A. Mines Department (Figures 19 and 21) is seen, but these are characteristically more altered (to clay minerals and are silicified) than the rhyolites of Roopena Volcanics now being discussed.

EX 24 (88529)

Stained thin section shows chips that have part plagioclasic groundmass appearance of rhyodacite.

Argillised rhyolite of microspherulitic aggregates and part-argillised orthoclase phenocrysts. Iron oxide blebs are more prolific than in 6333Y-6 (46041).

Altered glassy porphyritic rhyolite. Degree of alteration is not as great as that seen in rhyolites of Gawler Range Volcanics; phenocrysts are orthoclase.

Spherulitic rhyolite.

EX 31 (85618)

Microspherulitic rhyolite with part clear orthoclase phenocrysts are somewhat argillized. Abundant scattered iron oxides occur but groundmass is ferruginous, red, dusty. Compared with Gawler Range (TS 30997, Figure 19) the latter is largely silicified; phenocrysts present are sericitised orthoclase.

Spherulitic rhyolite.

EX 32 (85630)

Stained thin-section shows sanidine as unoriented laths with iron stained etched plagioclase and about three percent euhedral quartz (?). Finer grained sections present show no quartz.

Sections of various percussion drill pellets :

i) Part-argillised, long, lath-like feldspar network shows patchy sericitisation. Opaque oxides occupy interstices, occur to seven to ten percent and limonite stained sericite areas are fairly abundant; no quartz.

ii) Not at all like i). A mass of small and tubular ovoid vugs are filled with clay mineral, (possible illite) and bound by limonite which forms broad marginal zones to vugs.

iii) Ferruginised glassy volcanic fragments show poorly defined vug partitions, now silicified and clay mineral pseudomorphs microlites.

iv) As for i), but fine grained.

Possible argillized and potash metasomatised basalt phases.

EX 33 (85658)

Stained thin-section indicates fine flecks of potash feldspar in most sections.

Various sections of percussion drill pellets :

i) Fine grained argillite of quartz (40 percent), chert, potash feldspar and sericite, partly limonite stained. Quartz grains are quite rounded and are of finer silt size. Fragments of part argillized rhyolite are present.

ii) Quartz wacke of abundant sericite, quartz grains are of irregular size but are generally rounded, abundant leucoxene, a little chlorite, detrital tourmaline and scattered fine opaque mineral. One section shows large fragments of microspherulitic rhyolite in quartz wacke, and this shows similar alteration to Gawler Range Volcanics, (TS 30997, silicified rhyolite, S.A. Mines Department). (Figure 23).

Quartz wacke contains rhyolite fragments.

EX 34 (85672)

Stained thin-section shows a trachytic groundmass of sanidine laths and fewer squat plagioclase prisms. Rounded quartz phenocrysts, orthoclase phenocrysts and part (perthitic ?) phenocrysts.

Various sections of percussion drill chips :

i) In thin section it is seen that fine interlocking sanidine laths are tinged red with limonite. Large phenocrysts show patchy orthoclase in (albite ?) but lamellar twinning is not evident. Ferromagnesian mineral (biotite ?) is silicified

and limonitised. Possible silicified and limonitised biotite also occurs in groundmass. Iron oxide as magnetite euhedra occur to 10 volume percent. A possible altered trachyandesite.

ii) Vesicles present contain radiate clay mineral forms, limonite stains occur in one section of altered andesite or trachyte.

iii) Vesicular basalt or trachyte of limonitised hyalopilitic groundmass of microlites and glass. Vesicles contain limonite stained clay with radiate habit (pyrophyllite ?).

Evidence gathered from the sections observed show the rock to be a possible trachyandesite, shows some resemblance to TS 19858 (trachyte) from Roopena D.D.H. 1 (Figure 17).

EX 36 (85718) (Figure 3)
No stained thin section

Thin-sections of mounted drill chips :

i) Altered, sericitised decussate small plagioclase laths with interstitial clay mineral; vugs contain serpentinous chlorite, and are fairly abundant. Tuffaceous sediment is present as xenoliths of limonite-stained rock containing fragments of basalt and sedimentary quartz, a little carbonate. Large magnetite grains are abundant.

ii) As for i) but serpentinous clay shows alteration to greenish chlorite.

Coarse grained basalt , similar in texture to A 9657 (Beda Bore), but more altered.

Figure 3: Coarse grained basalt. EX36 (85718).

Intermeshing plagioclase laths, chlorite and iron oxides. Serpophite is seen to fill amygdules. Pyroxene grains (not clearly seen here) are pseudomorphed by chlorite.

Crossed nicols Magnification X 95

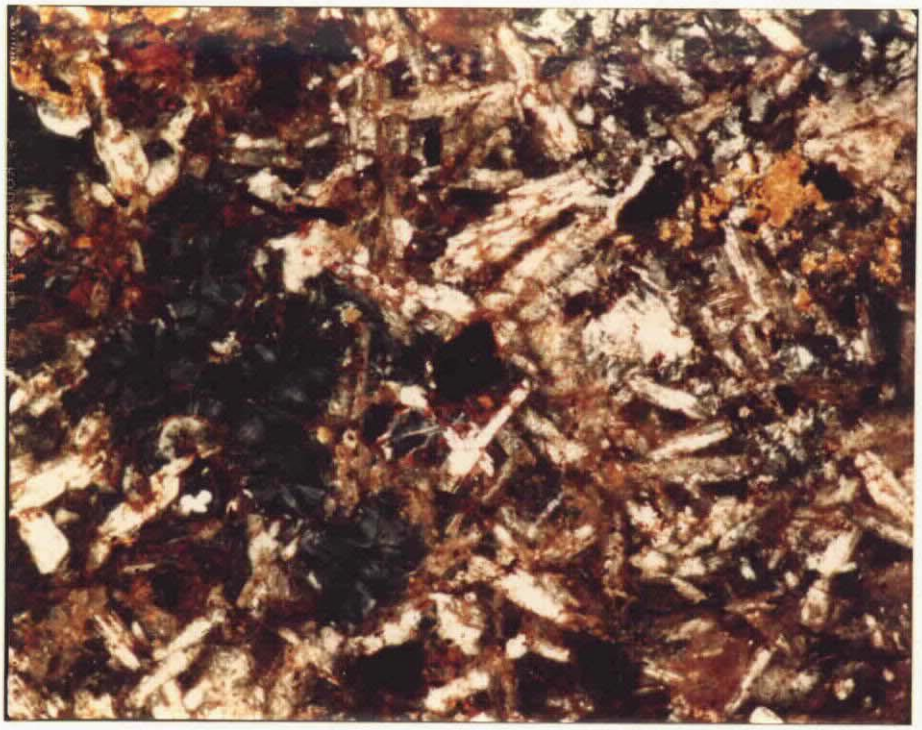


Figure 3

EX 38 (?) (Figure 4)

Stained thin section: some non-stained but etched volcanic fragments appear to contain yellow stained rhyolite, glassy fragments.

Thin section of drill chips :

i) Andesite with a groundmass of unoriented plagioclase laths and some phenocrysts with fragments of argillised rhyolite of altered spherulitic forms. Limonitised clay fills irregular cracks in rock. Veins of rhyolite, now much argillized and silicified appear to penetrate andesite.

ii) As for i) for andesite, but rhyolite present has been largely carbonatised then silicified.

iii) As for i).

iv) As for i).

v) As for i), but green chlorite occurs replacing interstitial minerals of groundmass and has possibly replaced spherulites in rhyolite.

Andesite shows some incursion by and veins of rhyolite substance and some intermixing is apparent.

EX 40 (85798) (Figure 5)

Stained thin section : patchy potash feldspar stain of fine unoriented laths and shows selective staining of phenocrysts along cleavages. Extent of staining varies from drill-chip to drill-chip (varying from 2 to 15 percent of groundmass of each chip). Unstained chloritised hornblend phenocrysts are seen.

Figure 4: Andesite intermixed with rhyolite. EX38(?).

Spherulitic rhyolite showing some alteration, (top left of photograph) in contact and intermixing with coarse andesite of intermeshing plagioclase laths tinged red-brown, chlorite and iron oxides.

Crossed nicols Magnification X 92

Figure 5: Trachy andesite or feldspathised andesite. EX40 (85798).

Oligoclase phenocrysts (white, left of centre). The intermesh of fine laths are white, flecked with green or brown-red here. From stained section interstitial laths show patchy potash feldspar and andesine with some partially altered andesine laths. Abundant interstitial chlorite and limonitised opaques are to be seen.

Crossed nicols Magnification X 91

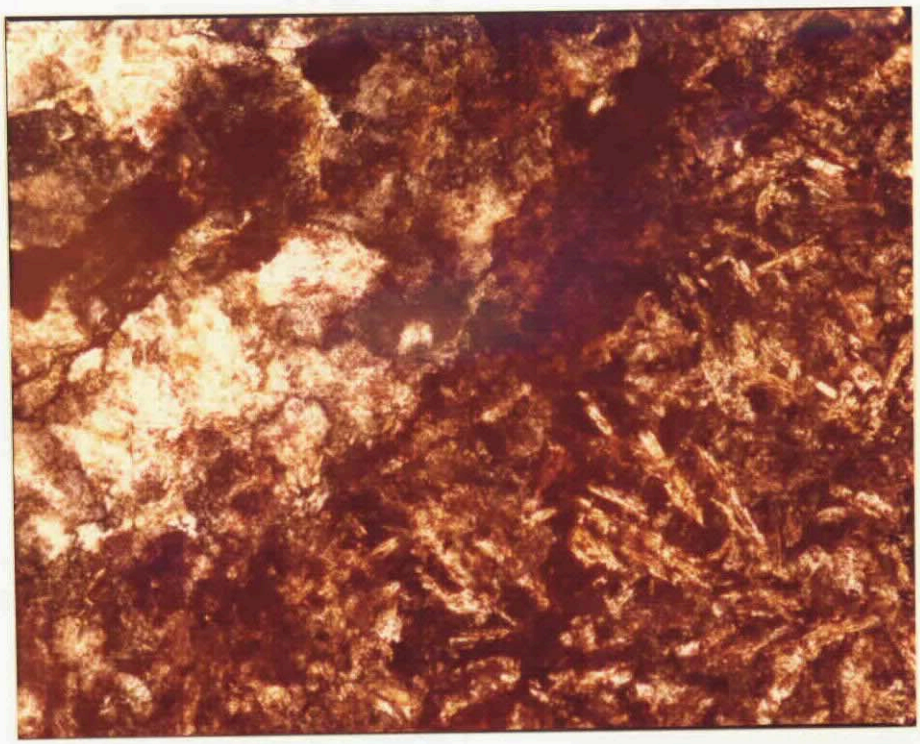


Figure 4



Figure 5

Thin sections of percussion drill chips :

i) Slender feldspar occurs as decussate laths; alteration is only slight. Twinned fresh phenocrysts of oligoclase occur. Interstitial altered hornblende occurs commonly as many small cross sections or phenocryst forms altered to green chlorite. Vugs present contain serpentinous clay. Patchy quartz occurs. Scattered groups of fine leucoxene granules pseudomorph magnetite.

ii) As for i) but a part chloritised plagioclase feldspar phenocryst is seen.

Trachandesite, which bears some resemblance in texture and mineralogy to TS 19858 (trachyte).

EX 46 (85940)

Stained thin-section shows quartzose bands which contain fine potash feldspar as fragments; one chip shows irregular fragments of potash feldspar scattered through the section.

Thin sections of percussion drill chips :

i) Bands of subangular to angular quartz and potash feldspar, irregular sized with associated coarse carbonate, mainly calcite, which alternate with finer bands of silty quartz and limonite stained dolomite.

ii) As for i) but not banded.

iii) A more regular grain size of dolomite - (1:1 HCL test indicates coarser carbonate in bands to be calcite; finer carbonate to be dolomite). Quartz and feldspar tend to be angular grains.

Calc-arenite and calcilutite bands as sediment containing fragmentary potash feldspar.

EX 57 (86138-86139) (Figures 6 and 7).

Stained section: an abundance of fine feldspar laths have stained for potash and these are likely to be metasomatised mineral groundmass. Unchanged plagioclase phenocrysts are seen.

i) Feldspar phenocrysts and fragments are argillized to kaolinite. Groundmass is of metasomatised fine laths and blebs of potash feldspar (altered plagioclase lath networks ?). There is a great abundance of fine iron oxide - not normally seen in the rhyolites. Also phenocrysts in the rhyolites are not commonly fragmented.

ii) Weathered coarse andesite is abundantly argillised. Chlorite areas are now limonitised. Plagioclase occurs as squat, zoned decussate laths which are argillised. An abundance of limonite occurs throughout.

iii) Various stages of argillised coarse basalt showing various stages of alteration to a point where the feldspar framework disappears into fine clay mineral as blocky "equigranular" sericite aggregate forms.

Argillized and altered potash feldspar metasomatised coarse andesite structure similar to that in TS 30998, (Roopena D.D.H. 1). Potash feldspar in all cores has penetrated right through the section; but phenocrysts have argillised > sericitised.

Potash metasomatised and argillised andesite.

Figure 6: Andesite, fine grained. EX57A (86138 to 86139).

Altered matrix of fine laths of feldspar and abundant iron oxides. Plagioclase phenocrysts (centre and right side of photograph) are also argillised. Clear quartz grains (blue-grey) occur.

Crossed nicols Magnification X 90

Figure 7: Andesite, coarse grained. EX57B (86138 to 86139).

Altered interlocking plagioclase laths in dense iron oxide which stains matrix. Coarser phenocrysts (near centre and right of centre of photograph) are altered but less iron-oxide stained.

Crossed nicols Magnification X 95

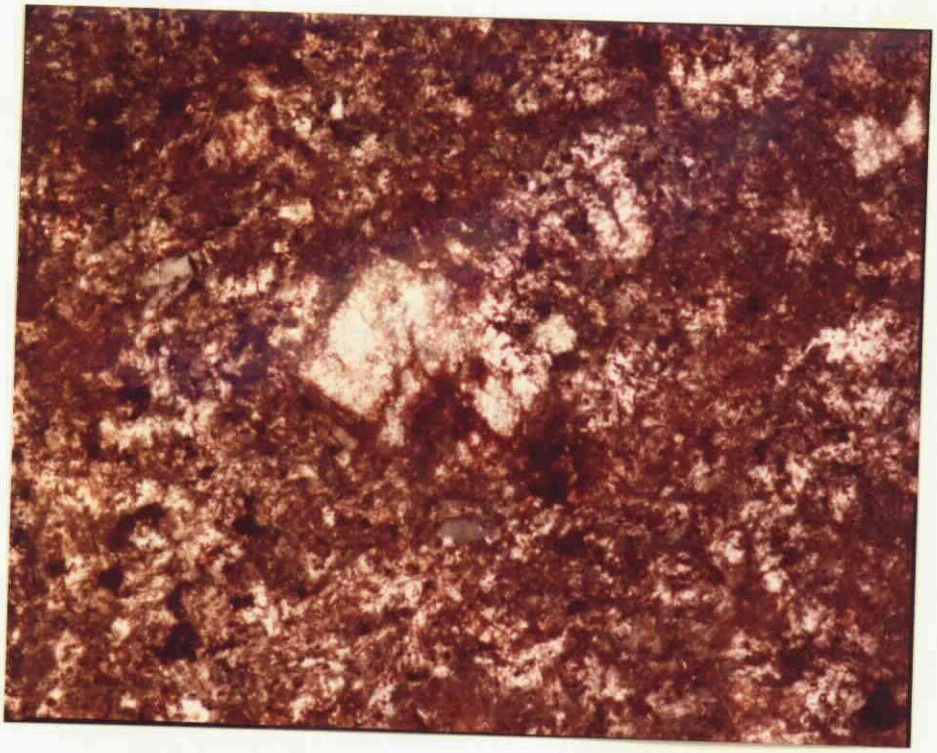


Figure 6

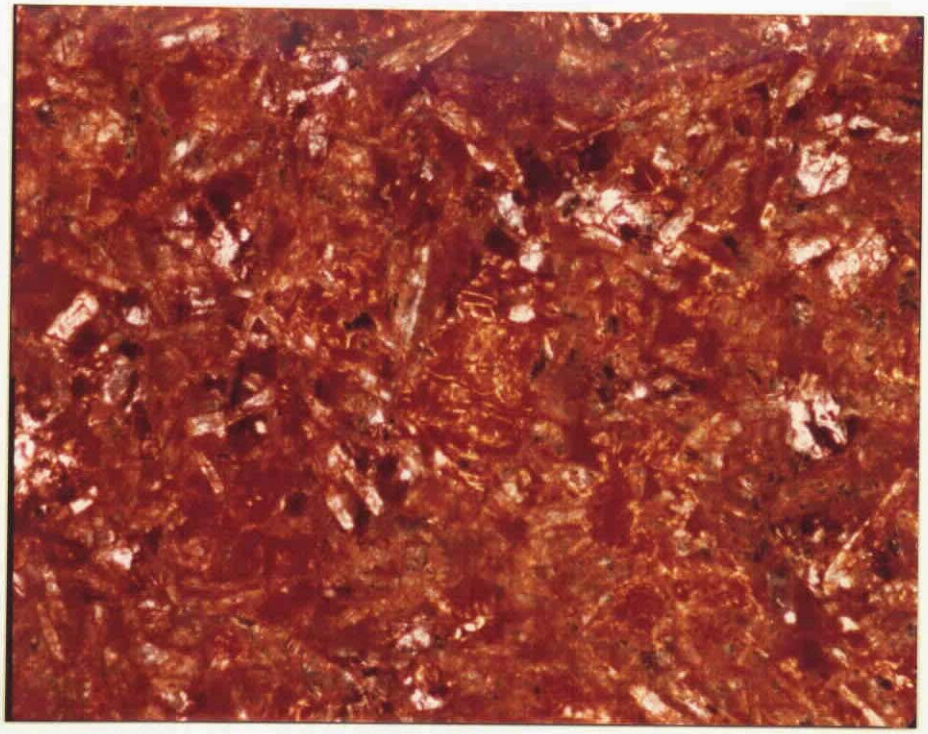


Figure 7

EX 90 (86573)

Stained thin section; shows abundance of potash feldspar blebs in a neutral matrix. The blebs are uniformly distributed. Unstained rounded amygdules occur. Sericitised coarse fragments are seen.

Somewhat similar to EX 57 but with more feldspathised rock fragments, i.e. potash feldspathised > argillised. A relict decussate fine feldspar network can be seen around edges of sections, etc. Groundmass is generally now mainly altered to potash feldspar or argillised to "blocky" fragments of clay mineral. Some apatite clusters of prisms are seen; a proportion are associated with a chloritised amphibole. Amygdules are filled with amorphous clay mineral. Ilmenite fragments show characteristic rhombohedral cleavage outlined by limonite residues.

Much altered porphyritic andesite.

EX 92 (86583)

No stained thin section.

Sections of percussion chips :

i) Recrystallized rhyolite of reddish-brown stained quartzo-feldspathic aggregates (originally micro-spherulites), large fresh oligoclase and fewer smaller orthoclase phenocrysts. Also rounded quartz phenocrysts occur to a less extent than feldspar phenocrysts. Yellow fine glassy aggregates of porphyritic rhyodacite with ortho-clase and plagioclase corroded phenocrysts. Very similar to TS 30990 of similar name from Gawler Range Volcanics - the latter are silicified and feldspar phenocrysts of Gawler Range Volcanics specimen show cloudy alteration to clay mineral and patchy yellowish glass occurs (?) as "sheared lenticles" within the feldspar mass, along prismatic cleavages.

ii) Similar to i) but more feldspar phenocrysts; plagioclase shows sericitisation along cleavages.

iii) Shows irregular silicification. Gawler Range Volcanic rhyolites appear to show an overall silicification effect of fine quartz replacing "microspherulites" and interstices.

An altered rhyodacite.

EX 95 (86635)

No stained section.

Thin sections of percussion drill chips :

i) Rhyolite of sericitised microspherulites contains an abundance of large and small (sand sized) rounded quartz as in EX 92 rhyodacite described. Zoned feldspar phenocrysts are completely sericitised. A drastically altered rhyodacite.

ii) Irregular quartz arenite with large sand sized spherical grains. Bimodal silt-sized quartz matrix; a little carbonate and amorphous clay. An abundance of rutile occurs associated with silt size quartz. Stream channel deposit.

iii) As for ii).

Quartz arenite and rhyodacite.

EX 97 (86661) (Figures 8 and 9).

No stained thin-section.

Thin sections of percussion drill chips :

i) Fine grained altered variolitic basalt of sericitised and silicified variolitic shapes contain abundant limonite specks, as for

Figure 8: Basalt, coarser grained. EX97 (86661).

Coarse altered plagioclase phenocryst (left side of photograph). Interlocking feldspar laths, mainly altered to clay and chlorite. Abundant iron oxides.

Crossed nicols Magnification X 90

Figure 9: Basalt amygdaloidal, finer grained. EX97 (86661).

Large amygdule containing chlorite and iron oxides (top right of photograph). Variolitic areas of variable chlorite, feldspar and iron oxide specks are seen. Silicified feldspar phenocryst occurring is white with chlorite specks.

Crossed nicols Magnification X 92

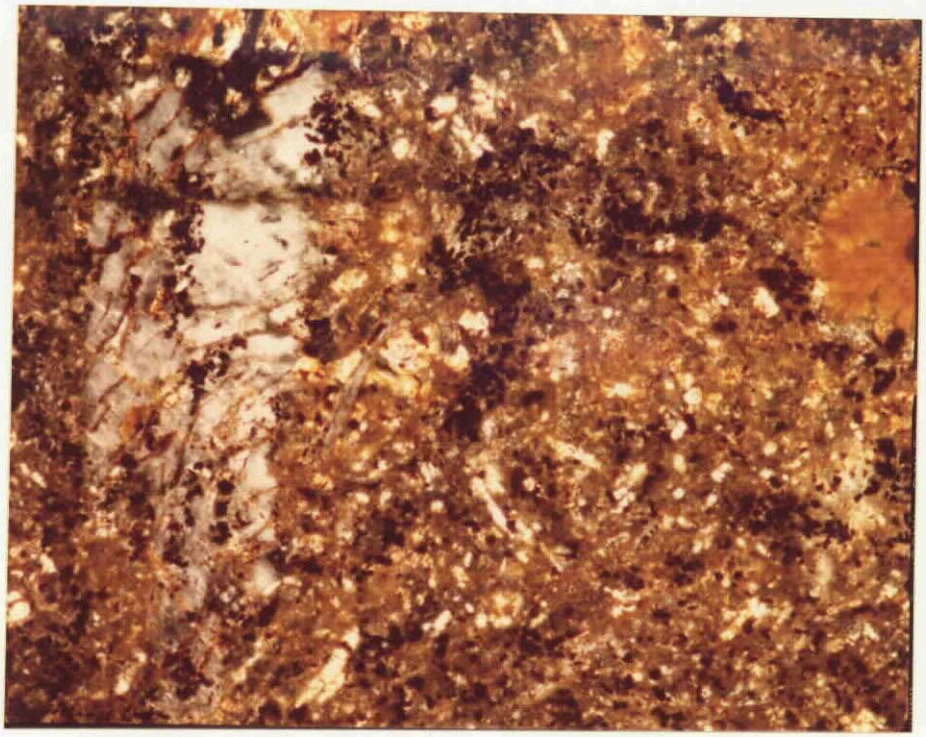


Figure 8

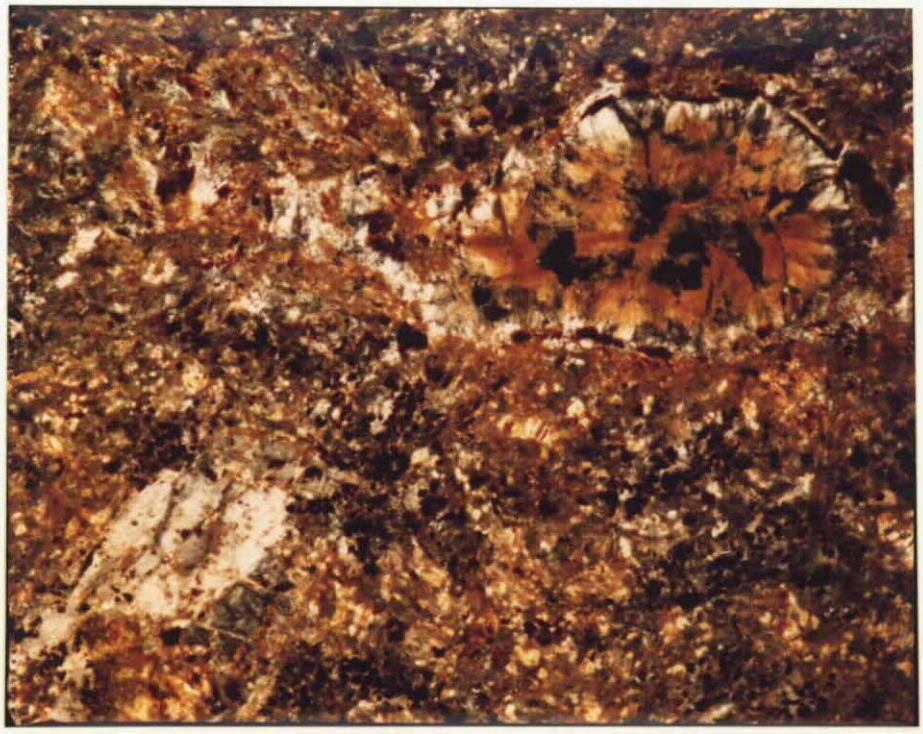


Figure 9

Roopena Volcanics section TS 19839 but texturally more like Gawler Range Volcanics slide TS 29693 (Figure 22) where however phenocrysts have been silicified. No twinning is seen in plagioclase of Roopena Volcanics basalt TS 19837 or of EX 97 (86661) (i), but both remain feldspathic.

As in rhyolites examined, those other volcanic rocks of D.G. Tonkin series and S.A. Mines Department Roopena Volcanics are generally less altered-spotty and overall less cloudy than those of Gawler Range Volcanics, S.A. Mines Department.

ii) Coarse basalt of fine plagioclase laths and larger plagioclase phenocrysts, abundant magnetite (now limonitised), clay mineral and sericite. Generally similar to Gawler Range Volcanics basalts texturally, but actinolite as seen in TS 29693 (Gawler Range Volcanics) is absent.

To summarise, sections show :-

i) Texturally similar to Gawler Range basalts, but with lack of Gawler Range Volcanics background cloudiness.

ii) Texturally similar to Roopena Volcanics basalts, and a lack of Gawler Range Volcanics cloudiness.

A variolitic basalt type and a coarser grained basalt.

EX 100 (86703) (Figure 10)
Stained thin-section: matrix is stained uniformly bright yellow for potash feldspar. Phenocrysts are etched and unstained.

All chip sections are similar and show potash feldspathised andesite; primary structure is similar to TS 19885 of Roopena Volcanics, D.D.H. 1. A felt of altered plagioclase laths (some are zoned) in

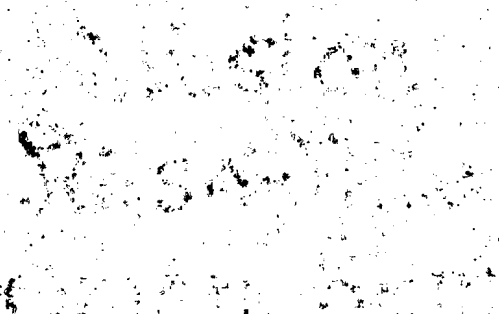


Figure 10: Porphyritic andesite. EX100 (86703).

Felt of interlocking feldspar laths which have been part potash feldspathised. Matrix is now largely potash-rich glass. Some feldspar phenocrysts contain limonite and chlorite (right edge of photograph). Amygdule with clay and limonite (left centre of photograph).

Crossed nicols Magnification X 90

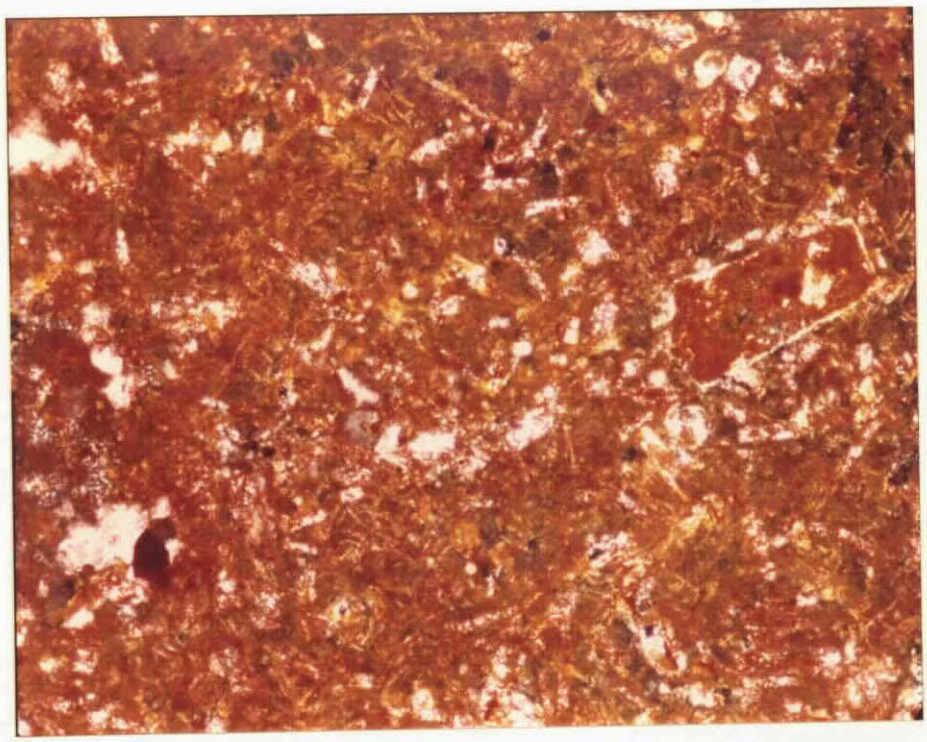


Figure 10

heavily limonitised potassic "glass" is seen. Phenocrysts of silicified laths of plagioclase are scattered around or occurs as intergrowths in the finer feldspar felts and in "glass". Amygdules contain quartz and clay mineral. Occasional xenoliths of quartz arenite as per EX 46 occur.

Potash feldspathised and silicified, tholeiitic porphyritic andesite.

EX 105 (86951) (Figure 11)
Stained thin-section: indicates potash feldspathic matrix, but non-stained feldspar phenocrysts > quartz phenocrysts occur.

The shapes and abundance of feldspar phenocrysts, now argillised suggest this rock to be an altered porphyritic rhyolite (c.f. Gawler Range Volcanic TS 30997 , Figure 23). The Gawler Range section shows a greater abundance of fine clay particle inclusions in "spherulite" structures. For EX 105, alteration of feldspar phenocrysts is almost totally that of kaolinisation except for patchy sericite alteration and fractures in feldspar are filled by sericite. The remainder of section consists of aggregates of altered fine feldspar matrix and "glass" potash feldspar specked by fine limonite, and quartz (including veins). Large originally titanomagnetite grains consist now of only limonite and leucoxene. Lenticles of leucoxene present contain brownish chlorite. Occasional large feldspar phenocrysts are patchy perthitic intergrowths, now partly silicified, with plagioclase areas which are now argillised. Possible rare chloritised hornblende phenocryst shapes also contain clay mineral and iron oxides. Phenocrysts show evidence of corroded crystal outlines which occurred before argillization.

An argillized porphyritic rhyolite.

Figure 11: Altered porphyritic rhyolite. EX105 (86951).

Argillised orthoclase phenocrysts (centre of photograph) are surrounded by argillised microspherulites (brownish to white).

Crossed nicols Magnification X 92

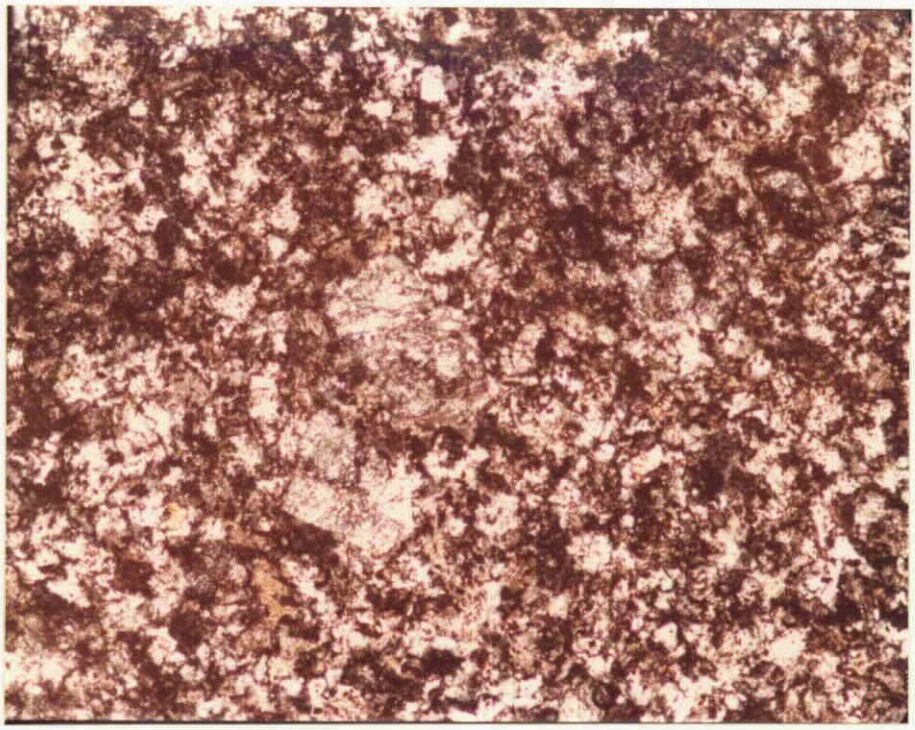


Figure 11

EX 106 (86757) (Figure 12).

Stained thin section: groundmass has strongly stained for potash feldspar. Some phenocrysts show part-replacement by feldspar, others remain unstained and unetched.

A mosaic of microspherulites of potassium feldspar intergrowths with quartz occupies interstices between spherulites. Feldspar phenocrysts present are completely argillised or are anattacked and unaltered except for slight limonite specking. Presumably the former phenocrysts are altered plagioclase and the latter are orthoclase. If so there are rather more orthoclase than plagioclase phenocrysts present. Similar to Gawler Range Volcanic rhyolites porphyritic rhyodacite (TS 30990) but as is usual with the D.G. Tonkin rhyolites the rock groundmass is generally clearer and not so cloudy from alteration.

A porphyritic rhyodacite.

EX 107 (86768) (Figure 13)

Stained thin section: lenticles and vugs present are lined by narrow zones rich in potash feldspar. Some fragments of potash feldspar are seen in a background of lightly coloured yellow stained sericite. Two rock types appear to be present, one glassy, the other microcrystalline.

A sericitised vesicular rhyolite, only one unaltered orthoclase lath occurs in one chip section. Red tinged microspherulites are sericitised and are of similar size to those seen in EX 106, albeit more altered. Vesicles contain quartz but are rimmed by a zone of fresh potash feldspar. Outside the red tinged area of microspherulites and in sharp contrast with it is an andesite with plagioclase, pilotaxitic microclites now altered to sericite, and chloritic groundmass, chlorite veins, chloritised hornblende

Figure 12: Porphyritic rhyodacite. EX106 (86757).

Altered perthite phenocryst (centre) surrounded by a 'mosaic' of potash feldspar spherulites with iron oxide stain.

Crossed nicols Magnification X 90

Figure 13: Associated rhyolite and andesite. EX107 (86768).

Microspherulitic rhyolite (left of photograph) in sharp contact with altered andesite with chlorite and clay mineral of altered feldspar microlite matrix and argillised feldspar phenocrysts (right side of photograph).

Crossed nicols Magnification X 92

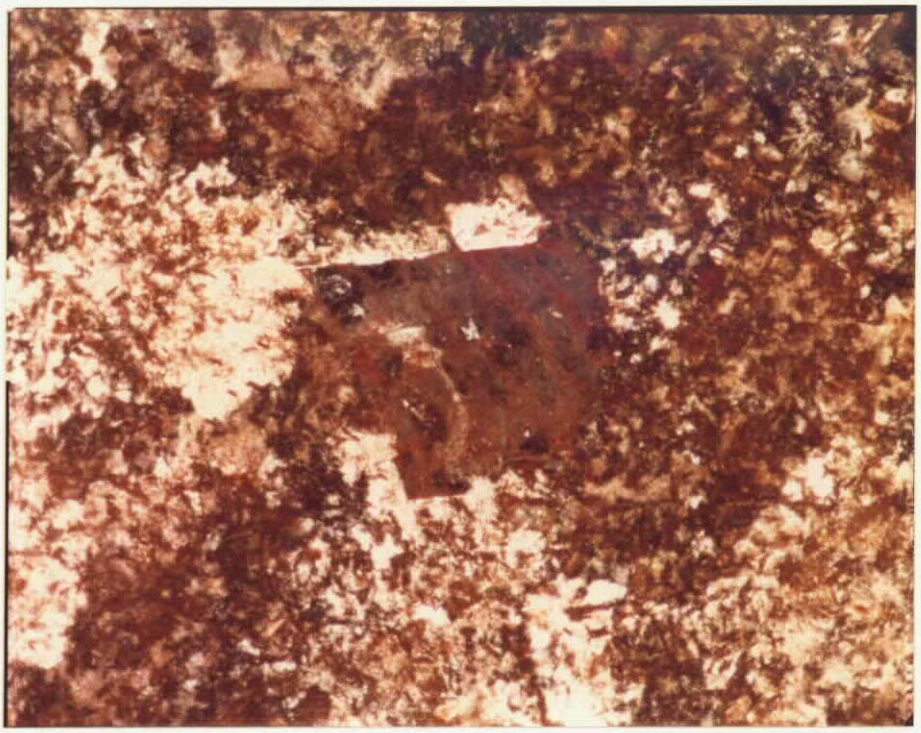


Figure 12

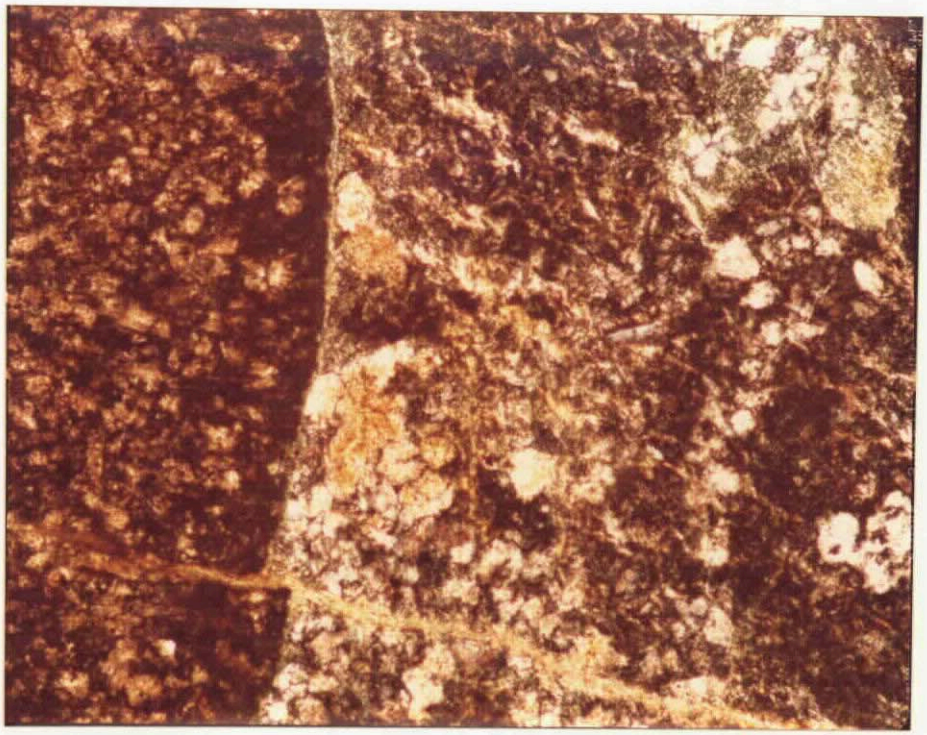


Figure 13

phenocrysts and amygdules filled with quartz are seen. A part digested (?) orthoclase xenocryst occurs.

A possible andesite-rhyolite contact. Parts of andesite in rhyolite and vice versa (?) occur with no thermal contact alteration effects now observed.

Andesite intermixed with rhyolite.

EX 108 (86779)

Stained thin-section: some fragments have corroded (?) inclusions of potash feldspar; others are stained overall bright yellow for potash feldspar.

Mainly fragments of adjoining reddish tinged microspherulites are seen to contain flecks of limonite. Some chips contain fragments of orthoclase which are clear except for patchy limonite staining. Sericitised, plagioclase crystals occur in some mounted fragments. Corroded quartz grains and a little chalcedony occupies vugs.

An altered porphyritic rhyodacite.

EX 113 (86872)

Stained thin-section: closely packed stained potash feldspar granules represent the groundmass. Perthite phenocrysts of mixed orthoclase , stained yellow and white etched plagioclase are present and unetched quartz phenocrysts are also seen.

Orthoclase phenocrysts are fresh and clear in some slides, part sericitised in others, quartz fills vugs.

Red tinged and colourless microspherulites occur of potash feldspar composition and a little quartz is seen to be intergrown, part graphically with the feldspar. Some silicified matrix areas occur.

Quartz fills amygdules.

Somewhat similar to Gawler Range Volcanics, rhyolite TS 30579 (S.A. Mines Department) but is much more clear of fine mineral inclusions than the Gawler Range rhyolite.

Porphyritic rhyolite.

EX 114 (86878) (Figure 14)
Stained section: a fine aggregate of bright yellow (potash feldspar) stained grains represents the matrix. Phenocrysts, unstained are etched, (plagioclase).

Thin-sections of unstained percussion drill-chips :

i) Mainly aggregates of recrystallized microspherulites which are red tinged. Orthoclase phenocrysts show heavy staining by limonite and slight alteration to sericite along cleavage, otherwise the grains are clear.

Coarse octahedra of limonitic leucoxene probably altered titanomagnetite(?) occurs, and some slightly corroded rounded quartz phenocrysts. Phenocrysts present which are argillized are assumed to be altered plagioclase. Scattered fine opaque inclusions occur distributed moderately throughout the section.

Quartz tends to concentrate as thin lenticles between microspherulites.

A porphyritic rhyodacite.

ii) An altered argillised felt of microlites form a shadowy greyish groundmass contains an abundance of dispersed iron oxides. Phenocrysts of plagioclase (?) are grossly sericitised. Large cubic intergrowths, (limonitised pyrite ?) occur.

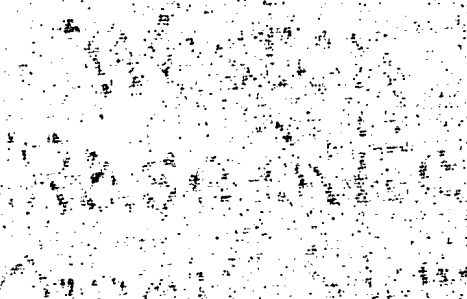


Figure 14: Porphyritic rhyodacite. EX114 (86878).

Red tinged microspherulites mainly. Part of stained orthoclase phenocryst (right of photograph). Somewhat argillised plagioclase phenocryst (bottom left of photograph). Abundance of iron oxide flecks is noted.

Crossed nicols Magnification X 88

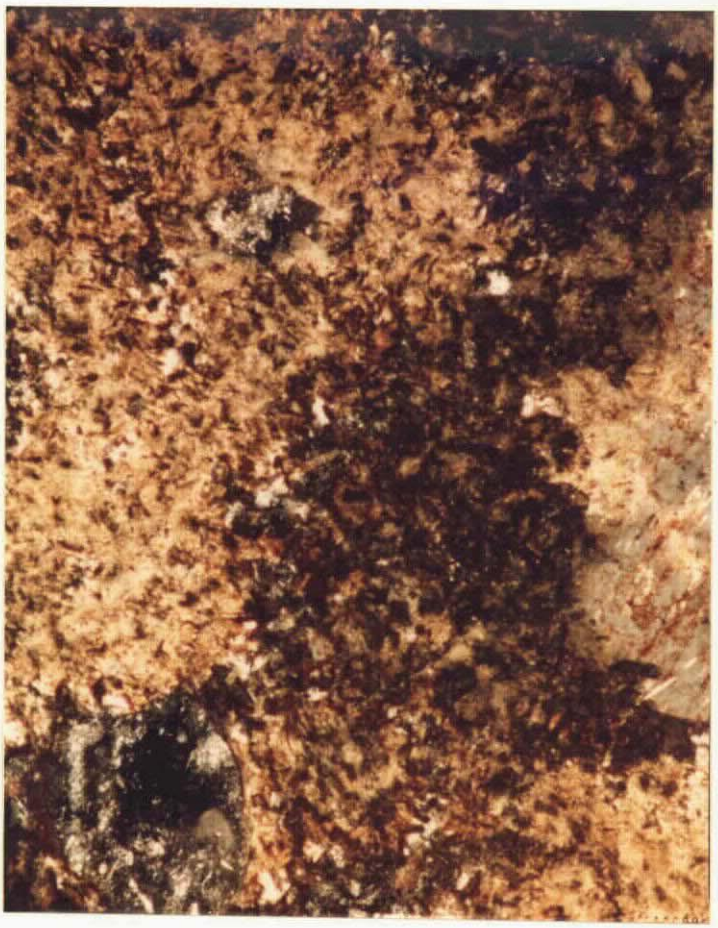


Figure 14

Aggregates of iron oxides and some chlorite suggests the shapes or original hornblende phenocrysts.

A porphyritic (pilotaxitic) andesite.

There is a strong resemblance of EX 114 (ii) to P 24, Roopena Volcanics in texture and degree of alteration. There is also a textural resemblance to Gawler Range Volcanics andesite, TS 30998 (Figure 25) but fresh pyroxene occurs in this rock and it is generally much fresher. Little resemblance is seen to the coarser grained andesite from the South Australian Mines Department, Roopena D.D.H. 1 which is in any case clearer and fresher in patches where the latter is not carbonatised/chloritised.

PREVIOUSLY EXAMINED ROOPENA VOLCANICS (COLLECTED BY D.G. TONKIN)

P 19 A volcanic rock with a coarse decussate plagioclase feldspar groundmass and few small chlorite filled pyroxene sections, occasional large hornblende phenocrysts now pseudomorphed by chloritic clay and large porphyritic feldspars, and amygdules now filled with quartz. There is a great abundance of massive iron oxides (15 to 20 percent) rather than loose aggregates of limonite dust.

Porphyritic basalt.

Roopena Volcanics.

P 24 Could be a porphyritic andesite or porphyrite since the groundmass is apparently argillised, and micro-crystalline. Phenocrysts present are altered, sericitised plagioclase and some show areas of very clear lamellar twinning. Occasional large corroded quartz phenocrysts occur as seen in dacite but fewer occur than are common in dacite.

More likely to be a Roopena Volcanics andesite (than Gawler Range Volcanics andesite as previously reported, Reference 2), as dictated by its stratigraphic position.

A 9657 (Beda Bore)

After studying B.H.P. petrographic reports (Reference 7) and Roopena Volcanics thin-sections of basalts it is thought that this rock is a coarse grained basalt containing abundant amygdules of chlorite. This agrees with the views of B.P. Thomson of the S.A. Mines Department. The rock consists of decussate medium grained plagioclase laths and interstitial amygdules containing as mentioned above, abundant chlorite. Small subophitic chlorite pseudomorphs of augite and possible large altered olivine (?) grains occur. Some 'amygdules' grew (?) after feldspar crystallization since encroachment by chlorite feldspar groups is seen.

Probable central zone of a basalt flow.

Roopena Volcanics.

HYPABYSSAL DOLERITE INTRUSIVES

OK 68 (45236) (Figure 15)

An intensely argillized coarse grained dolerite of unoriented, now brownish tinged plagioclase laths where not completely altered to clay mineral. Chlorite and actinolite occupy the interstices, with opaque iron oxides, primary coarse magnetite forms and some abundant concentrations of specks of the mineral associated with chlorite. Relict augite (diopside?) forms occur in places.

Silicification by a quartz vein which cuts through one section is seen. One argillized large olivine (?) grain is seen.

An argillized, dolerite - intrusive rock.

Figure 15: Dolerite. OK68 (45236).

Argillised decussate plagioclase laths and blue-green chlorite relicts of altered pyroxene. Dense iron oxides are present mainly from primary magnetite.

Crossed nicols Magnification X 94

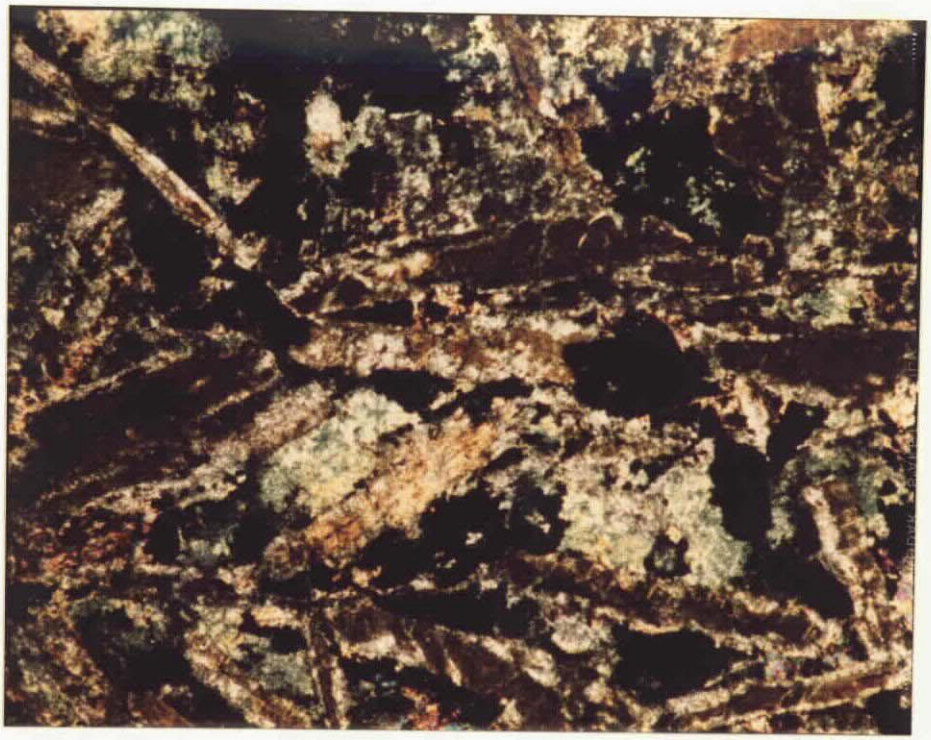


Figure 15

J 4 (6332)

No stained section available.

Altered coarse dolerite, texturally similar to 45236 but carbonatised. Plagioclase laths are altered to carbonate or are part silicified. Subophitic ferromagnesian augite and less olivine (?), now entirely altered to anhedral fibrous masses of pale blue-grey fibrous chlorite (10 percent of section). Iron oxides are mainly present as large magnetite euhedra (largely altered to leucoxene and limonite), with some fine opaque oxide inclusions along cleavages of altered pyroxene grains. Magnetite occurs altogether to 7 percent.

Altered dolerite intrusive.

J 7 (45817)

No stained section available.

Thin sections of percussion drill chips :-

i) A carbonate and chalcedonic quartz concretion with segregations of layered iron oxide grains and carbonate. Chalcedony pseudomorphs possible spherulitic masses.

ii) Altered, carbonatised coarse dolerite, very similar to J 5 (6332) but subophitic iron oxides occur to 10 to 12 percent of section. Interstitial, minimal chlorite present contains secondary iron oxides. Locally, feldspar is sericitised rather than carbonatised but the latter alteration has followed the sericitisation process. Possible potash feldspathisation associated with fine symplectic intergrowths of potash feldspar and albite are seen as are common in Capertee metadolerite (Reference 1).

Some bending of feldspar laths due to minor rock dislocation which occurred during feldspathisation, is seen.

iii) As for i) but along one side of the section is an acid glassy differentiate as seen on the edge of the LY 3 type of dolerite intrusive at Mount Gunson (Reference 3). This is separated from a quartz:carbonate concretion by a dense iron oxide band.

iv) Concretion as in i) cemented to much sericitised metadolerite.

Contact of metadolerite and concretion shows abundance of non-feldspathic microspherulitic aggregates, altering to sericite as seen in early drill chips; this may be a feature of contact alteration of sandstone quartz grains to cristobalite?

Metadolerite hyabyssal intrusive now much altered.

4. REFERENCES

0445

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2. CURTIS, P.J. : "A Petrographic Study of Rocks from the Capertee Area, N.S.W. - 101", Report No. 2, Pacminex Pty. Limited Report, PMR 56/74.

3. CURTIS, P.J. : "A Review of Stratigraphic Petrology, Pandurra Area", Pacminex Pty. Limited Report, PMR 127/75.

4. CURTIS, P.J. : "LY 3 Drill Core Petrography, Cattle Grid, Mount Gunson, Part II", Pacminex Pty. Limited Report, PMR 115/74.

5. FANDER, H.W. : "The Wooltana Lavas", Trans. Roy. Soc. Aust. 87, pp 155-158, 1963.

6. JOPLIN, G.A. : "A Petrography of Australian Igneous Rocks", published by Angus and Robertson - 1971. (See Chapter 4 on "The Tholeiitic Magma").

7. PARKIN, L.W. Ed.: "Handbook of South Australian Geology", Geol. Survey of S.A., 1969.

8. THOMSON, B.P. : "The Lower Boundary of the Adelaide System and Older Basement Relationships in South Australia" - B.P. Thomson, J. of the Geol. Soc. of Australia, 13, pp 203-228.

9. TURNER, A.R. : "Investigation of the Anzac Dam Magnetic Anomaly S.M.H. 204 : Appendix I, 'The Petrography of Fourteen Rock Samples from the Gawler Range Volcanic Complex", B.H.P. Report, January 1970.

10. TURNER, A.R. : "The Petrology of the Eastern Gawler Ranges, Volcanic Complex", G.S. of S.A., Bull. 45, 1975.

11. VAN WEESE, H. : "Investigation of Basic Rocks East of Iron Knob, S.M.L. 204 and 205, South Australia". B.H.P. Report, April, 1970.

APPENDIX I

Minerals Division

0448

MEMO TO MR. P.J. CURTIS REF. DGT/LK:

FROM D.G. TONKIN DATE 16th February, 1976.
(typed 24/2/76)

PANDURRA IGNEOUS PETROLOGY

Would you please examine the thin sections sent to you with the aim of classification into the following three groups :

1. Gawler Range Volcanics
2. Roopena Volcanics
3. Basic Intrusives

Enclosed are three petrographic reports from B.H.P.'s work on these rocks in 1970, in their S.M.L.'s 204, and 205 for reference.

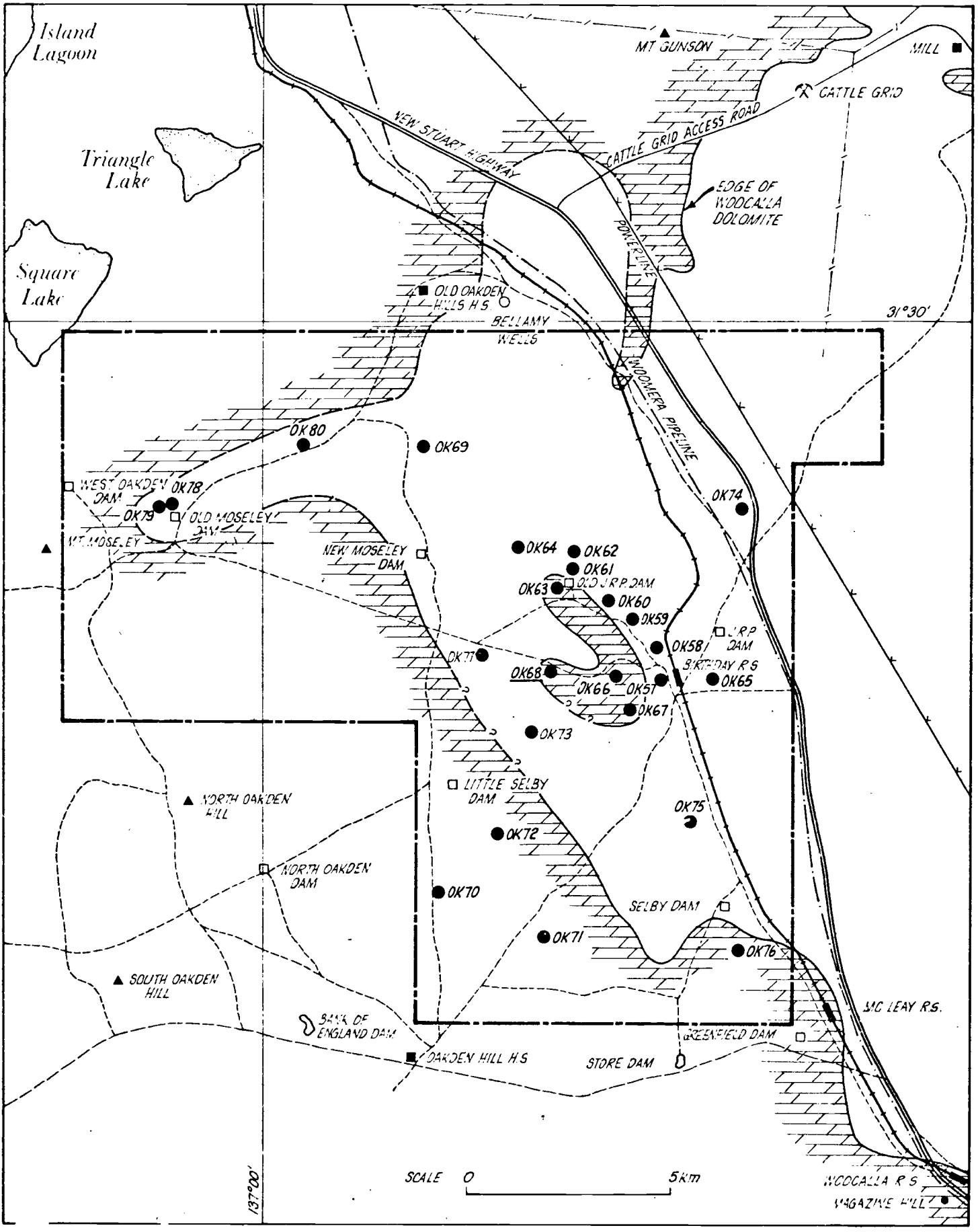
D.G. TONKIN
(signed)

c.c. R.W. Gersteling

APPENDIX II

(IN POCKET)

APPENDIX III



APPENDIX 3: LOCATION MAP OF OK 68 DRILL HOLE, OAKDEN HILLS

APPENDIX IV

Telephone: 272 5711
Telegrams: Domex

Your reference.....
In reply, please quote
EL186 SD:RM

PLEASE ADDRESS ALL CORRESPONDENCE TO:

The Director of Mines,
P.O. Box 151,
Eastwood, S.A. 5063

DEPARTMENT OF MINES · SOUTH AUSTRALIA

191 GREENHILL ROAD, PARKSIDE (CORNER OF GLEN OSMOND ROAD)

10th June, 1976.

The Manager,
Pacminex Pty. Ltd.,
P.O. Box R221 Royal Exchange,
SYDNEY. N.S.W. 2000

Attention: Peter Curtis

Dear Sir,

In reply to your letter dated 2nd June, the following thin sections have been selected as a representative sample of the Roopena Volcanics and Gawler Range Volcanics.

Roopena Volcanics:

Roopena DDH No. 1

DEPTH	PETROLOGICAL NO. (SADM)	THIN SECTION NO. (AMDL)
23' - 23.3'	P437/67	TS 19837 A & B
51.2' - 51.6 '	P439/67	TS 19839
100'	P461/67	TS 19883
105.5'	P462/67	TS 19884
149.5'	P463/67	TS 19885
307'	P472/67	TS 19963
350'	P473/67	TS 19964
364.5'	P474/67	TS 19965
388.5'	P475/67	TS 19966
406'	P476/67	TS 19967
420'	P478/67	TS 19969
428.5'	P502/67	TS 19988, 19989
430.1	P503/67	TS 19990, 19991

In addition P446/75, TS 19858 (a surface sample) has been included as an example with high alkali content (see also enclosed analysis and pet.)

..../2

0454

Gawler Range Volcanics:

Rock name	Locality	Thin Section No.
Porphyritic dacite	7m S.W. of Ten mile Hut Moonaree Station	TS 30551
	4 m east of Yardea H.S.	TS 32325
Porphyritic rhyodacite	3½ m NNW of Glyde Hill O.S.	TS 30990
Porphyritic rhyolite	1½ m N.W. of Lake Everand H.S.	TS 30997
Rhyodacite	4 m S.W. of Roan Well	TS 30129
Rhyolite	3 m SSW of Block Dam Kokatha	TS 30579
Andesite	3 m SSE of Glyde Hill O.S.	TS 30998
Basalt	8 m NE of Kokatha H.S.	TS 29979
	¾ m NW of Chitanilga Hill	TS 29693

Please find enclosed the above thin sections. Their return a month after receipt would be appreciated.

Yours faithfully,

B P Webb

DIRECTOR OF MINES

per CDD

cataclastically deformed. Consequent recrystallization has destroyed most of the definitive properties of the primary rock(s).

Some features of P447 suggest that this semischist has been derived from a sediment and there appear to be no features in common with this and the other two rocks.

P443 and P432 compositionally resemble one another although the deformation and recrystallization has been more severe in the former. Features of the relict primary minerals are similar and it seems probable that these two rocks could be intimately related.

The three rocks have been subjected to similar metamorphic histories.

Sample ~~P447~~ P446/67: TS19858

Location:

About 200 ft West 1400 N peg. Isotopic age sample site (GA369). Sample identical with age-dating sample.

Rock Name:

A vesicular trachyte.

Hand Specimen:

A fine-grained, highly vesicular, massive rock that has a deep reddish-brown colouration.

Thin Section:

The rock is composed of a few small phenocrysts of untwinned orthoclase set in a pilotaxitic groundmass of twinned orthoclase microlites, opaque minerals (?hematite) and occasional chlorite (?serpophite). The feldspars are magmatically reddened but quite fresh. The rock is dotted with numerous, large, rounded to irregular shaped amygdules. The amygdules range up to 10 mm in diameter and are formed of a selvedge of potash feldspar (?microcline), which rims the vesicle wall, and are infilled with secondary granular silica. The quartz usually has a subradiating habit.

History:

Igneous intrusive.

Discussion of P446 and Age Dating Sample

Compston, Crawford and Bofinger (1966)[1] report that a sample collected for isotopic age-dating determination contains " ..... magmatically reddened laths of anorthoclase ... in a groundmass ..... of the same feldspar and much finely divided hematite. " P446/67 is reported to be identical to the age-dating sample but optics and microchemical staining techniques indicate the feldspar in this sample to be orthoclase.

---

1. COMPSTON, W., CRAWFORD, A.R. and BOFINGER, V.M. (1966). A radiometric estimate of the duration of sedimentation in the Adelaide Geosyncline, South Australia. Jour. Geol. Soc. Aust. Vol 13 pt 1, p 271.

This identification is confirmed by the analysis of sample P446 (Table 1). A modal analysis (Table 1) of P446 indicates that the total primary feldspar content of the whole rock is approximately 40%. Table 2 lists partial chemical analyses of two anorthoclase samples. The calculated molecular norms of these samples show that a rock composed of 100% anorthoclase should contain 65 to 68% normative albite. A rock composed of 40% anorthoclase should then contain $^2/_5$ of 65 to 68% or 26 to 27% normative albite. Sample P446 contains only 1% normative albite.

Similar calculations show that the analysis of P446 is that which would be expected from a rock containing 40% modal orthoclase.

TABLE 1: CHEMICAL, NORMATIVE AND MOCAL ANALYSES
A2242/67: P446/67 ROOPENA VOLCANICS

Analysis	%	Norm	%	Mode (1000 points)	%
SiO_2	54.0	Quartz	0.7	Feldspar microlites	38.5
Al_2O_3	15.1	Orthoclase	76.0	Feldspar phenocrysts	1.4
Fe_2O_3	9.55	Albite	1.0	Opaques	32.9
FeO	1.00	Anorthite	3.0	Amygdules	27.2
MgO	3.05	Corundum	0.6		
CaO	1.12	Enstatite	8.8		
Na_2O	0.14	Magnetite	-		
K_2O	12.30	Hematite	6.9		
H_2O^+	1.72	Ilmenite	1.4		
H_2O^-	0.58	Calcite	0.4		
CO_2	0.10	Apatite	0.5		
TiO_2	1.21				
P_2O_5	0.31				
MnO	0.05				
	100.23		99.3		100.0

APPENDIX V

Figure 16: Roopena DDH 1, 51.2'-51.6' (TS 19839/P439/67)

Coarse grained iron oxide-rich (black background). basalt of fresh plagioclase laths, unaltered pyroxene (bright colours and pastel shades). Altered orthopyroxene(?) to brown biotite (centre of photograph).

Crossed nicols Magnification X 95

Figure 17: Vesicular trachyte, Roopena area (TS 19858/P446/67).

Groundmass of iron-oxide stained pilotaxitic orthoclase microlites. Amygdule is filled with quartz. See Appendix for AMDEL description.

Crossed nicols Magnification X 92



Figure 16



Figure 17

Figure 18: Roopena DDH 1, 100'. (TS 19883/P461/67).

Part argillised and silicified coarse andesite of interlocking plagioclase laths. Argillised patch (left of photograph). Carbonate vein traverses argillised zone.

Crossed nicols Magnification X 92

Figure 19: Roopena DDH 1, 105.5'. (TS 19884/P462/67).

Part argillised coarse grained andesite of plagioclase laths, larger phenocrysts of plagioclase and interstitial clay mineral.

Crossed nicols Magnification X 90

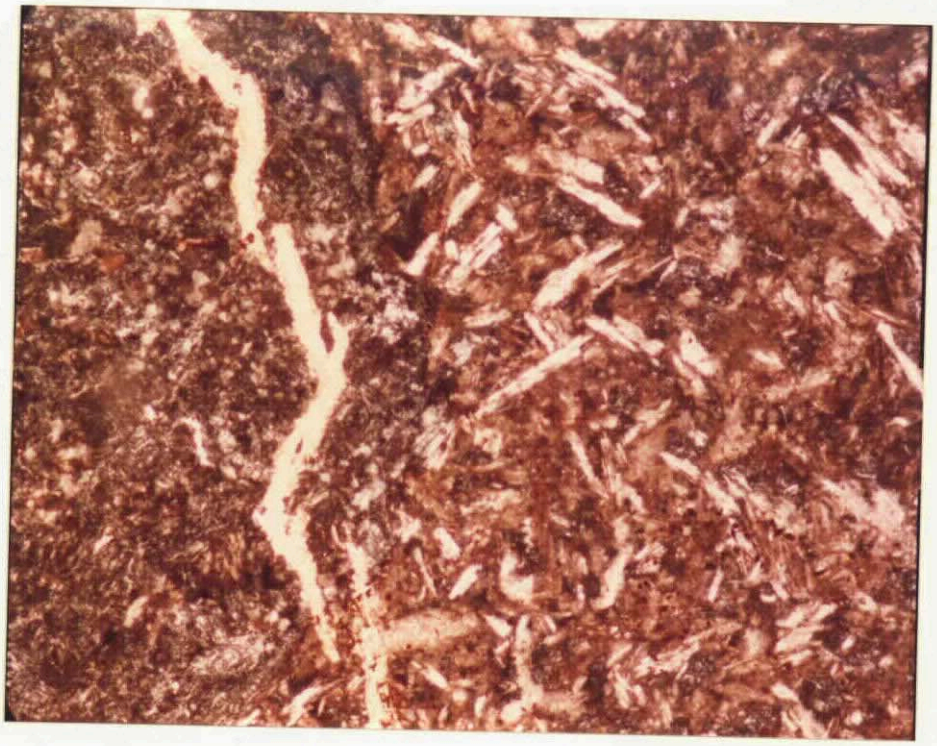


Figure 18



Figure 19

Figure 20: Roopena DDH 1, 307'. (TS 19963/P472/67).

Part argillised andesite, lightly dusted with iron oxides. Fragments of altered rhyolite (top and bottom of photograph) showing a narrow chlorite zone of contact.

Crossed nicols Magnification X 95

Figure 21: Roopena DDH 1, 364.5'. (TS 19964/P473/67).

Coarse andesite shows alteration to carbonate, sphene, chlorite, etc.

Crossed nicols Magnification X 88



Figure 20

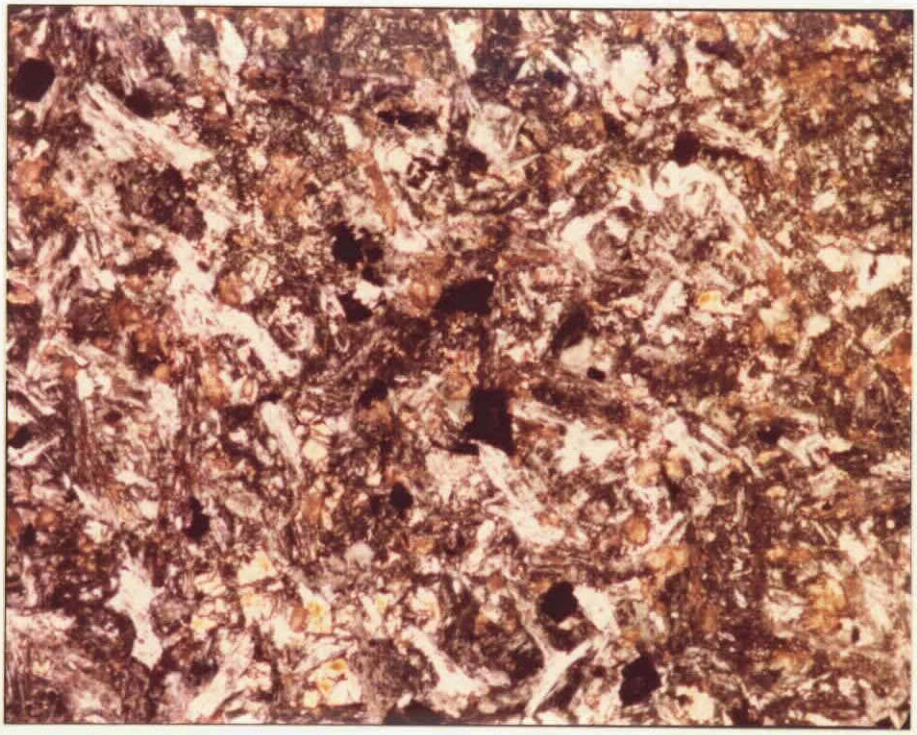


Figure 21

Figure 22: Basalt, 3/4 m N.W. of Chitanilga Hill (TS 29693).

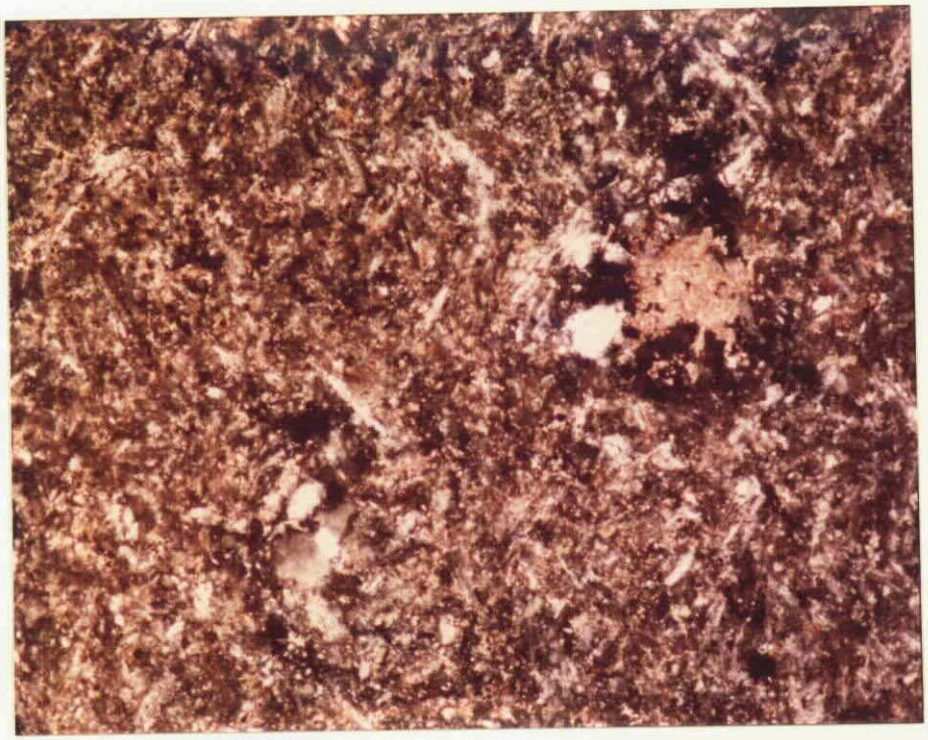
Argillised and chloritised iron-poor basalt. Large carbonate bleb (right of photograph) occupies an amygdule.

Crossed nicols Magnification X 93

Figure 23: Porphyritic rhyolite, 1½ m N.W. of Lake Everand H.S. (TS 30997).

Microcline phenocryst (right of photograph); elsewhere, cloudy altered microspherulites of potash feldspar and quartz.

Crossed nicols Magnification X 90



Ficure 22



Figure 23

Figure 24: Rhyodacite, 4 m S.W. of Roan Well (TS 30129).

Altered plagioclase lath (centre of photograph). Otherwise a pattern of potash feldspar microspherulites cloudy with clay mineral specks and quartz.

Crossed nicols Magnification X 95

Figure 25: Andesite, 3 m S.S.E. of Glyde Hill O.S. (TS 30998).

Plagioclase feldspar phenocryst intergrowths (top and bottom, left of photograph). Unaltered clinopyroxene (blue, magenta and blue-green colours) in a groundmass of cloudy feldspar microlites.

Crossed nicols Magnification X 95



Figure 24

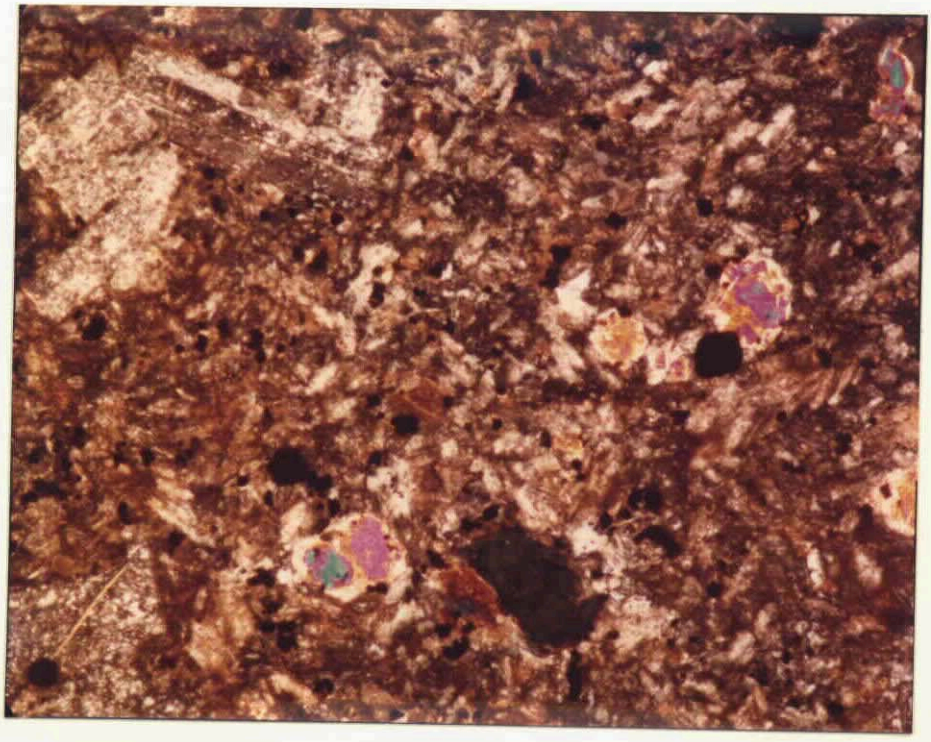


Figure 25

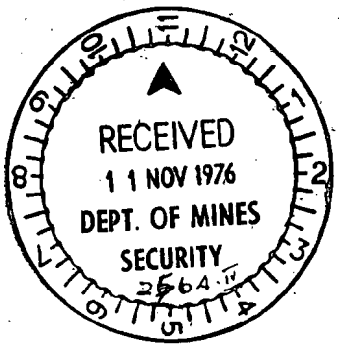
4

Prospect 405 0468

PACMINEX PTY. LIMITED

SIXTH QUARTERLY REPORT
ON EXPLORATION LICENCE 186
PANDURRA AREA
FOR PERIOD ENDED 7TH OCTOBER, 1976

PMR 194/76



PORT AUGUSTA
October, 1976.

D.G. TONKIN

EXPLORATION LICENCE 186 (PANDURRA)
SUMMARY OF EXPENDITURE
FOR THE THREE MONTH PERIOD ENDING 30TH SEPTEMBER, 1976

Expenditure for the 6th Quarterly period was $12,970, making a total of $168,549 since the E.L. was granted.

The quarterly expenditure was incurred as follows :-

Geological and Geophysical	$ 1,396
Drilling Costs	686
Logistics (including salaries and wages)	10,635
Depreciation	nil
Administration	253
Other Costs	nil
Total	$12,970

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FIELD	4

CONTENTS

		PAGE NO.
1.	INTRODUCTION	1
2.	SUMMARY	2
3.	GEOLOGY	3
	3.1 Bedrock Lithology	3
	3.2 Volcanic Rocks	3
	3.3 Stratigraphy	3
4.	GEOPHYSICS	7
	4.1 Aeromagnetics	7
5.	GEOCHEMISTRY	8

APPENDICES

I STRATIGRAPHIC INTERPRETATION OF PANDURRA AREA DRILL HOLES

II PRELIMINARY INTERPRETATION OF AIRBORNE MAGNETIC DATA FOR YUDNAPINNA AREA, BY R.J. SMITH

LIST OF ILLUSTRATIONS

FIGURES		FACING PAGE NO.
1	LOCALITY PLAN, E.L. 186, PANDURRA AREA, SOUTH AUSTRALIA	1

PLANS (IN POCKET) PMX DWG NO.		SCALE
I 534-4 A AND B	DRILL HOLE LOCATIONS AND INTERPRETIVE BEDROCK LITHOLOGY, E.L. 186, PANDURRA AREA, SOUTH AUSTRALIA (in two sheets)	1:50,000

KEYWORDS

SOUTH AUSTRALIA	9PANDURRA
9E L 186	8SI 53-04
EXPLORATION	STPATIGRAPHY
COPPER	GEOLOGY
AERIAL	MAGNETIC
SURVEY	GEOCHEMISTRY

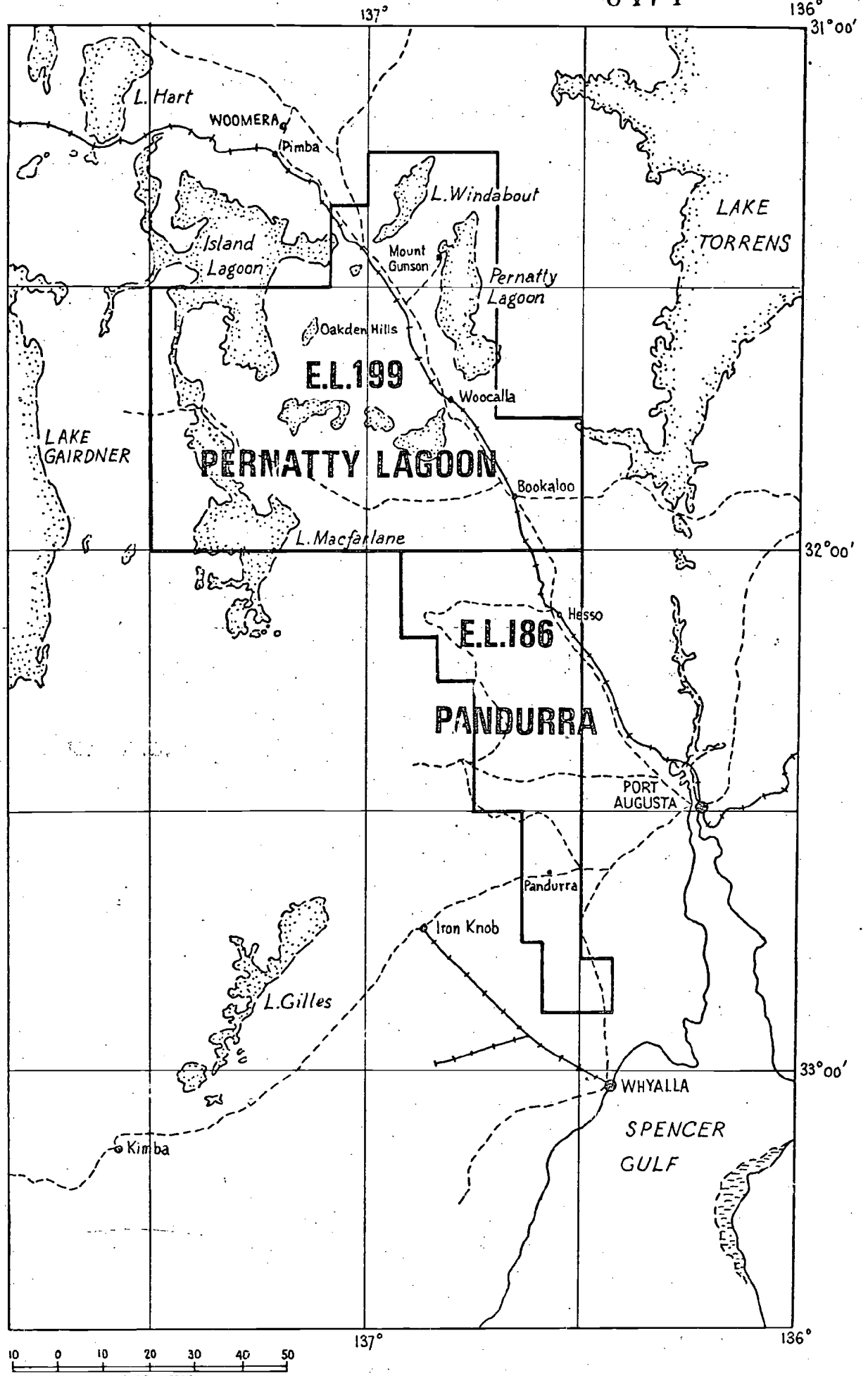


Fig. 1. LOCATION MAP
MT. GUNSON–PANDURRA AREAS, S.A.

1. INTRODUCTION

This report summarises exploration activities in Exploration Licence 186 (E.L. 186), Pandurra Area, South Australia, during the quarter 7th July to 7th October, 1976. It is the sixth quarterly report submitted to the South Australian Department of Mines for E.L. 186.

2. SUMMARY

Work during the quarterly period included:

2.1 Compilation of a 1:50,000 scale interpretive bedrock lithology plan.

2.2 Stratigraphic interpretation of the 204 rotary/percussion holes drilled since 1973.

2.3 Re-defining of outcropping and shallowly concealed volcanic rocks as Roopena Volcanics.

2.4 A preliminary interpretation of the Yudnapinna low level aeromagnetic data.

2.5 Encoding of drill hole data to enable computer studies to be carried out.

0477

3. GEOLOGY

3.1 Bedrock Lithology

A revised bedrock lithology plan at the scale of 1:50,000 has been compiled for this report (PMX DWG NO. I 534-4 , in two sheets). The E.L. boundaries on this plan are shown as they were when the licence was granted. There has since been a reduction of area. The locations of exploration holes drilled since 1973 are shown on this plan with reasonable accuracy.

3.2 Volcanic Rocks

P.J. Curtis, Pacminex petrologist, submitted a petrographic report on samples of fine grained igneous rocks (PMR 81/76). A copy of this report was appended to the previous quarterly report for E.L. 186 (PMR 165/76).

Lithologies identified included basalt, andesite, trachyandesite, trachyte, rhyodacite, rhyolite and tuffaceous rhyolite. Comparison of E.L. 186 volcanics with Gawler Range Volcanics and Roopena Volcanics suites suggested that all E.L. 186 volcanic samples might belong to the Roopena Volcanics.

The interpretation fits the known stratigraphic associations. Volcanic outcrop and sub-outcrop on the western side of E.L. 186 between "Cariewerloo" and "Roopena" stations was formerly mapped as Gawler Range Volcanics. It is now redefined as Roopena Volcanics, overlying the Gawler Craton and forming the basal unit of the Adelaiden sequence on the Stuart Shelf.

3.3 Stratigraphy

Drill logs of the 204 stratigraphic holes drilled in E.L. 186 (formerly E.L. 50) since September 1973 have been re-identified in the light of present day geological knowledge. These current stratigraphic interpretations are tabled in Appendix I.

Reinterpretations of the stratigraphy became necessary in the course of compilation of geological cross sections (submitted in Quarterly Report No. 3, January 1976) and bedrock lithology plans (PMX DWG NO. I 534-4). Consistent interpretations were also needed to allow encoding of geological and geochemical drill hole data for computer analysis.

Twelve stratigraphic units were recognised. Subdivision was influenced by the need to define homogeneous lithologies for statistical purposes. The units are:

3.3.1 Cainozoic : Unconsolidated sediment, dune sands, salt lake sediments, calcrete, aeolian deposits.

3.3.2 Tertiary : Poorly consolidated, clay rich, sand deposits, believed to be much younger than Precambrian. Interpreted as Tertiary, but possibly Cainozoic. Originally thought to be Whyalla Sandstone, which is possible but now thought unlikely.

3.3.3 Tregolana Shale : Chocolate-brown shales, basal to Tent Hill and Horseshoe Hill. Overlies Yudnapinna Beds in E.L. 186.

3.3.4 Whyalla Sandstone : Quartzose sandstone, with coloured lithic grains in most places. Grains mostly well rounded. Near Mount Gunson (E.L. 199) the unit is well developed, but it is discontinuous in E.L. 186 and is found only in the northern half of the area. The contact with the underlying Yudnapinna Beds is gradational.

3.3.5 Yudnapinna Beds : Siltstones, typically red-brown with calcareous (dolomite) matrix, but in many places green or grey, non-calcareous and in some places pyritic. May have interbedded lenses of "typical" Whyalla Sandstone sediments. The near-surface beds in many localities are deeply weathered

to a soft silty or sandy clay. Interpretation of such clayey sediments is problematical and possible confusion between weathered Yudnapinna Beds, Whyalla Sandstone and Tertiary sand deposits may arise. Sand grains very similar to those of Whyalla Sandstone are scattered through most Yudnapinna siltstones.

3.3.6 Magazine Hill clay, Tapley Hill Formation : Leached black shales and dolomitic laminites, occurring at the top of the Tapley Hill Formation in many places. Typically grades from relatively pure white kaolinite clay (e.g. Magazine Hill quarry, near Woocalla in E.L. 199) through pale green, mauve, khaki, light grey and dark grey clay then eventually into unleached black shales. The leaching was probably due to Tertiary and Cainozoic weathering, but in some localities there is a suggestion of Precambrian weathering prior to deposition of the Yudnapinna Beds.

3.3.7 Undifferentiated Tapley Hill Formation : Dark grey and black shales and dolomitic laminites, with lenses of massive grey dolomitic limestone in places. Pyritic in many places. In earlier reports this unit was generally referred to as the "Woocalla Dolomite".

3.3.8 Woocalla Dolomite Member of the Tapley Hill Formation : Massive, grey dolomitic limestone, occurring at the base of the Tapley Hill Formation in most places. In E.L. 186 the member is usually only about 3 m thick. So far no stromatolitic dolomites, such as occur at the type locality have been identified in E.L. 186.

3.3.9 McLeay Beds : Unsorted, poorly consolidated, discontinuous, sandy conglomerate or sedimentary breccia of possible fluvio-glacial origin. Pebbles consist of angular banded iron formation (Middleback Group?), sub-angular red quartzite (Pandurra Formation?)

and rounded milky quartz (reworked Corunna Conglomerate?). At one locality "granite" (crystalline basement?) pebbles were present. The McLeay Beds in E.L. 186 are mostly restricted to the portion south of "Cariewerloo" station. They are up to more than 50 m thick.

3.3.10 Pandurra Formation : Red-brown arenites. The upper portion, outcropping east of Red Rock fault on "Roopena" station, is silicified.

3.3.11 Roopena Volcanics : Mainly intermediate and basic volcanics, but with some late stage acid differentiates. Outcrop and suboutcrop on the western side of the licence area south of "Cariewerloo" and previously mapped as Gawler Range Volcanics (acid) is now identified as Roopena Volcanics.

3.3.12 Dolerite Dykes : These intrude the Pandurra Formation in drill holes 6332 J-4 and 6332 J-7. The second locality coincides with a basic dyke interpreted by B.H.P. in 1970 from low-level aeromagnetics flown over their S.M.L. 204.

4. GEOPHYSICS

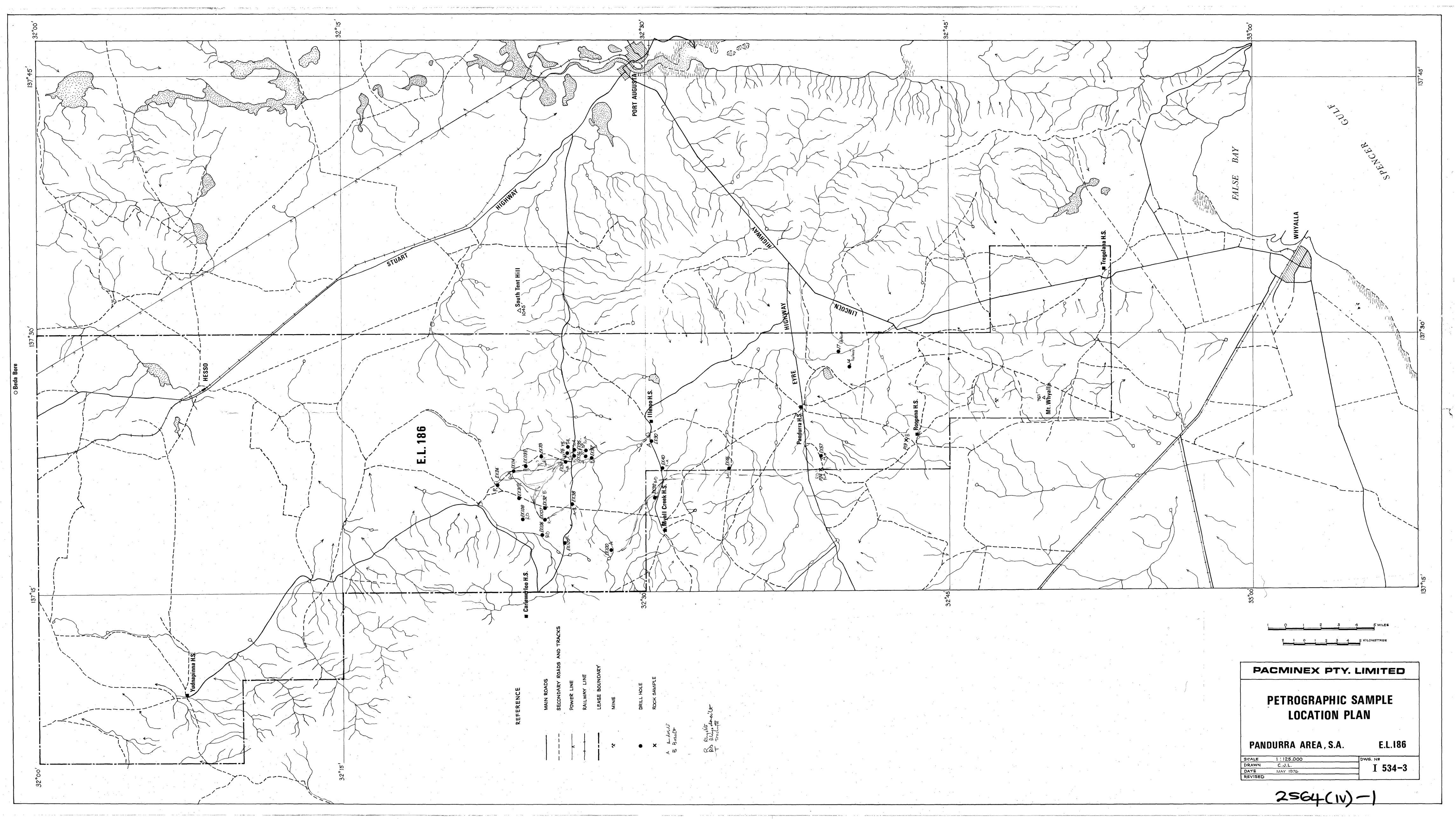
4.1 Aeromagnetics

R.J. Smith, a consulting geophysicist, interpreted the magnetic data from the Yudnapinna airborne geophysical survey of February 1975. His report is appended. It includes an isomagnetic contour plan with an interpretive overlay, both at 1:100,000 scale.

5. GEOCHEMISTRY

Encoding of drill hole geochemical and geological data for computer analysis is in progress. It is hoped that statistical analysis might point to unrecognised anomalous areas, as well as providing additional background data for studies in E.L. 199, to the north.

D.G. TONKIN
(LK)


32°00'
32°15'
32°30'
32°45'
33°00'
137°45'
137°30'
137°15'
PORT AUGUSTA
STUART HIGHWAY
LINCOLN HIGHWAY
EYRE HIGHWAY
SPENCER GULF
FALSE BAY
WHYALLA
HESSO
E.L. 186
South Tent Hill
1045
Tregolana H.S.
Mt. Whyalla
761
Ilinco H.S.
Pandurra H.S.
Roopena H.S.
Mt. Hill Creek H.S.
Carlewatloo H.S.
Yudnapinna H.S.
Bede Bore
REFERENCE
MAIN ROADS
SECONDARY ROADS AND TRACKS
POWER LINE
RAILWAY LINE
LEASE BOUNDARY
MINE
DRILL HOLE
ROCK SAMPLE
5 MILES
5 KILOMETRES
PACMINEX PTY. LIMITED
PETROGRAPHIC SAMPLE LOCATION PLAN
PANDURRA AREA, S.A.
E.L.186
SCALE 1:125,000
DRAWN C.J.L.
DATE MAY 1976
REVISED
DWG. No
I 534-3
2564(IV)-1

137°05' 137°30' 32°00' 32°10' 32°15' 32°30'

YB PF WSs Tertiary Sands THF TS CSs SQ McB RV

EDGE OF TAPLEY HILL FM. (Concealed)

Nine Mile Well · White Dam · Tank and Troughs · Piela Dam · Dam · Hut · Ryans Basin Dams · Yarramundi Dam · Yards · Rosie Dam · Yudnapinna H.S. · Airstrip · Bore · Murray Bore · Rodger Dam · Kalora Dam · Marousen Dam · G.W.R. Dam · Tank and Troughs · Old Woolshed Dams · Ives Dam · Abandoned Dams · Honeymoon Dam · Hesso Pump Station · Hesso H.S. & Woolshed · No.1 Dam · Hesso R.S. · 5 Mile Tank · Pine Well · Pine Well Dams · Pine Well Dam · Freddy Dam · Broken Dam · Square Dam · Huts · Little Swamp Dam · Red Dam · Koolcutta Dam · Caldwell Dam · Pinnacle Dam · Bore · Hammels Well · Peter Dam · Fresh Water Dam · Fresh Water Well and Hut · Welcome Well and Tank · Hanrahans Dam · Knocks Dam · Tent Hill Dam · Bryant Dam · Gunters Dam · Small Dm · Jackies Dam · Corner Dam · Burks Hut · Burks Yard · Burks Dam · Yard · North Four Mile Dam · South Four Mile Dam · Nine Mile Bank · Small Dam · Horseshoe Dam · Nine Mile Dam · Birthday Dam · Junction Dam · White Dam · Princefoot Dam · Anzac Dam · House · Woolshed · Tent Hill Dam

YUDNAPINNA RUN 1/039 · YUDNAPINNA RUN 2/018 · CARIEWERLOO RUN 1/018 · CARIEWERLOO RUN 2/065 · 1/041 · 1/043 · 1/016 · 2/016 · 2/067

YUDNAPINNA HILL ▲ · COOLCUTTA HILL · PINBUTA HILL ▲ · PETER HILL ▲ · RED HILL · HORSESHOE HILL ▲ · NORTH TENT HILL · SUGARLOAF HILL

REFER SHEET 2

REFERENCE

- TERTIARY SANDS
- SQ SIMMENS QUARTZITE MEMBER
- CSs CORRABERRA SANDSTONE MEMBER
- TS TREGOLANA SHALE MEMBER
- WSs WHYALLA SANDSTONE ? MEMBER (Discontinuous)

} TENT HILL FM.

- YB YUDNAPINNA BEDS
- THF TAPLEY HILL FORMATION

Unconformity

- McB Mc. LEAY BEDS (Discontinuous)

Unconformity

- PF PANDURRA FORMATION

Unconformity

- RV ROOPENA VOLCANICS

Unconformity

- MF MOONABIE FORMATION
- d DOLERITE (Dykes intrude Pandurra Fm.) (Concealed)

Sandune · Homestead · Hut, shed · Dam · Well, bore · Trig station · Hill · Photo centre · Mine · Highway · Road, track · Fence · Power line · Pipeline · Telegraph line · Railway line · E.L. boundary · Drill hole

PACMINEX PTY. LIMITED

E.L.186 PANDURRA AREA, S.A.
SHEET 1 OF 2

BEDROCK LITHOLOGY

SCALE : 1 : 50,000	DWG. No.
DRAWN : P.R./D.G.T.	I 534-4A
DATE : September 1976	
REVISED :	

2564(IV)-2

REFER SHEET 1

137°30'

32°30'

RV

McB

RV

THF

YB

YB

YB

RV

THF

PF

McB

RV

PF

PF

MF

RV

PF

MF

32°45'

137°22'

137°35'

32°47'

32°53'

137°25'

137°35'

32°53'

Illeroo Dam

Illeroo H.S.

EX90

EX41

EX91

EX40

EX89

EX45

Notting Dam

EX46

CORUNNA RUN 1/44

Hut

Shed

(Concealed)

Tank

EX47

EX87

EX88

Hean Dam

EX48

EX49

Pandurra H.S.

EX86

EX53

EX52

EX51

EX50

EX56

EX55

dry well

Cu

EX57

J9

J10

J8

EX85

EX54

J11

J7

I1

J5

J4

J6

EX81

J2

J3

EX82

EX84

CORUNNA RUN 2/73

EX80

Lenartowicz Dam

J1

Tank Hill

Quarry

EX60

EX79

EX58

Stud Dam

EX59

Central Dam

EX76

EX77

Tertiary Sands

EX75

EX78

P4

P1

(Concealed)

EX61

EX74

EX73

EX72

EX71

Paddy Dam

House Dam

Roopena H.S.

Honeymoon Dam

P2

EX70

Tertiary Sands

P3

Comet Bore

Well

EX67

EX68

EX69

Ba

Adam Dam

ROOPENA RUN 1/90

PF

THF

YB

Aqua Dam

White Cliff Dam

EX64

EX62

EX63

Cocky Dam

Corner Dam

EX65

Q2

EX66

Q1

Tregolana H.S.

Sandune
Homestead
Hut, shed
Dam
Well, bore
Trig station
Hill
Photo centre
Mine
Highway
Road, track
Fence
Power line
Pipeline
Telegraph line
Railway line
E.L. boundary

Drill hole

REFERENCE

	TERTIARY SANDS
SQ	SIMMENS QUARTZITE MEMBER
CSs	CORRABERRA SANDSTONE MEMBER
TS	TREGOLANA SHALE MEMBER
WSs	WHYALLA SANDSTONE ? MEMBER (Discontinuous)
	} TENT HILL FM.
YB	YUDNAPINNA BEDS
THF	TAPLEY HILL FORMATION
	Unconformity
McB	Mc. LEAY BEDS (Discontinuous)
	Unconformity
PF	PANDURRA FORMATION
	Unconformity
RV	ROOPENA VOLCANICS
	Unconformity
MF	MOONABIE FORMATION
d	DOLERITE (Dykes intrude Pandurra Fm.) (Concealed)

PACMINEX PTY. LIMITED

E.L.186 PANDURRA AREA, S.A.
SHEET 2 OF 2

BEDROCK LITHOLOGY

SCALE : 1 : 50,000	DWG. No.
DRAWN : P.R./D.G.T.	I534-4B
DATE : September 1976	
REVISED :	

2564(IV)-3

RECORD AIRBORNE EM AND MAGNETOMETER SURVEY
CONDUCTED "INPUT" ELECTROMAGNETIC SYSTEM

ISOMAGNETIC CONTOUR MAP

WINNIE PINNIE and YUONAPINNA AREAS

SOUTH AUSTRALIA

FOR

PACMINEX PTY. LIMITED

SHEET 1

SCALE 1 : 50,000

LOCATION MAP
SCALE 1 : 1000000

YUONAPINNA

YUONAPINNA H.S.

Childs Dam

Red Dam

2564(IV)-4

BENCH MARK VALUES

B.M.No.	Elevation(m)	B.M.No.	Elevation (m)
353	102·931	0435	107·219
354	97·877	0436	122·932
355	111·482	0437	121·851
356	100·074	0438	126·558
360	10·197	0439	85·438
361	15·940	0440	85·837
362	31·363	0441	88·588
363	50·504	0442	85·547
364	48·058	0443	102·275
365	52·203	0444	126·165
366	65·681	0445	129·574
367	85·450	0446	120·873
368	111·206	0447	97·198
369	122·148	0448	103·767
370	118·087	0449	114·961
371	99·781	0450	114·822
372	121·533	601	76·010
373	103·498	602	83·315
374	98·932	603	87·524
375	103·699	604	93·328
376	94·483	605	95·545
377	89·611	606	92·811
378	83·676	607	85·849
379	80·240	608	81·958
380	78·136	609	105·129
381	75·880	610	124·380
382	70·925	611	149·008
383	65·566	612	139·109
384	57·283	613	130·442
385	52·356	614	122·387
386	50·815	615	124·252
387	47·691	616	92·664
388	43·050	617	115·961
389	44·204	618	112·410
390	82·884	619	114·128
391	89·408	620	118·536
392	84·169	621	111·023
393	85·886	622	114·305
394	48·555	623	119·756
395	58·193	624	116·974
396	66·845	625	123·998
397	72·798	626	137·094
398	69·558	627	140·251
399	73·759	628	137·845
400	84·677	629	138·125
0414	75·643	630	133·407
0415	68·826	631	131·376
0416	91·447	632	129·874
0417	107·997	633	117·891
0418	95·696	634	109·201
0419	117·687	635	102·148
0420	134·285	636	98·694
0421	138·854	637	95·239
0422	87·012	638	90·251
0423	90·306	639	88·662
0424	94·348	640	86·673
0425	97·685	641	91·217
0426	100·121	642	90·660
0427	107·688	643	100·182
0428	114·845	644	104·071
0429	125·832	645	111·254
0430	118·527	646	107·617
0431	111·751	647	99·786
0432	110·322	648	106·474
0433	122·390	649	126·733
0434	100·933	650	114·500

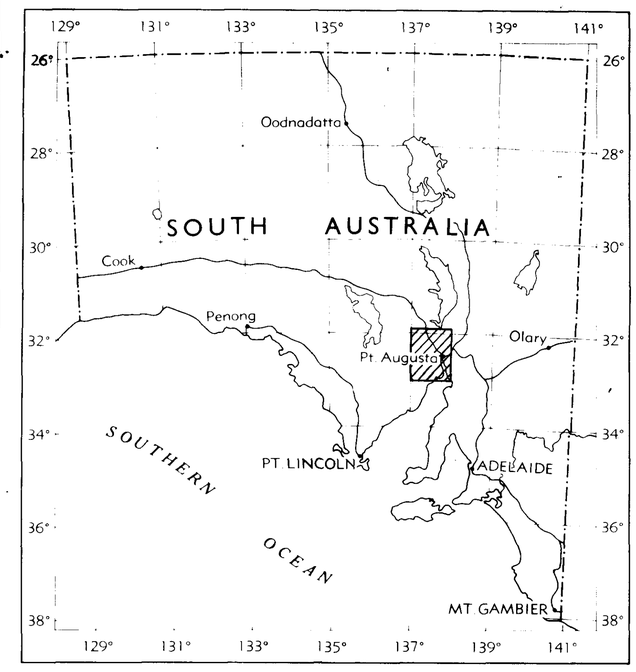
REFERENCE

S.A Dept of Lands Bench Mark; Level in metres ..... 1694 • 39·792

S.A. Dept of Mines Bench Mark; for value see list above ..... • 600

Boreholes levelled ..... • 145

LOCALITY



SCALE 1:126 720

km 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

S.A. DEPARTMENT OF MINES

STUART SHELF LEVEL SURVEY

Surveyed by :- N.Edwards — April — Nov. 1975

Level book :- 464, 482 — Datum – M.S.L. 1

Base map compiled from S.A.D.M. 1"=2 mile PT. AUGUSTA / TORRENS sheets with amendments.

RECEIVED 12 NOV 1976 DEPT. OF MINES SECURITY 2564

E.L. 186

J.B. 18·12·75

Rcd. frm. I. Grant

2564(V)—1

APPENDIX I

STRATIGRAPHIC INTERPRETATIONS OF PANDURRA AREA DRILL HOLES

Hole No.	Recent	Tertiary	Tregolana Shale	Whyalla S/St.	Yudnapin. Beds	TAPLEY HILL FORMATION Magazine Hill clay	Undifferentiated	Woocalla Dol. Memb.	McLeay Beds	Pandurra Fm.	Roopena Volcanics	Dolerite Dykes
EX 1	0-7.5	-	-	7.5-36	36-60	-	60-91 *					
EX 2	0-19.5	-	-	-	19.5-26	26-36	36-64	-	-	64-65 *		
EX 3A	0-6	6-42.4	-	-	-	-	-	-	-	42.4-42.5*		
EX 4	0-3	3-12	-	-	-	-	-	-	-	12-24 *		
EX 5	0-6	6-30	-	-	-	-	-	-	-	30-33 *		
EX 6	0-12	-	-	12-24	24-84 *							
EX 7	0-9	9-79 *										
EX 8	0-3	-	-	-	3-9	9-24	24-89 *					
EX 9	0-15	-	-	-	15-37	37-49	49-70 *					
EX 10	0-7	-	-	-	7-55	-	-	55-59	-	59-61 *		
EX 11	-	-	-	0-12	12-67	-	-	-	-	67-68.6 *		
EX 12	0-1.5	-	-	-	1.5-93 *							
EX 13	0-6	-	-	-	6-18	-	-	-	-	18-20 *		
EX 14	0-9 *											
EX 15	0-3	3-15	-	-	15-33	-	-	-	-	33-34 *		
EX 16	0-3	-	-	3-34	34-64	-	-	-	-	64-68 *		
EX 17	0-3	-	-	3-9	9-64	-	64-76	-	-	76-79 *		
EX 18	0-6	-	-	-	6-25.5	-	25.5-67	67-71.6	-	71.6-75 *		
EX 19	0-18	-	-	-	18-30	30-49	49-97.5 *					
EX 20	0-9	-	9-15	-	15-64	-	64-96 *					
EX 21	0-3	-	-	-	3-76	-	76-97.5 *					
EX 22	0-9	9-52 *										
EX 23	0-21	21-43 *										
EX 24	0-3	-	-	-	-	-	-	-	-	3-88	88-97.5 *	
EX 25	0-18	-	-	-	18-43	43-49	49-85	85-87.5	-	87.5-89 *		
EX 26	0-6	-	-	-	6-12	-	-	-	-	12-15 *		
EX 27	0-4	-	-	-	-	-	-	-	-	4-6 *		
EX 28	0-10	-	-	-	10-19.5	-	-	-	-	19.5-21 *		
EX 29	0-10.5	10.5-24	-	-	-	-	-	-	-	24-48 *		
EX 30	0-15	-	-	-	-	-	-	-	-	15-24.4 *		
EX 31	0-3	-	-	-	-	-	-	-	-	3-53.6	53.6-55 *	
EX 32	0-6	-	-	-	6-18	-	-	-	-	-	18-42.7 *	
EX 33	0-3	-	-	-	-	3-24	24-30	-	-	30-78	78-90 *	

Hole	Recent	Tertiary	Treg.Sh.	Whyall.S.	TAPLEY HILL FORMATION Yud.Bed.	Mag.Hill	Undiffer.	Woocall.D	McLeay.B	Pandurra	Roop.Vol.	Dolerite
Ex 34	0-3	-	-	-	-	3-21	-	-	-	-	21-38 *	
EX 35	0-7.5	-	7.5-64	-	64-93 *							
EX 36	0-3	-	-	-	3-37	-	-	-	-	-	37-50 *	
EX 37	0-6	-	-	-	6-97.5 *							
EX 38	0-3	-	-	-	-	-	-	-	-	-	3-56.4 *	
EX 39	0-9	-	-	-	-	9-15	15-49	-	-	49-50.3 *		
EX 40	0-7.5	-	-	-	-	-	-	-	-	-	7.5-43.3 *	
Ex 41	0-12	-	-	-	-	12-24	24-34	-	34-41	41-65.5 *		
EX 42	0-3	-	-	-	-	3-15	15-40	40-42	42-52.7	52.7-55 *		
EX 43	0-1	-	-	-	1-46	-	46-97.5 *					
EX 44	0-3	-	-	-	3-80 *							
EX 45	0-6	-	-	-	-	6-27	27-43	-	43-52	52-56.4 *		
EX 46	0-6	-	-	-	6-30	-	30-40	-	40-80.8 *			
EX 47	0-3	-	-	-	-	3-18	18-97.5 *					
EX 48	0-9	-	-	-	-	9-18	18-79.3 *					
EX 49	0-7.5	-	-	-	-	7.5-18	18-91.4 *					
EX 50	0-3	-	-	-	-	3-9	9-33.5	-	-	33.5-36.6 *		
EX 51	0-3	-	-	-	-	3-6		-	6-12	12-18.6 *		
EX 52	-	-	-	-	-	-	0-9	-	9-9.3	9.3-18.3 *		
EX 53	0-0.6	-	-	-	-	0.6-3	3-49	-	49-55.5	55.5-61 *		
EX 54	0-6	-	-	-	-	6-21	21-84	-	-	84-85.3 *		
EX 55	0-3	-	-	-	-	-	-	-	-	3-13.7 *		
EX 56	0-3	-	-	-	-	3-9	9-37	-	37-43	43-45.7 *		
EX 57	0-3	-	-	-	-	-	-	-	-	3-53	53-61 *	
EX 58	0-3	-	-	-	-	-	-	-	-	3-54 *		
EX 59	0-12	-	-	-	-	-	-	-	12-22	22-24.7 *		
EX 60	0-6	-	-	-	-	-	-	-	-	6-15.8 *		
EX 61	0-6	0-33.5 *										
EX 62	-	-	-	-	-	0-9.1	9-33.5	-	-	33.5-35 *		
EX 63	0-1	-	-	-	-	-	1-38 *					
EX 64	0-12	-	-	-	12-56	-	56-70 *					
EX 65	0-6	-	-	-	-	-	-	-	-	6-61 *		
EX 66	0-6	-	-	-	-	6-21	21-27	-	-	27-30.5 *		
EX 67	0-4	-	-	-	-	4-12	12-56 *					
EX 68	-	-	-	-	-	-	0-28.5 *					
EX 69	0-13.5	-	-	-	-	-	-	-	-	13.5-37.5 *		

Hole	Recent	Tertiary	Treg.Sh.	Why.SS.	Yud.Beds	TAPLEY HILL FORMATION Mag.Hill	Undiffer.	Woocalla	McLeay.B	Pandurra	Roop.Vol.	Dolerite
EX 70	0-15	15-30	-	-	-	-	-	-	-	30-33.3 *		
EX 71	0-6	-	-	-	-	-	-	-	-	6-9 *		
EX 72	0-6	-	-	-	-	-	-	-	-	6-7 *		
EX 73	0-6	6-20.5	-	-	-	-	-	-	-	20.5-24 *		
EX 74	0-3	3-32	-	-	-	-	32-34	-	-	34-48 *		
EX 75	0-3	3-14	-	-	-	14-18	18-36 *					
EX 76	0-6	6-24	-	-	-	-	-	24-30	30-33	33-37.5 *		
EX 77	0-4	4-13	-	-	-	-	-	-	13-17	17-19 *		
EX 78	0-3	-	-	-	-	-	-	-	-	3-3.2 *		
EX 79	0-5	-	-	-	-	5-12.5	-	-	12.5-45	45.0-46 *		
EX 80	0-6	-	-	-	-	6-18	-	-	18-72 *			
EX 81	0-1.5	-	-	-	-	1.5-3	3-15.5	-	15.5-48 *			
EX 82	0-3	-	-	-	-	-	-	-	-	3-90 *		
EX 83	0-3	3-12	-	-	-	12-28	-	-	28-39.5	39.5-40 *		
EX 84	0-3	-	-	-	-	-	-	-	-	3-87 *		
EX 85	0-2	-	-	-	-	2-12	12-19	-	-	19-21 *		
EX 86	0-8	8023	-	-	-	-	-	-	23-28 *			
EX 87	0-3 *											
EX 88	0-3	-	-	-	-	3-6	6-17	-	17-63 *			
EX 89	0-4	-	-	-	4-23	23-29	29-45 *					
EX 90	0-2	-	-	-	-	2-20	-	-	20-28	-	28-36 *	
EX 91	0-3 *											
EX 92	0-4	-	-	-	-	-	-	-	-	-	4-27 *	
EX 93	-	-	0-33	-	33-42 *							
EX 94	0-9	-	9-66	-	66-78 *							
EX 95	0-4	-	-	-	4-10	10-21	21-30.5	30.5-32.5	32.5-35 *			
EX 96	0-4	-	-	-	4-39	-	39-56	-	56-60 *			
EX 97	0-3	-	-	-	-	-	-	-	-	-	3-17 *	
EX 98	0-1	-	-	-	-	-	1-53	-	-	53-54 *		
EX 99	0-3	-	-	-	-	-	3-57.5	-	-	57.5-64 *		
EX 100	0-3	-	-	-	-	-	-	-	-	-	3-9 *	
EX 101	0-3	-	-	-	-	-	-	-	-	3-46.5 *		
EX 102	0-6	-	-	-	-	-	-	-	-	6-15 *		
EX 103	0-3	-	-	-	-	3-6	6-33 *					
EX 104	0-6	-	-	-	-	-	6-31 *					

TAPLEY HILL FORMATION

Hole	Recent	Tertiary	Treg. Sh.	Why. Ss.	Yud. Beds	Mag. Hill	Undiffer.	Woocalla	McLeay B.	Pandurra	Roopena V.
EX 105	0-5	-	-	-	-	-	-	-	-	-	5-18 *
EX 106	0-9	-	-	-	-	-	-	-	-	-	9-18 *
EX 107	0-12	-	-	-	-	-	-	-	-	-	12-33 *
EX 108	0-7.5	-	-	-	-	-	-	-	-	-	7.5-33 *
EX 109	0-3	-	-	-	-	-	-	-	-	3-77 *	
EX 110	0-2	-	-	-	-	-	-	-	-	2-72 *	
EX 111	0-3	-	-	-	3-52	-	52-60 *				
EX 112	0-5	-	-	-	5-43.5	-	43.5-51 *				
EX 113	0-9	-	-	-	-	9-16	-	-	-	-	16-20.7 *
EX 114	0-5	-	-	-	-	5-14	-	-	-	-	14-18 *
EX 115	0-1	-	-	-	-	-	-	-	-	1-23	23-45 *
EX 116	-	-	-	-	-	-	-	-	-	0-10 *	
EX 117	0-6	6-39	-	-	-	-	-	-	39-43.5	43.5-44*	
EX 118	0-9	9-21	-	-	-	21-31.5	-	-	-	31.5-36 *	
EX 119	0-6	-	-	-	6-17.5	-	-	-	-	17.5-18 *	
EX 120	0-3	-	-	-	3-27 *						
EX 121	0-6	-	-	-	6-48 *						
EX 122	0-3	-	-	-	3-27	-	-	-	-	27-28 *	
EX 123	0-12	-	-	-	12-47 *						
EX 124	0-3	-	-	3-42	42-47 *						
EX 125	0-3	-	-	-	-	-	-	-	-	3-17.5 *	
EX 126	0-6	6-25	-	-	-	-	-	-	-	25-42 *	
EX 127	0-9	9-62	-	-	-	-	-	-	-	62-64 *	
EX 128	0-8	-	-	-	8-63 *						
EX 129	0-1.5	-	-	1.5-45	45-48 *						
EX 130	0-7.5	7.5-54	-	-	-	-	-	-	-	54-56 *	
EX 131	0-1	-	-	1-12	12-47 *						
EX 132	0-7	7-52.5	-	-	-	-	-	-	-	52.5-53 *	
EX 133	0-4.5	-	-	-	4.5-24	-	-	-	-	24-26.5*	
EX 134	0-12	12-37 *									
EX 135	0-6	6-95 *									
EX 136	0-6	6-84	-	-	-	-	-	-	-	84-84.5*	
EX 137	0-6	6-67 *									
EX 138	0-12	12-45	-	-	-	-	-	45-52 *			
EX 139	0-9	9-46	-	-	-	-	-	46-59 *			

0488

		TAPLEY HILL FORMATION										
Hole	Recent	Tertiary	Treg.Sh.	Why. Ss.	Yud.Bed.	Mag.Hill	Undiffer	Woocalla	McLeay	Pandurra	Roopena	
Ex 140	0-6	6-56.5	-	-	-	-	-	-	-	56.5-57	*	
EX 141	0-6	6-37.5	-	-	-	-	-	-	-	37.5-38	*	
EX 142	0-3	3-21	-	-	21-51	-	-	51-52.0	-	52-52.5	*	
EX 143	0-4.5	4.5-12	-	-	12-37.5	-	-	37.5-41.5	-	41.5-42	*	
EX 144	0-6	6-21	-	-	21-57	-	-	-	57-59.5	59.5-60	*	
EX 145	-	-	-	-	-	-	-	-	-	0-7	*	
EX 146	0-5	-	-	-	5-46	*						
EX 147	0-3	3-69	-	-	-	-	69-72.5	-	-	72.5-73	*	
EX 148	0-6	6-11	-	-	-	-	-	-	-	11-13	*	
EX 149	0-6	6-47	-	-	-	-	-	47-48.5	-	48.5-49	*	
EX 150	0-1	-	-	-	-	-	-	-	-	1-4	*	
EX 151	0-3	-	-	-	3-21.5	-	-	-	-	21.5-22	*	
EX 152	0-12	12-54	-	-	-	-	-	-	-	54-56	*	
EX 153	0-3	-	-	-	-	-	-	-	-	3-4	*	
EX 154	0-1	-	-	-	1-13.5	-	-	-	-	13.5-14	*	
EX 155	0-7	-	-	-	-	-	-	-	-	7-26	*	
EX 156	0-9	-	-	-	-	-	-	-	-	9-23	*	
EX 157	0-27	*										
BEDA BORE	0-3	-	-	3-54	54-86	-	86-140	-	-	-	140-335	*

PANDURRA E.L. 186 1975 DRILL HOLES
STRATIGRAPHIC INTERPRETATIONS

Hole 6332 P-1	0	-12	:	Cainozoic
	12	-35	:	Tertiary
Hole 6332 P-2	0	- 4.5	:	Cainozoic
	4.5	-16	:	Tertiary
	16	-19.5	:	Pandurra Formation
Hole 6332 P-3	0	- 3	:	Cainozoic
	3	-15	:	Tertiary
	15	-21	:	Pandurra Formation
Hole 6332 P-4	0	- 2	:	Cainozoic
	2	- 6	:	Pandurra Formation
Hole 6332 J-1	0	- 6	:	Cainozoic
	6	-10	:	Tertiary
	10	-19.5	:	Magazine Hill clay, Tapley Hill Formation
	19.5	-42	:	Undifferentiated Tapley Hill Formation
	42	-45	:	Woocalla Dolomite Member, Tapley Hill Formation
	45	-48	:	Pandurra Formation
Hole 6332 J-2	0	- 2	:	Cainozoic
	2	-10.5	:	Tapley Hill Formation
	10.5	-15	:	Pandurra Formation
Hole 6332 J-3	0	- 1.5	:	Cainozoic
	1.5	- 5	:	Pandurra Formation
Hole 6332 J-4	0	- 1	:	Cainozoic
	1	- 6	:	Magazine Hill Clay, Tapley Hill Formation
	6	-53	:	Tapley Hill Formation (Undifferentiated)
	53	-64	:	Dolerite Dyke

0490

Hole 6332 J-5	0	- 2	:	Cainozoic
	2	- 6	:	Pandurra Formation
Hole 6332 J-6	0	- 9	:	Cainozoic
	9	-33	:	Undifferentiated Tapley Hill Formation
	33	-36.5	:	Woocalla Dolomite Member, Tapley Hill Formation
	36.5	-37.5	:	McLeay Beds
	37.5	-42	:	Pandurra Formation
Hole 6332 J-7	0	- 6	:	Cainozoic
	6	-27	:	Undifferentiated Tapley Hill Formation
	27	-30	:	Woocalla Dolomite Member, Tapley Hill Formation
	30	-35	:	McLeay Beds
	35	-39	:	Dolerite Dyke
Hole 6332 J-8	0	- 9	:	Cainozoic
	9	-12	:	Magazine Hill clay, Tapley Hill Formation
	12	-36	:	Undifferentiated Tapley Hill Formation
	36	-39	:	Woocalla Dolomite Member, Tapley Hill Formation
	39	-45	:	Pandurra Formation
Hole 6332 J-9	0	- 1	:	Cainozoic
	1	-16	:	Weathered Undifferentiated Tapley Hill Formation
	16	-35	:	Undifferentiated Tapley Hill Formation
	35	-37-5	:	Woocalla Dolomite Member of Tapley Hill Formation
	37.5	-57	:	McLeay Beds

Hole 6332 J-10	0	- 2	:	Cainozoic
	2	-14	:	Weathered Tapley Hill Formation
	14	-17.5	:	Tapley Hill Formation (Undifferentiated)
	17.5	-37.5	:	McLeay Beds
Hole 6332 J-11	0	- 6	:	Cainozoic
	6	-12.5	:	Magazine Hill clay, Tapley Hill Formation
	12.5	-21	:	Weathered Tapley Hill Formation
	21	-36.5	:	Undifferentiated Tapley Hill Formation
	36.5	-40.5	:	McLeay Beds
	40.5	-69.5	:	Pandurra Formation
Hole 6332 I-1	0	- 6	:	Cainozoic
	6	-16	:	Weathered Tapley Hill Formation
	16	-26	:	Undifferentiated Tapley Hill Formation
	26	-33	:	Pandurra Formation
Hole 6432 Q-1	0	- 4	:	Cainozoic
	4	-12	:	Magazine Hill clay, Tapley Hill Formation
	12	-29.5	:	Weathered Tapley Hill Formation
	29.5	-31.5	:	Pandurra Formation
Hole 6432 Q-2	0	- 3	:	Cainozoic
	3	-16.5	:	Magazine Hill clay, Tapley Hill Formation
	16.5	-45	:	Undifferentiated Tapley Hill Formation
	45	-48	:	Pandurra Formation

0492

Hole 6333 Y-1	0	- 1	:	Cainozoic
	1	-12	:	Weathered Roopena Volcanics (clay)
	12	-24	:	Roopena Volcanics
Hole 6333 Y-2	0	- 3	:	Cainozoic
	3	-15	:	Weathered Yudnapinna Beds
	15	-24	:	Roopena Volcanics
Hole 6333 Y-3	0	- 3.5	:	Cainozoic
	3.5	-25.5	:	Weathered Yudnapinna Beds
	25.5	-81	:	Yudnapinna Beds
Hole 6333 Y-4	0	- 3	:	Cainozoic
	3	-53	:	Tregolana Shale
	53	-69	:	Yudnapinna Beds
Hole 6333 Y-5	0	- 3	:	Cainozoic
	3	-28.5	:	Weathered Yudnapinna Beds
	28.5	-54	:	Undifferentiated Tapley Hill Formation
	54	-59	:	Woocalla Dolomite Member, Tapley Hill Formation
	59	-69	:	Roopena Volcanics
Hole 6333 Y-6	0	- 2	:	Cainozoic
	2	-16	:	Weathered Yudnapinna Beds
	16	-24	:	Magazine Hill clay, Tapley Hill Formation
	24	-37	:	Undifferentiated Tapley Hill Formation
	37	-41.5	:	Woocalla Dolomite Member of Tapley Hill Formation
	41.5	-66	:	Weathered Roopena Volcanics?
	66	-76	:	Roopena Volcanics

0493

Hole 6333 T-1	0	- 9	:	Cainozoic
	9	-23.5	:	Tertiary
	23.5	-34.5	:	Pandurra Formation
Hole 6333 T-2	0	- 6	:	Cainozoic
	6	-21	:	Tertiary
	21	-36	:	Magazine Hill clay, Tapley Hill Formation
	36	-44.5	:	Undifferentiated Tapley Hill Formation
	44.5	-46	:	Woocalla Dolomite Member, Tapley Hill Formation
	46	-49.5	:	Pandurra Formation
Hole 6333 T-3	0	- 9	:	Cainozoic
	9	-41	:	Tertiary
	41	-46.5	:	Magazine Hill clay, Tapley Hill Formation
	46.5	-58.5	:	Undifferentiated Tapley Hill Formation
	58.5	-61	:	Woocalla Dolomite Member, Tapley Hill Formation
	61	-66	:	McLeay Beds
	66	-69	:	Pandurra Formation
Hole 6333 T-4	0	- 4	:	Cainozoic
	4	-42.5	:	Tertiary
	42.5	-45	:	Pandurra Formation
Hole 6333 T-5	0	-12	:	Cainozoic
	12	-37.5	:	Tertiary
	37.5	-49.5	:	Pandurra Formation
Hole 6333 X-1	0	- 1	:	Cainozoic
	1	-18	:	Weathered Undifferentiated Tapley Hill Formation
	18	-61.5	:	Undifferentiated Tapley Hill Formation
	61.5	-64.5	:	McLeay Beds
	64.5	-90	:	Pandurra Formation

Hole 6333 X-2	0	- 1	:	Cainozoic
	1	-13	:	Weathered Undifferentiated Tapley Hill Formation
	13	-49.5	:	Undifferentiated Tapley Hill Formation
	49.5	-54	:	Pandurra Formation
Hole 6333 X-3	0	- 4	:	Cainozoic
	4	- 6	:	Magazine Hill clay, Tapley Hill Formation
	6	-24	:	Weathered Undifferentiated Tapley Hill Formation
	24	-41	:	Undifferentiated Tapley Hill Formation
	41	-45	:	McLeay Beds
	45	-48	:	Pandurra Formation

PANDURRA E.L. 186 1975 DRILL HOLES

STRATIGRAPHIC INTERPRETATIONS

Hole YD-1	0 - 9 m	:	Cainozoic
	9 -45 m	:	Yudnapinna Beds
	45 -86 m (END)	:	Tapley Hill Formation (Undifferentiated)
Hole YD-2	0 - 6 m	:	Cainozoic
	6 -39 m	:	Weathered Yudnapinna Beds?
	39 -42 m (END)	:	Yudnapinna Beds
Hole YD-3	0 -12 m	:	Cainozoic
	12 -54 m	:	Yudnapinna Beds
	54 -60 m (END)	:	Pandurra Formation
Hole YD-4	0 -12 m	:	Cainozoic
	12 -30 m	:	Weathered Yudnapinna Beds
	30 -50 m	:	Yudnapinna Beds
	50 -64 m (END)	:	Pandurra Formation
Hole YD-5	0 - 7.5 m	:	Cainozoic
	7.5 -39 m	:	Weathered Yudnapinna Beds
	39 -69 m	:	Yudnapinna Beds
	69 -89 m	:	Tapley Hill Formation (Undifferentiated)
	89 -94 m(END)	:	Pandurra Formation
Hole YD-6	0 -15 m	:	Cainozoic
	15 -24 m	:	Weathered Yudnapinna Beds
	24 -36 m (END)	:	Pandurra Formation
Hole YD-7	0 - 6 m	:	Cainozoic
	6 -22.5 m	:	Yudnapinna Beds
	22.5 -30 m (END)	:	Pandurra Formation
Hole YD-8	0 - 3 m	:	Cainozoic
	3 -24 m	:	Yudnapinna Beds
	24 -42 m (END)	:	Pandurra Formation

Hole YD-9	0	- 1 m	: Cainozoic
	1	- 6 m (END)	: Pandurra Formation
Hole YD-10	0	- 1 m	: Cainozoic
	1	-15 m	: ? Weathered Yudnapinna Beds
	15	-20 m (END)	: Pandurra Formation
Hole YD-11	0	-15 m	: Cainozoic
	15	-27 m	: ? Weathered Yudnapinna Beds
	27	-33 m (END)	: Pandurra Formation
Hold YD-12	0	- 9 m	: Cainozoic
	9	-18 m (END)	: Pandurra Formation
Hole YD-13	0	- 4.5 m	: Cainozoic
	4.5	-63 m	: Yudnapinna Beds
	63	-69 m (END)	: Pandurra Formation
Hole YD-14	0	- 3 m	: Cainozoic
	3	-39 m (approx)	? Tertiary
	39	-42 m (END)	: ? Tapley Hill Formation (Undifferentiated)
Hole YD-15	0	- 8 m	: Cainozoic
	8	-37 m	: ? Tertiary
	37	-40 m	: Pandurra Formation

APPENDIX II

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CONSULTING GEOPHYSICIST

0498

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July 20th, 1976

MEMORANDUM TO : MR. D. TONKIN,
PACMINEX PTY. LTD.,
P.O. BOX 595,
PORT AUGUSTA, S.A.

c.c. to : MR. W. LANGRON,
PACMINEX PTY. LTD.,
BOX R221,
ROYAL EXCHANGE,
SYDNEY, N.S.W. 2000

MEMORANDUM FROM : MR. R.J. SMITH,
CONSULTING GEOPHYSICIST.

SUBJECT : PRELIMINARY INTERPRETATION OF AIRBORNE MAGNETIC DATA FROM WINNIE PINNIE AND YDNAPINNA AREAS, S.A.

0499

I. INTRODUCTION

At the request of Mr. W. Langron and Mr. D. Tonkin of Pacminex Pty. Ltd., the author has undertaken a preliminary interpretation of airborne mangetic data from Winnie Pinnie (sheets 1,2) and Yudnapinna (sheets 3,4,5 and 6) ares of S.A. The magnetic data was collected concurrently with an airborne INPUT survey carried out by Geoterrex Ltd. during February 1975. The survey area is located partly on the Torrens and partly on the Port Augusta 1:250000 sheet areas south of Pernatty Lagoon and the Mt. Gunson copper mineralisation.

The survey area is underlain by a sequence of Upper Proterozoic Adelaidean sediments, relatively flat lying and poorly exposed. The regional geology is described in Report of Investigations 42 of the Geological Survey of South Australia ("Base Metal Mineralisation in the Pernatty Lagoon Region" by R.K. Johns). The oldest clastic rocks in the sequence belong to the Pandurra Formation and consist of horizontally disposed pebbly quartzite, grits and sandstones. This formation is thought to suboutcrop over most of the western half of the survey area.

Overlying the Pandurra Formation, but not always present, is the Woocalla Dolomite (dolomitic shales, dolomites and finely laminated black shales) which rests disconformably on the Pandurra Formation and fills depressions in its surface. No Woocalla Dolomite appears to have been mapped within the survey area although it presumably may exist beneath cover, particularly in the eastern half of the survey area.

The Whyalla Sandstone Member of the Tent Hill Formation (white sandstones, basal grits and sandstones) overlies the Woocalla Dolomite (locally) and frequently rests disconformably on Pandurra Formation. Whyalla Sandstone has been mapped over most of the eastern part of the survey area.

A swarm of basic dykes (dolerite with magnetite) are known to exist in the area intruding the Pandurra Formation and possibly also other younger formations. These are evident as numerous north west trending linear magnetic anomalies on the regional aeromagnetics (Torrens 1:250,000 sheet) but have not generally been mapped on the ground in any detail.

The aim of this preliminary interpretation is to identify general features in the magnetic data (e.g. linear anomalies) and hopefully note dislocation which may suggest faulting. The disconformity between Pandurra Formation and either Woocalla Dolomite or Whyalla Sandstones is considered to be prospective for further "Mt. Gunson type" mineralisation and the depth of this disconformity is therefore of great interest. Some general conclusio are drawn and recommendations for possible additional work are made at the end of this memorandum.

Data supplied by Pacminex Pty. Ltd. to assist in this preliminary interpretation consisted of:

(1) Isomagnetic contour maps (sheets 1 to 6) of the Winnie Pinnie and Ydnapinna Areas (scale 1:25000, contour interval 10 gamma) prepared by Geoterrex Ltd.

(2) Interpretation of INPUT data maps (sheets 1 to 5) for E.L. 199 Pernatty Lagoon and E.L. 186 Pandurra S.A., Winnie Pinnie and Yudnapinna Areas (scale 1:25000) prepared by Pacminex Pty. Ltd.

(3) A photoreduction of the isomagnetic contours on to one sheet at a scale of 1:100,000.

(4) Regional aeromagnetic contour maps of the Torrens and Port Augusta 1:250,000 sheets areas (scale 1:250,000).

(5) Report of Investigations 42, Geological Survey of S.A., "Base Metal Mineralisation in the Pernatty Lagoon Region" by R.K. Johns.

In addition, Mr. D. Tonkin of Pacminex Pty. Ltd. spent some time in discussions with the author to clarify current ideas on exploration in the area.

It must be stressed that this is intended as a prelinary interpretation only A more exhaustive treatment would necessitate reference to the original flight profiles and quantitative interpretation of depth, dip, etc., for magnetic sources. This has not been attempted to date.

2. INTERPRETATION

Regional aeromagnetic data on the Torrens 1:250,000 sheet was collected for S.A. Dept. of Mines and processed by them. The survey was flown at an altitude of 500 ft. on east west lines approximately 1 mile apart and the survey is described in B.M.R. Record 1964/31. This data was initially published as a series of 1 mile sheets (1:63,360) and subsequently reduced for presentation at a scale of 1:250,000. In this form it was published in 1966 with a 10 gamma contour interval. This data has been interpreted previously by Webb, J.E. and Woyzbun, P., 1967 (Interpretation of the results of airborne magnetometer survey covering S.M.L. 139,152 to Noranda Australia Ltd., S.A. Dept. Mines open file Envelope 886 - unpublished). A summary of their interpretation is included in Report of Investigations 42 by R.K. Johns.

Is this Report?

Webb and Woyzbun defined three main zones of which the "western zone" includes the area of interest in this memorandum. This zone displayed a number of linear, north west trending magnetic anomalies, apparently interrupted by perpendicular linearments interpreted as fractures and faults. The north west trending anomalies have been demonstrated to be related to dolerite dykes (Jones M.T., 1970 "Results of drilling of a magnetic anomaly 4 miles southeast of Katunga Hills, S.A."; Report to The Borken Hill Pty. Ltd. S.A. Dept. Mines open file Envelope 1175 - unpublished). The depth of these dykes was estimated by Webb and Woyzbun at 500 ft. to 1200 ft.

Although it has been concluded that the north-west striking linear magnetic anomalies are dolerite dykes they cannot be considered equivalent to the dolerite dyke tested by B.H.P. near Katunga Hills. This dyke was shown to contain 6 to 10 percent magnetite and resulted in a linear aeromagnetic anomaly with an amplitude of approximately 1500 gamma (greater than 2000 gamma on the ground). The anomalies of interest on the Torrens sheet rarely exceed 100 to 200 gamma although they have a similar strike direction and dolerite dykes represent a probable source.

Regional aeromagnetic data on the Port August 1:250,000 sheet has recently become available. This survey was flown and compiled by the Bureau of Mineral Resources, Geology and Geophysics. The survey was flown on east-west lines 1.5 km. apart at an altitude of 150 metre. The data has been published as preliminary contours at a scale of 1:250,000 (contour interval 50 gamma). This broad contour interval results in the suppression of the linear trends which stand out so clearly on the Torrens sheet. No detailed interpretation is possible on this data however the profiles may be available and future published maps may provide a closer contour interval.

check S.H.P.

The detailed aeromagnetic data available in the Winnie Pinnie and Yudnapinna areas was collected concurrently with an airborne INPUT survey by Geoterrex Ltd. The survey was flown on east-west lines approximately 400 metre apart at an altitude of 120 metre. The data was recorded on analogue charts and compiled by Geoterrex Ltd. into a contour plan at a scale of 1:25000 (contour interval 10 gamma).

The data was presented on six sheets and also on one sheet, photoreduced to a scale of 1:100,000. Interpretation was made by reference to both of these scales but, for convenience, it is summarized on the enclosed overlay at a scale of 1:100,000. For a line spacing of 400 metre, the survey altitude (120 metre) is greater than normal for a magnetic survey (in this case altitude was determined primarily by the requirements of

? Will D.G.T.

INPUT) resulting in smooth, regular contours which can be reduced to 1:100,000 scale without much loss of detail. A number of features were recognizable and they are discussed below.

(1) The most obvious feature, which dominates the entire survey area, is the profusion of approximately north north-west striking linear magnetic anomalies. These are presumably due to the swarm of dolerite dykes described by Webb and Woyzbun but the detailed survey has revealed more than were evident in the regional data. A number of these linear anomalies have been shown in green on the enclosed overlay. Some of the less definite trends (shown with broken lines) may be the result of somewhat subjective contouring however most of the anomalies are well established and quite definite. There appear to be two main strike directions, one approximately 30° west of north and a second approximately 20° west of north. The difference is barely recognizable and may not be significant. The anomaly shapes suggest a steep dip but no quantitative estimates of dip, depth, etc. have been attempted.

(2) The north east corner and southern boundary of the survey area show increasing magnetic intensity indicating probable major anomalies outside the survey area. The northern anomaly forms the southern limit of a pronounced magnetic anomaly which extends north north west through the "central zone" defined by Webb and Woyzbun. This anomaly apparently correlates with the "Pernatty Culmination", it is estimated to be deep seated (4000 ft. to 6000 ft.) and is considered to be related to a basement uplift.

The southern anomaly is outlined on the Port Augusta, 1:250,000 sheet, but definition is poor with the wide contour interval. It seems likely to also indicate a deep seated source and, by analogy with the Pernatty Culmination, may also be related to a basement uplift.

(3) A number of breaks or dislocations are suggested by the linear magnetic anomalies in the survey area, but the perpendicular linearments suggested by Webb and Woyzbun are not obvious. They may be more apparent if a larger area is considered.

Instead, a broad zone of possible dislocation is proposed, trending approximately 60° west of north and extending across the centre of the survey area. This suggested lineament must be considered tentative but it presents an alternative to some of the earlier interpretation. Dislocations in this direction would be parallel to several major faults further north and to the east in S.A. (McDonald, Nor West, Lake Eyre and Lake Blanche) and therefore could be of major structural significance. There is evidence of other possible dislocations, in this direction, within the survey area and outside it, on the Torrens 1:250,000 sheet.

These suggested dislocations are shown in blue on the enclosed overlay. They cannot be regarded as established facts but are submitted for discussion.

(4) Apart from the major positive anomalies in the north east and southern parts of the survey area, total magnetic intensity variations rarely exceed about 200 gamma. The western half of the survey area is generally less than 5200 gamma and the eastern half generally more than 5200 gamma. The boundary between these two zones trends about 30° west of north, roughly parallel with the dyke swarm.

All of the mapped Pandurra Formation occurs west of this boundary, further east it is apparently deeper and overlain by Whyalla Sandstone. This apparent relationship between magnetic field intensity and geology may be fortuitous but it suggests that the Pandurra Formation may be related to magnetic "lows", presumably due to a higher magnetic susceptibility in the overlying formations.

A cluster of drill holes near the centre of sheet 1 (WP1 - WP30) suggest a local depression in the Pandurra Formation, possibly fault bounded, with a subsurface ridge defined by WP9 and WP18. This would also coincide with a local zone of relatively high magnetic intensity and the subsurface ridge would be close to a trough in the magnetic data.

~~This~~ apparent correlation is far from proven and no doubt it tends to oversimplify the true situation. It does however suggest some interesting possibilities. The broad magnetic "lows" near the south east corner of Sheet 1 and near Marouson Dam on Sheet 4 may represent areas of shallow Pandurra Formation although this does not appear to be supported by the INPUT interpretation. The anomalies on sheet 1 may simply be part of the anomaly pattern due to the Pernatty Culmination.

(5) An apparent local anomaly, showing a typical dipolar pattern, was evident on sheet 6. The anomaly is defined on flight lines 555W, 556E and 557W, close to Hotel Creek. It is marked in red on the enclosed overlay and designated anomaly A.

There is no obvious source for this anomaly and it may represent a discrete portion of a dolerite dyke dislocated by faulting. In any case it represents a discrete magnetic source and it should not be difficult to locate on the ground by measurements with a portable magnetometer. It should be possible to draw more definite conclusions about the nature of the source.

(6) Although it is not possible to draw definite conclusions about the depth of the "dolerite dykes" from the magnetic contour pattern, some general conclusions may be possible. The contour pattern over linear anomalies in the western half of the survey area suggests shallower sources than anomalies further east (e.g. compare anomalies B and C with anomalies D and E). This could be checked by depth estimates on the flight profiles.

If this apparent depth difference proves to be real, it perhaps suggests that the dolerite dykes intrude to the top of the Pandurra Formation but not into the overlying Whyalla Sandstone (and possibly not into the Woocalla Dolomite). Depth estimates on the dolerite dykes would then be equivalent to depth estimates on the Pandurra Formation. The dykes are so common and clearly defined that this may present a straightforward method of estimating depth to Pandurra Formation throughout the survey area.

3. CONCLUSIONS AND RECOMMENDATIONS

A preliminary interpretation of the Winnie Pinnie and Yudnapinna aeromagnetic results is shown on the enclosed overlay and supplemented by explanatory notes in this memorandum. The most obvious features are the large numbers of linear magnetic anomalies, interpreted as dolerite dykes, trending north north west throughout the survey area

Possible dislocations in the interpreted dyke pattern are noted and a general azimuth of 300° is suggested for these dislocations.

Apparent correlation between magnetic "lows" and outcropping Pandurra Formation was noted and may assist in locating other areas of shallow Pandurra Formation. In addition, depth estimates on the "dyke" anomalic may be equivalent to depth estimates to Pandurra Formation.

Additional drilling results from the 1976 field program should be compiled and checked for general agreement with the above conclusions. Depth estimates should be made on the dyke anomalies using flight profil and compared with depths from drilling or from mapped outcrop.

Several magnetic anomalies (e.g. Anomaly A and a number of dyke anomalie in areas of outcrop) should be located on the ground by measurements with a portable magnetometer. It may be possible to draw conclusions about the nature of the source by a surface inspection. Anomaly A may be of direct significance but detailed measurements on the ground will be necessary before reaching any further conclusions.

A number of points raised in this interpretation are tentative but are submitted for consideration and possible discussion. Further discussion would be welcomed and it may be possible to further extend the interpretation as additional geological information becomes available from drilling.

Robert J. Smith

ROBERT J. SMITH,
Geophysicist.

5

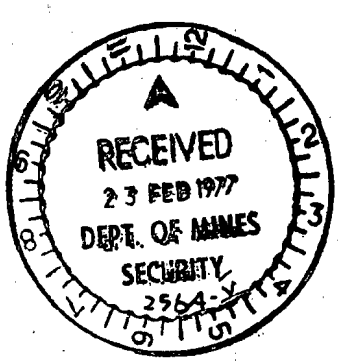
0506

Prospect 405

PACMINEX PTY. LIMITED

SEVENTH QUARTERLY REPORT
ON EXPLORATION LICENCE 186
PANDURRA AREA, S.A.
FOR PERIOD ENDED 7TH JANUARY, 1977

PMR 14/77



PORT AUGUSTA
January, 1977

D.G. TONKIN

EXPLORATION LICENCE 186 (PANDURRA)

SUMMARY OF EXPENDITURE FOR THE THREE MONTH PERIOD ENDING 31ST DECEMBER, 1976

Expenditure for the 7th Quarterly period was $12,018, making a total of $180,567 since the E.L. was granted.

The quarterly expenditure was incurred as follows:-

Geological and Geophysical:	$ 198
Drilling Costs:	$ 927
Logistics (including salaries and wages)	$ 10,684
Depreciation:	Nil
Administration:	$ 209
Other Costs:	Nil
Total:	$ 12,018

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0508

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CONTENTS

		PAGE NO.
1.	INTRODUCTION	1
2.	SUMMARY	2
3.	INPUT ORIENTATION EVALUATION	3
	3.1 Cariewerloo Target	3
	3.2 Pandurra Target	3
4.	PROPOSED RESISTIVITY AND MAGNETIC SURVEY	4
5.	AEROMAGNETIC INTERPRETATION	5

APPENDIX

I LIST OF EQUIPMENT USED BY GEOTERREX IN GEOPHYSICAL SURVEYS

LIST OF ILLUSTRATIONS

FIGURES		FACING PAGE NO.
1.	LOCALITY PLAN, E.L. 186, PANDURRA AREA, SOUTH AUSTRALIA	1
2.	AIRBORNE INPUT ORIENTATION SURVEY FLIGHT LINES, CARIEWERLOO AND PANDURRA TARGETS	3
3.	PANDURRA TARGET, PROPOSED RESISTIVITY AND MAGNETIC SURVEY LINES	4

PLANS (IN POCKET) PMX DWG NO.		SCALE
I 534 - 6	INPUT AND GEOLOGY, CARIEWERLOO TARGET	1:50,000
I 534 - 5	INPUT AND GEOLOGY, PANDURRA TARGET	1:50,000

KEYWORDS

SOUTH AUSTRALIA
9E L 186
9PANDURRA
EXPLORATION
GEOLOGY
INPUT
SURVEY
EVALUATION
AERIAL
MAGNETIC
1977
8SI 53-04

1. INTRODUCTION

This report summarises exploration in E.L. 186, Pandurra Area, South Australia during the quarter 7th October, 1976 to 7th January, 1977. It is the seventh quarterly report submitted to the South Australian Department of Mines for E.L. 186.

2. SUMMARY

Work during the quarter consisted mainly of evaluation and planning. This report deals especially with :-

2.1 Evaluation of orientation INPUT surveys at Cariewerloo and Pandurra targets.

2.2 Planning of resistivity and magnetic surveys at Pandurra target, and

2.3 Interpretation of regional aeromagnetic data.

Other activities during the quarter included :-

2.4 Computer encoding of drilling data, and

2.5 Re-evaluation of the exploration potential in the light of Western Mining Corporation's discovery at Olympic Dam.

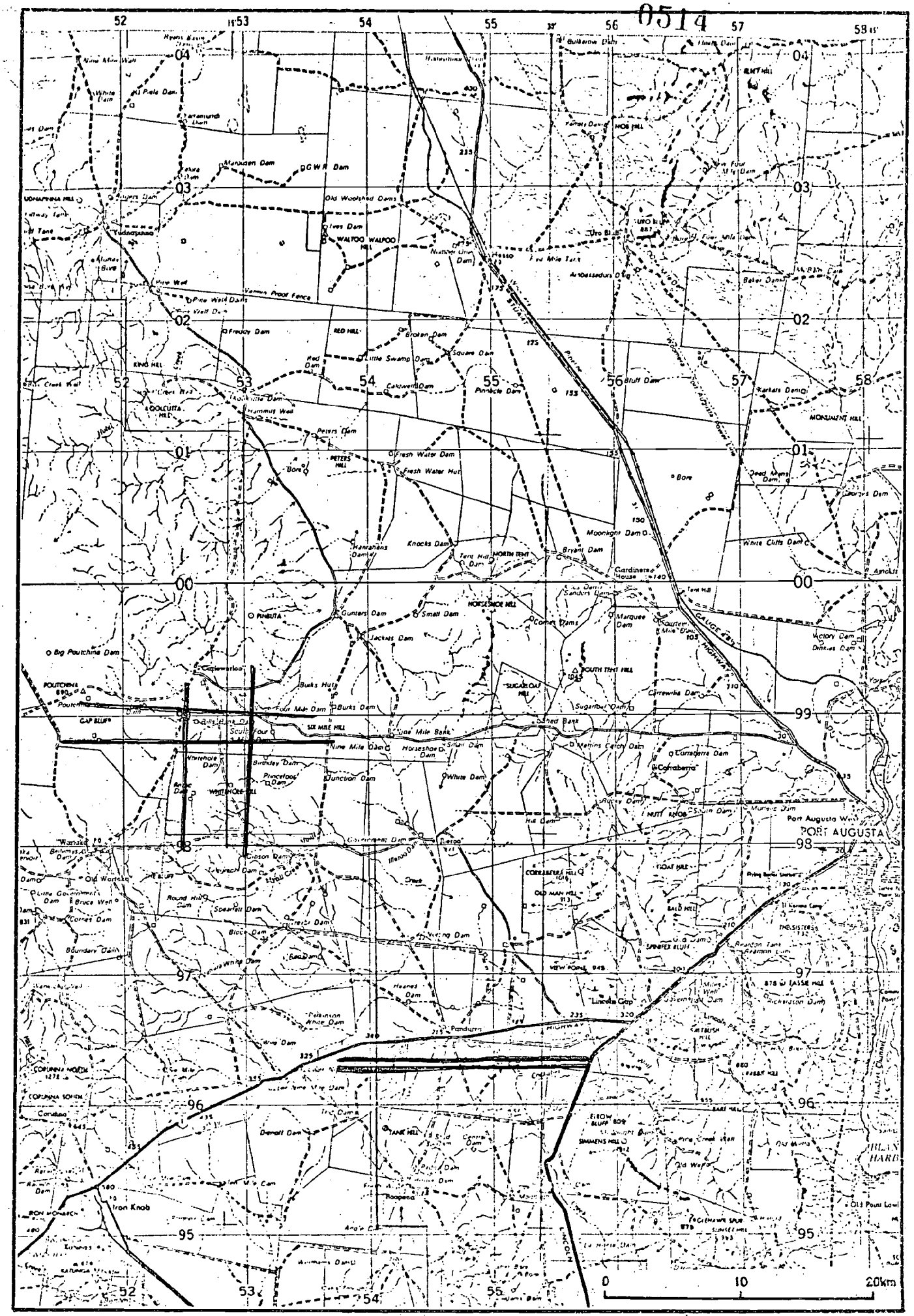


FIGURE 2 : AIRBORNE INPUT ORIENTATION SURVEY FLIGHT LINES, CARIEWERLOO AND PANDURRA AREAS

3. INPUT ORIENTATION EVALUATION

The results from six INPUT orientation lines flown in February, 1976 (reported in Quarterly Report No. 4, E.L. 186) were evaluated. Amplitude ratio analyses of the INPUT references were compared with geology as known from mapping and drilling. The locations of the test lines are shown on Figure 2. A summary of the equipment used in this survey will be found in Appendix I.

3.1 Cariewerloo Target

A grid of four lines was flown over an outlier of Tapley Hill Formation black shales lying between Anzac Dam and South Four Mile Dam (Figure 2). The object was to find the extent of the sub-outcropping outlier. A sub-circular zone of enhanced INPUT response corresponded well with the known limits of the Tapley Hill Formation and suggested that there were no undetected extensions to this basin-filling deposit (see DWG No. I 534 - 6).

3.2 Pandurra Target

Two parallel east-west lines were flown across this target to evaluate the capability of INPUT to map the extent of sub-outcropping Tapley Hill Formation. A secondary test was to find out whether the system could detect a palaeo stream channel buried beneath the Tapley Hill Formation. On the basis of INPUT amplitude ratio analysis, the system was not effective on either count (see DWG No. I 534 - 5).

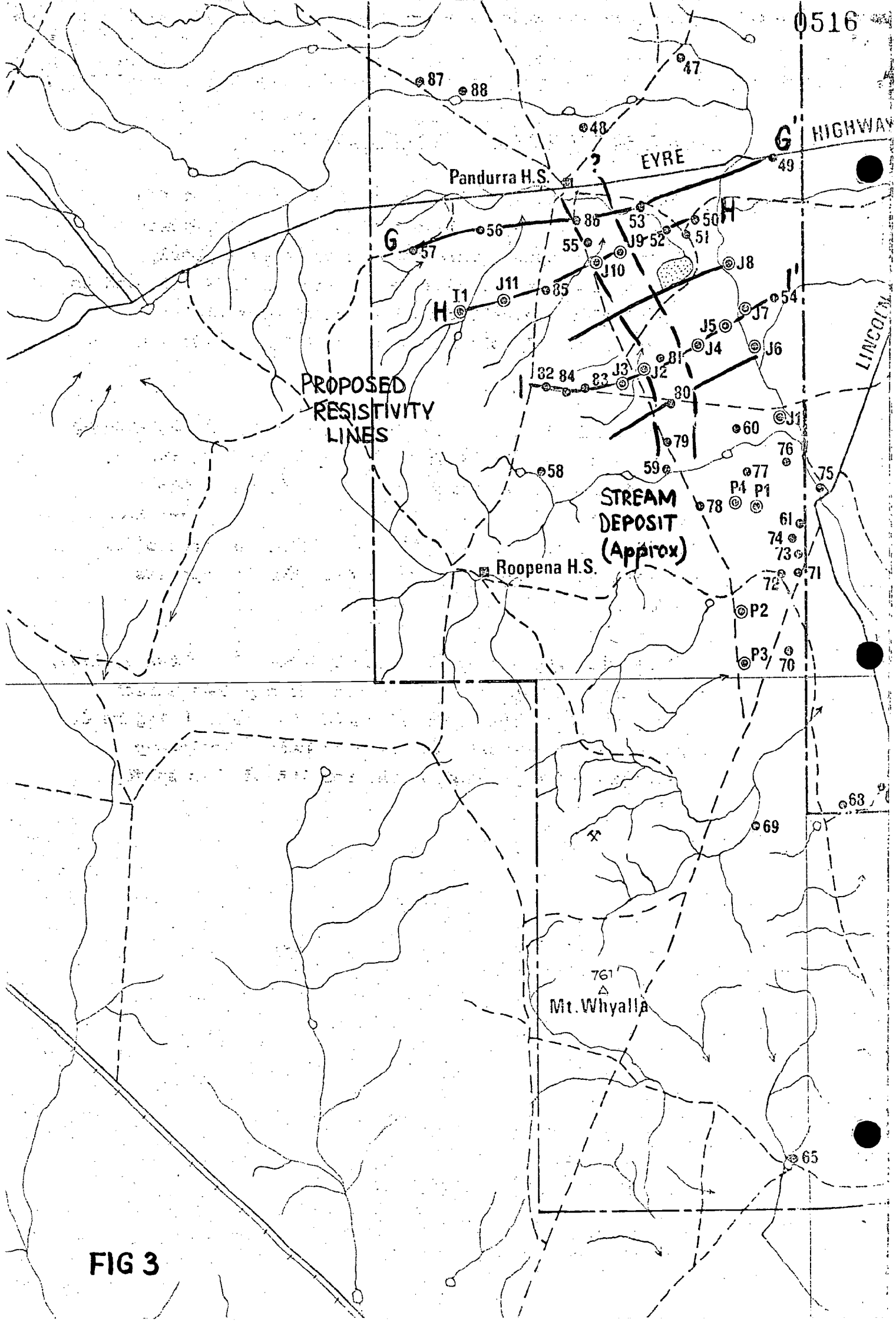

0516
87
88
47
48
G'
HIGHWAY
?
EYRE
Pandurra H.S.
49
H
86
53
50
G
56
55
J9
52
51
57
J10
J8
I'
J11
85
I1
H
54
J7
J5
J4
J6
LINCOLN
PROPOSED
RESISTIVITY
LINES
32
84
83
J3
J2
81
80
J1
60
79
76
58
59
77
75
P4
P1
STREAM
DEPOSIT
(Approx)
78
61
74
73
Roopena H.S.
72
71
P2
P3
70
68
69
761'
Mt. Whyalla
65

FIG 3

0517

4. PROPOSED RESISTIVITY AND MAGNETIC SURVEY

Stratigraphic drilling detected an ancient stream channel beneath the Tapley Hill Formation between "Roopena" and "Pandurra" homesteads. This channel contains a poorly consolidated conglomeratic sandstone deposit which is believed to be stratigraphically equivalent to the McLeay Beds of the Pernatty area. At drill hole EX 80, this deposit attains a thickness in excess of 54 m.

Drill hole 6332 J-4, on the eastern side of the channel, intersected a dolerite dyke beneath the Tapley Hill Formation. At drill hole 6332 J-10, abundant pyrite was found in the conglomeratic sandstone deposit. The Pandurra copper prospect lies about 2.5 km east of hole 6332 J-10. This combination of geological features has much in common with the Cu deposits at Mt. Gunson.

A resistivity survey, to be conducted in February, 1977, is planned to trace the path of the buried McLeay Beds stream channel. The extent of the proposed survey is shown on Figure 3. Ground magnetometer traverses will also be made. Follow-up drilling is envisaged depending on the results of this survey.

0518

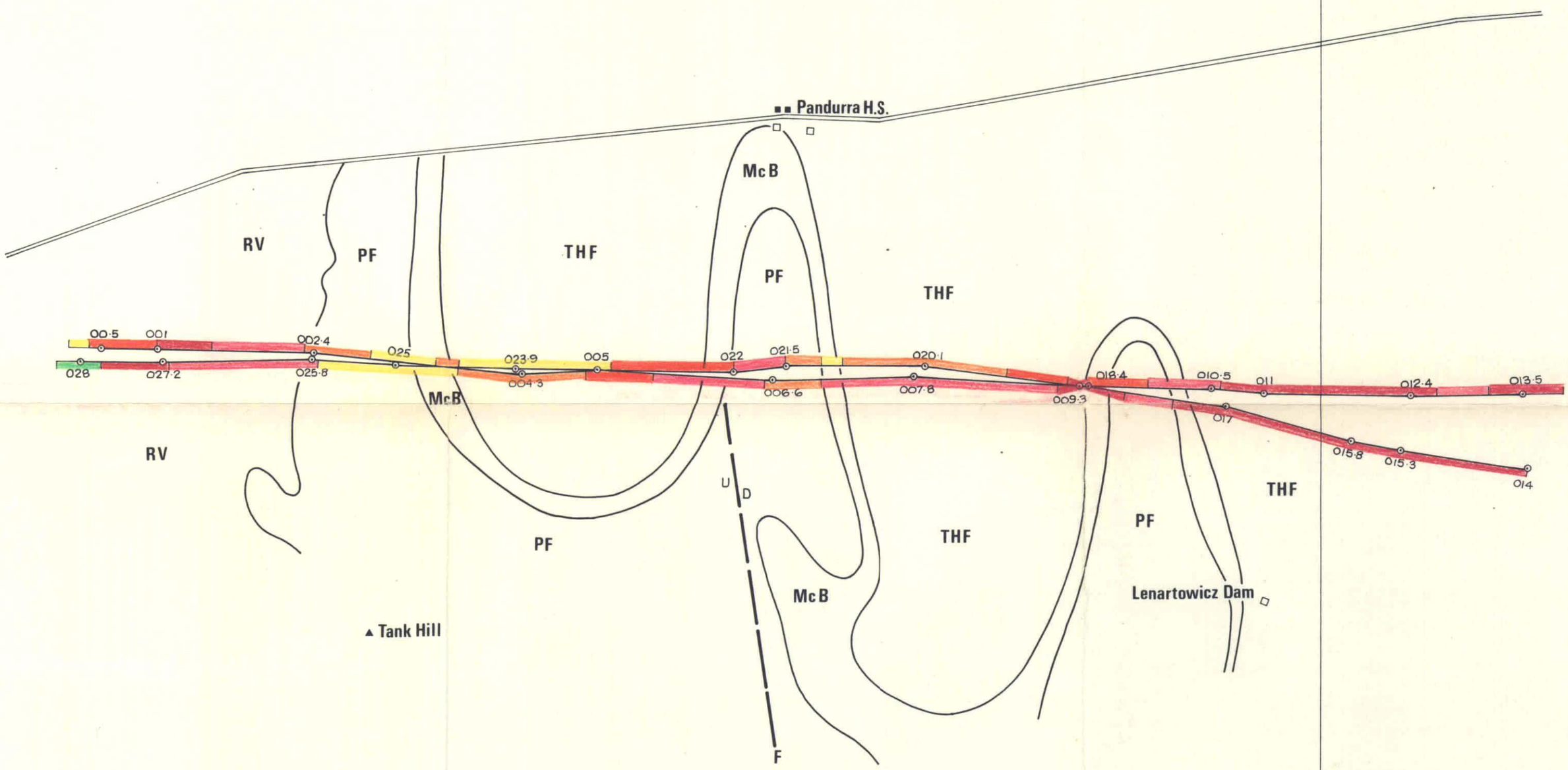
5. AEROMAGNETIC INTERPRETATION

Interpretation of regional aeromagnetic data on the Torrens Sheet suggests the presence of an ancient lineament running through the Mt. Gunson copper deposits and trending southwards through E.L. 186. The trend of this lineament would run somewhere between "Yudnapinna" and "Hesso" (Figure 1).

Exploration along this proposed lineament is planned, probably by deep drilling. However, this work cannot proceed until a more detailed aeromagnetic contour map for the Port Augusta Sheet becomes available.

D.G. TONKIN

L.K.



REFERENCE

THF	TAPLEY HILL FORMATION
McB	Mc LEAY BEDS
PF	PANDURRA FORMATION
RV	ROOPENA VOLCANICS

RATIO OF 1ST. & 6TH CHANNELS

- <7
- 7-9
- 9-12
- 12-16
- 16-21
- 21-27
- 27-35
- 35-44
- 44-54
- >54

PACMINEX PTY. LIMITED

E.L.186 PANDURRA AREA S.A.
TRIAL INPUT SURVEY
PANDURRA AREA–TEST 264/265

RECEIVED
23 FEB 1977
DEPT. OF MINES
SECURITY
2564 (V)

SCALE	1:50,000	DRG. No.
DRAWN		I 534–5
DATE	February 1976 / January 1977	
REVISED		

2564 (V)–2



REFERENCE

THF	TAPLEY HILL FORMATION
PF	PANDURRA FORMATION
RV	ROOPENA VOLCANICS

RATIO OF 1ST. & 6TH CHANNELS

- < 7
- 7-9
- 9-12
- 12-16
- 16-21
- 21-27
- 27-35
- 35-44
- 44-54
- >54

PACMINEX PTY. LIMITED

E.L. 186 PANDURRA AREA S.A.
TRIAL INPUT SURVEY
CARIEWERLOO AREA – TEST 264/265

SCALE	1 : 50,000	DRG. No.	I 534-6
DRAWN			
DATE	February '76 / January '77		
REVISED			

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SECURITY
2564

2564(V)3

APPENDIX I

LIST OF EQUIPMENT USED BY GEOTERREX IN GEOPHYSICAL SURVEYS

INSTRUMENT SPECIFICATIONS - PANDURRA TEST

0520

MARK V INPUT SYSTEM

TRANSMITTER : Repetition Rate : 288 pulses/sec.

Pulse Width : 1.0 msec.

Pulse Separation : 2.47 msec.

RECEIVER :

CHANNEL	GATE CENTRE (usec)	GATE WIDTH (usec)
1	450	200
2	550	200
3	750	400
4	1150	400
5	1550	600
6	1850	600

Time Constant : 2.5 secs.

Calibration : Rx signal = 0.8V.
2mV at cable amplifier = 1.5" (38mm) trace deflection.
Sensitivity of received signal, as ppm/ 0.1" of peak-peak primary field, measured during straight and level flight, is 166.

MAGNETOMETER : GeoMetrics Model 803

		Sensitivity	Scale
Fine Scale :	200γ Full Scale	$\pm$ 2γ	inch = 40γ
Coarse Scale :	2000γ Full Scale	$\pm$ 20γ	inch = 400γ

Total field increases downwards.

Magnetometer reads every 1.05 sec.

0521

ALTIMETER : Model APN-1

Approximate scale : 1 inch = 200 feet

Height increases downwards.

FIDUCIAL SYSTEM : 1 fiducial = 21 secs = 20 magnetometer readings.

INPUT lag = 4.5 secs = .21 fiducials.

Prospect 405

PACMINEX PTY. LIMITED

PANDURRA AREA
FINAL QUARTERLY REPORT ON EXPLORATION FOR EXPLORATION LICENCE 186
PERIOD ENDING 7TH APRIL 1977

PMR 105/77



PORT AUGUSTA
May, 1977

D.G. TONKIN

EXPLORATION LICENCE 186 (PANDURRA)

SUMMARY OF EXPENDITURE

FOR THE THREE MONTH PERIOD

ENDING 31st MARCH, 1977

Expenditure for the 8th Quarterly period was $23,045 making a total of $203,612 since the E.L. was granted.

The quarterly expenditure was incurred as follows:

	$
Geological and Geophysical	7350
Drilling Costs	Nil
Logistics (including Salaries & Wages)	13490
Depreciation	Nil
Administration	2205
Other Costs	Nil
TOTAL	23045

0524

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CONTENTS

		PAGE NO.
1.	INTRODUCTION	1
2.	SUMMARY	2
3.	PANDURRA RESISTIVITY AND MAGNETOMETER SURVEYS	3
4.	REGIONAL GEOPHYSICAL INTERPRETATION	5

APPENDIX

I MURDOCH GEOPHYSICS REPORT NO. 265
PART A - TEXT; PART B - MAPS
"A RESISTIVITY SURVEY AT PANDURRA, NEAR PORT AUGUSTA, S.A. FOR PACMINEX PTY. LIMITED."

LIST OF ILLUSTRATIONS

FIGURES		FACING PAGE NO.
1	LOCALITY PLAN, E.L. 186, PANDURRA AREA, SOUTH AUSTRALIA	1
2	PANDURRA TARGET, LOCATION OF RESISTIVITY AND MAGNETIC SURVEY LINES	3

PLANS (IN POCKET)

PMX DWG. NO.			SCALE
I 534-7	E.L. 186 PANDURRA AREA, S.A. MAGNETIC PROFILE LOCATION PLAN		1:25,000
I534-8	E.L. 186 PANDURRA AREA, S.A. MAGNETIC PROFILES	HORIZONTAL	1:50,000
		VERTICAL	1:25,000

KEYWORDS

SOUTH AUSTRALIA
RESISTIVITY
REGIONAL
9EL 186
SURVEY
1977
9PANDURRA
EVALUATION
8SI 53-04
MAGNETIC
GROUND

1. INTRODUCTION

This report summarises exploration in E.L. 186, Pandurra Area, South Australia, during the quarter 7th January to 7th April, 1977. It is the eighth and final quarterly report to the South Australian Department of Mines for E.L. 186, which expired on 7th April, 1977. An application by CSR Limited for a new E.L.to cover the same area has been approved (DM 106/77).

0529

2. SUMMARY

Work during the quarterly period consisted of :-

2.1 A resistivity survey covering 40 line km about the Pandurra Copper Prospect.

2.2 A ground magnetometer survey covering 52 line km about the Pandurra Copper Prospect

2.3 Assembly and preliminary study of regional aeromagnetic and gravity survey data.

2.4 Planning of drilling to depth in the Pandurra area on geological and geophysical targets. Drilling was planned on hole J12 from mid April subsequent to the closing date of this quarter. Sites and results of drilling will be reported in subsequent reports.

2.5 Constant discussion has been held with Department of Mines geologists and geophysicists concerning current work in progress and work planned.

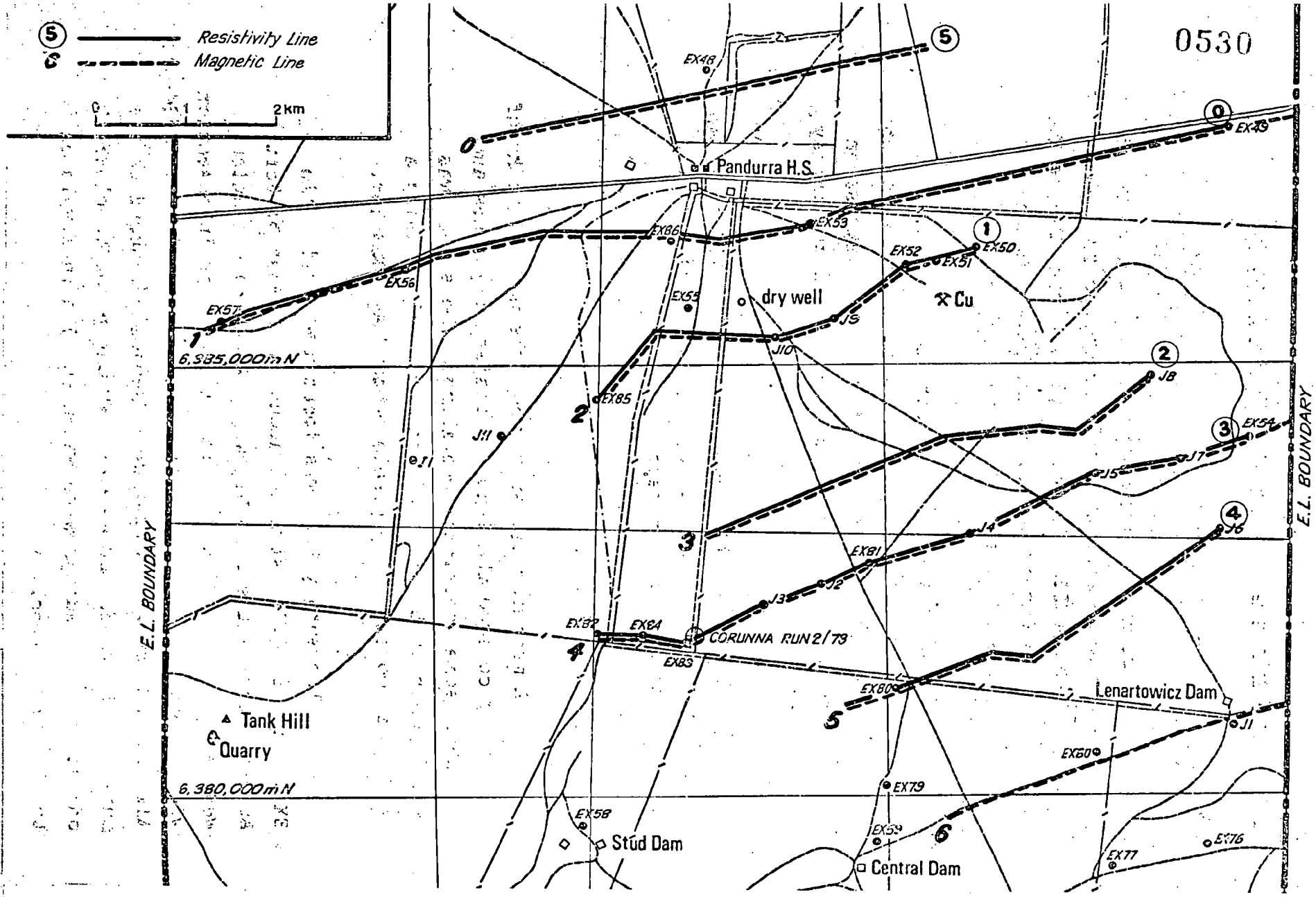


FIGURE 2: PANDURRA TARGET, LOCATION OF RESISTIVITY AND MAGNETIC SURVEY LINES

3. PANDURRA RESISTIVITY AND MAGNETOMETER SURVEYS

3.1 Resistivity Survey

A resistivity survey covering 40 line km of traverse was made over the Pandurra Copper Prospect locality between 21st February and 12 March (Figure 2). The aim of the survey was to define paleo-channels indicated by earlier stratigraphic drilling.

A preliminary assessment of the results suggests that the survey defined a paleo depression in electrically resistive rocks and that this depression is occupied by more conductive sediments of the Tapley Hill Formation.

The survey was made by Murdoch Geophysics Pty. Ltd. A technical report including plans and profiles forms Appendix I to this report.

3.2 Magnetometer Survey

A magnetometer survey comprising 52 line km of traversing covered the Pandurra resistivity lines and included some additional profiling. The survey was made between 25th March and 7th April, 1977. using a Geometrics model G816 portable proton magnetometer.

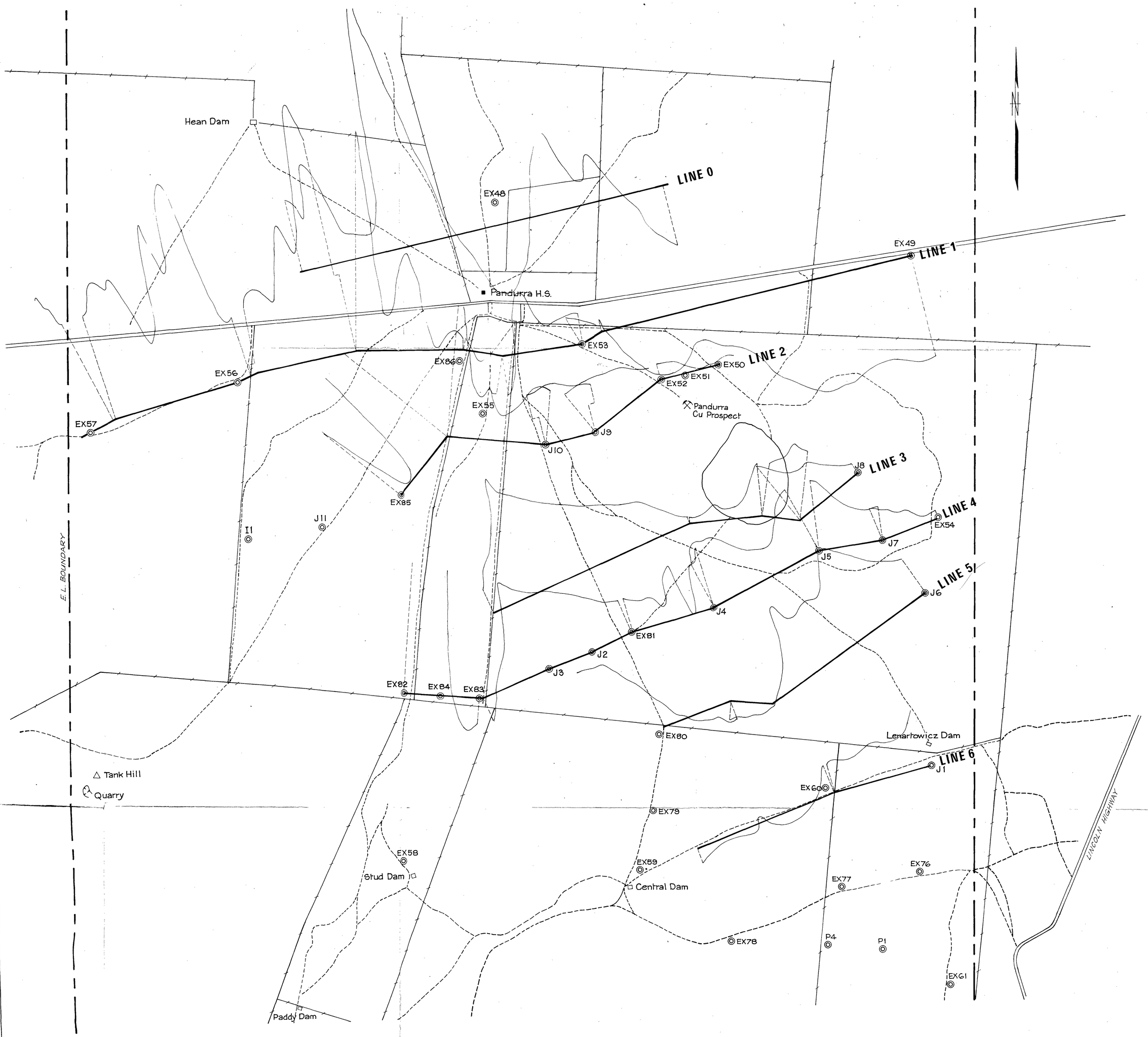
The survey base was located at drill hole EX49 (Line 1, 0.0), situated about 34 km. west of Port Augusta, beside the Eyre Highway. A sub-base station was established on each traverse line at its intersection with a central south trending track (refer Dwg. No. I 534-7). All readings from each traverse line were reduced to the sub-base and to the grid base stations prior to plotting on sections. Readings were taken at 20 m intervals on the traverse lines.

Magnetometer readings were plotted as magnetic profiles. These are shown on Dwg Nos. I 534-7 and I 534-8.

4. REGIONAL GEOPHYSICAL INTERPRETATION

An interpretation of regional aeromagnetic and gravity data is being made by R.J. Smith, consulting geophysicist. The available data has been assembled and some preliminary interpretation done. Progress was delayed whilst waiting for the B.M.R. to produce contours for the Port Augusta sheet area at 25 gamma intervals.

The magnetic data presentation for the Port Augusta sheet area is not considered to show sufficient detail at either the 1:250,000 (50 gamma contour intervals) or the 1:100,000 (25 gamma contour intervals) scales used by the B.M.R. Consideration is being given to obtaining the magnetic data in digital form from the B.M.R. and reprocessing of this data at 1:50,000 scale, using a 10 gamma contour interval.



REFERENCE

Road

Track

Fence

Drill hole

Traverse with profile (↓)

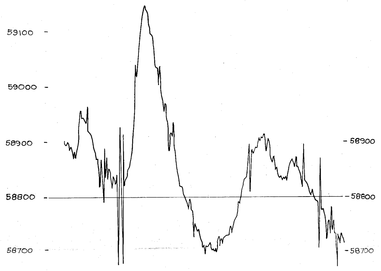
PACMINEX PTY. LIMITED

E.L.186 PANDURRA AREA S.A.

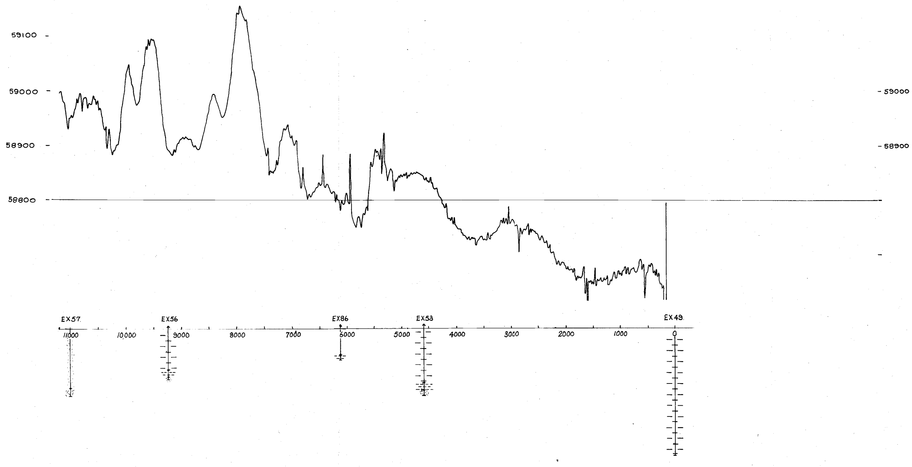
MAGNETIC PROFILE LOCATION PLAN

SCALE	1:25,000	DRG. No.
DRAWN	G.H.	I 534-7
DATE	APRIL '77	
REVISED		

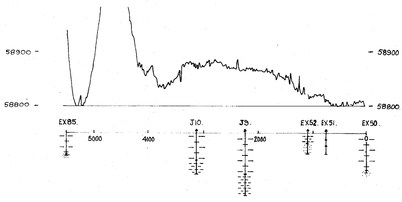
2564(V)-4



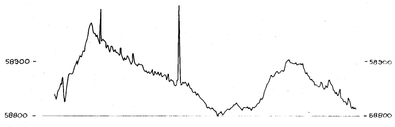
TRAVERSE
L_0



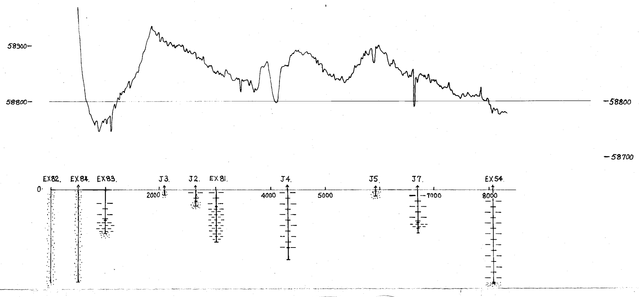
TRAVERSE
L_1



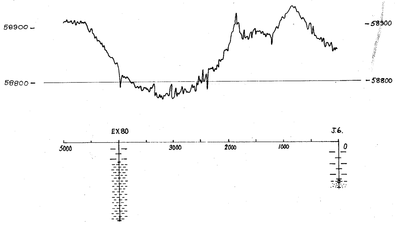
TRAVERSE
L_2



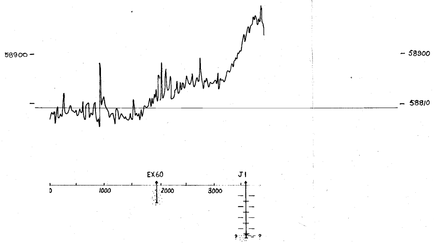
TRAVERSE
L_3



TRAVERSE
L_4



TRAVERSE
L_5



TRAVERSE
L_6

REFERENCE

- TAPLEY HILL FORMATION
- Mc. LEAY BEDS
- PANDURRA FORMATION
- ROOPENA VOLCANICS

PACMINEX PTY. LIMITED

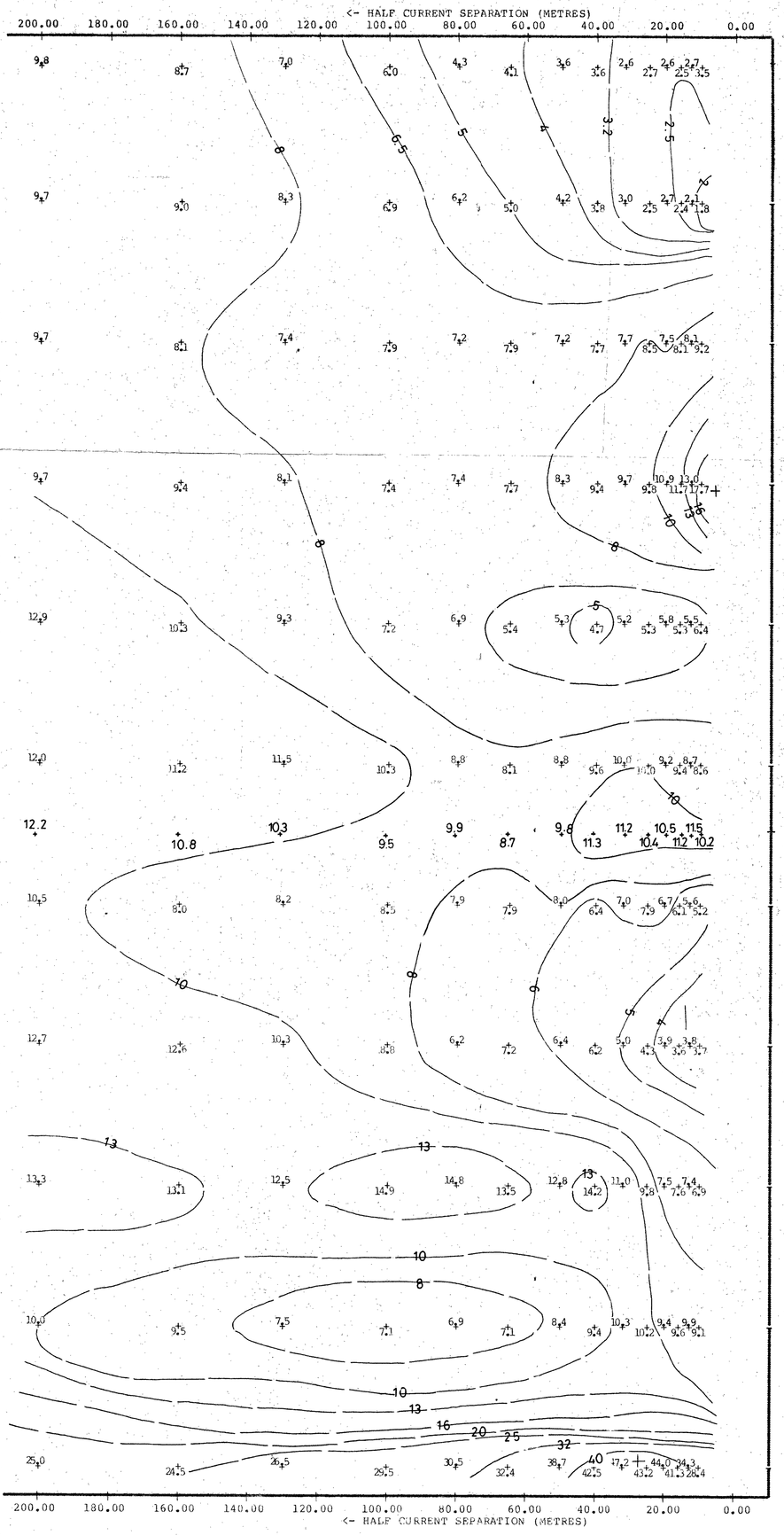
E.L. 186 PANDURRA AREA S.A.

MAGNETIC PROFILES (gammas)

SCALE : HORIZ. 1:50,000 / VERT. 1:2500	DRG No.
DRAWN : G.H.	I 534-8
DATE : APRIL '77	
REVISED :	

2564(V)-5

PANDURRA LINE 1



MURDOCH GEOPHYSICS AUSTRALIA PTY. LTD.

resistivity survey

for : PACMINEX PTY. LTD.

at : PANDURRA SOUTH AUSTRALIA

pseudo section

lines: 1

scales: vertical 1cm = 8 metres of current electrode separation (r)

horizontal 1cm = 100 metres

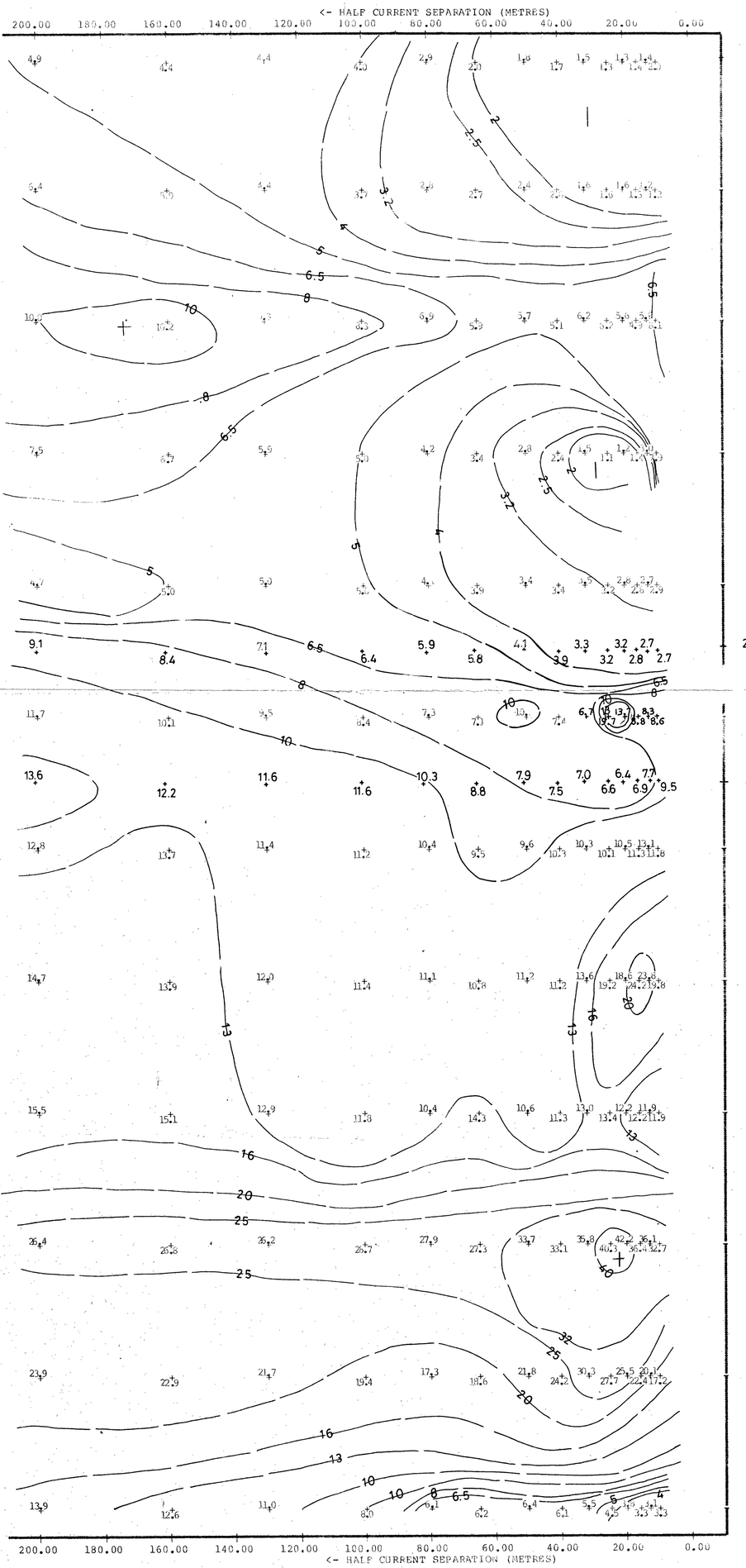
plate no: 1

report no: 265

date: Mar. 77

2564 (V)-6

PANDURRA LINE 2



2564(V)-7

MURDOCH GEOPHYSICS AUSTRALIA PTY. LTD.

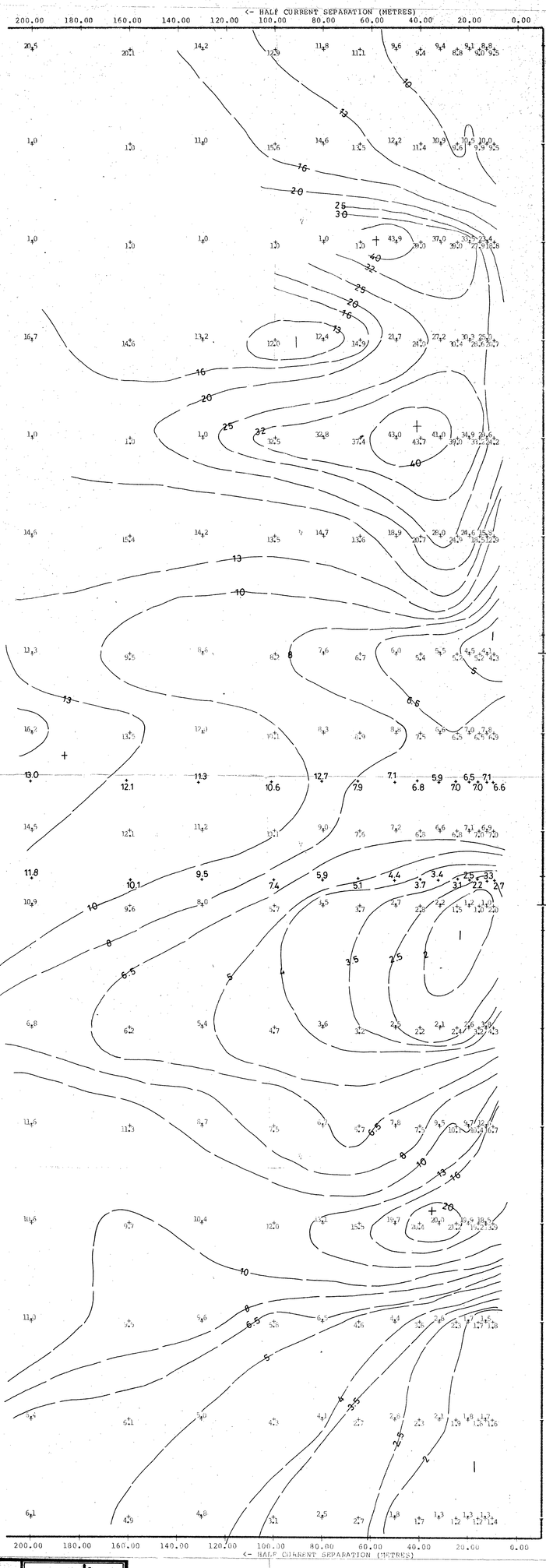
resistivity survey
for : PACMINEX PTY. LTD.
at : PANDURRA SOUTH AUSTRALIA

pseudo section
lines: 2

scales: vertical 1cm = 8 metres of current electrode separation (r)
horizontal 1cm = 100 metres

plate no: 2 | report no: 265 | date Mar. '77

PANDURRA LINE 3



MURDOCH GEOPHYSICS AUSTRALIA PTY. LTD.

resistivity survey

for : PACMINEX

at : PANDURRA PTY. LTD.
SOUTH AUSTRALIA

pseudo section

lines: 3

scales:

vertical
1cm = 8 metres of current electrode separation

horizontal
1cm = 100 metres

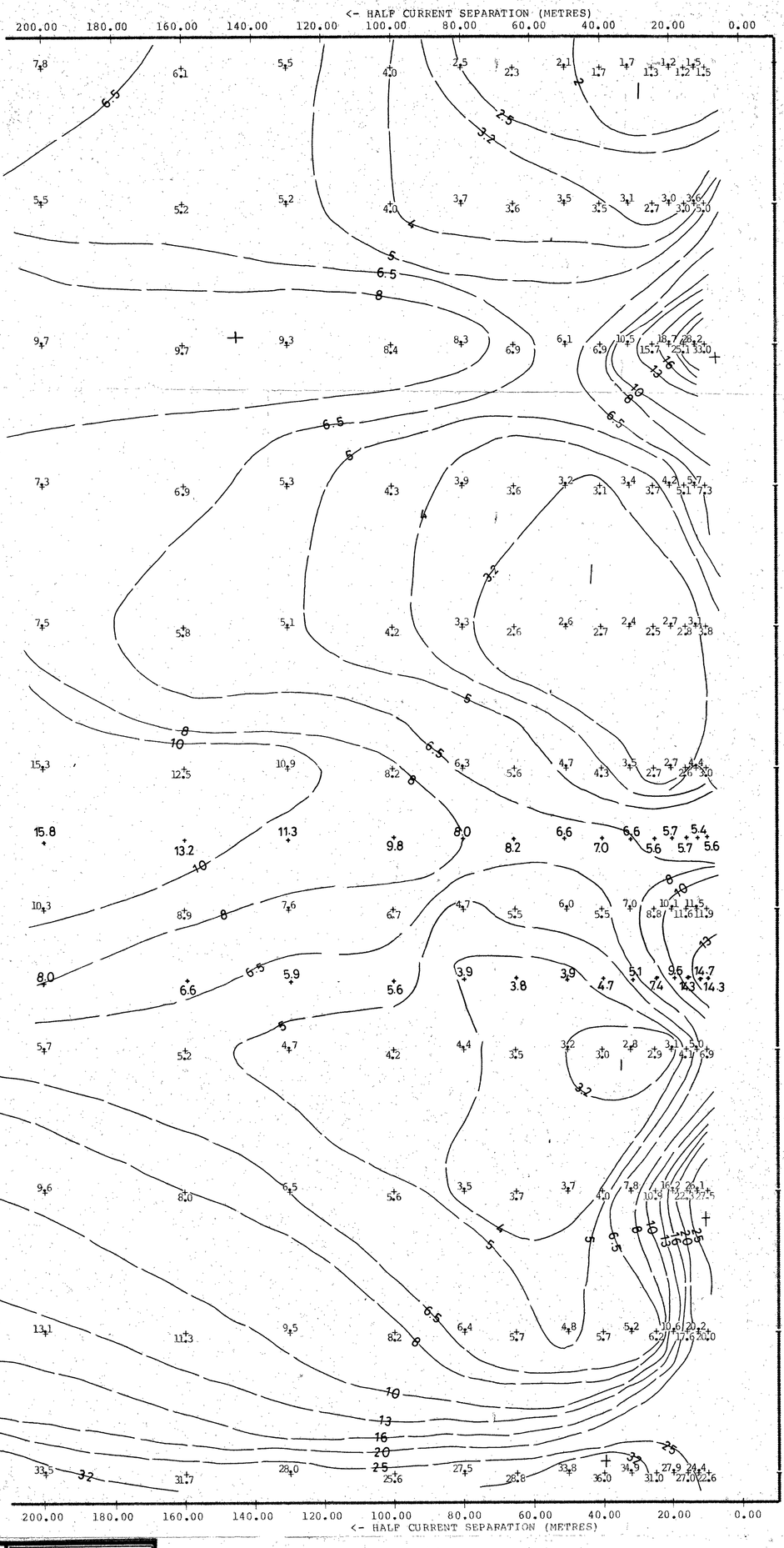
plate no: 3

report no: 265

date: Mar. '77

2564(V)-8

PANDURRA LINE 4



MURDOCH GEOPHYSICS AUSTRALIA PTY. LTD.

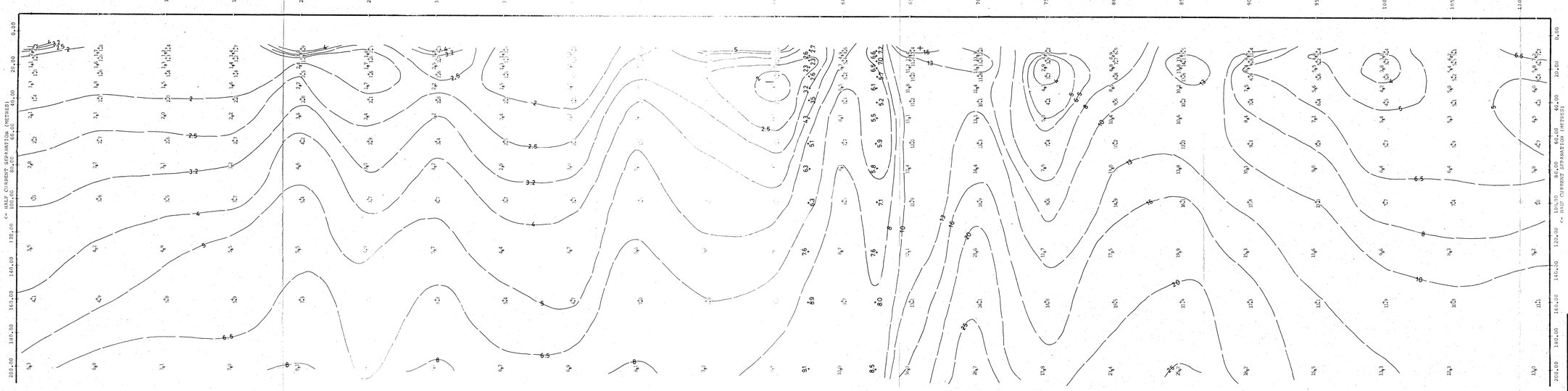
resistivity survey
for : PACMINEX PTY. LTD.
at : PANDURRA SOUTH AUSTRALIA

pseudo section
lines: 4

scales:
vertical
1cm = 8 metres of current electrode separation (r)
horizontal
1cm = 100 metres

plate no: 4
report no: 265
date: Mar. '77

2564(V)-9



PANDORA LINE 0

2564(V)-10

MURDOCH GEOPHYSICS AUSTRALIA PTY. LTD.

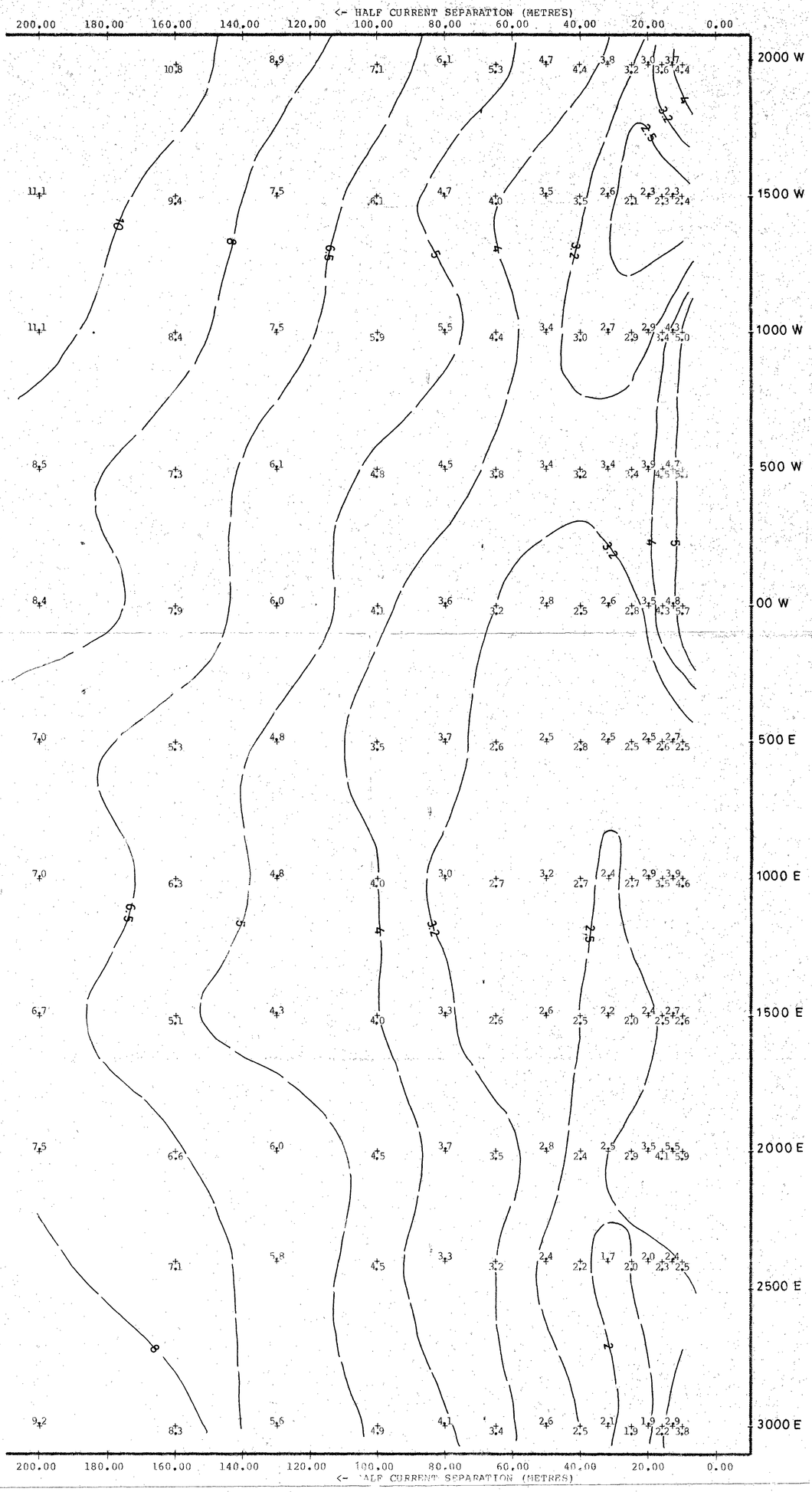
resistivity survey
for : PACMINEX PTY. LTD.
at : PANDURRA SOUTH AUSTRALIA

pseudo section
lines: 0

scales: vertical 1cm = 8 metres of current electrode separation (r)
horizontal 1cm = 100 metres

plate no: 5 | report no: 265 | date: Mar. '77

PANDURRA LINE 5



2564(V)-11

MURDOCH GEOPHYSICS AUSTRALIA PTY. LTD.

resistivity survey
for : PACMINEX PTY. LTD.
at : PANDURRA SOUTH AUSTRALIA

pseudo section
lines: 5

scales: vertical 1cm = 8 metres of current electrode separation (r)
horizontal 1cm = 100 metres

plate no: 6 | report no: 265 | date: Mar. '77

MURDOCH GEOPHYSICS AUSTRALIA PTY. LTD.

resistivity survey
for : PACMINEX PTY. LTD.
at : PANDURRA SOUTH AUSTRALIA

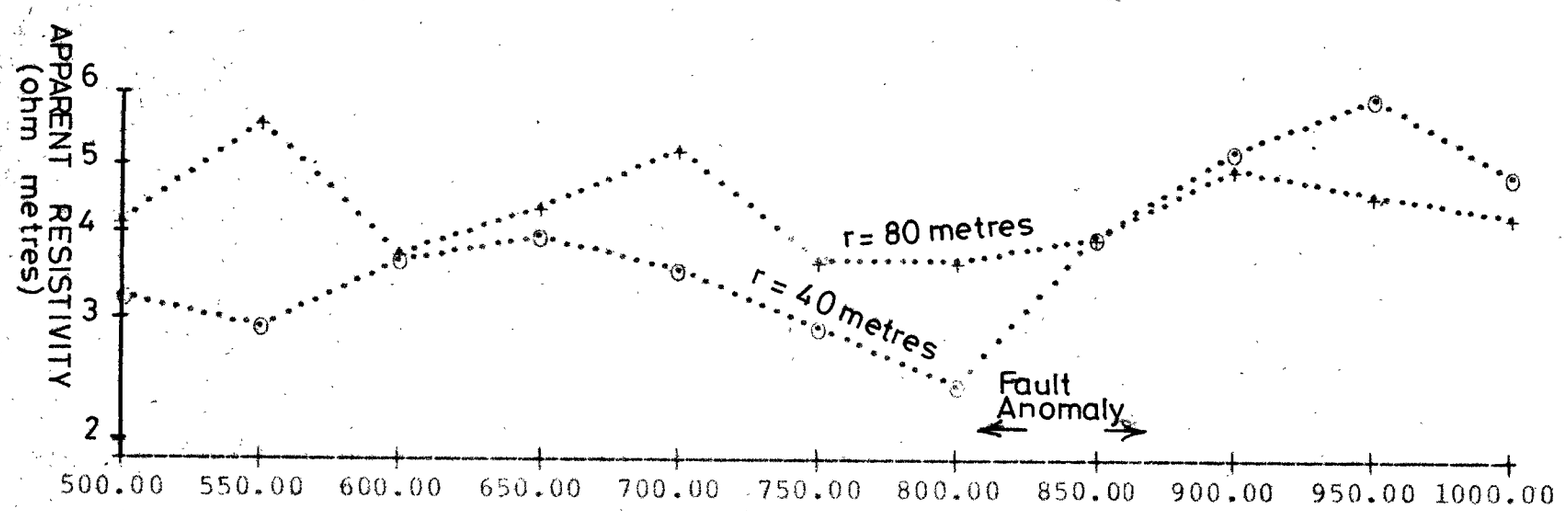
resistivity profiles
lines: 1 (500 — 1000)

scales:	vertical	horizontal
profiles	1cm = ohm metres logarithmic	1 cm = 25 metres

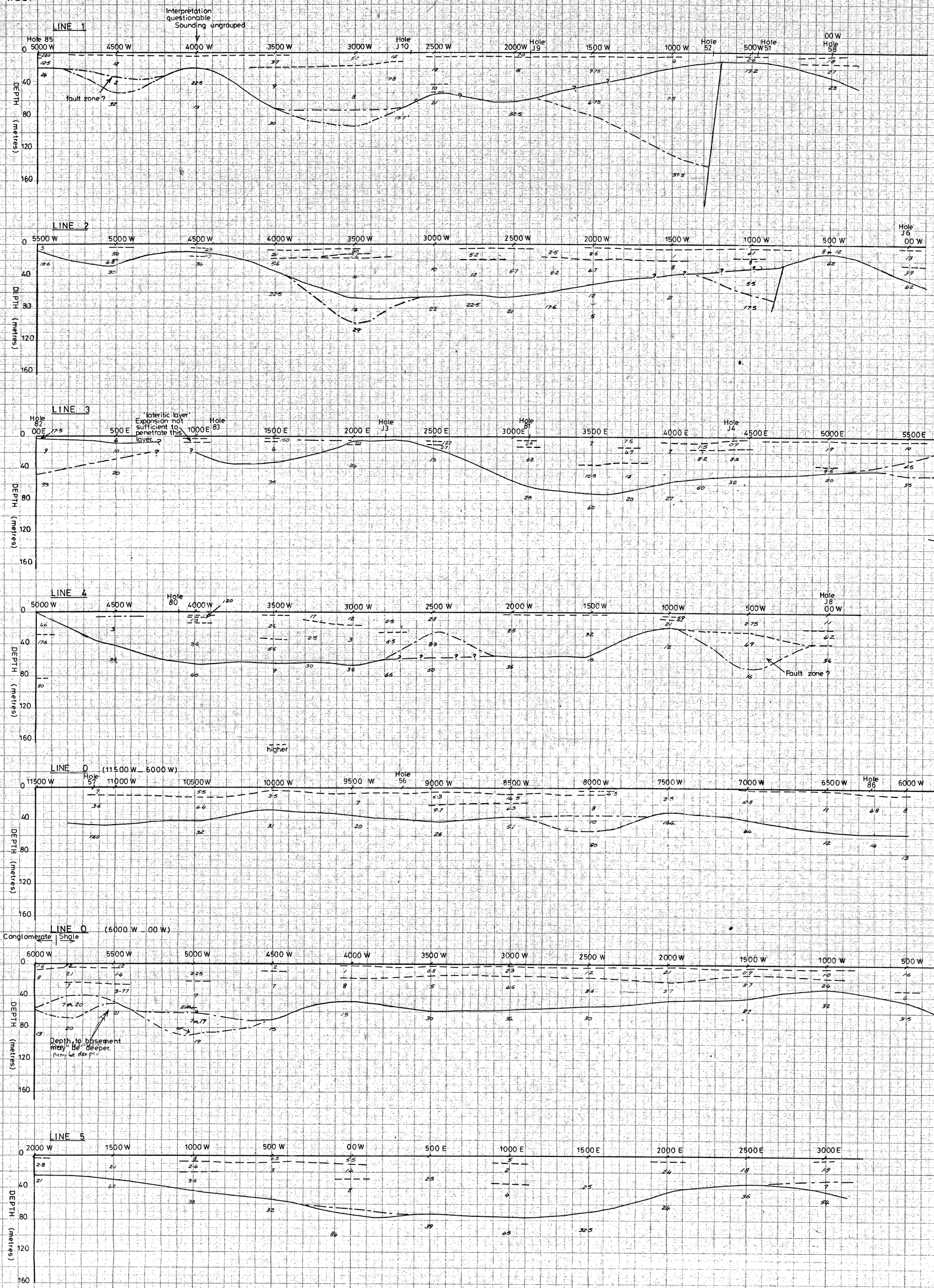
plate no: 7 | report no: 265 | date: March '77

2564(V)-12

LINE 1



WEST



MURDOCH GEOPHYSICS AUSTRALIA PTY. LTD.

RESISTIVITY SURVEY
FOR : PACMINEX PTY. LTD.
AT : PANDURRA SOUTH AUSTRALIA

INTERPRETED SECTION
1, 2, 3, 4, 0, & 5.

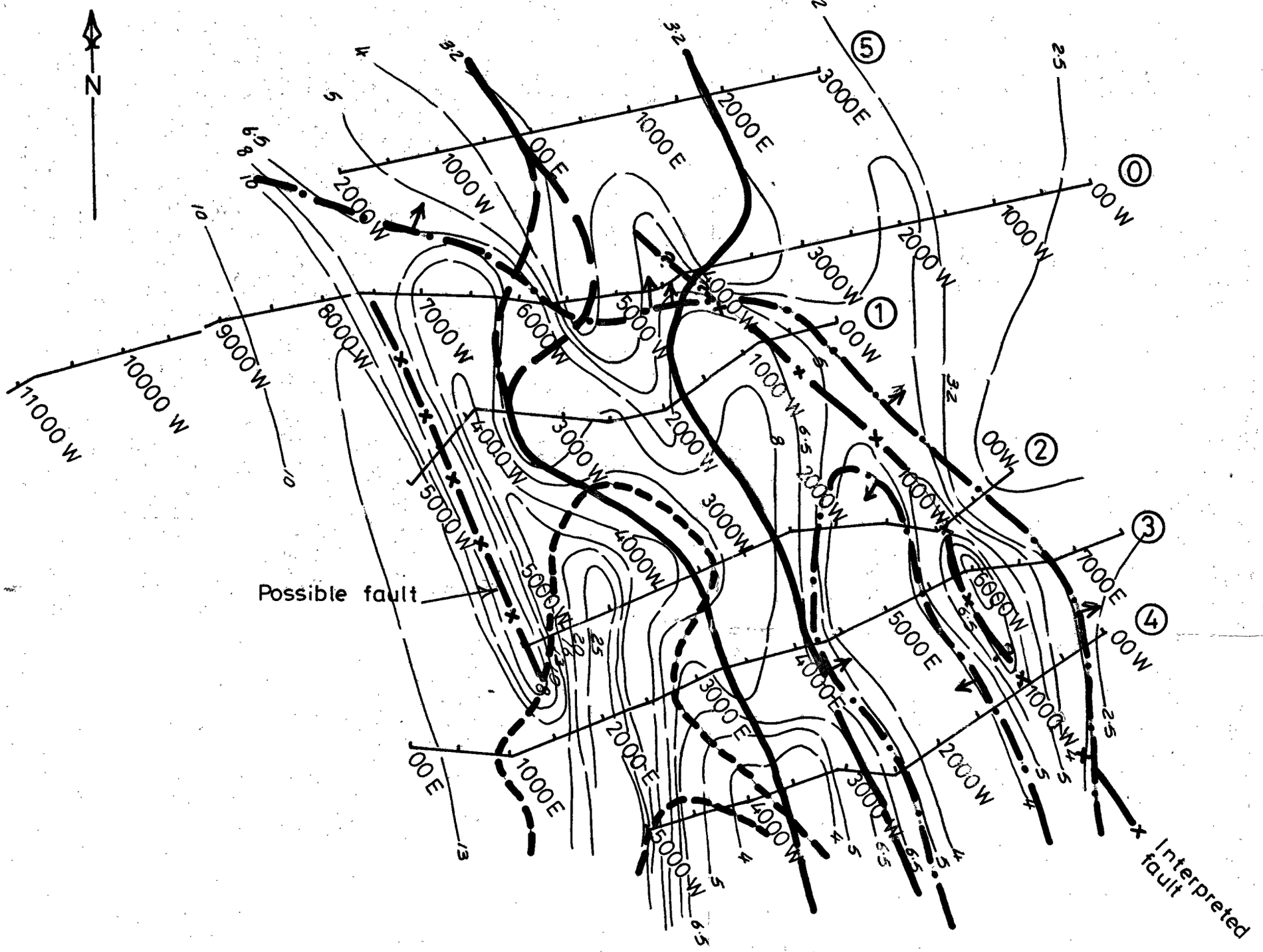
SCALES: Vertical
1 cm = 20 metres
Horizontal
1 cm = 100 metres

——— Most likely basement profile
—·—·— Alternative basement profile
– – – Geo-electric boundaries above basement.

2564(V)-13

PLATE N°. 8 | REPORT N°. 265 | DATE March 1977

PANDURRA _ SOUTH AUSTRALIA



2564(V)-14

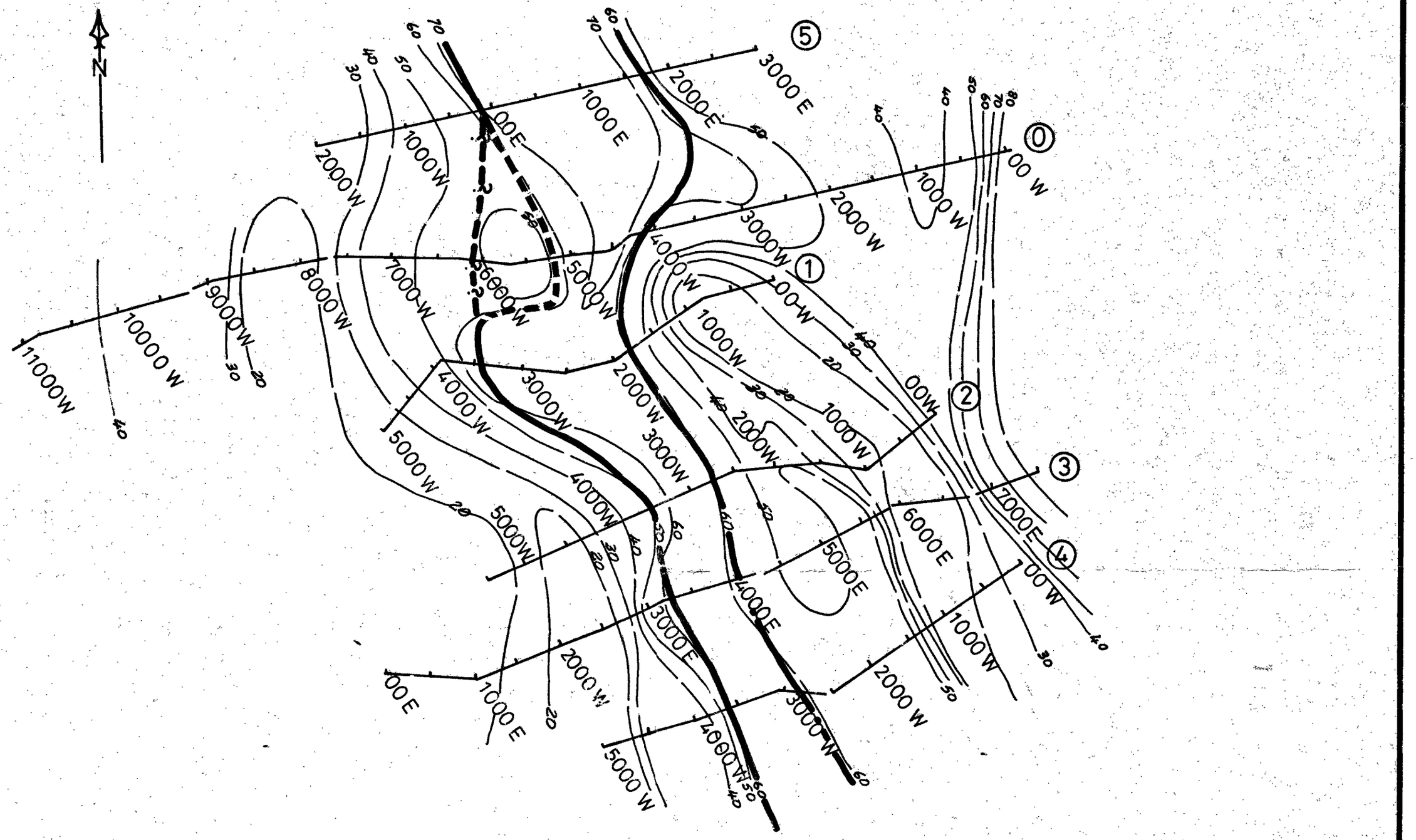
Interpreted fault anomaly
Lateritic Zone
Interpreted thick shale
Channel Anomaly (likely)
" " (possible)

SCALE: 1 cm = 500 metres

MURDOCH GEOPHYSICS (AUST.) PTY. LTD.

PLATE: 9 _ Report 265
Contour Plan: r = 65 metres
Apparent Resistivity Data

PANDURRA — SOUTH AUSTRALIA



2564(V)-15

LEGEND

Channel Anomaly (likely)

" " (alternate paths)

20 Depth to basement contacts

SCALE: 1 cm = 500 metres

MURDOCH GEOPHYSICS (AUST) PTY. LTD.

PLATE: 10 Report 265

Contour Plan_ Resistivity

Interpreted Depth to Basement

APPENDIX I

MURDOCH GEOPHYSICS REPORT NO. 265

PART A - TEXT: PART B - MAPS

"A RESISTIVITY SURVEY AT PANDURRA, NEAR PORT AUGUSTA, S.A. FOR PACMINEX PTY. LIMITED."

PMR 60/77

A RESISTIVITY SURVEY AT

PANDURRA, PORT AUGUSTA, SOUTH AUSTRALIA,

FOR PACMINEX PTY. LTD.

By: R. B. Murdoch, B.A. (Earth Sciences),
Murdoch Geophysics (Australia) P/L,
21 Parker Street,
Maroochydore Qld. 4558.

Tel: (071) 43 3178

Report No. 265

March, 1977.

Conclusions

A resistivity survey has been conducted at Pandurra, near Port Augusta, South Australia. The aim of the survey was to define a fluvial channel incised into Precambrian quartzites, volcanics and sandstones, (termed 'basement' in the report). The fluvialite sediments comprised conglomeratic sandstones and shales of a younger Precambrian age, (termed 'sediments' in the report). A secondary aim of the survey was to try to define areas within the channel, where conglomerates dominate the fluvial section, and areas where shales dominate.

The survey comprised soundings at intervals of 500 metres on the 6 traverses marked on Plate 9. The soundings could be divided into 4 major and 2 minor groups on the basis of curve shape. The grouping was largely dependent upon resistivity changes within or near the weathered layer. Such variations are very characteristic in mapping major shale/conglomerate boundaries and in defining near surface basement and 'lateritic zones'. The term 'lateritic zone' has been used to describe very resistive near-surface layers (e.g. laterites, calcrete, silicified zones etc.).

Some caution is required in using depth to basement derived for type A3-A curves because of equivalence and soundings plotted on Plate 15 because of poor basement inflections. Other possible alternative depth to basement interpretations are shown on Plate 8 by broken lines.

The interpreted channel anomaly is shown on Plate 10. It runs roughly south to north, diverging slightly to the east between lines 1 and 0. It may widen slightly at both ends. Interpreted depths to basement within the channel are in the order of 60-70 metres.

Interpreted faulting, the extent of the 'lateritic zone' and areas of thick shale are outlined on Plate 10. There appears to be a major facies change within the channel near line 0. 5 and possibly 8 drillsites have been recommended within the channel anomaly, in areas where thicker conglomerates appear to occur.

.../2

0537

Introduction

Murdoch Geophysics (Australia) Pty. Ltd. have undertaken a resistivity survey at "Pandurra", a property situated approximately 40 kilometres west of Port Augusta in South Australia. The survey was carried out by Mr. R. Timmins, Geophysicist, assisted by Mr. P. Harrop and C. Johnson. It commenced on the 21st February and was completed on the 12th March 1977. It was conducted in conjunction with a short 3-day survey at Mount Gunson, which is described separately in Report 266.

The basic objectives of the Pandurra survey were to map depth to quartzite or volcanic basement on the 6 lines surveyed. A particular aim was to identify the lateral position of any channels or depressions incised into the basement rock. A secondary aim was to attempt to delineate between occurrences of fluvial conglomerates and shales within the fluviatile section.

Field procedures

The resistivity survey was conducted along the 6 traverses shown on Plate 9. Each of the traverses surveyed were pre-pegged, by Pacminex personnel, at intervals of 200 metres.

The survey procedure comprised Schlumberger Array vertical electrical soundings at regular intervals of ½ kilometre. All the soundings were expanded perpendicular to the traverse line, to a logarithmic formula. An average of 21 individual readings being taken on each sounding expansion, for various half current electrode separations (r) between 5 and 250 metres. Some soundings were expanded out as far as 400 metres and others, where basement appeared shallow, were terminated at shorter separations.

A short multi-separation profile was conducted between 500W and 1000W on Line 1 to locate the position of a postulated fault. Two different r separations were used for the profiling (viz. r = 40 and 80 metres). The reading interval (d) was 50 metres and the half potential electrode separation (m) was 5 metres.

.../3

0538

Presentation of Results

1. Soundings graphs (Plates 11-32) - The sounding results were intially plotted on bilogarithmic graphs of apparent resistivity measured in ohm metres (vertical axis) against r in metres (horizontal axis). For the purpose of presentation in this report, the soundings have been grouped into a number of types having similar properties.

2. Pseudo-sections (Plates 1-6) - The sounding data has also been plotted in the two-dimensional pseudo-section form. The pseudo-section data has been contoured on a logarithmic scale to allow a qualitative interpretation.

3. Profiles - Profiles of the short traverse conducted on Line 1 are presented on Plate 7.

4. Interpreted Geological Sections - Interpreted geological sections for each of the lines have been plotted on Plate 8.

5. Contour Plans - Two contour plans accompany the report.

   a) Plate 9 - A contour plan of apparent resistivity at r = 65 metres. This plan allows the survey area to be sub-divided into a number of different geo-electric zones.

   b) Plate 10 - is a contour plan of depth to basement interpreted from the soundings, guided by existing drill data.

Sounding Interpretation

(a) Qualitative interpretation

The soundings at Pandurra are generally resolvable into either 3 or 4 layer cases. Some 2 layer cases also occur. In general the 3 layer soundings are similar to the 4 layer cases, but with either layer No. 2/layer No. 3 or layer 3/layer 4 being unresolvable.

On the basis of curve shape, the soundings can be grouped as follows:

1) The initial grouping for 4 layer curves is on the basis of whether or not, the first 3 layers form a maxima, minima, double

.../4

ascending or double descending graph.

Type A - maxima
Type B - double ascending
Type C - minima
Type D - double descending

3 layer curves whose 3rd and 4th layers are unresolvable are grouped initially on the same basis as the 4 layer cases.

3 layer curves where layer No. 2 and layer No. 3 are unresolvable, either grouped as follows:

Type A - combined second/third layer is more resistive than first.

Type C - combined second/third layer is more conductive than first.

2) The second grouping for 4 layer curves is on the basis of whether or not the 2nd, 3rd and 4th layer form a maxima, minima or double ascending or double descending curve.

Type 1 - maxima
2 - double ascending
3 - minima
4 - double descending

The two classification groups listed above are combined to classify each curve. For example, in the case of a curve whose first 3 layers form a maxima and the last three form a minima the classification for that curve is Type A.3.

3layer cases whose second/third layers are unresolvable, are grouped depending on their fourth layer is more conductive or more resistive than their 3rd layer.

Type 1 more resistive
Type 3 more conductive

3 layer cases whose third/fourth layers are unresolvable are grouped dependent on whether or not the combined third/fourth layer is more conductive or more resistive than the second layer.

Type 1 more resistive
Type 3 more conductive

.../5

With one exception the two layer cases are classified as type C1 as layer 2 is more resistive than layer 1. At Line 3 1000E the r expansion was insufficient to penetrate a near-surface 'lateritic layer'. This sounding has been grouped as Type A3.

(b) Quantitative Interpretation

The soundings have been quantitatively interpreted as follows:

TABLE 1 - SOUNDING INTERPRETATION

	Layer	Resistivity (ohm metres)	Depth Interval (metres)	Possibly Geology
Line 1 00W	1	9	0 - 3	Surface layer
Type C2	2	1.8	3 - 13	Weathered zone
	3	3.8	13 - 32	"Shale"
	4	23	32+	Basement
500W	1	1.5	0 - 4.5	Surface layer
Type A1	2	2.6	4.5 - 11	Weathered zone
	3/4	13.3	11+	Basement
1000W	1	15	0 - 3	Surface layer
Type C2-B	2	4	3 - 9	Weathered zone
	3	7.5	9 - 116	'Conductive' basement (sediments?)
	4	37.5	116+	Basement
1500W	1	39	0 - 3	Surface layer
Type D3	2	9.5	3 - 41	"Sediments"
	3	4.75	41 - 100	'Conductive' basement
	4	40	100+	Basement
2000W	1	10	0 - 3	Surface layer
Type C1	2/3	5	3 - 63	Sediments
	4	32.5	63+	Basement
2500W	1	6	0 - 6	Surface layer
Type A3	2	12	6 - 38	Sediments
	3	lower	38 - 45	Sediments (possibly weathered basement)
	4	21	45+	Basement

.../6

TABLE 1 (CONTINUED)

	Layer	Resistivity (ohm metres)	Depth Interval (metres)	Possible Geology
Line 1 2750W	1	12	0 - 12	Weathered layer
Type C1	2/3	7.8	12 - 68	Sediments
	4	16	68+	Basement
3000W	1	5.7	0 - 14	Weathered layer
Type A1	2/3	8	14 - approx. 65	Sediments
	4	approx. 30	65+ approx.	Basement
Basement contrast poor (depth to basement could be as great as 90 metres).				
Line 1 3500W	1	4.6	0 - 2.5	Surface layer
Type C2	2	3.7	2.5 - 20	Weathered layer
	3	10.8	20 - 71	Sediments
	4	29.4	71+	Basement
4000W	1	5	0 - 4.2	Surface layer
Type B1	2	8.7	4.2 - 20	Weathered layer
	3	22.5	20 - 46	Basement?
	4	13	46+	Basement
4500W	1	7	0 - 7.5	Surface layer
Type A3	2	12	7.5 - 35	Sediments
	3	2	35 - 56	Sediments or 'conductive' basement
	4	32	56+	Basement
5000W	1	7	0 - 3	Surface layer
Type A3	2	280	3 - 7	Lateritic layer
	3	12.5	7 - 23	Sediments
	4	30 - 25	23+	Basement
Line 2 00W	1	3.2	0 - 4	Surface layer
Type C2	2	1.3	4 - 26	Weathered zone
	3	3.9	26 - 48	Sediments
	4	42	48+	Basement

.../7

TABLE 1 - (CONTINUED)

	Layer	Resistivity (ohm metres)	Depth Interval (metres)	Possible Geology
Line 2 500W	1/2	8 - 12	0 - 12	Weathered layer
Type C1	3/4	42	12+	Basement
1000W	1	13.5	0 - 4	Surface layer
Type C2	2	4.1	4 - 18	Weathered zone
	3(a)	8	18 - 30	Sediments
	3(b)	5.5	30 - 65	Conductive Basement
	4	17.5	65+	Basement
1500W	1	Very high	0 - (-5)	Surface layer
Type C2	2	approx. 1	(-5) - 20	Weathered zone
	3	8	20 - 35 approx.	Sediments
	4	21	35+ approx.	Basement
	Basement contrast poor.			
2000W	1	4	0 - 3	Surface layer
Type C2	2	2.6	3 - 20	Weathered zone
	3	4.7	20 - 50	Sediments
	4	12	50 - 74	Basement
	5	5	74+	Conductive basement
	5th layer is ignored in classifying this curve.			
2250W	1	2.5	0 - 17	Weathered zone
Type A1	2/3	6.2	17 - 47	Sediments
	4	17.6	47+	Basement
2500W	1	15	0 - 5	Surface layer
Type C1	2/3	6.7	5 - 67.5	Sediments
	4	21	67.5+	Basement
2750W	1	13	0 - 5	Surface layer
Type C2	2	5.2	5 - 20	Weathered zone
	3	12	20 - 60	Sediments
	4	22.5	60+	Basement

.../8

TABLE 1 - (CONTINUED)

	Layer	Resistivity (ohm metres)	Depth Interval (metres)	Possible Geology
Line 2 3000W	1-3	10	0 - 70	Sediments
Type C1	4	22	70+	Basement
3500W	1	16	0 - 6	Surface layer
Type A3	2(a)	40	6 - 13	Lateritic zone
	2(b)	2.6	13 - 16.5	Weathered zone
	3	11	16.5 - 65	Sediments
	4(a)	12	65 - 103	Conductive Basement
	4(b)	29	103+	Basement
4000W	1	7	0 - 6	Surface layer
Type A3	2	21	6 - 18	'Lateritic' and weathered zone
	3	5.6	18 - 36	Sediments?
	4	22.5	36+	Basement
4500W	1(a)	35	0 - (-5)	Surface layer
Type A3	1(b)	23	(-5) - 9approx.	Weathered layer
	2	113	9 - 14	Basement
	3/4	34	14+	Basement
5000W	1	10 assumed	0 - 4 assumed	Surface
Type A3	2	50	4 - 20	Lateritic layer
	3	4.8	20 - 26	Sediments
	4	30	26+	Basement
5500W	1	3	0 - less than 10	Sediments
Type A1	2	18.6	less than 10+	Basement
Line 3 00E	1	17.5	0 - 2	Surface layer
Type C2-B	2/3	9	2 - 50	"Conductive basement" (sandstone)
	4	33	50+	Basement

.../9

0544

TABLE 1 (CONTINUED)

	Layer	Resistivity (ohm metres)	Depth Interval (metres)	Possible Geology
Line 500E	1	10	0 - 4	Surface layer
Type C2-8	2	4	4 - 9	Weathered layer
	3	10	9 - 30	"Conductive basement" (sandstone)
	4	20	30+	Basement
1000E	1	less than 8	0 - (-5)	Surface layer
Type A3	2	Very high	5+	'Lateritic layer'
	Expansion not sufficient to penetrate this layer.			
1500E	1	4	0 - 2	Surface layer
Type A3	2	160	2 - 6	'Lateritic' zone
	3	4	6 - 30	Sediments or conductive basement
	4	35	30+	Basement
2000E	1	less than 9	0 - 5	Surface layer
Type A3	2	80	5 - 8	Lateritic or silicified zone
	3/4	24	8+	Basement
2500E	1	8.5	0 - 6.5	Surface layer
Type A3	2	127	6.5 - 10	"Silicified basement"
	3	2.7	10 - 14	Weathered layer
	4	13	14+	Basement
3100E	1	9.5	0 - 6.5	Surface layer
Type C2	2	2.8	6.5 - 10	Weathered layer
	3	6.2	10 - 60	Sediments
	4	25	60+	Basement
3500E	1	7	0 - 27	Sediments
Type A1	2/3	10.5	27 - 73	Sediments
	4	40	73+	Basement

.../10

TABLE 1 (CONTINUED)

	Layer	Resistivity (ohm metres)	Depth Interval (metres)	Possible Geology
Line 3 3750E	1	7.5	0 - 14	Weathered layer
Type C_2	2	4.9	14 - 32	Sediments
	3	12	32 - 64	Sediments
	4	20	64+	Basement
4000E	1	10.7	0 - 7	Surface
Type C_1	2/3	7	7 - 55	Sediments
	4	27	55+	Basement
4250E	1	3	0 - 7	Surface
Type C_2	2	1.5	7 - 15	Weathered layer
	3	8.2	15 - 52	Sediments
	4	50	52+	Basement
4400E	1	18	0 - 2	Surface
Type C_2	2	0.9	2 - 15	Weathered layer
	3	8.3	15 - 49	Sediments
	4	32.5	49+	Basement
5000E	1	7.5	0 - 5	Surface
Type C_2	2	1.9	5 - 44	Sediments
	3	7.5	37 - 45	Sediments
	4	25	45+	Basement
5500E	1	9	0 - 4	Surface
Type A3	2	10	4 - 15	Sediments?
	3	less than 5	15 - 63	Sediments or basement (conductive)
	4	35	63+	Basement
6000E	1	5	0 - 3	Surface
Type A3	2	85	3 - 10	'Silicified' layer
	3	7.5	10 - 126	Basement
	4	28	126+	Basement

.../11

TABLE 1 (CONTINUED)

	Layer	Resistivity (ohm metres)	Depth Interval (metres)	Possible Geology
Line 3 6500E	1-3	1.7	0 - 19	Weathered layer
Type C1	4	34	19+	Basement
7000E	1	1.5	0 - 9	Weathered layer
Type C1	2	2.8	9 - 63	Sediments
	3	40	63+	Basement
7500E	1	10	0 - 1.5	Surface
Type C2	2	1.2	1.5 - 20	Weathered layer
	3	6	20 - 82	Sediments
	4	40	82+	Basement
Line 4 00W	1	2.7	0 - 3	Surface
Type C2	2	1.1	3 - 20	Weathered layer
	3	4.2	20 - 38	Sediments
	4	36	38+	Basement
500W	1	11	0 - 3	Surface
Type C2	2	2.75	3 - 25	Weathered layer
	3	4.9	25 - 77	Sediments or conductive basement
	4	16	77+	Basement
1000W	1	10	0 - 3	Surface
Type A3	2	59	3 - 8	Lateritic layer
	3	2.1	8 - 18	Sediments
	4	12	18+	Basement
1500W	1	17	0 - 3	Surface
Type C1	2/3	3.2	3 - 52	Sediments
	4	16	52+	Basement
2000W	1	11	0 - 2.6	Surface
Type C1	2/3	2.5	2.6 - 56	Sediments
	4	36	56+	Basement

.../12

TABLE 1 (CONTINUED)

	Layer	Resistivity (ohm metres)	Depth Interval (metres)	Possible Geology
Line 4 2500W	1	1.9	0 - 10	Surface
Type C2	2	2.7	10 - 27	Sediments
	3	8.3	27 - 58	Sediments
	4	50	58+	Basement
	Layer 3/4 contrast poor, layer 3 resistivity assumed.			
2750W	1	5.5	0 - 26	Sediments
Type C1	2/3	6.5	26 - 55	Sediments
	4	46	55+	Basement
3000W	1	12	0 - 16	Surface
Type C1	2/3	3	16 - 64	Sediments
	4	36	64+	Basement
3250W	1	17	0 - 11	Surface
Type C1	2	2.5	11 - 57	Sediments
	3	30	57+	Basement
3500W	1	22	0 - 4	Surface
Type C2	2	2.6	4 - 33	Sediments
	3	5.6	33 - 63	Sediments
	4	9	63+	Basement
4000W	1	11	0 - 4	Surface
Type A3	2(a)	120	4 - 7	Silicified sediments
	2(b)	1.3	7 - 13	Weathered layer
	3	3.6	13 - 64	Sediments
	4	40	64+	Basement
4500W	1	?	less than 5	Surface
Type A3	2	30	to 5	'Lateritic' sediments
	3	3	5 - 37	Sediments
	4	36	37+	Basement

.../13

TABLE 1 (CONTINUED)

	Layer	Resistivity (ohm metres)	Depth Interval (metres)	Possible Geology
Line 4 5000W	1	11	0 - 4	Surface
Type A3	2	46	4 - 29	Basement
	3	17.5	29 - 83	Basement
	4	80	83+	Basement
Line 0 00W	1	13	0 - 4	Surface
Type C2	2	0,65	4 - 18	Weathered layer
	3	7.2	18 - 103	Sediments
	4	32.5	103+	Basement
500W	1/2	1.6	0 - 32	Sediments
Type C2	3	4	32 - 46	Sediments
	4	31.5	46+	Basement
1000W	1	5.2	0 - 2.6	Surface
Type C2	2	1.0	2.6 - 15	Weathered layer
	3	2.4	15 - 31	Sediments
	4	32	31+	Basement
1500W	1	7.5	0 - 3	Surface
Type C2	2	0.9	3 - 15	Weathered layer
	3	3.3	15 - 45	Sediments
	4	27	45+	Basement
2000W	1	16	0 - 3	Surface
Type C2	2	2.1	3 - 22	Weathered zone
	3	3.7	22 - 44	Sediments
	4	21	44+	Basement
2500W	1	5.8	0 - 4	Surface
Type C2	2	1.2	4 - 19	Weathered zone
	3	5.6	19 - 54	Sediments
	4	30	54+	Basement

.../14

TABLE 1 - (CONTINUED)

	Layer	Resistivity (ohm metres)	Depth Interval (metres)	Possible Geology
Line 0 3000W	1	12	0 - 3	Surface
Type C2	2	2.3	3 - 18	Weathered layer
	3	4.6	18 - 60	Sediments
	4	34	60+	Basement
3500W	1	3.2	0 - 4	Surface
Type C2	2	0.8	4 - 13	Weathered layer
	3	5	13 - 59	Sediments
	4	30	59+	Basement
4000W	1	more than 1	less than 5	Surface
Type C2	2	1	up to 20	Weathered layer
	3	8	20 - 53	Sediments
	4	15	53+	Basement
4500W	1	more than 2	less than 5	Surface
Type C2	2	2	up to 12	Weathered layer
	3	7	12 - 78	Sediments
	4	15	78+	Basement
5000W	1	9	0 - 4	Surface layer
Type C2	2	2.2	4 - 25	Weathered layer
	3	7	25 - 61 (or 88)	Sediments
	4	19	61 (or 88+)	Basement
5500W	1	12	0 - 4.5	Surface layer
Type C2	2	1.4	4.5 - 26.5	Weathered layer
	3	3 - 7	26.5 - 47	Sediments
	4	21	47+	Basement
5750W	1	3.2	0 - 5	Surface layer
Type C2	2	2.1	5 - 22	Weathered layer
	3	7 approx.	22 - 38	Sediments
	4	20	38+	Basement

Basement may be as deep as 68 metres.

.../15

550

TABLE 1 (CONTINUED)

	Layer	Resistivity (ohm metres)	Depth Interval (metres)	Possible Geology
Line 0 6000E	1	3.6	0 - 7	Surface
Type A1	2/3	8	7 - 57	Sediments
	4	13	57+	Basement
6250E	1	7.5	0 - 9	Surface
Type C1	2/3	4.8	9 - 55	Sediments
	4	14	55+	Basement
6500E	1	34	0 - 3	Surface
Type C2	2	11	3 - 53	Sediments
	3	12	53 - 138	Basement
	4	higher	138+	Basement
7000E	1	13.5	0 - 4	Surface
Type C1	2/3	10.8	4 - 40	Sediments
	4	44	40+	Basement
7500E	1	26	0 - 2	Surface
Type C1	2/3	3.5 - 5	2 - (35 to 45)	Sediments
	4	144	(35 to 45)+	Basement
8000E	1	9	0 - 4	Surface
Type C2	2	4.5	4 - 10	Weathered layer
	3	8 - 10	10 - 55	Sediments
	4	80	55+	Basement
8500E	1	8.5	0 - 6.5	Surface
Type A3	2	14.5	6.5 - 19.5	Sediments
	3	4.3	19.5 - 35	Weathered layer
	4	57	35+	Basement

.../16

0551

TABLE 1 (CONTINUED)

	Layer	Resistivity (ohm metres)	Depth Interval (metres)	Possible Geology
Line 0 9000E	1	20	0 - 3	Surface
Type C2	2	6.3	3 - 21.5	Weathered layer
	3	9.7	21.5 - 42	Sediments
	4	26	42+	Basement
9500E	1	4	0 - 7	Surface
Type A1	2/3	7	7 - 35	Sediments
	4	20	35+	Basement
10000E	1	4.4	0 - 3.5	Surface
Type C1	2/3	3.5	3.5 - 27 to 33	Sediments
	4	31	27 to 33+	Basement
10500E	1	5.5	0 - 15	Surface
Type C1	2	4.4	15 - 44	Sediments
	3	32	44+	Basement
11125E	1	9	0 - 8	Surface
Type C1	2	3.6	8 - 48	Sediments
	3	160	48+	Basement
Line 5 00E	1	5.5	0 - 11	Surface
Type C2	2	1,4	11 - 27	Weathered zone
	3	8	27 - 76	Sediments
	4	84	76+	Basement
500W	1	6	0 - 6.5	Surface
Type C1	2/3	3	6.5 - 52	Sediments
	4	32	52+	Basement
1000W	1	8	0 - 5	Surface
Type C2	2	2.4	5 - 19	Weathered zone
	3	3.6	19 - 42	Sediments
	4	38	42+	Basement

.../17

TABLE 1 (CONTINUED)

	Layer	Resistivity (ohm metres)	Depth Interval (metres)	Possible Geology
Line 5 1500W	1/2	2.1	0 - 28	Weathered zone
Type C1	3/4	42	28+	Basement
2000W	1	7	0 - 4	Surface
Type C1	2/3	2.8	4 - 26	Weathered zone
	4	21+	26+	Basement
500E	1-3	2.5	0 - 80	Sediments
Type C1	4	52+	80+	Basement
1000E	1	5	0 - 8	Surface
Type C2	2	2	8 - 33	Weathered zone
	3	4	33 - 75	Sediments
	4	45	75+	Basement
1500E	1-3	2.5	0 - 70	Sediments (depth of weathering 25 metres)
Type C1	4	32.5	70+	Basement
2000E	1	9.5	0 - 4	Surface
Type C1	2/3	2.4	4 - 42	Sediments
	4	24	42+	Basement
2400E	1/2	1.8	0 - 34	Sediments
Type C1	3/4	36	34+	Basement
3000E	1	7	0 - 5	Surface
Type C2	2	1.9	5 - 30	Weathered layer
	3	7	30 - 44	Sediments
	4	54	44+	Basement

..../18

0553

The numbers of soundings falling into each group are as follows:

A1	-	7
A3	-	17
B1	-	1
C1	-	27
C2	-	39
D3	-	1

The type A1 curves present are all 3 layer double ascending curves. The basement inflection occurs at the base of the second layer. In general the first layer will reflect weathered sediments.

The A3 curves all have a highly resistive second layer. We suspect this layer to be caused by near-surface laterite, calcrete or silliceous zones (loosely termed 'lateritic zone' in Table 1). There are 2 sub-groups within the A3 classification.

A3-A: The third layer is very conductive and we suspect it to be sediments (either weathered and/or fresh). The basement inflection will occur at the base of the third layer.

A3-B: The third layer has resistivities in the basement range (15 - 100 ohm metres). In these cases basement may either underlie the 'lateritic' zone or the 'lateritic zone' may reflect a near-surface silicification of the quartzite.

Only one example of group type B1 occurs, (viz. line 1 4000W). The curve shape is unlike any other at Pandurra. The first three layers form a double ascending curve and the last three a maxima. From an examination of nearby resistivities and thicknesses, one might expect layer 3 to be basement (22.5 ohm metres) and layer 4 a 'more conductive' basement. Therefore, if we ignore the fourth layer, the curve would have an A1 classification.

The most dominant groupings at Pandurra are C1 and C2. With the exception of the 2 layer curves, the second layer of both curve-types is the most conductive. With 2 layer curves, naturally the first layer is the most conductive.

There are 3 subgroups within the C1 classification.

.../19

C_1-A: 2 layer curves. The layer 1/layer 2 inflection point is interpreted as basement.

C_1-B: 3 layer curves, second layer is the minimum. The basement coincides with the layer 2/layer 3 inflection (one exception line 3 00E).

C_1-C: 4 layer curves, the last three layers form a maxima. There is only one of these examples, (viz: line 2 4500W) which is really a variation of curve type A3-B. The extra layer is a small conductive zone above the 'lateritic or silicified' maxima layer.

The C_2 curves can be separated into two subgroups;

C_2-A: Where basement coincides with the layer 3/layer 4 inflection point. Layer 2 probably reflects the depth of weathering.

C_2-B: Where basement coincides with the layer 2/layer 3 inflection point.

The majority of type C_2 are of the first type. Curves at line 1 1000W, line 3 00E and the C_1 curve at line 1 500W, all appear to have a 'conductive' basement overlying the quartzite. All of these curves have been plotted together on Plate 17. The 'conductive basement' was only identified by comparison with drill data at boreholes 52 and 82. In borehole 52 the conductivity is believed to be due to pyrite. At hole 82 the sandstone present is probably physically similar to the fluvial conglomerates. The identifying characteristics of the curves plotted on Plate 17, are that in each case the resistivity of the 'conductive basement' layer is very uniform, whilst this is not typical of fluvial sections. This characteristic is not only observed at Pandurra, but is a feature commonly occurring in fluvial areas. 'Conductive basement' can be suspected in areas where depths to basement on one or two soundings would be much greater than normal. Examples of this are; line 1 3000W, line 2 3500W and 1000W, line 3 5500E and line 4 500W.

Only one sounding falls into class type D3 (viz: line 1 1500W). In this case the third layer is probably the same 'conductive basement' that occurs at 1000W.

.../20

The most difficult curves to interpret at Pandurra are those plotted on Plate 12. These are all C2 types curves, that could be readily mistaken for type C1 curves with a basement inflection at about 20 metres. Sounding line 3 4400E, occurs adjacent to drillhole J4, where 50 metres of shale overlie basement. The inflection point at about r = 20 metres only reflects depth of weathering within a thick shale unit. By computer modelling sounding 3/4400E we can obtain a suitable curve-match by using the geo-electric model;

Resistivity (ohm metres)	Thickness (metres)
18	2
0.9	13
8.3	34
32.5	

On this model the basement inflection point coincides with a minor change in slope at about r = 80 metres. The inflection is hard to see because layer 2 is so conductive in relation to layers 3 and 4. However, the inflection can be assumed to occur at about that point if the curve is qualitatively compared with its neighbours (see Plate 21). The layer 3 resistivity derived above, can be used to help interpret similar soundings. However, exact depth to basement for soundings having poor layer 3/layer 4 inflection contrasts must be treated with caution.

In summary, the depth to basement interpreted for the following curve types should be treated with some caution.

A3-A : Because of equivalence problems with maxima/minima curves.

C2 : Where highly conductive second layers occur (see Plate 15).

B1 : Unique sounding type.

Depths interpreted for these curve types should at least be relative.

The possible major sources of error could be

(a) Layers interpreted as 'conductive basement' on line 1 may be sediments, although drill evidence suggests this

.../21

is unlikely.

(b) Some layers interpreted as sediments could be 'conductive basement'.
Areas where this might occur have been identified on Plate 8. Drill evidence and our past experiences, mapping in fluvial areas, suggests that 'conductive' basement is very unlikely to occur outside those areas delineated on Plate 8.

Profile Interpretation

Plate 7 - The fault anomaly (profile change), is more apparent on the r = 40 metre profile than on the r = 80 metre profile. The profile change associated with the anomaly is centred at 850W. Apparent resistivities west of the fault anomaly decrease at wider separations (conductive basement). East of the fault anomaly apparent resistivities increase at wider r separations.

Pseudo-sections

The pseudo-sections provide a 2-Dimension display of the sounding data recorded on each traverse. They act as a qualitative aid to the quantitative sounding interpretation. The contouring on the pseudo-sections determines whether a feature has horizontal or vertical boundaries. If the contours tend to be horizontal the geo-electric features are likely to be fluvial and if vertical, basement contrasts.

One drawback with the pseudo-sections presented, is that at the moment our plotting programme is not directionally orientated and hence some sections go from east to west and others from west to east. Therefore some pseudo-sections are back-to-front in relation to the intersected sections plotted on Plate 8, where west is always to the left hand side of the plan.

The individual pseudo-sections, are briefly discussed.

Line 1 (Plate 1) - This pseudo-section highlights the conductive basement from 1000W - 1500W and suggests that the conductive thin layer at 4500W is a basement feature rather than fluvial (vertical

.../22

contours). This zone may be a wide fault zone or weathered dyke? 0557
The pseudo-section also suggests the depth to basement at 2500W may be slightly deeper than interpreted (perhaps basement hump on Plate 8 is in error?).

Line 2 (Plate 2) - A lot of the contours on this pseudo-section tend to be vertical, with horizontal deviations occurring at or about the point of basement inflection. The most conductive basement occurs at 2000W. The highest resistivities are associated with 'lateritic zones' and shallow basement at the western end of the line. The pseudo-section suggests that perhaps the interpretation at 5000W is in error and basement is shallower at this point. Very conductive, thick shale areas occur east of 500W and at 1500W.

Line 3 (Plate 3) - The pseudo-section reflects the channelling from 3000E - 5000E. High resistivities caused by shallow basement and lateritic zones occur either side. Low resistivity values at depth at 1500E coincide with either sediments below the 'lateritic zone' or conductive basement. Drillhole 83 suggests that these results are due to the former case. The sounding at 1000E did not penetrate the 'lateritic zone'. The pseudo-section also shows the extent of the 'conductive' sandstone basement known to occur at shallow depths in hole 82 and provides information on the conglomeratic sandstone-shale interface, which occurs between 4000E-4200E. Shales are also prevalent east of 6500E.

Line 4 (Plate 4) - The pseudo-section probably favours the shallowest of the two possible interpretations at 500W (see Plate 8). It tends to suggest thick shale occurs at 1500W, 2000W and 3500W. It suggests that the possible basement ridge at 2500W (see Plate 8) probably does not occur.

Line 0 (Plate 5) - The predominantly horizontal contours on Plate 5 suggest a geo-electrically more uniform basement on this line. Shales would seem to dominate the section east of 6000W. Some doubt occurs in the quantitative sounding interpretation between 4500W - 6000W. The pseudo-sections tend to suggest that the depth to basement at 5000W may be slightly deeper than interpreted.

..../23

Line 5 (Plate 6) - Because of the relatively uniform basement and fluvial section, the pseudo-section contours parallel the interpreted section on Plate 8. Shale seems to be very widespread on this line and little conglomeratic sandstone is interpreted to occur.

Contour Plans

Plate 10 - The contour plan of interpreted depth to basement suggests that a fluvial depression or channel is continuous from line 4 northwards through the survey area to line 5. Depth to basement within the channel is in the order of 60-70 metres from line 4 to line 0, deepening to 70-80 metres on line 5.

A basement ridge occurs to the east of the interpreted channel on lines 4 to 1. It appears to have been abruptly truncated between line 1 and line 0. A close inspection of soundings line 0 3000W-4000W, indicates that shallow basement is unlikely. The soundings are supported by drillhole 53 and by contouring on Plate 9.

Basement deepens very rapidly east of the ridge. However, it appears that only shales were located.

Depths to basement are relatively shallow (40 metres and less) over the western part of the survey area.

Plate 9 - Contour plan r = 65 metre apparent resistivity data. Lower values would tend to reflect thicker shales and deeper basement. Higher values shallow basement and near-surface 'laterization'. A north-south lineation from about line 2 5500W to about line 0 7500W suggests a possible fault. Another fault will probably extend from line 1850W to line 3 about 5500W. It may continue south crossing line 4 at 500W and north to line 0 (4000-4500W).

The extent of the 'lateritic zone' and the area where the sediments are thought to be predominantly shales are also outlined on Plate 9. The 'lateritic zone' is confined to the S.W. corner of the survey area. The thick shales to the northern and eastern sections and to an area between the easterly fault anomaly and the channel anomaly (possibly a remnant flood-plain anomaly).

.../24

The Channel Anomaly

The channel anomaly as defined by the 60 metre contour on Plate 10 diverges slightly to the east between line 1 and 0. This divergance may be caused by faulting. There appears to be a major facies change within the channel near line 0. Shales predominating to the north, with shale overlying a basal conglomerate to the south.

The conglomerate within the channel is probably thickest where the apparent resistivities above basement are highest. An examination of the relative plates suggests that the thickest conglomerate might occur as follows;

Line 1 (Plate 16) 2500W-3000W
Line 2 (Plate 20) 3000W
Line 3 (Plate 21) 3500E-4000E
Line 4 (Plate 22) - The apparent resistivities with the sediments on this line are lower than those above suggesting less conglomerate in the sequence.
Line 0 (Plates 24/25) 6000W - Possibly slightly off channel, depending upon correct interpretation of sounding 0/5500W. Alternative - 4500W.

Recommendations

(a) Drilling - From the resistivity results the thickest conglomerates would appear to occur on lines 1-3. Any reasonable thickness of conglomerate would appear to terminate about line 0. We would suggest line 1 3000W, line 2 3000W, 3500W, line 3 3750E, line 0 6000W as worthwhile drillsites. Perhaps line 0 4500W, line 4 3000W and line 1 2500W could also be added.

(b) Resistivity - The method used during this survey is satisfactory for reconnaissance work. Profiling with separations of r = 25 and/or r = 65 metres would be adequate for any subsequent detailing of conglomerate/shale and channel boundaries within the survey area. The rate of progress of this type of work might be 3-4 kilometres a day if both profiles were conducted and if the station spacing was 50 metres, up to 7 kilometres a day if only one separation was used and the station spacing was 100 metres.

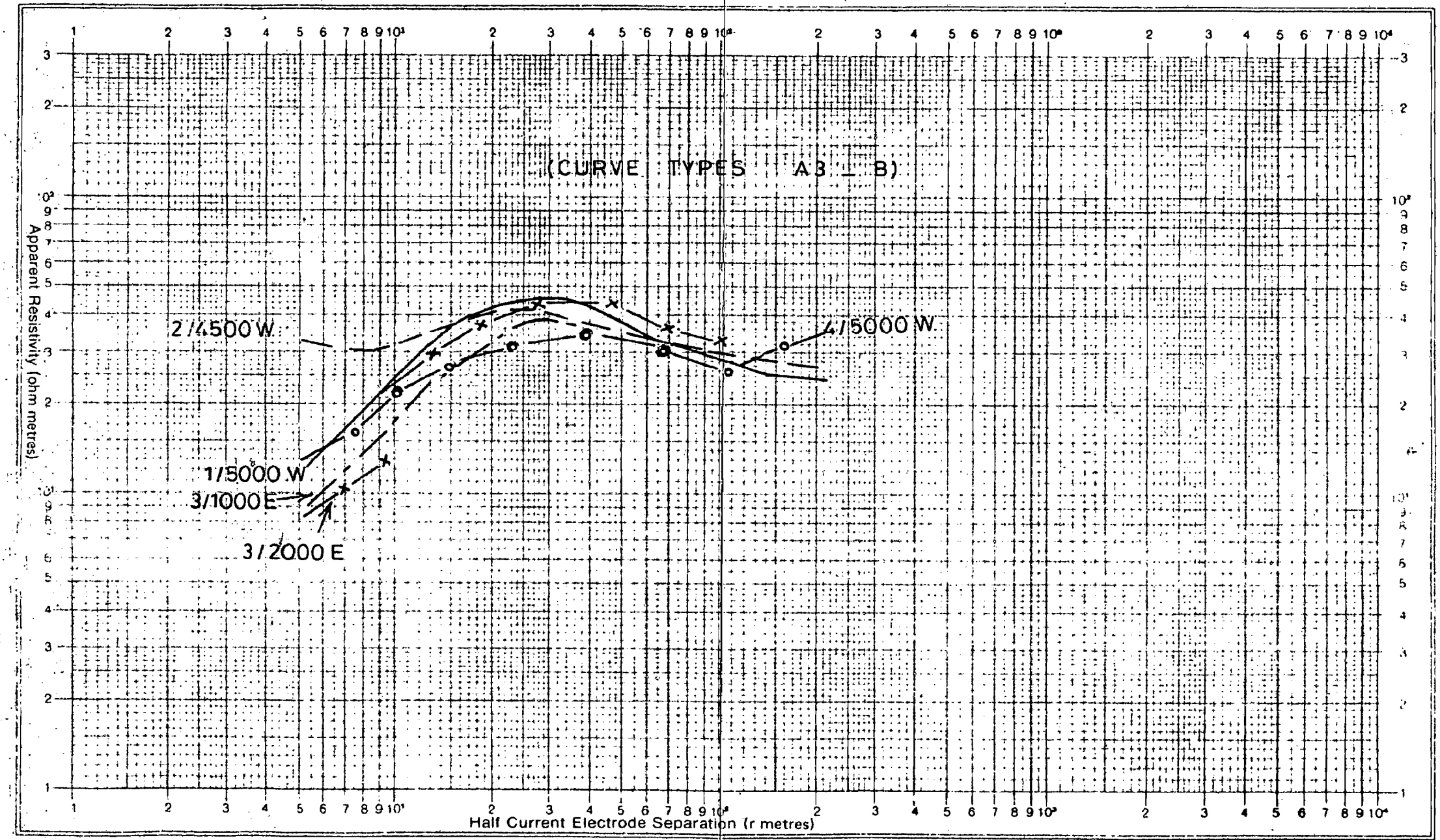
RESISTIVITY SOUNDING

CLIENT: PACMINEX AREA: PANDURRA LINE STATION:

Plate 11

Report 265

0560



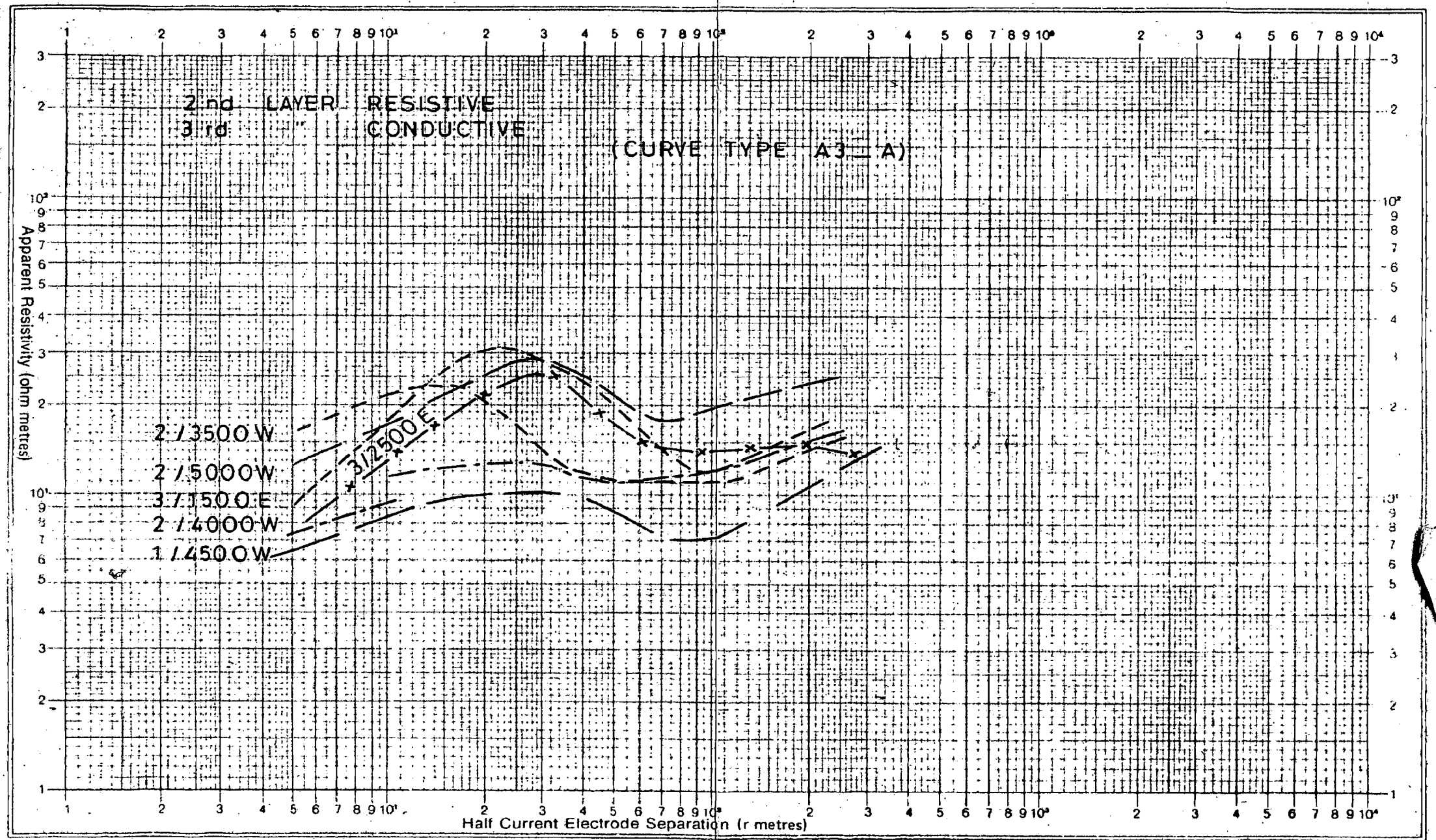
MURDOCH GEOPHYSICS (AUSTRALIA) PTY. LTD.

RESISTIVITY SOUNDING

CLIENT: PACMINEX AREA: PANDURRA LINE STATION:

Plate 12

Report 265 0561

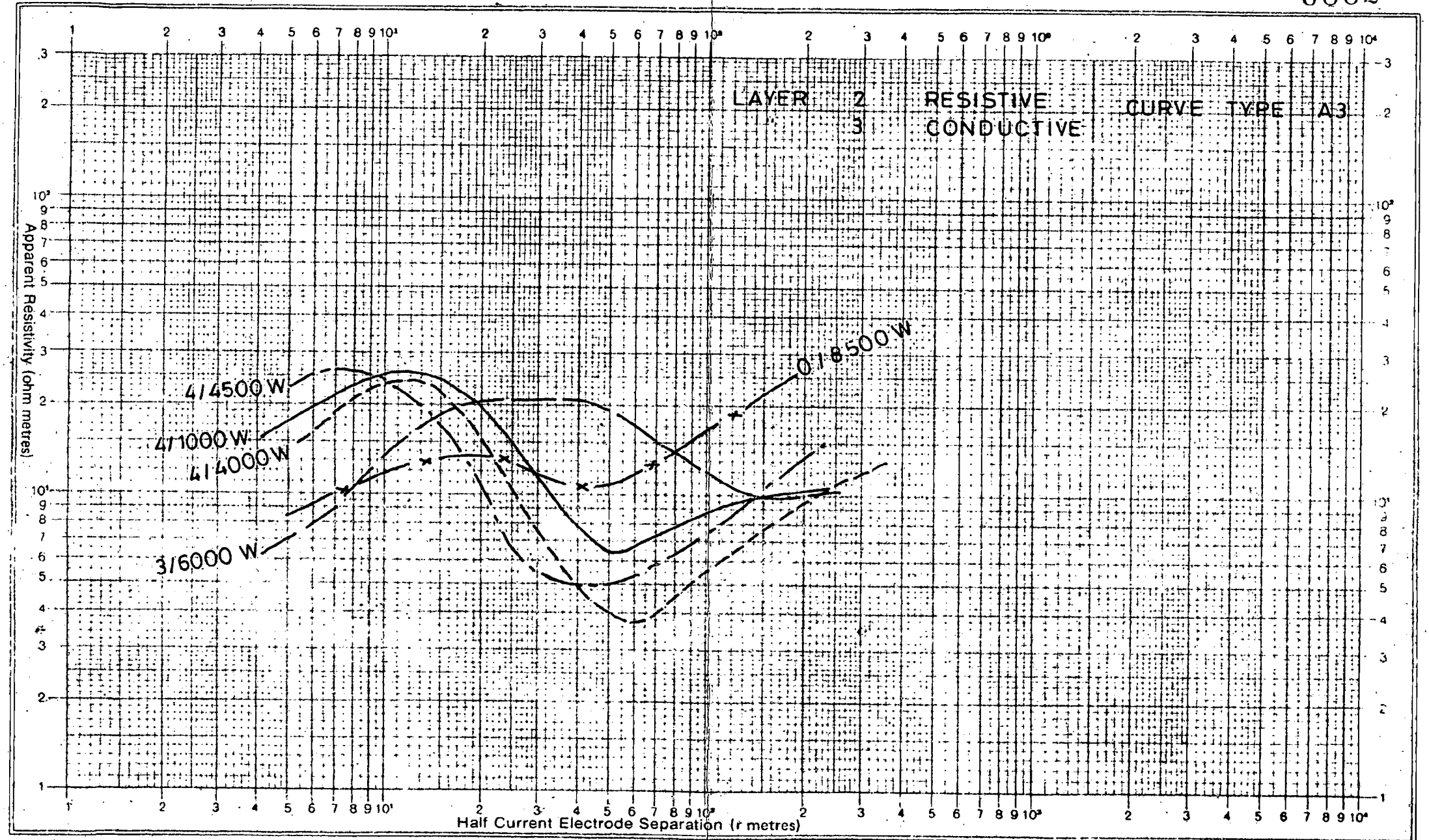


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RESISTIVITY SOUNDING

Plate 13

CLIENT: PACMINEX AREA: PANDURRA LINE: STATION: Report 265 0562



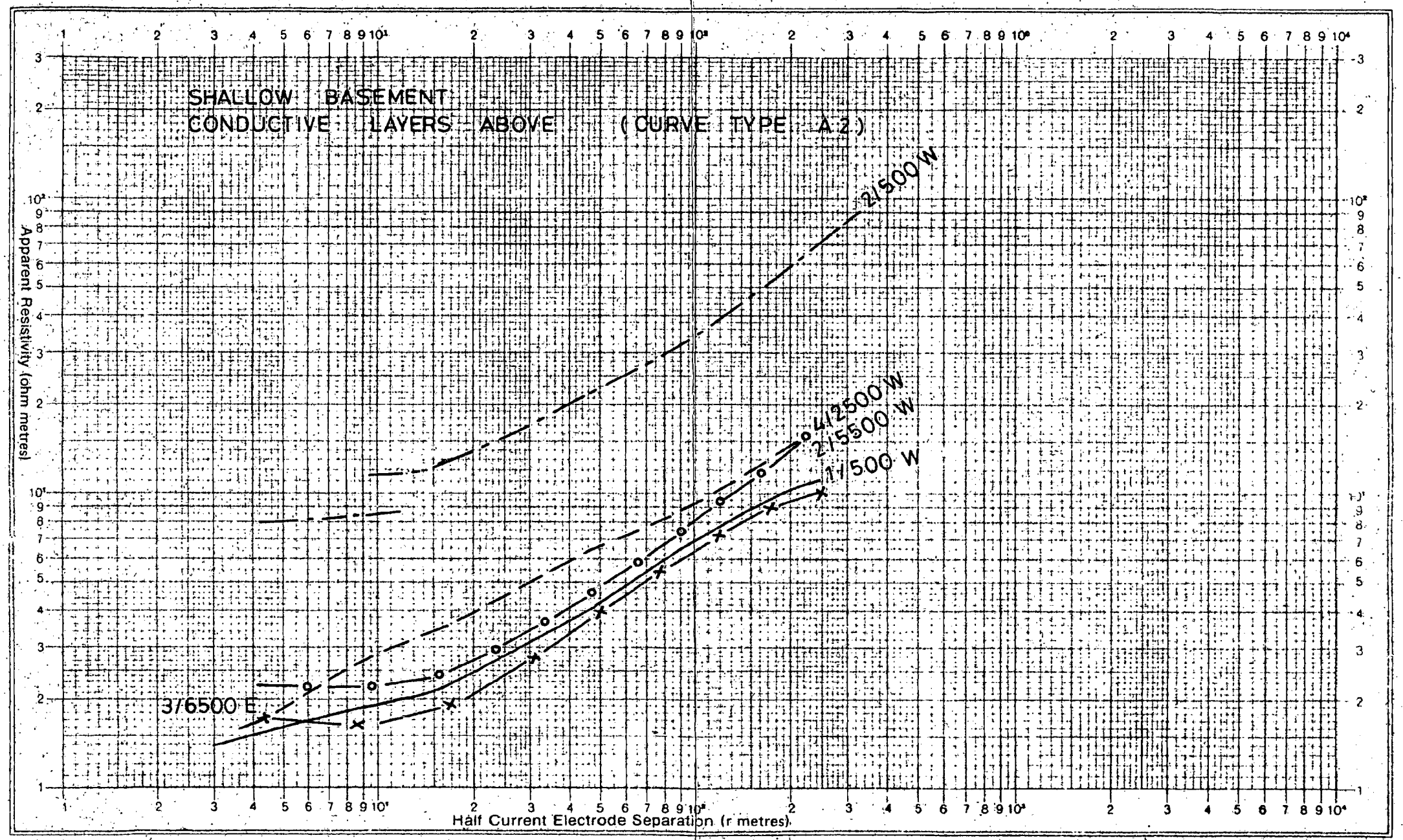
MURDOCH GEOPHYSICS (AUSTRALIA) PTY. LTD.

RESISTIVITY SOUNDING

CLIENT: PACMINEX AREA: PANDURRA LINE: STATION:

Plate 14

Report 265 0563



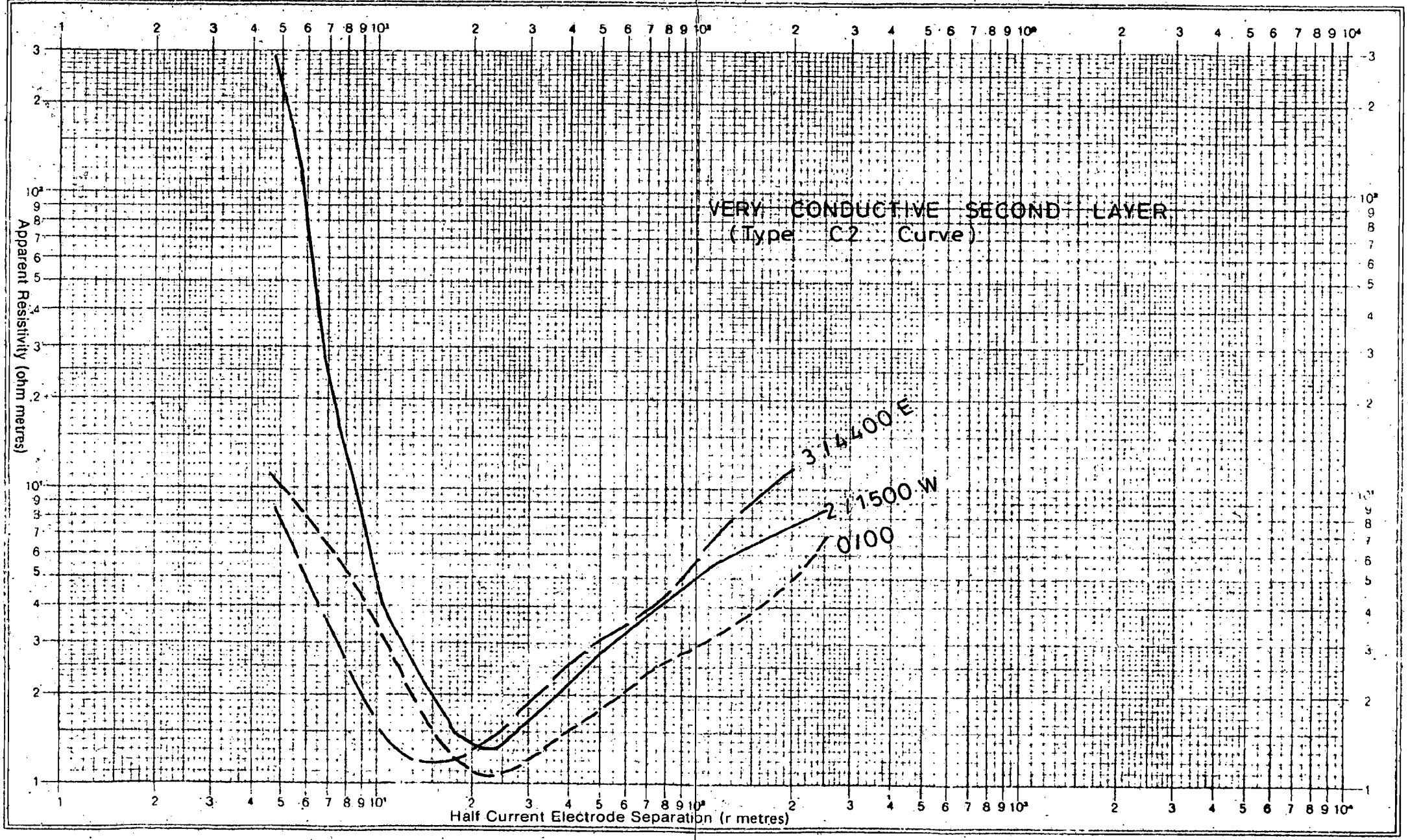
MURDOCH GEOPHYSICS (AUSTRALIA) PTY. LTD.

RESISTIVITY SOUNDING

Plate 15

CLIENT: PACMINEX AREA: PANDURRA LINE: STATION:

Report 265 0564

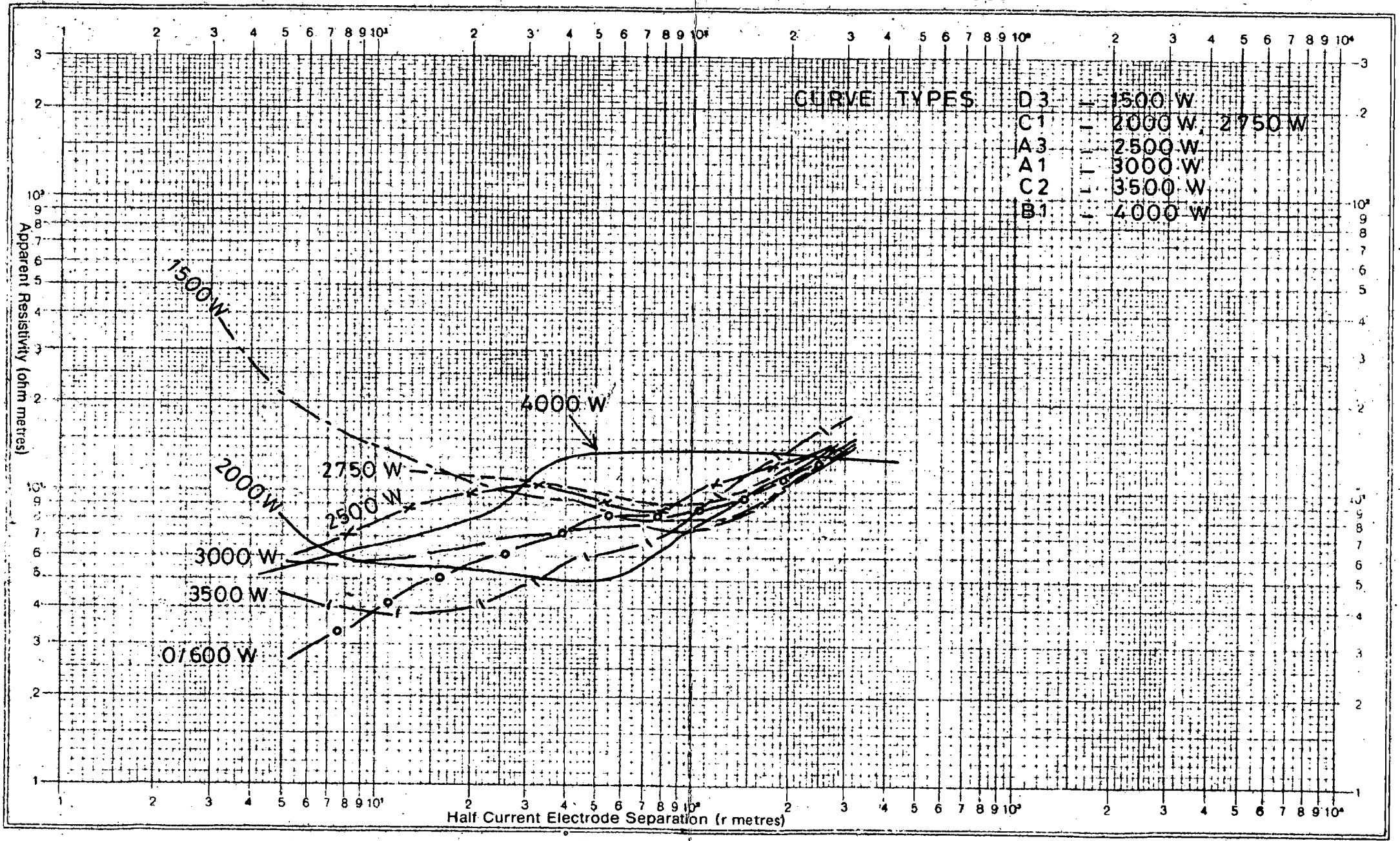


MURDOCH GEOPHYSICS (AUSTRALIA) PTY. LTD.

RESISTIVITY SOUNDING

Plate 16 0565

CLIENT: PACMINEX AREA: PANDURRA LINE: 1 STATION: 1500W-4000W Report 265



MURDOCH GEOPHYSICS (AUSTRALIA) PTY. LTD.

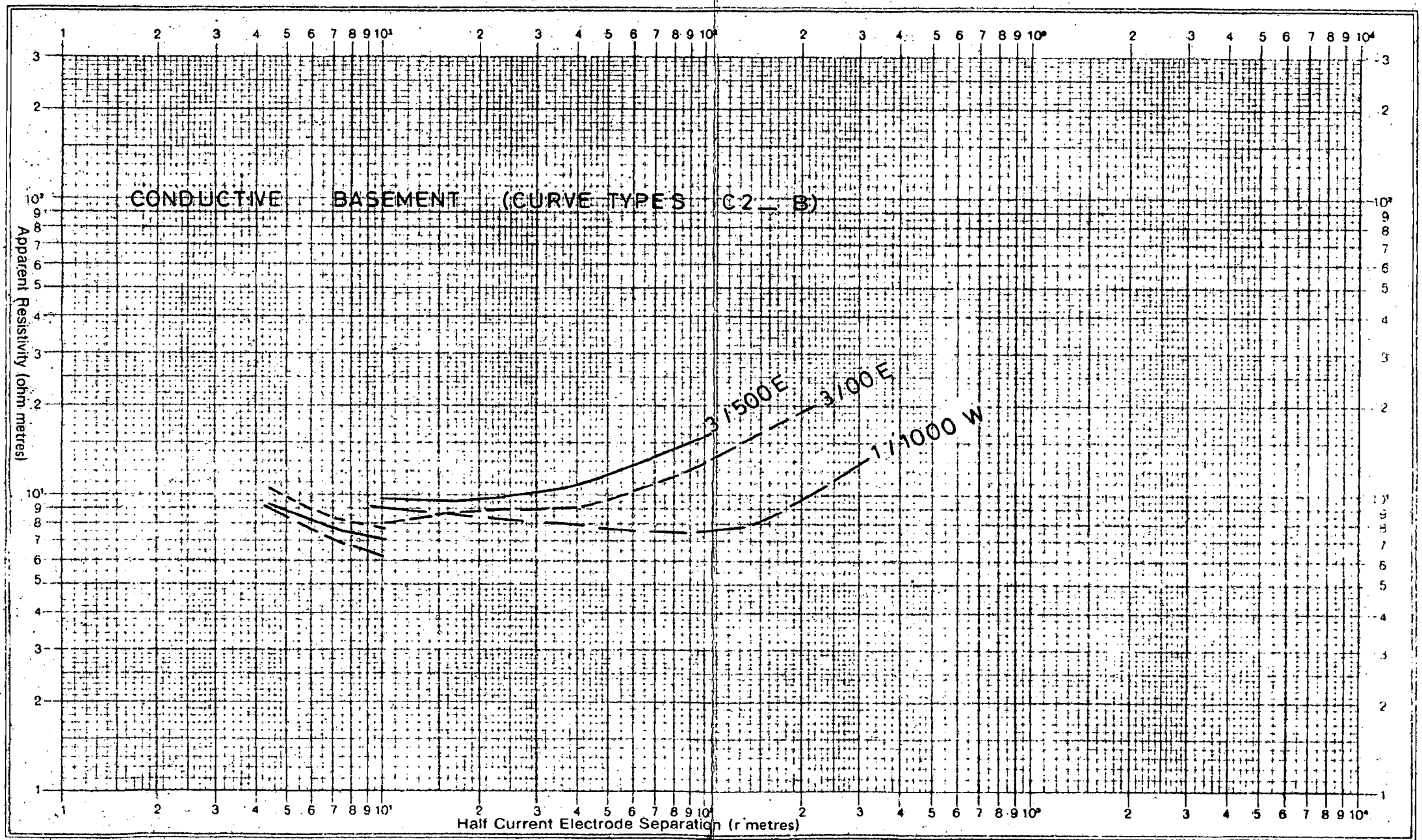
RESISTIVITY SOUNDING

CLIENT: PACMINEX AREA: PANDURRA LINE: STATION:

Plate 17

Report 265

0566

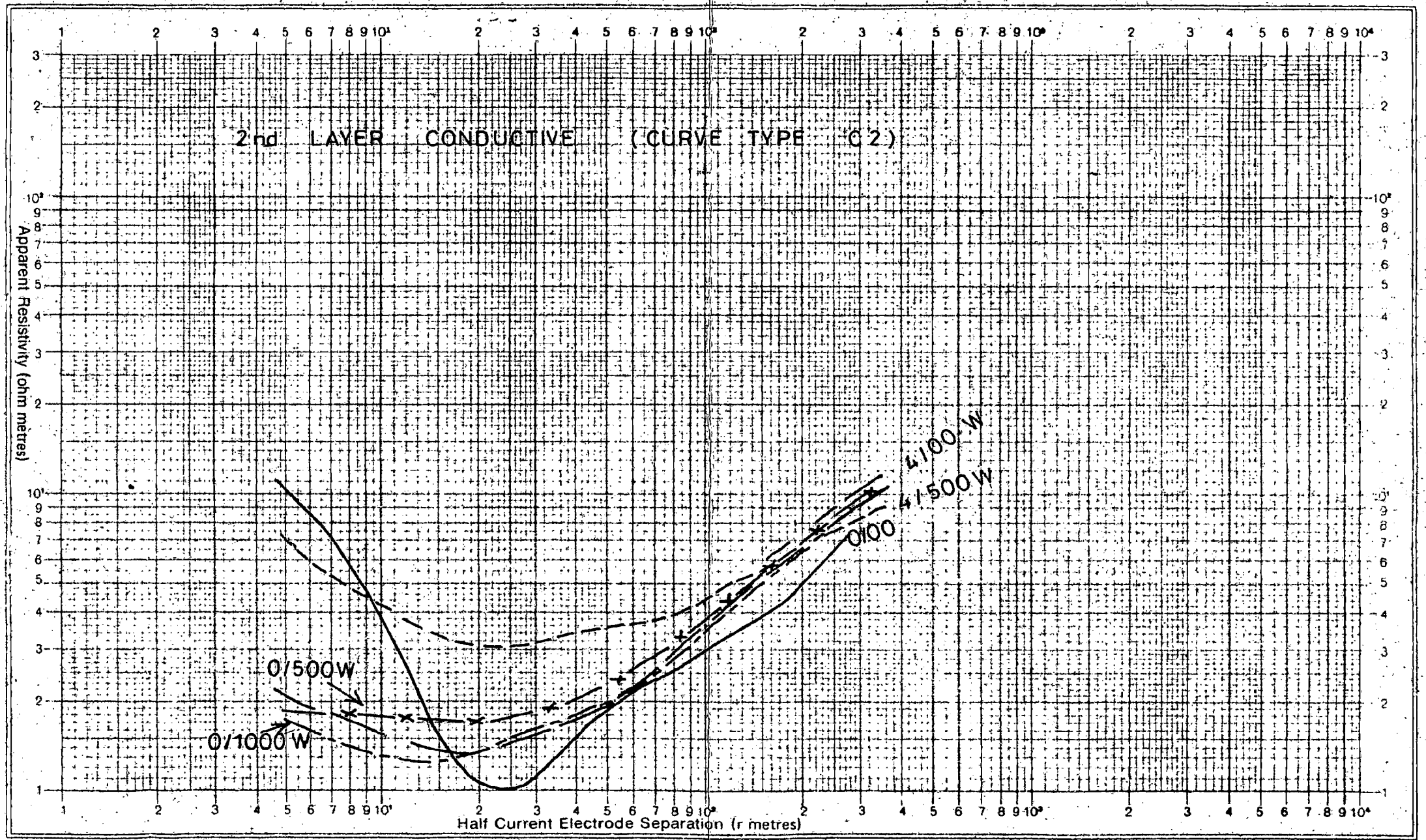


MURDOCH GEOPHYSICS (AUSTRALIA) PTY. LTD.

RESISTIVITY SOUNDING

CLIENT: PACMINEX AREA: PANDURRA LINE 4 0 STATION: 00W-500W 100W-1000W Plate 18 Report 265

0567



MURDOCH GEOPHYSICS (AUSTRALIA) PTY. LTD.

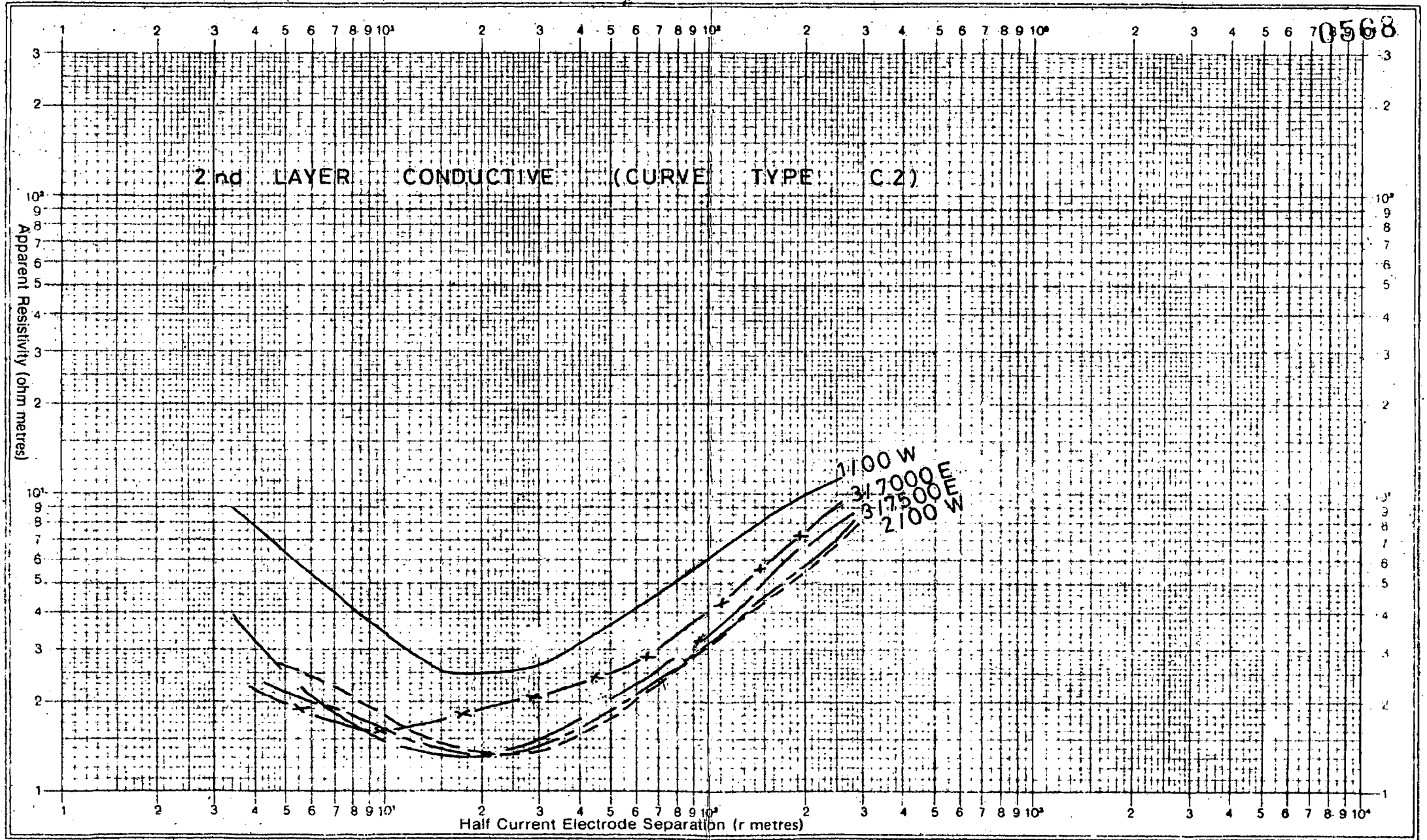
RESISTIVITY SOUNDING

CLIENT: PACMINEX AREA: PANDURRA LINE: STATION:

Plate 19

Report 265

0568

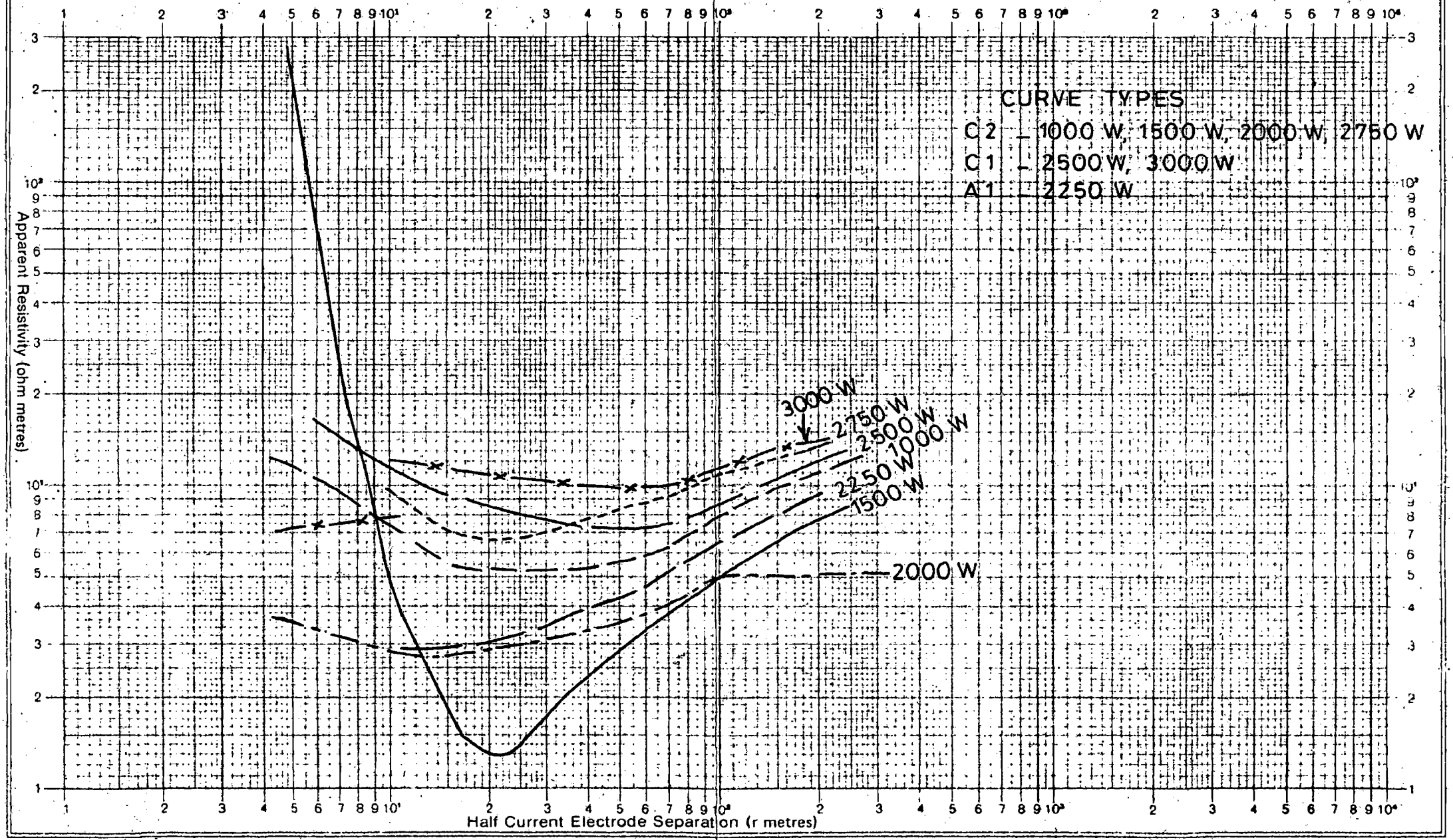


MURDOCH GEOPHYSICS (AUSTRALIA) PTY. LTD.

RESISTIVITY SOUNDING

Plate 20

CLIENT: PACMINEX AREA: PANDURRA LINE: 2 STATION: 1000W_3000W Report 265 0569

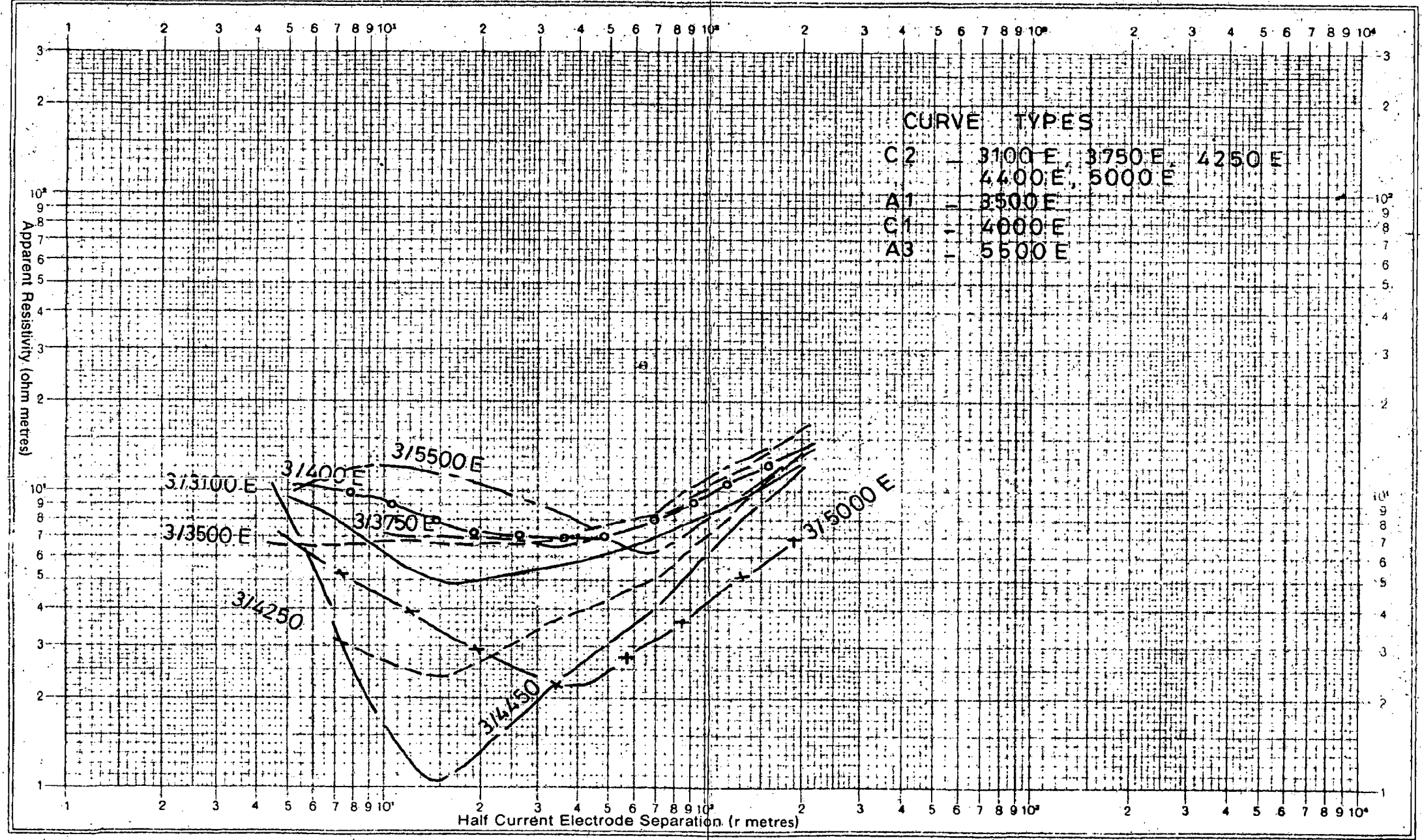


MURDOCH GEOPHYSICS (AUSTRALIA) PTY. LTD.

RESISTIVITY SOUNDING

Plate 21

CLIENT: PACMINEX AREA: PANDURRA LINE 3 STATION: 3100E_5500E Report 265 0570



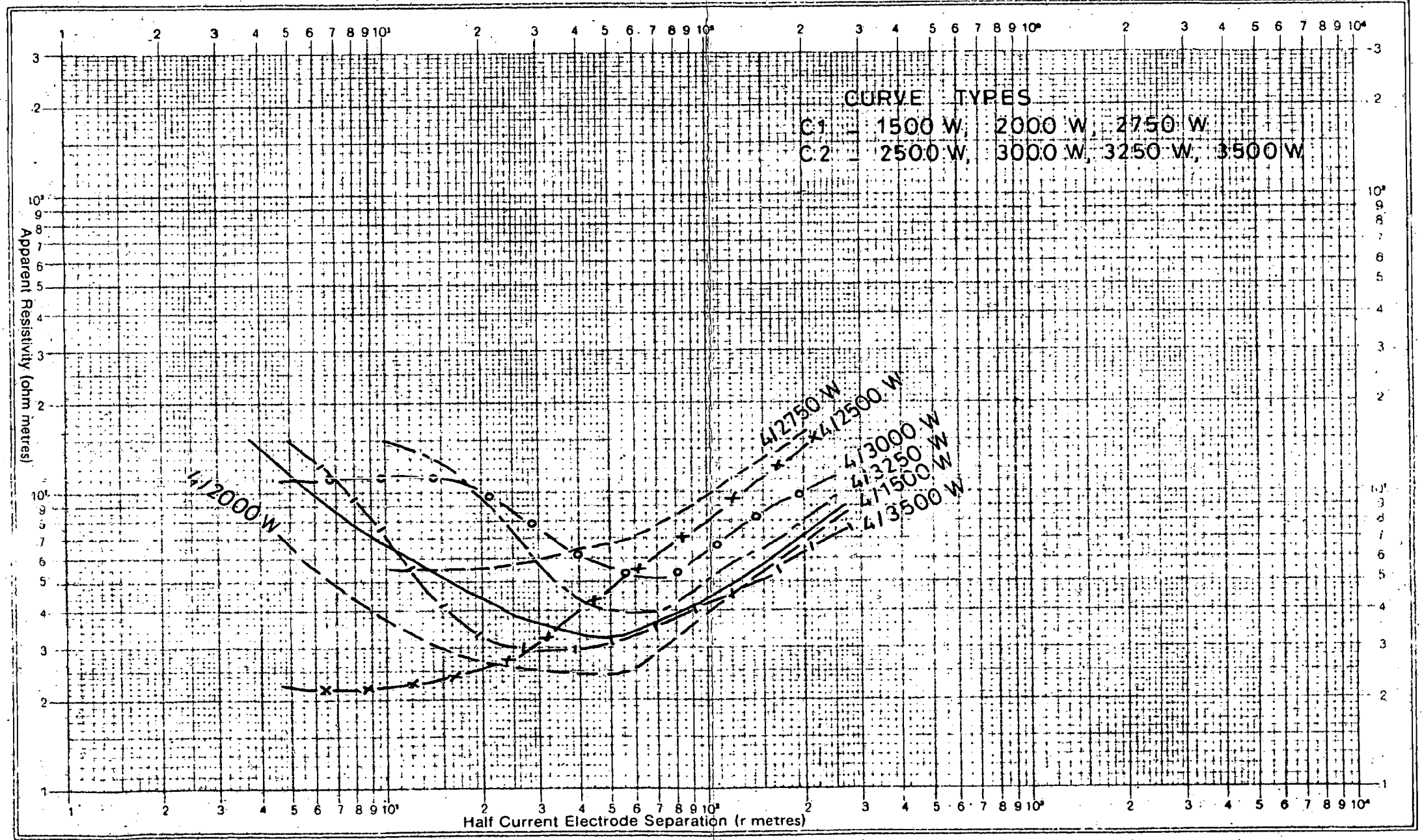
MURDOCH GEOPHYSICS (AUSTRALIA) PTY. LTD.

RESISTIVITY SOUNDING

Plate 22

0571

CLIENT: PACMINEX AREA: PANDURRA LINE 4 STATION: 1500W-3250W Report 265



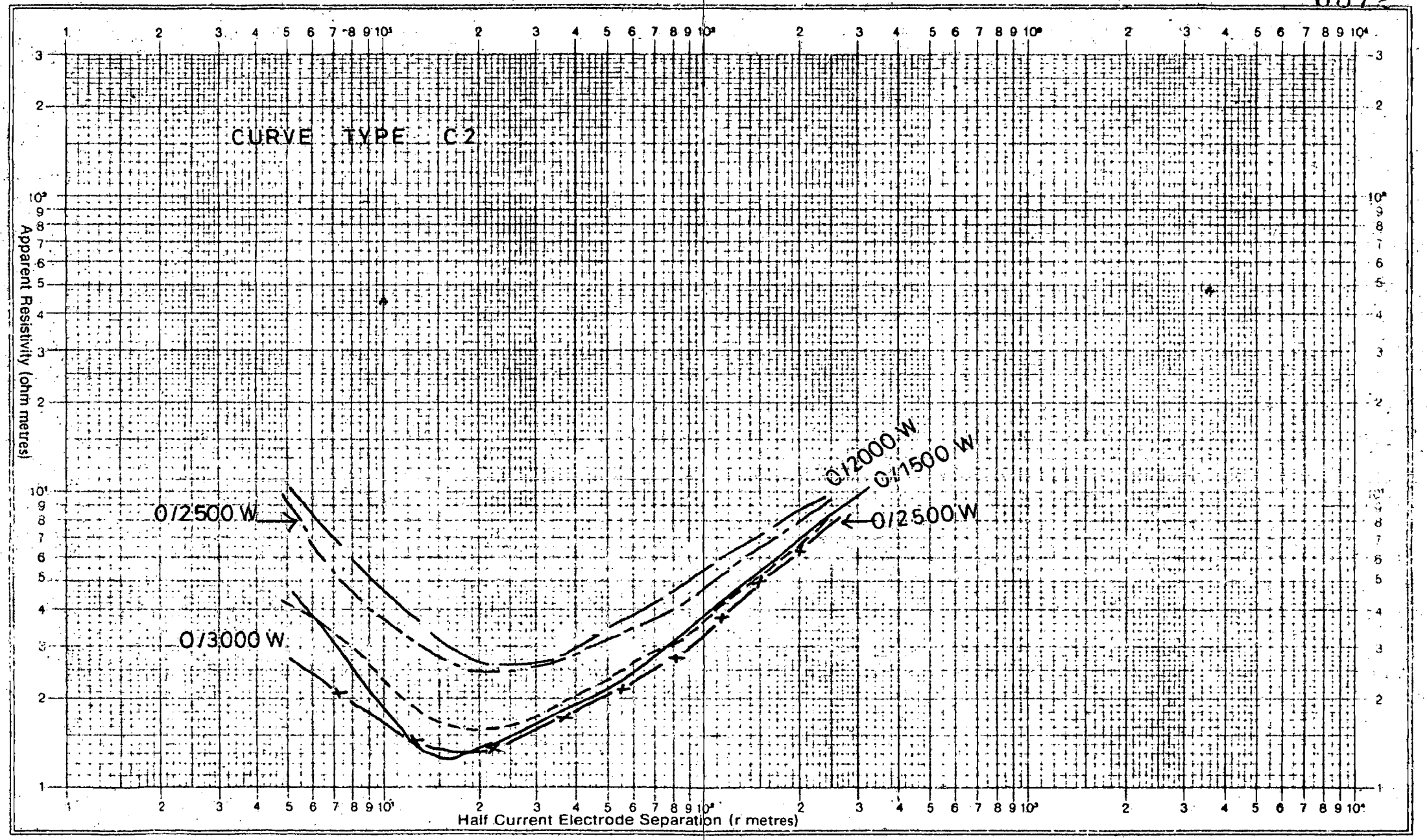
MURDOCH GEOPHYSICS (AUSTRALIA) PTY. LTD.

RESISTIVITY SOUNDING

Plate 23

CLIENT: PACMINEX AREA: PANDURRA LINE: 0 STATION: 1500W-3000W Report 265

0572



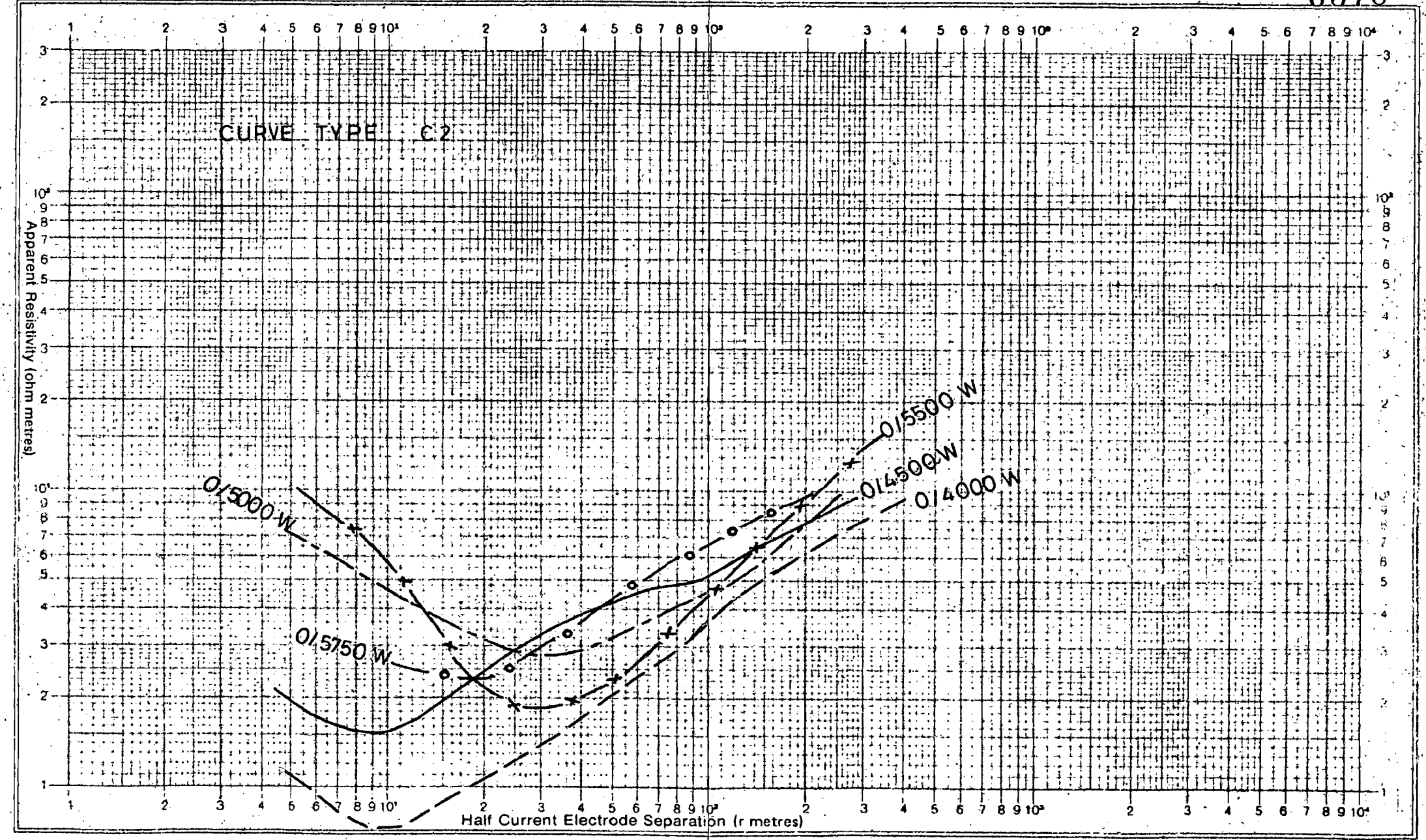
MURDOCH GEOPHYSICS (AUSTRALIA) PTY. LTD.

RESISTIVITY SOUNDING

Plate 24

CLIENT: PACMINEX AREA: PANDURRA LINE: 0 STATION: 4000W-5750W Report 265

0573

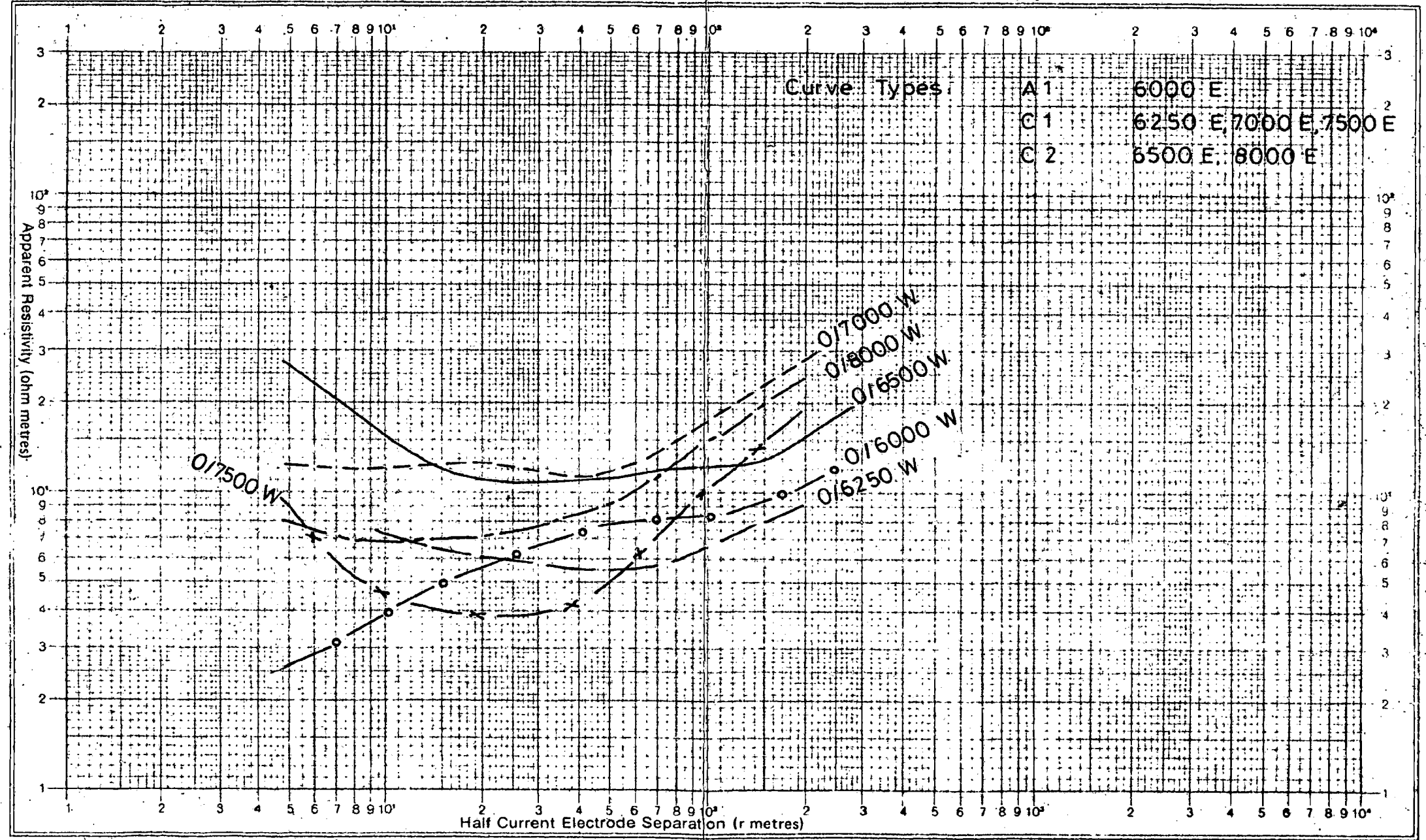


MURDOCH GEOPHYSICS (AUSTRALIA) PTY. LTD.

RESISTIVITY SOUNDING

Plate 25 0574

CLIENT: PACMINEX AREA: PANDURRA LINE: 0 STATION: 6000W-8000W Report 265



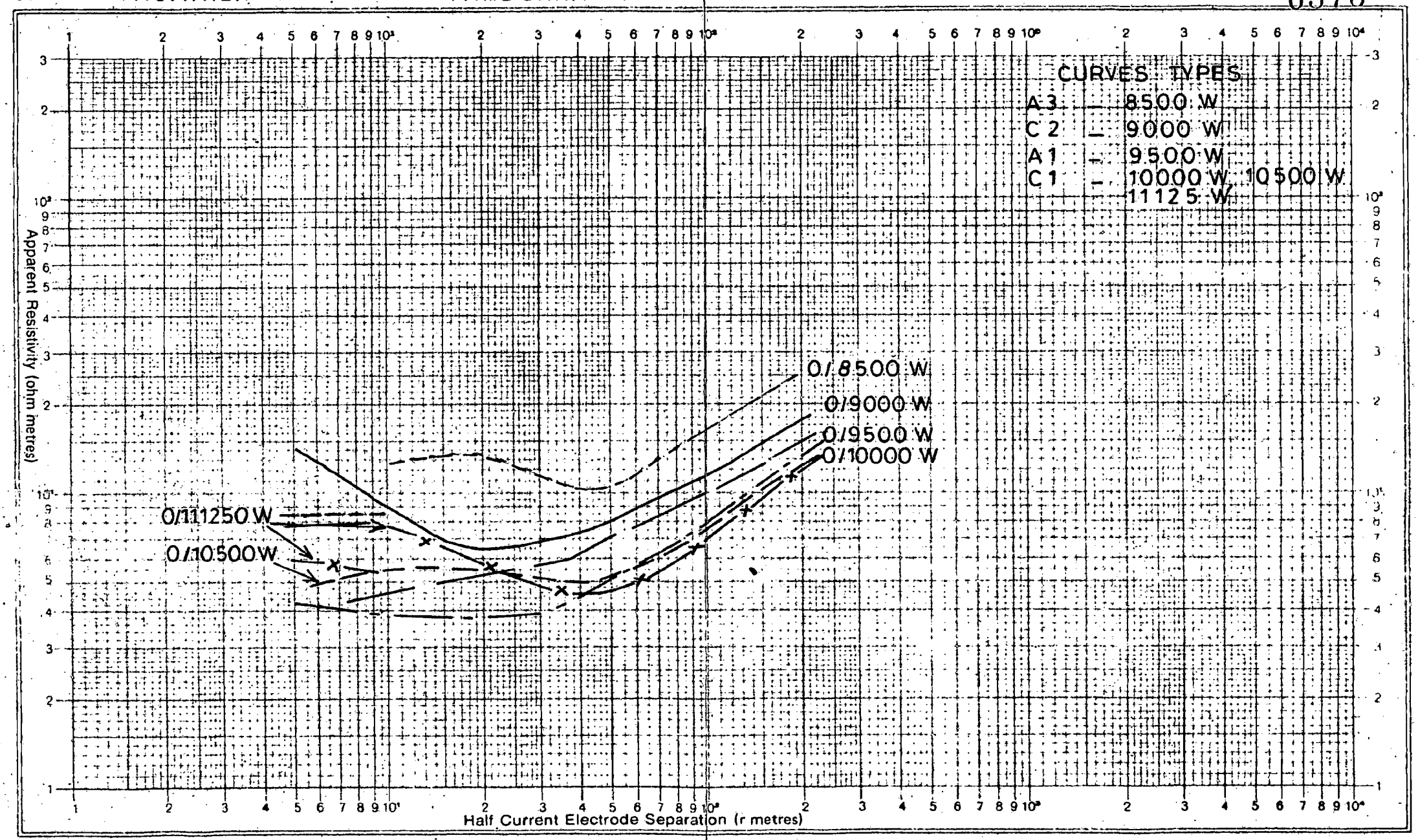
MURDOCH GEOPHYSICS (AUSTRALIA) PTY. LTD.

RESISTIVITY SOUNDING

Plate 26

CLIENT: PACMINEX AREA: PANDURRA LINE: 0 STATION: 8500W-11125W Report 265

0575

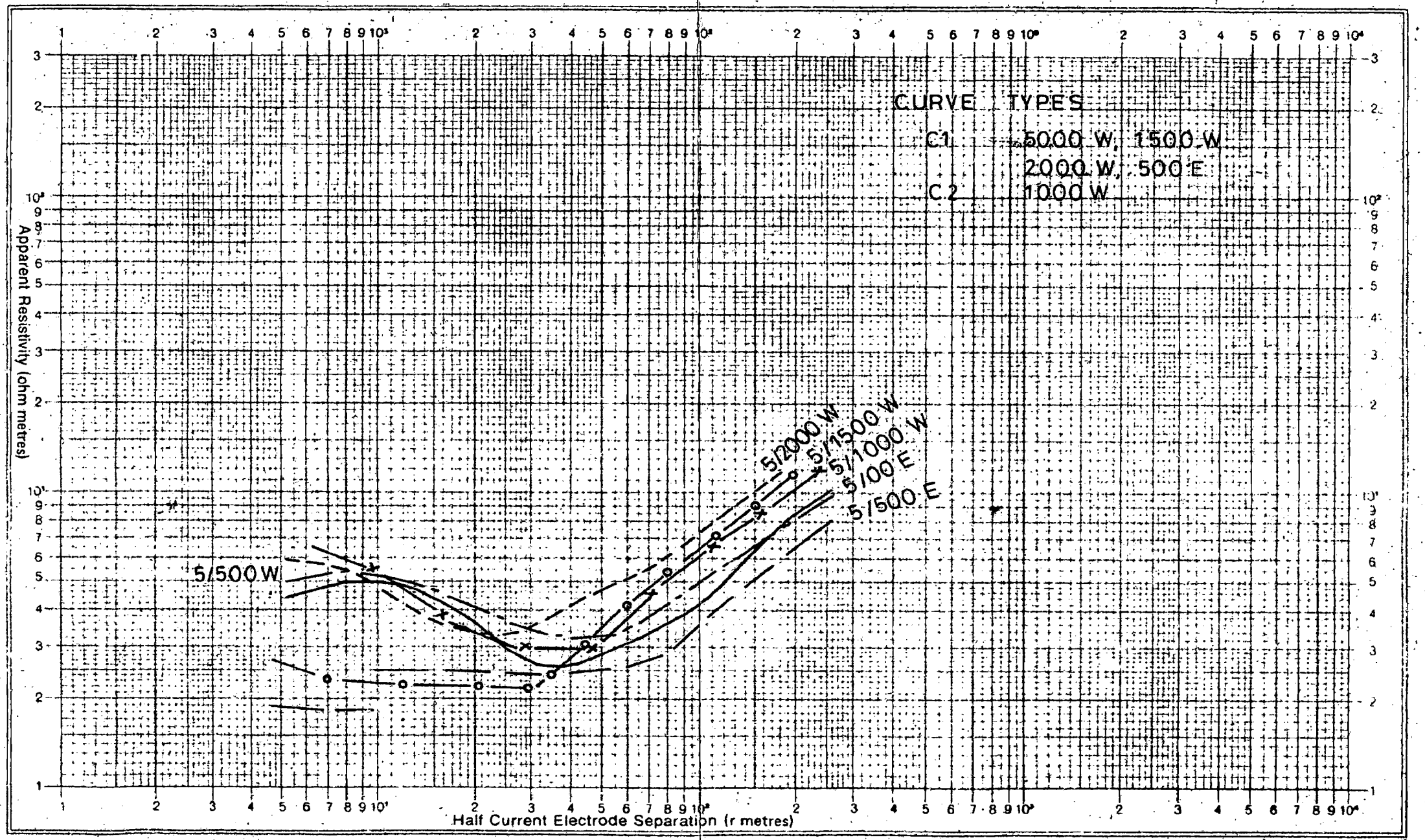


MURDOCH GEOPHYSICS (AUSTRALIA) PTY. LTD.

RESISTIVITY SOUNDING

Plate 27

CLIENT: PACMINEX AREA: PANDURRA LINE: 5 STATION: 2000W_500 E Report 265 0576

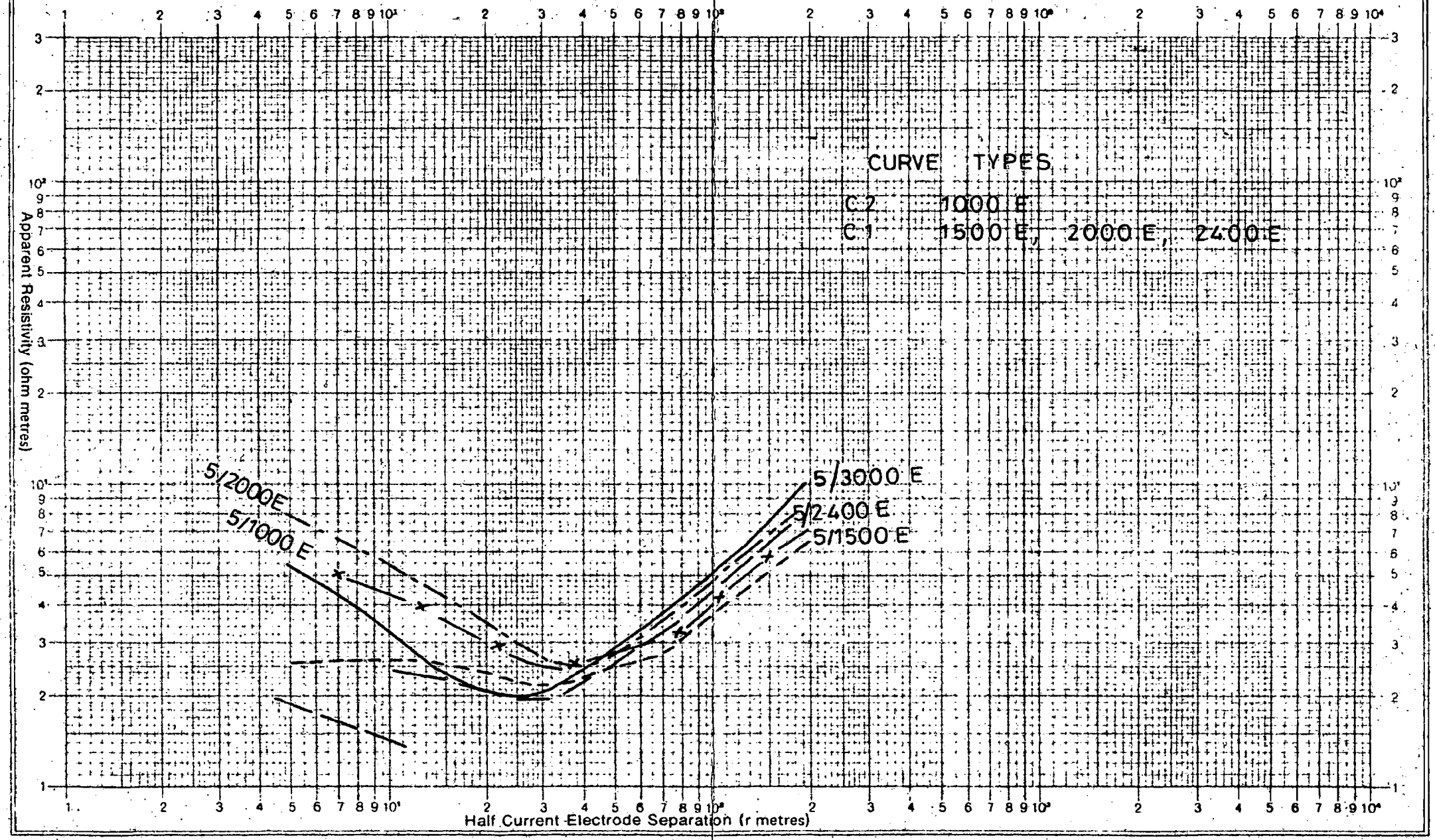


MURDOCH GEOPHYSICS (AUSTRALIA) PTY. LTD.

RESISTIVITY SOUNDING

Plate 28

CLIENT: PACMINEX AREA: PANDURRA LINE: 5 STATION: 1000E-3000E Report 265 0577



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