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EL 184

GIDDI GIDDINNA CREEK

FIRST QUARTERLY REPORT AND FINAL REPORT

Submitted by

Australian Selection Pty Ltd
1975

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PRIMARY INDUSTRIES AND RESOURCES SA

CONTENTS ENVELOPE. 2556. TRANSPARENT CYLINDER. 2556/1.

TENEMENT: E.L. 184.
TENEMENT HOLDER: AUSTRALIAN SELECTION PTY. LTD.

REPORT:
MASON M.G. 1975.
E.L. 184, Murloocoppie Coal Prospect.
First quarterly report;
(Period: March 3rd, to June 2nd, 1975) pgs. (2-7)

PLANS:
F.1. Murloocoppie Coal Prospect E.L. 184.
Drillhole locations. (2556-1-1)

REPORT:
MASON M.G. 1975.
Groundwater near Giddi Giddinna Creek, 37km
North - Coober Pedy, S.A. pgs. (8-35)

PLANS:
F.1. Localty plan of E.L. 184. pg. (19)
F.2. E.L. 184, Aquifer thickness & Isohalines. (2556-1-4)
F.3. Drill levels & contours on top of permian & base of Bulldog shale. (2556-1-3)
F.4. Isohalines & limit of artesian wells. (2556-1-2)

APPENDICES:
1. Australian Mineral Development Laboratories- water analysis, report job no. 3769/75. pgs. (20-21)
2. Rotary - percussion drill logs. pgs. (22-35)

REPORT:
MASON M.G. 1975.
E.L. 184. Murloocoppie Coal Prospect S.A.
Final report.
(Period: August, 1975) pgs. (36-87)

CONTENTS ENVELOPE. 2556. TRANSPARENT CYLINDER. 2556/1.

PLANS:

APPENDICES:

REPORT:

AUSTRALIAN SELECTION (PTY) LIMITED

004

MURLOOCOPPIE COAL PROSPECT

First Quarterly Report
for
Exploration Licence 184.
3rd March to 2nd June, 1975.

The area covered by Exploration Licence 184 was applied for by Australian Selection (Pty) Limited on the 4th December, 1974, and was granted effective as from the 3rd March, 1975 for a period of tenancy of one year.

The licence area, which abuts the north-eastern edge of the Coober Pedy proclaimed opal field, covers an area of 1,789 square kilometres and is centred 30 kilometres N.E. of the Coober Pedy township.

Portion of the licence area is within the Woomera Prohibited area. Access was granted on the 20th March, 1975, and entry permits collected on 7th April, 1975.

A detailed geological reconnaissance was carried out from the 7th to 10th April, 1975. A schramm rotary percussion drill entered the area on 28th April, 1975 and continued drilling until the 29th May, 1975. A total of fourteen(14) holes were drilled for an advance of 1,362 metres. Of these, 10 holes intersected Mt. Toondina Formation between 65 and 110 metres

Rec. 2556

below surface, and two holes intersected Proterozoic granite (with Mt. Toondina Formation absent).

No significant intersections of coal were made in the Mt. Toondina Formation.

The stratigraphic section intersected in most holes was Bulldog Shale from surface to shallow depth. (Cadnaowie Formation outcrops only around Lake Cadibarrawirracanna and to the east and north as a wide strip parallel to the Peake and Denison Ranges). A thin un-named basal silty shale member with thin cone-in-cone limestones was present in most holes. Thence sands of the Cadnaowie Formation and the Algebuckina Sandstone. The boundary was often difficult to distinguish. Thence the Mt. Toondina Formation of sandy silts and siltstones generally with fine carbonaceous fragments.

Several sections of coal were intersected in the Cadnaowie Formation. The most significant in hole MU-13 from 56-60 metres where two seams totalling 3 metres were intersected. This coal has been sent to Robertson Research for analysis.

Structurally the area consists of two Proterozoic highs of granite extending from Mt. Woods in the south; one north under Lake Cadibarrawirracanna, the other passing just to the north of Coober Pedy township. The Permian on-laps these highs. The coal formation near the top of the Mt. Toondina Formation has been eroded from the licence area.

The top of the Permian and the overlying units appears to dip very shallowly northwards. No true anticlinal structure can be shown.

Large quantities of generally brackish water were intersected in most holes. The water is not artesian; is contained within the Cadnaowie and Algebuckina Formations; and is separated from the Coober Pedy highly saline waters by a Proterozoic high. The least saline water is centred around Giddi Giddinna Creek and indicates local intake. A north-easterly movement of sulphate-rich waters in this sub-basin of the Great Artesian Basin is suggested. Flows of greater than 2200 cubic metres per day were encountered from an aquifer thickness of about 60 metres.

A detailed report on this groundwater will shortly follows.

Conclusions

Prospects of Permian coal deposits in this area are poor. The coal-bearing section of the Permian has been eroded over most, if not all, of the licence area. A full detailed report will be forwarded as soon as all results are to hand.

P.D. Nicholson

for M. G. MASON
PROJECT GEOLOGIST

Attachments

Drill Hole Location Plan
Drill Logs
Financial Report

MURLOOCOPPIE COAL E.L. 184

007

FINANCIAL REPORT

Expenditure to 2nd June, 1975 is as follows

Geological Survey	Salaries - Field	4,557	
	Salaries - Drafting	320	
	Maps & Aerial Photos	102	
	Sample Bags	220	
	Plan Reproduction	118	
	External Consulting	606	5,923.00
Logistics	Field Support	3,453	
	Transport	1,901	
	Equipment Repairs	54	
	Mines Dept. Rental	895	6,303.00
Drilling	Percussion Drilling	7,367	7,367.00
Depreciation	Drill Equipment	696	
	Exploration Equipment Including Vehicles and Office	358	1,054.00
Administration Costs - Port Augusta			
	Salaries	535	
	Office Maintenance (Includes power, phone etc.)	257	792.00
Other Costs	We maintain an Office at 32 Main Street, Port Augusta as a base for operations within South Australia. Most of our administration costs are generated in Kalgoorlie and Perth. We therefore make application to have these costs included and deemed applicable.		1,967.00
		Total Expenditure	$23,406.00

P. R. GRAHAM
OFFICE MANAGER

134° 45'
135° 00'
135° 15'
28° 30'
28° 35'
28° 38'
28° 45'
28° 52'
29° 00'
135° 16'

MU-4 Klb - 40 Klc - +16 Jua - Plt -

MU-3 Klb - 42 Klc - 28 Jua - 36 Plt - +44

MU-12 Klb - 36 Klc - 52 Jua - 12 Plt - 28

MU-13 Klb - 26 Klc - 44 Jua - 24 Plt - +6

MU-2 Klb - 14 Klc - 34 Jua - 32 Plt - +31

MU-5 Klb - 8 Klc - 46 Jua - 12 Plt - +29

MU-6 Klb - 8 Klc - 40 Jua - 16 Plt - +28

MU-1 Klb - 8 Klc - 64
MU-14 Jua - 16 Plt - +16

MU-10 Klb - 6 Klc - } 58 Jua - Plt - +53

MU-8 Klb - 8 Klc - 56 Jua - 20 Plt - +24

MU-9 Klc - 52 Jua - 13 Pt - +14

MU-11 Klb - 18 Klc - } 40 Jua - Plt - +55

MU-7 Klb - 6 Klc - 32 Jua - 12 Pt - +10

STUART RANGE No2 Klb - 18 Klc - } 64 Jua - Plt - 228

SABRINA BORE (approx) Klb - 60 Plt - 5 Pt - +16

STUART RANGE No1 Klb - 64 Klc - 72 Plt - +78

STUART RANGE No3

VERMIN PROOF FENCE

STUART RANGE

location of MU-10 ?

5 0 5 10 KILOMETRES

SCALE~ 1: 250,000

LEGEND

- ROTARY PERCUSSION DRILL HOLE
- PERMIAN JURASIC CRETACEOUS
  - Klb – BULLDOG SHALE
  - Klc – CADNAOWIE FORMATION
  - Jua – ALGEBUCKINA SANDSTONE
  - Plt – MOUNT TOONDINA FORMATION
- PROT.
  - Pt – GRANITE

Same as 2556(2)–1

ENV 2556[redacted]–1

AUSTRALIAN SELECTION (PTY) LTD. F.1.

MURLOOCOPPIE COAL PROSPECT
E.L.184
DRILL HOLE LOCATIONS

Revisions.	Date.			Date.
		Compiled by:	M.G.M.	June '75
		Drawn by:	M.G.M.	" "
		Traced by:	E.M.S.	" "
		Checked by:		
		PLAN NUMBER:	A.S. 5610	

A3 SHEET.

2556.

GROUNDWATER NEAR GIDDI GIDDINNA CREEK 37 KMS. NORTH OF COOBER PEDY, SOUTH AUSTRALIA

EL 184

M. G. MASON
SENIOR GEOLOGIST
AUSTRALIAN SELECTION (PROPRIETARY) LTD

Duplicate

009

GROUNDWATER NEAR GIDDI GIDDINNA CREEK
37 KMS. NORTH OF COOBER PEDY,
SOUTH AUSTRALIA

C O N T E N T S

FIGURES

APPENDIX I

Australian Mineral Development Laboratories
Water Analysis Report.

APPENDIX 2

Rotary-Percussion Drill Logs (14)

SUMMARY

During the course of an exploration programme for Lower Permian coal, in an Exploration Licence area 30 km. north of Coober Pedy, South Australia, a previously unknown significant occurrence of brackish groundwater was discovered during rotary-percussion drilling. Flow rates from individual holes ranged from 330 to 2000 cub. m. per day and salinity ranged from 2600 ppm to 5000 ppm. The Upper Jurassic, Algebuckina Sandstone and the Lower Cretaceous Cadnaowie Formation form the aquifer which is overlain, in the E.L. area by Lower Cretaceous Bulldog Shale. Local recharge along the fracture-controlled Giddi-Giddinna Creek is considered to account for the general low groundwater salinity, relative to surrounding areas.

The groundwater occurrence will be of immediate benefit to the township of Coober Pedy and may be of value to future mineral development in the Lake Phillipson area.

1. INTRODUCTION

Australian Selection (Pty) Limited were granted Exploration Licence 184 on 2nd March, 1975 (Fig. 1) for one year, to explore for coal, in an area centred about 42 km. N.N.E. of Coober Pedy, South Australia. Rotary-percussion drilling was carried out during May 1975, and resulted in the discovery of significant quantities of brackish groundwater.

This report describes the groundwater occurrence.

2. GEOLOGY

The E.L. area lies central to the Permian Arkaringa Basin near the south west margin of the Great Artesian Basin.

Within the E.L., Lower Permian Mount Toondina Formation sediments are unconformably overlain by Jurassic, Algebuckina Sandstone and Cretaceous Cadnaowie Formation respectively.

The two units are extremely difficult to tell apart visually in rotary percussion chips. Both are coarse to medium grained, relatively unconsolidated sands with minor fine sand, silts and silty shale layers. The Cadnaowie Formation contains thin calcarenites in the northern part of the Exploration Licence, and has thin woody coal measures in several parts of the profile.

.../2

Coarse grits, with round pebbles of pitted porphyritic rhyolite, are common at the top of the unit.

Together, these units form the aquifer and average about 60 metres thick (see Fig. 2).

Overlying the Cadnaowie Formation is the Bulldog Shale; again of Cretaceous age. At the base of the Bulldog Shale is a more silty member which, though only several metres thick, can be recognised over most of the area. This equates to the un-named Transition member of Ludbrook in the Stuart Range No. 3 Bore. Thin calcarenites with cone in cone structure are common to this interval, but do not occur elsewhere in the overlying section. This unit consists generally of khaki, black to grey carbonaceous shales.

The Bulldog Shale outcrops over wide areas. Where the Tertiary silcrete profile is present (e.g. opal workings at Coober Pedy) it is pale brown to off-white silty claystone. However, where the profile has been stripped, which is the case over most of the Exploration Licence, the shales are khaki, dark grey, soft and contain abundant gypsum veins. The land surface is covered with cobbles, generally rounded, of Proterozoic-Archaean age. These are interpreted as being reworked from the Permian sequence (Parkin, 1969). Silcrete pebbles from the dissected silcrete surface are common - several meandering zones of these probably indicating ancient stream channels. Cadnaowie Formation outcrops around

Lake Cadibarrawirracanna, and to the east as a strip parallel to the Peak and Denison Ranges. This area is typified by sand dunes and salinas; with springs near the outcrop edge of the Cadnaowie with the Bulldog Shale.

2.1 Structure

Drilling has shown two basement highs: one under Sabrina bore extending south east, the other under Lake Cadibarrawirracanna and extending south; both joining to the Mt. Woods Lower Proterozoic outcrop area.

Preliminary work indicates the Permian unconformable surface and later units dip gently towards the north from the basement high at the south edge of the Exploration Licence. However, interpretation is hampered by lack of accurate levelling. A weak, broad anticline may be present as shown by the base of the Bulldog Shale in Fig. 3. However, the top of the Permian is more complex. A low is present almost directly beneath the anticlinal structure where the thickest development of aquifer occurs.

Several lineaments have been noted. One passes along a W.S.W. branch of Oolgelima Creek to the N.W. of Sabrina bore. The Sabrina Ridge appears to be affected by this feature becoming less pronounced on the northern side. This lineament lines up with the Karari Fault mapped to the S.W. (Townsend 1973). A similar lineament parallels Giddi Giddinna Creek and the southern edge of Lake Cadibarrawirracanna.

3. GROUNDWATER

Groundwater was cut at depths which ranged from 40 metres to 3 metres. In holes MU-1, MU-5, MU-7, MU-9, MU-10, MU-11 and MU-14 the water table was static, unconfined within the Cadnaowie Formation. In holes MU-2, MU-3, MU-4, MU-6, MU-8, MU-12 and MU-13 water was cut at the top of the Cadnaowie Formation and rose varying depths into the overlying and confining Bulldog Shale. This could be termed pressure water. A good example was in MU-4 where water rose 24 metres. No artesian flows were recorded. The final static water levels varied from 1.5 to about 35 metres, and averaged 12 metres below surface.

Pressure water will only be encountered where the aquifer is overlain by impermeable Bulldog Shale and for this reason many springs are located close to the limit of Bulldog Shale, e.g. around Lake Cadibarrawirracanna and north to Lake Conway.

This therefore places the limit of artesian waters much further north than previously anticipated. The approximate limit has been noted on Figure 4.

3.1 Supply

Supply rates from drill holes were visually estimated by the amount of water air-lifted from the holes during rotary drilling. In general, supply was fairly constant throughout the basin, reflecting the coarse grained

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nature of the aquifer. Towards the north and east, supply rates did appear to decrease somewhat, possibly related to finer grain size of the Cadnaowie Formation. Quantities of 1,000 cub. metres per day, or greater, may be expected from the central part of the basin. Since drill times were of about eight hours duration, this period was in effect an eight hour pump test. No lessening of flow was noted with time.

3.2 Salinity

Salinity varied markedly throughout the basin. To the south, and close to the basement highs, salinities of about 15,000 ppm were recorded. The basement highs mark the southern limit of the Giddi Giddinna "Basin". In fact, the aquifer is absent, or thin, above the Sabrina Ridge, and it is doubtful if there is any substantial movement of groundwater across these features.

From the basin edge the salinity rapidly drops to 5,000 ppm and then gradually drops towards the "basin" centre where a minimum value of 2,600 ppm at hole MU-3 was recorded. East, west and north the salinity gradually increases to between 5,000 to 10,000 ppm (see Fig. 4). However, north of Mt. Barry, the salinity decreases as the well known areas of the Great Artesian Basin are approached.

The lower salinity areas of the Giddi Giddinna Basin form two east-west tongues which join near MU-2. These

parallel the upper reaches of Oolgelima and Giddi Giddinna Creeks, but are displaced several kilometres to the north-east.

Water at the top of the Cadnaowie Formation, at its contact with the overlying gypsiferous Bulldog Shale, is generally about 40% more saline than the remainder of the aquifer.

A full water analysis was conducted on a sample from 38 metres depth in MU-2 by AMDEL (Appendix 1). The water is sulphate rich and carbonate poor, as is most water from the south-west part of the Great Artesian Basin. The analysis also showed that measurement of salinity by electrical conductivity methods by the E and W.S. in Coober Pedy was 40% above the true value. This error is mainly due to the high sulphate content of the water. All other salinity measurements were by conductivity methods and have been reduced by 10% to give a more realistic value.

3.3 Source of Groundwater

The sulphate waters of the south-west Great Artesian Basin must have entered the aquifer from the gypsiferous surface areas to the south and west. A north-easterly movement of these sulphate rich waters is in keeping with the hydraulic gradient, and natural removal of water from the basin at the large mould springs to

the north-east. These springs form the mixing zone for these western sulphate waters and carbonate water from the east.

However, this simple picture is complicated by the less saline Giddi Giddinna "Basin". This indicates a super-imposition of less saline waters on an older, higher salinity regime. That is, local recharge through 4 to 8 metres of Bulldog Shale into the Cadnaowie Formation has occurred in relatively recent times following removal of much of the laterised Bulldog Shale. Major influx has occurred beneath the Giddi Giddinna and Oolgelima Creeks where the shale is very thin and has been affected to some degree by the structural lineaments mentioned before. The displacement of these less saline zones to the north-east suggests a north-easterly movement for the groundwater.

4. CONCLUSIONS

Drilling has indicated a groundwater basin of some magnitude. The good supplies and relatively low salinities should prove of immediate interest to the Coober Pedy opal field and may be of value to large scale developments in the adjacent areas; such as the Lake Phillipson Coal Deposit held by Utah Pty. Ltd.

M. G. MASON
SENIOR GEOLOGIST

21 June 1973

018

REFERENCES

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CHUGG, R. I. - 1957 The Hydrogeology of Portion of the Great Artesian Basin, Near the Peak and Denison Ranges.
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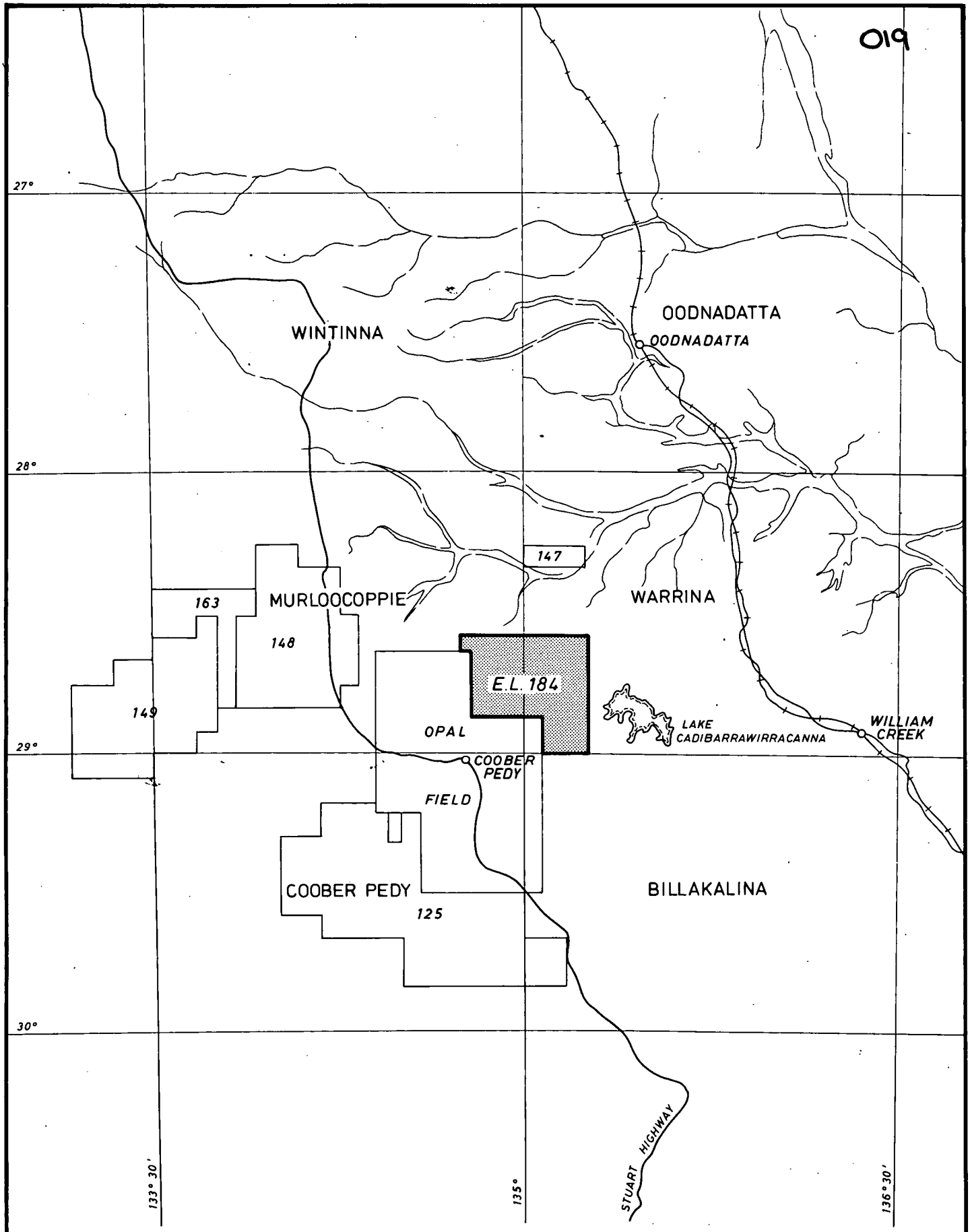


SCALE 1:2,000,000

20 0 20 40 60 80

KILOMETRES

FIGURE 1.

AUSTRALIAN SELECTION (PTY) LTD.

LOCALITY PLAN OF E.L. 184

20th JUNE 1975

AS 5633

LEGEND

GREAT ARTESIAN BASIN SUCCESSION.

MESOZOIC — CRETACEOUS — APTIAN — Klb — BULLDOG SHALE. Khaki, grey, grey-blue shales. Silty at lower and upper boundaries. Cone in cone limestones. Gypsified at surface, altered near laterite profile surface. Scattered various Adelaiden boulders and cobbles. Rounded.

NEOCOMIAN — Klc — CADNAOWIE FORMATION. Fine to coarse grained impure quartz sandstones. Feldspathic, micaceous. Thin indurated calcareous sandstones. Exotic Adelaidean cobbles. Aquifer.

JURASSIC — Juo — ALGEBUCKINA SANDSTONE. White, kaolinitic uncemented. Medium to coarse grained quartz sandstone. Pebble horizons. Minor siltstones and shale. Aquifer.

ARCKARINGA BASIN SUCCESSION.

PALAEOZOIC — PERMIAN — ARTINSKIAN — Pit — MOUNT TOONDINA FORMATION. Upper part, interbedded. Fine to medium grained sandstone, siltstone, shales. Some carbonaceous. Coal seams. Lower part sandier. Pyrite nodules. Few Prot. boulders. Micaceous. Top coal section may be absent (erosion).

PROTEROZOIC — ADELAIDEAN — E+ — GRANITE. Grey, coarse grained, equigranular biotite, K-plag, quartz.

Track.

Main road.

MU-2 (3400) Klb-14 Klc-34 Juo-32 Pit-+31 91cu.m/h — Rotary drill hole. Groundwater salinity in ppm. Stratigraphic units and Thickness in metres. Groundwater flow in cubic metres per hour.

Natural spring.

Dog proof fence and gate.

Limit of exploration licence 184.

Lineament.

60m — Contour thickness (metres) of aquifer i.e. Cadnaowie and Algebuckina Formations.

5000 — Isohalines in ppm.

TRUE NORTH.

MU-4 (2400) Klb-40 Klc-+76 18cu.m/h

MU-3 (2600) Klb-42 Klc-28 } 64 Juo-36 Pit-+64 36cu.m/h

MU-13 (4500) Klb-28 Klc-44 } 68 Juo-24 Pit-+6 27cu.m/h

MU-12 (3400) Klb-36 Klc-52 } 64 Juo-12 Pit-28 29cu.m/h

MU-2 (3400) Klb-14 Klc-34 } 66 Juo-32 Pit-+31 91cu.m/h

MU-1 (4300) Klb-8 Klc-64 } 80 Juo-16 Pit-+16 46cu.m/h

MU-14

MU-5 (4100) Klb-8 Klc-46 } 58 Juo-12 Pit-29 46cu.m/h

MU-6 (3500) Klb-4 Klc-40 } 56 Juo-12 Pit-29 36cu.m/h

MU-10 (5000) Klb-6 Klc } 58 Juo-5 Pit-+53 32cu.m/h

MU-8 (5000) Klb-6 Klc-35 } 74 Juo- Pit-24 68cu.m/h

MU-9 (5300) Klb-32 } 63 Klc-44 Pit-44 94cu.m/h

MU-11 (5000) Klb-18 Klc } 40 Juo- Pit-+55 14 cu.m/h

MU-7 (+10000) Klb-6 Klc-32 } 44 Juo-12 Pit-+10 27cu.m/h

Stuart Range No 1 (18000) Klb-64 Klc } 72 Juo-? Pit-78

Stuart Range No 2 Bore (abandoned) Klb-13 Klc } 64 Juo- Pit } 228

Sabrina Bore (approx) (15,000) Klb-60 Pit-5 P+-9

Stuart Range No 3 (18000) Klb-80 Klc } 69 Juo-? Pit-128

COOBER PEDY

CENTRAL ARCKARINGA BASIN

SABRINA RIDGE

LAKE CADIBARRAWIRRACANNA

Wirraconna Trig

OOLGELIMA HILL

Giddi Giddina Creek

Giddi Giddina Springs

Oolgelima Creek

Playa

North edge of Coober Pedy High

KILOMETRES. 6 4 2 0 2 4 6

SCALE 1:100,000

NOTE: Uncontrolled photo-mosaic used as base.

ENV 2556 -4

RECEIVED 18 JUL 1975 DEPT. OF MINES SECURITY 2556

FIG. 2.6

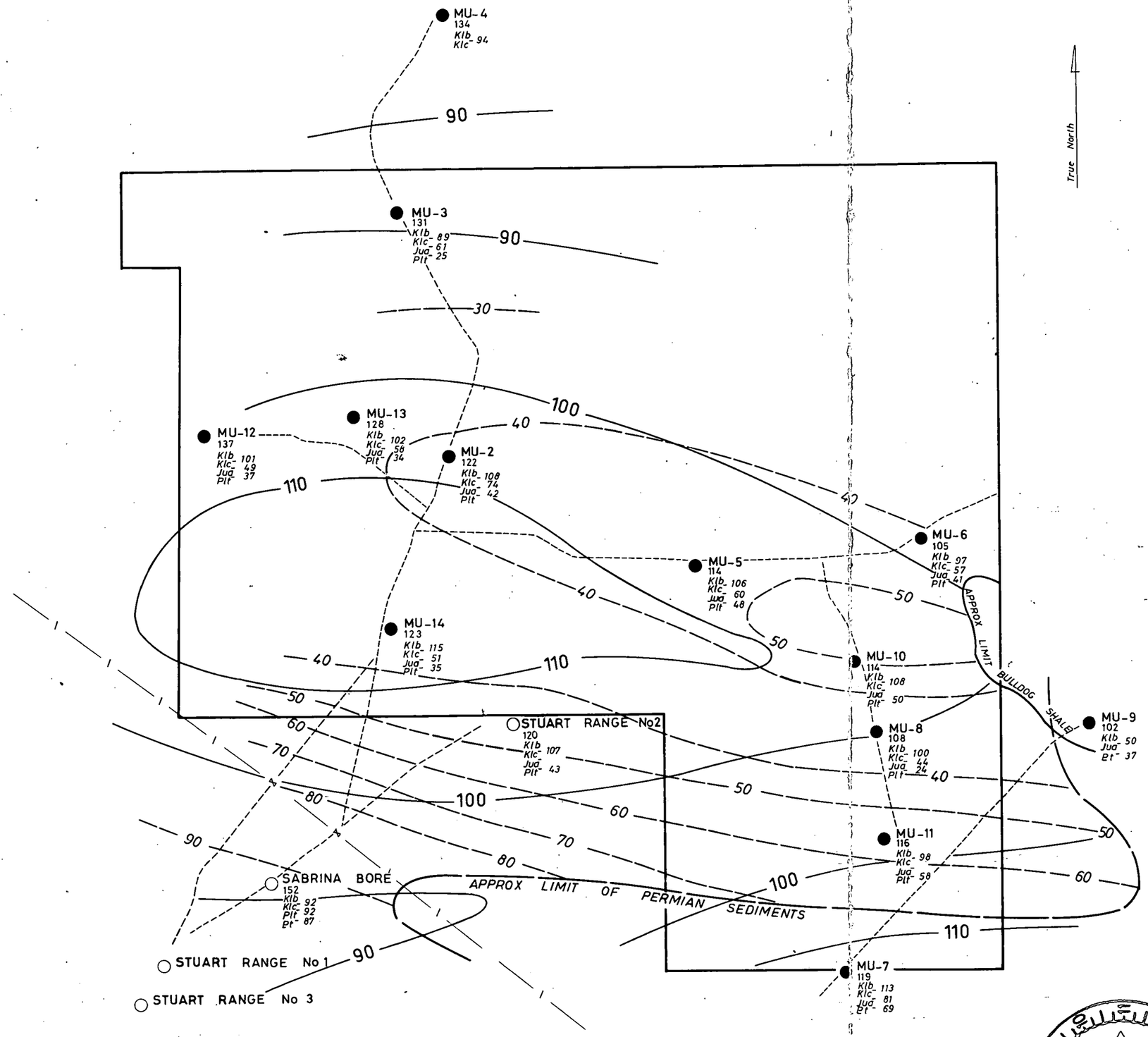
AUSTRALIAN SELECTION (PTY) LTD.

GEOLOGICAL PLAN E.L. 184

GIDDI GIDDINA BASIN AQUIFER THICKNESS AND ISOHALINES.

(MURLOOCOPPIE COAL PROSPECT) ARCKARINGA BASIN

Revisions	Date			Date
		Compiled by:	M.G.M.	May '75
		Drawn by:	M.G.M.	May '75
		Traced by:	K.J.C.	July '75
		Checked by:		
		PLAN NUMBER:	A.S. 5631	



LEGEND

MU-6 105 Klb 97 Klc 97		Rotary percussion drill hole. Approx height hole collar (metres) above M.S.L. Approx height (metres) above M.S.L. of contact between units.
	Klb	Bulldog Shale
CRETACEOUS	Klc	Cadnaowie Formation
JURASSIC	Jua	Algebuckina Sandstone
PERMIAN	Plt	Mount Toondina Formation
PRE-€	Et	Granite
100		Contours of base bulldog shale top of cadnaowie formation
100		Contours of top of permian in metres

5 0 5 10 KILOMETRES

SCALE - 1: 250,000

Height datum M.S.L. Adelaide converted to metres from regional gravity station heights by dept mines S.A. Barometric accuracy ± 5 metres.

FIG 5

ENV 2556 -3

AUSTRALIAN SELECTION (PTY) LTD.

E.L. 184

DRILL LEVELS AND CONTOURS ON TOP OF PERMIAN AND BASE BULLDOG SHALE

Revisions.	Date.			Date.
		Compiled by:	M.G.M.	June '75
		Drawn by:	M.G.M.	" "
		Traced by:	S.J.S.	
		Checked by:		
		PLAN NUMBER:	A.S. 5632.	

LEGEND

- CRETACEOUS
  - Klb — BULLDOG SHALE
  - Klc — CADNAOWIE FORMATION
- PROTEROZOIC
  - METASEDIMENTS AND GRANITE
- GEOLOGICAL BOUNDARY
- LIMIT OF ARTESIAN WATER
- 5000 — GROUND WATER SALINITY IN P.P.M.
- MU-9 +5000 — AUSTRALIAN SELECTION DRILL HOLE GROUND WATER SALINITY IN P.P.M.
- TRACK

KILOMETRES
15 10 5 0 5 10 15
SCALE - 1: 250,000

ENV 2556 -2

AUSTRALIAN SELECTION (PTY) LTD.

E.L. 184

GIDDI GIDDINA GROUNDWATER "BASIN"

ISOHALINES AND LIMIT OF ARTESIAN WELLS

FIG. 4

Revisions	Date			Date
		Compiled by:	M.G.M.	June '75
		Drawn by:	"	" "
		Traced by:	E.M.S.	July '75
		Checked by:		
		PLAN NUMBER:	A.S. 5630	

APPENDIX I

AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES

WATER ANALYSIS REPORT

JOB NO. 3769-75

NAME : AUSTRALIANS SELECTION LTD.
ADDRESS : MURLOOCOPPIE
DATE COLLECTED : 1ST MAY, 1975.
DATE RECEIVED :
HOLE NO. : MU-2
SUPPLY : 20,000 gph

SAMPLE COLLECTED BY : M. G. MASON
WATER CUT : 8 metres
WATER LEVEL : 7.3 metres
DEPTH OF SAMPLE : 38 metres
TOTAL DEPTH HOLE : 111 metres

SAMPLE NO. HOLE 2

CHEMICAL COMPOSITION		MILLIGRAMS PER LITRE MG/L	MILLIEQUIVS. PER LITRE ME/L
CATIONS			
CALCIUM	(Ca)	225.	11.2
MAGNESIUM	(Mg)	130.	10.7
SODIUM	(Na)	835.	36.3
POTASSIUM	(K)	47.	1.2
ANIONS			
HYDROXIDE	(OH)	.	.0
CARBONATE	(CO3)	.	.0
BICARBONATE	(HCO3)	247.	4.0
SULPHATE	(SO4)	754.	15.7
CHLORIDE	(CL)	1398.	39.4
NITRATE	(NO3)	5.	.1

TOTALS AND BALANCE

CATIONS	(ME/L)	59.4	DIFF =	.2
ANIONS	(ME/L)	59.3	SUM =	118.7

$\frac{\text{DIFF}*100}{\text{SUM}}$ = 0.2%

DERIVED AND OTHER DATA

	MILLIGRAMS PER LITRE MG/L
CONDUCTIVITY (E.C.) MICRO-S/CM AT 25 DEG.C	5063.
TOTAL DISSOLVED SOLIDS	
A. BASED ON E.C.	
B. CALCULATED (HC03-C03)	3516.
C. RESIDUE ON EVAP. AT 180 DEG.C	
TOTAL HARDNESS AS CaCO3	1097.
CARBONATE HARDNESS AS CaCO3	202.
NON-CARBONATE HARDNESS AS CaCO3	894.
TOTAL ALKALINITY AS CaCO3	202.
FREE CARBON DIOXIDE (CO2)	
SUSPENDED SOLIDS	
SILICA (SiO2)	
BORON (B)	
	UNITS
REACTION - PH	7.6
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	
SODIUM TO TOTAL CATION RATION (ME/L)	61.1%

APPENDIX 2

Rotary Percussion Drill logs.

PROJECT: ARKARINGA BASIN — AUSTRALIAN SELECTION (PTY) LTD — HOLE Nº MU-1022

LOG OF PERCUSSION DRILL HOLE

PROSPECT: MURLOOCOPPIE COAL — Murloocoppie 1:250,000 Sheet.

LOCATION: 26km NNE Coober Pedy — MAP CO-ORDS: 2827 4277

R.L. COLLAR: ....

INCLINATION: -90°

DIRECTION: ....

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	Cu (ppm)	Zn (ppm)	REMARKS
1 May 75	CADNAOWIE FORMATION - Cone in cone limestone - some Ferruginous zones						20% gypsum veins
	Bulldog: CLAYSTONE 10% F-m.g. sand 15% mica. 70% clay. grey. minor brown. HW-CW becoming khaki. Some sandy clay bands / Clay siltstone. 35% silt. dark grey as above						Uncemented; 5% pyrite
	CLAY SAND - Grey 85% m.g. rounded quartz 15% mica. Rest clay / 15% mica, 85% m.g. quartz. 2% green mineral? - Grey.	10 m					2% pyrite 5% black ~~hornblende~~ quartz? (carbon)
① Samples 5600ppm ← Water cut	SAND v. pale grey 90% F-c.g. quartz c.g. subrounded F-m.g. rounded, 2-5% mica minor clay						2% pyrite 1% black ~~hornblende~~ (carbon); 2% carbonaceous Fragments
		20 m					
3000gph ② 4900ppm	Cadnaowie Formation: COARSE SAND - v. pale grey minor mica & clay. 15% m.g. sand Rest c.g. subangular quartz - 40% m.g. quartz						
	SAND - light grey. 60% m.g. rounded quartz. 5% pyrite. minor tourmaline. 10% clay bands. 5% mica Rest clay. Thin coal seam.						5% F.g. Fragments coal matrix to sandstone
	COARSE SAND - v. pale grey. 30% c.g. subangular quartz. Minor clay & silt. Rest F-m.g. subrounded quartz / 10% c.g. quartz. Rest F-m.g.	30 m					1% F.g. coal Frag. 3% clay pieces
7000gph							5% Kaolin m.g. sand
	minor tourmaline, pyrite, Feldspar. 15% clay silt with coal fragments	40 m					10% Kaolin
	10% coal lumps - woody. (Seam)						
	30% Fine sandstone with 20% F.g. coal Fragments - detrital 2% pyrite.						30% m.g. coal Fragments 1-3cm interlayers with Fine sandstone coal being washed away.
10,000gph	Algebuckina: Fine Sandstone - 30% Feldspar minor clay 10% mica Rest quartz. Subangular. 5% F.g. detrital coal. 20% F.g. sandstone 30% detrital coal						5% kaolin sandstone
③ 4800ppm	COARSE SAND - white. 80% c.g. subangular v. minor clay Rest m.g. quartz	50 m					Contamination due to high water inflows.
	10% coal Fine sandstone & 10% clay bands minor pyrite						
	becoming m.g. sandstone v. minor coal & pyrite.						
	END OF HOLE 59 metres	60 m					
	60 Ft steel 5" casing lost in hole.						
		70 m					
		80 m					
		90 m					
		100 m					
		110 m					

DRILL TYPE: Schramm — DATE DRILLED: 29 April - 30 April. 1975

DRILLER: D. BLISTON — LOGGED: M. Mason

SCALE 1:500 — DRG Nº A5-5611

AUSTRALIAN SELECTION (PTY) LTD

LOG OF PERCUSSION DRILL HOLE

HOLE Nº MU-2 023

PROJECT: ~~ARCKARINGA BASIN~~

PROSPECT: MURLOOCOPPIE COAL

LOCATION: 37Km NNE Coober Pedy.

Murloocoppie 1:250,000 sheet.

MAP CO-ORDS: 2868 4382

R.L. COLLAR: ....

INCLINATION: -90°

DIRECTION: —

WATER CUT	Formation	DESCRIPTION	DEPTH METRES	REMARKS
Water Cut 12 May 75	Bulldog Shale	CLAY khaki high plasticity. 35% silt quartz 15% mica. Rest clay		10% gypsum veins.
		15% silty sandstone		45% cone in cone limestone brown
		dark grey 5–10% pyrite 20% F.g. quartz 15% mica. 2% tourmaline. Rest clay	10 m	2% F.g. detrital coal.
8000gph Sample (1) 3900ppm	Cadnaowie	COARSE SANDSTONE - v. pale grey. 35% c.g. subangular quartz. minor porphyry pebbles, minor clay, 2% pyrite. 10% silt. Rest f-m.g. subrounded quartz. Uncemented		some sections pyritic cemented in nodules
		25% silty sandstone with 10% F-m.g. coal lenses and fragments	20 m	minor coal fragments; minor kaolin
	Algebuckina Sandstone	minor sandy siltstone		Amount of contamination not known
		15% c.g. subangular quartz	30 m	
(2) 3900ppm			40 m	
14000gph →		5% shale & silt bands; shale - carbonaceous green-grey to dark grey. 35% quartz silt.	50 m	
	CORE	uncemented. v. vague bedding 10–50mm. thick. minor carbonaceous fragments 50% core loss.	60 m	
		5% yellow brown F.g. cemented sandstone.	70 m	
		MEDIUM GRAINED SANDSTONE		
	Mount Toondina Beds	10% silty sandstone - with 5% heavy minerals 2–3% including garnet - distinctive	80 m	2% coal detrital fragments
	CORE LOST	COAL SEAM - black, layered - subresinous. probably about 1m. thick.		coal seam 0.2m
		Black shales and sandy silts relative amounts not known. Rest		0.05m.
		garnet sand - grey. 10% c.g. 25% m.g. 20% silt angular quartz. minor mica, pyrite. 2% coal fragments 2% garnet poorly sorted.	90 m	0.05m.
		SILTSTONE - grey. 2% garnet 45% quartz silt. 5% mica 2% coal f.g. fragments minor pyrite Rest clay 20% m.g. sand layers		0.05m; 0.05m.
		SILTSTONE - grey f.g. 55% f.g. quartz silt. 2% pyrite 5% mica 5% m-c.g. quartz 2% garnet. Rest clay - some shale & sand layers	100m	0.2m. 0.05m. 0.05m. Estimated thickness - exact position not known
+20,000 gph →		SILTSTONE - dark grey 50% F.g. silt quartz 20% m.g. quartz 2% garnet. 5% mica 2% pyrite 5% carbon fragments. Rest clay. v. poorly sorted		
		v. vague 5–10mm layering. 10% mica 25% clay	110 m	
		END OF HOLE 111metres.		

GEOCHEM: (ppm) \| Cu (ppm) \| Zn (ppm) — at c. 92 m: 10% m.g. coal fragments

DRILL TYPE: Schramm

DATE DRILLED: 30 April - 2 May 1975

DRILLER: D. BILSTON

LOGGED: M. Moson.

SCALE 1:500

DRG Nº A556/2

PROJECT: ARCKARINGA BASIN — AUSTRALIAN SELECTION (PTY) LTD — HOLE No MU-3 — 024

LOG OF PERCUSSION DRILL HOLE

Murloocoppie 1:250,000 Sheet.

PROSPECT: MURLOOCOPPIE COAL

R.L. COLLAR: ....

INCLINATION: – 90°

LOCATION: 48 Km NNE Coober Pedy — MAP CO-ORDS: 2838 4534

DIRECTION: –

WATER CUT	FORMATION	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	Cu (ppm)	Zn (ppm)	REMARKS
4 May 1975	BULLDOG SHALE	KHAKI CLAY F.g. 30% rounded quartz silt. 20% mica. Rest clay. high plasticity moderate swelling. vague layering. 2% carbon fragments.						5% 100mm gypsum veins
			10 m					
		Grey & Khaki – 40% vague layering grey clay. 10% silt quartz. 30% mica Rest clay.						
		BLACK CLAY F.g. 30% mica 5% carbon fragments Rest clay 5% quartz silt 2% v.F.g. pyrite. vague Foliation	20 m					
			30 m					
		· gradational boundary ·						
2000gph Cut		CLAY – Dark green-grey. F.g. 15% silt quartz. 3% tourmaline 2% F.g. pyrite 3% carbon fragments 20% F-m.g. mica. Some Feldspar Rest clay. [SAND – pale grey. m.g. quartz pyrite nodules – coarse mica]	40 m					50mm coal seam.
		COAL SEAM 1. metre. brown black						Water return brown
		SILT-SAND – pale grey c.g. 30% ~~25%~~ m.g. Rest F.g. 10% c.g. mica. 50 – 150mm coal seams (above 4) minor pyrite mica. Coalseam 0.1m thick						relatively hard to drill — brown return
water sample ① 3500ppm water	CADNAOWIE FORMATION	15% siltstone layers 10% m.g. coal. SILTY SAND 40% m.g. rounded quartz, 10% m.g. mica rest silt, clay & carbonate / 20% c.g. coal fragments	50 m					calc. cemented sand with pyrite
		COARSE SAND – pale grey 50% c.g. minor silt, clay, mica, pyrite – thin coal seam 57m. minor kaolin cement.						5% massive green shale.
		Coal Seam 0.2m. 5% sand silt with carbon fragments.						
		Sand becoming m.g. only 15% c.g. — 20% thin massive dark grey green shales possibly carbonaceous.	60 m					thin 10mm coal seams
								50mm coal seam
		FINE SAND v. pale grey well sorted 90% F.g. sand. 5% m.g. muscovite minor silt kaolin. 5% greenshale						50mm coal seam
2900 ppm ② 8000gph	ALGEBUCKINA SANDSTONE	MEDIUM SAND – pale grey 15% c.g. minor silt kaolin (cog-?) 5% m.g. muscovite 5% carbonaceous shale layers. well sorted.	70 m					minor coal
		becoming coarser & less well sorted	80 m					10% kaolin cemented fine sand.
		20% carbonaceous shale.						
		coarser well sorted angular minor muscovite 5% carb. shale.	90 m					minor coal
		FINE SAND – v. pale grey well sorted subrounded 80% F-m.g. sand minor kaolin & silt. 5% c-m.g. muscovite						Few m.g. bright coal grains.
			100 m					
2900ppm ③	MT TOONDINA	COARSE SAND 1% garnet. 30% c.g. Rest m.g. quartz minor coal angular.						minor carbonaceous shale.
		SILTY SAND – grey. 40% F.g. subrounded quartz. 2% garnet 2% F.g. coal fragments minor pyrite, poorly sorted, 25% silt Rest clay. v. minor garnet 1% nickel? tourmaline	110 m					

DRILL TYPE: Schramm

DATE DRILLED: 2nd May 1975

DRILLER: P. BIXSTON

LOGGED: M. Mason

SCALE 1:500

DRG. No VS 5643

PROJECT: ARCKARINGA BASIN

AUSTRALIAN SELECTION (PTY) LTD

LOG OF PERCUSSION DRILL HOLE

HOLE Nº MU-4 025

PROSPECT MUALOOCOPPIE COAL

R.L. COLLAR: ....

INCLINATION: -90°

LOCATION 55 km NNE Coober Pedy.

MAP CO-ORDS: 2860 4660

DIRECTION: -

WATER CUT		DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	Cu (ppm)	Zn (ppm)	REMARKS
		CLAY SOIL - Red brown.						10% gypsum.
4 may 75	SHALE	CLAY KHAKI. - F.g. 20% rounded silt. minor m.g. quartz. 10% muscovite. Rest clay. — grey brown —	10 m					
	SHALE	CARBONACEOUS SHALE - Black F.g. 10% graphite 15% mica Rest clay. 5% pyrite	20 m					
	BULL DOG							0.1m hard band.
	BULL DOG	SANDY SILTSTONE - pale grey. 10% m.g. 50% F.g quartz tourmaline mica etc	30 m					
		LIMESTONE - pale brown - massive - indurated						
		SILTY CLAY - 35-30% silt - 10-20% mica, 5% pyrite, minor graphite Rest clay.						
4100 ppm 2000 gph. Cut ①	MOUNT ANNA	COARSE SAND. - Off white 30% c.g. rounded quartz. 15% F.g. muscovite Rest clay. minor pyrite, tourmaline, graphite frags.	40 m					30% silty clay
4000 gph. Water ② 3800 ppm	CADNA-OWIE	SAND 20% m.g. 50% F.g. minor pyrite & mica, coal grains. Rest clay. Few thin grey shale layers & siltstone — 0.1 m. coal seam.						
	CADNA-OWIE	CORE 80% loss. — indurated, buff 40% sand. 0.2m. calc F.g. arenite — SAND - medium minor thin coal layers 1-3mm. gr 30% silt 2% mica, 3% coal fragments. 15-30% clay 10% c.g. Rest m.g	50 m					0.1m calc arenite. calcarenite calcarenite
		END OF HOLE - 56 metres.						
			60 m					
			70 m					
		Cased to 30 metres & equipped for pastoral bore by Mt Barry Station.						
			80 m					
			90 m					
			100 m					
			110 m					

DRILL TYPE: Schramm.

DATE DRILLED: 4. May. 1975.

DRILLER: R. BINSTON

LOGGED: M. Mason.

SCALE 1:500

DRG Nº AS 5615

PROJECT: ARCKARINGA BASIN

AUSTRALIAN SELECTION (PTY) LTD

LOG OF PERCUSSION DRILL HOLE

Warrina 1:250,000 Sheet

HOLE Nº MU-5 026

PROSPECT: MULLOOCOPPIE COAL

R.L. COLLAR: .....

INCLINATION: -90°

LOCATION 40km NE. Coober Pedy. MAP CO-ORDS: 3024 ... 4315

DIRECTION: .....

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
	TOOLDOG SHALE — CLAY Khaki & dark grey. F.g. 20% silt quartz 5-10% mica Rest clay.						
	dark grey. 5% graphitic 30% silty						
	MT ANNA SANDSTONE — SANDY SILTSTONE grey. 10% m.g. quartz						
7 May 75 ↓ water cut	SAND - light grey 50mm coal seam bright 80% m.g. d.c.g. sub rounded quartz minor mica silt rare clay 10% silt 10% clay	10 m					
4600ppm ①	SAND-grey. 70% m.g. sand minor pyrite etc some c.g. layers also silt layers. Feldspathic.						some carbonaceous layers.
	Feldspathic Minor pebbles pinked green weathered porphyry.	20 m					
	CADNA-OWIE FORMATION — SAND - 80% F-m.g. sub rounded quartz minor Feldspar, mica, pyrite, silt & clay. minor sandy siltstone layers						
10,000 gph. 4600ppm. ②		30 m					
		40 m					
	5% 5mm coal seams	50 m					
	ALGEBUCKINA SANDSTONE — SAND - m.g. 20% Kaolin matrix. 70% m.g. angular quartz. No Feldspar some opaline quartz. Minor coal, pyrite, silt.	60 m					
	MOUNT TOONDINNA FORMATION — SILTSTONE - green. 15% F-m.g. quartz subrounded minor pyrite. 18% Mica. 55% silt. 5% graphite. Rest clay.	70 m					
		80 m					
10,000gph. 4600ppm. ③	5% m.g. sand 25% clay.	90 m					50mm calcarenite lens with pyrite nodules. calcarenite.
	END OF HOLE 95 metres.	100 m					
		110 m					

DRILL TYPE: Schramm

DATE DRILLED: 5-6th May 1975

DRILLER: D. BILSTON

LOGGED: M. MASON

SCALE 1:500

DRG Nº AS 5616

AUSTRALIAN SELECTION (PTY) LTD

LOG OF PERCUSSION DRILL HOLE

PROJECT: ARCKARINGA BASIN

PROSPECT: MURLOOCOPPIE COAL — Warrina 1:250,000 sheet

LOCATION: 15km NW Oolgelima Hill — MAP CO-ORDS: 3164 ... 4329

HOLE Nº MU-6 — 027

R.L. COLLAR: ...

INCLINATION: -90°

DIRECTION: ...

WATER CUT	Formation	DESCRIPTION	DEPTH METRES	GEOCHEM (ppm)	Cu (ppm)	Zn (ppm)	REMARKS
1Ms	BULLDOG SHALE	CLAY - Khaki - 20% silt. 20% mica. high plasticity. Rest clay					20% c.g. sand.
① 4100 ppm Water Cut	MT ANNA SANDSTONE	COARSE SAND - pale grey. Minor mica, silt, clay. 20% f.g. 20% m.g. 25% c.g. quartz. Also Few porphyry pebbles.	10 m				50mm coal seam
5000 ppm ② 4000 ppm	CADNA-OWIE FORMATION	SAND - pale grey. Minor silt, clay pyrite. mica. 10% c.g. 20% m.g. 50% F.g. quartz. Feldspar common subrounded.	20 m				
	CADNA-OWIE FORMATION	COARSE SAND - pale grey. minor pyrite, silt clay. mica. 30% c.g. 30% m.g. 10% F.g. quartz. Feldspar. 50mm coal seam	30 m, 40 m				
8000 ppm	ALGEBUCKINA SANDSTONE	COARSE SAND pale grey. minor pyrite silt. 10% kaolin. 40% c.g. 20% m.g. 10% F.g. quartz. Some opaline.	50 m, 60 m				
③ 3900 ppm	MT TOONDINNA FORMATION	SILTSTONE - grey. 15% F-m.g. subangular quartz 55% silt 10% mica minor pyrite. 5% carbonaceous F.g. pieces. Rest clay.	70 m, 80 m				
		END OF HOLE 82 metres.	90 m, 100 m, 110 m				

DRILL TYPE: Schramm

DATE DRILLED: 6-7 May 1975

DRILLER: D. BILSTON

LOGGED: M. Mason

SCALE 1:500

DRG Nº AS 5/17

PROJECT: ARCKARINGA BASIN — AUSTRALIAN SELECTION (PTY) LTD

LOG OF PERCUSSION DRILL HOLE

HOLE Nº MV-7 028

PROSPECT: MULLOOD COPPIE COAL

R.L. COLLAR: .....

INCLINATION: -90°

LOCATION: ..... CO-ORDS: ..... DIRECTION: —

WATER CUT		DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
	BULLDOG SHALE	CLAY - khaki. 25% silt minor m.g. sand, 15% mica. Rest clay.		G-G				50% gypsum 20% gypsum
	CADNAOWIE FORMATION	SAND - pale yellow. 20% c.g. 45% m.g. Rest F.g. angular quartz 5% Feldspar	10 m					
		SAND - v. pale yellow. 10% mica. minor slag. 20% silt. some Feldspar 10% c.-m.g. Rest c.g. sub angular quartz.						
Water cut ↓ 6030 gph		COARSE SAND. yellow. 35% c.g. 30% m.g. minor silt, clay & mica Rest F.g. sand. Sub angular. Iron oxide coated surface. Limit of oxidation?	20 m					
		MEDIUM SAND. white. 5% mica. sub angular. 35% m.g. minor c.g. Rest F.g. quartz. 10% white Feldspar.	30 m					
	ALGEBUCKINA SANDSTONE	MEDIUM SAND - white. minor mica 10-20% kaolin, 60% F.g. Rest m.g. sub angular quartz. Minor opaline quartz	40 m					
	PROTEROZOIC	GRANITE grey m.g. 30% biotite 30% quartz (grey-blue) & 30% Feldspar. equigranular	50 m	+ + + + + +	30	45	230	35% sand as above Pb 40
		END OF HOLE 60m.	60 m					
			70 m					
			80 m					
			90 m					
			100 m					
			110 m					

DRILL TYPE: Schramm — DATE DRILLED: 15-16th May 1975

DRILLER: O. BIBSTON — LOGGED: M. Mason

SCALE 1:500 — DRG Nº AS 3016

PROJECT: ARKARINGA BASIN — AUSTRALIAN SELECTION (PTY) LTD

LOG OF PERCUSSION DRILL HOLE

HOLE Nº MU-8 029

PROSPECT: MURLOOCOPPIE COAL

WARRINA SHEET 1:250,000

LOCATION: ..... CO-ORDS: 3136 4207

R.L. COLLAR: .....

INCLINATION: 90°

DIRECTION: —

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
17/5/75 WATER FLOW 2/5,000gph. SALINITY > 5,000ppm.	BULLDOG SHALE: Medium Grey Fissile Fresh SHALE CLAYSTONE						
	Medium Grey SILTSTONE						
	CADNA-OWIE FORMATION: Medium-Coarse Grained Transparent QUARTZ + minor white FELDSPATHIC SAND	10 m					
	Medium-Fine Grained Transparent QUARTZ + minor white FELDSPATHIC SAND						
	Medium-Coarse Grained Transparent QUARTZ + minor white FELDSPATHIC SAND + Medium Grey Poorly Sorted Qtz Sediment + minor pyrite + minor siltstone	20 m					
	As Above + Black Carbonaceous Shale + minor Muscovite						
	Medium + Fine Grained Transparent QUARTZ + minor FELDSPATHIC SAND	30 m					
	Fine Grained Transparent QUARTZ + minor FELDSPATHIC SAND + white SANDY SILTSTONE	40 m					
	Medium Grained Very Clean Transparent QUARTZ SAND + minor spherulitic pyrite						
	Medium + Coarse Grained Transparent QUARTZ + minor FELDSPATHIC SAND + minor spherulitic pyrite	50 m					
		60 m					
	+ minor pyrite						
	ALGEBUCKINA SANDSTONE: Fine Grained Light Grey QUARTZ SAND + very minor very fine grained coal fragments + minor fine grained coal fragments + minor mica + 5% medium-coarse grained fragments of black sooty coal + minor muscovite	70 m					
	+ minor soft brown-black crumbly coal + 5-10% pyrite + Medium Grey Shaly Siltstone	80 m					
	MT. TOONDINA FORMATION: Medium Grey Crumbly SHALY SILTSTONE - very little sample	90 m					
	Dark Grey Graphitic Crumbly SHALY SILTSTONE + minor pyrite + muscovite + muscovite & minor very fine grained fragments of coal	100 m					
		110 m					

DRILL TYPE: Schramm

DRILLER: BILSTON

DATE DRILLED: 16th MAY 1975

LOGGED: B.J.U.

SCALE 1:500

DRG Nº AS 5619

AUSTRALIAN SELECTION (PTY) LTD

LOG OF PERCUSSION DRILL HOLE

HOLE Nº MU-9 030

PROJECT: ARKARINGA BASIN

PROSPECT: MURLOCOPPIE COAL

LOCATION: .....

CO-ORDS: WARRINA 1:250,000 ..3257..4210.....

R.L. COLLAR: .....

INCLINATION: 90°

DIRECTION: —

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
	Buff Dust + Gypsum						
	Buff + Yellow Medium Grained Weathered Clayey SANDSTONE						
	becoming less weathered & less clayey	10 m					
	As Above + minor grey SHALE + pink fine grained SANDSTONE						
	Coarse Grained Transparent, Medium Grained Yellow QUARTZ SAND + minor white FELDSPATHIC SAND						
	As Above + Light Grey SANDY SILTSTONE	20 m					
	Medium + Coarse Grained Transparent QUARTZ SAND + minor FELDSPATHIC SAND — very clean						
	Fine + Medium Grained Transparent QUARTZ + minor white FELDSPATHIC SAND — very clean						
	+ very minor friable black coal	30 m					
	+ 5-7% Friable Black coal						
	As Above + 20% Medium Grey SANDY SILTSTONE + minor black friable coal						
	Fine - Medium Grained Transparent QUARTZ + minor white FELDSPATHIC SAND + 2% black coal						
	+ very minor black coal	40 m					
	+ minor very friable black coal						
	Fine Grained Transparent QUARTZ + minor white FELDSPATHIC SAND + very minor black coal						
	Fine - Medium Grained Transparent QUARTZ + minor white FELDSPATHIC SAND						
	As Above + 15% Black Graphitic Shale						
	Fine Grained Transparent QUARTZ SAND + minor muscovite	50 m					
	+ minor black friable coal						
	Fine - Medium Grained Transparent QUARTZ SAND + minor black friable coal						
	Fine - Medium - Coarse Grained Transparent QUARTZ SAND + Medium - Dark Grey Graphitic SHALE	60 m					5% interstitial pyrite.
	Fine - Medium Grained Transparent QUARTZ SAND + Medium - Dark Grey Graphitic SHALE						+ unconformity
	GRANITE - grey. C.g. 40% quartz 30% felds. Rank biotite. (clays due to weathering						
	BOTTOM OF HOLE 65m.	70 m					
		80 m					
		90 m					
		100 m					
		110 m					

ESTIMATED WATER FLOW 800 g/pa. >5000 ppm

CADNA-OWIE FORMATION

ALEPUCHINA SANDSTONE

PROT

18/5/75

DRILL TYPE: Schramm

DRILLER: BIRSTON

DATE DRILLED: 17th MAY 1975

LOGGED: B.J.U.

SCALE 1:500

DRG. Nº 16 5000

PROJECT: ARKARINGA BASIN — AUSTRALIAN SELECTION (PTY) LTD

LOG OF PERCUSSION DRILL HOLE

HOLE Nº MU-10 031

PROSPECT: MURLOOCOPPIE COAL

R.L. COLLAR: .....

INCLINATION: 90°

LOCATION: ..... CO-ORDS: WARRINA SHEET 1:250,000 3124 4252

DIRECTION: —

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
BULLOO SHALE	Dark Grey – Black Fissile SHALE + Gypsum						
CADNA-OWIE FORMATION ≈ 5,000 g.p.h. >5000 ppm	Mid-Grey SANDY-SILTSTONE with Carbonaceous Matrix	10 m					
	Medium – Coarse Grained Clean Transparent QUARTZ SAND + very minor pyrite + coal	20 m					
	Medium – Fine Grained Clean – Transparent QUARTZ SAND + Buff Clay						
	Medium Grained Clean Transparent QUARTZ + white FELDSPATHIC SAND	30 m					
	Coarse + Medium Grained Very Clean Transparent QUARTZ + White FELDSPATHIC SAND	40 m					
	Medium – Fine Very Clean Transparent QUARTZ + White FELDSPATHIC SAND						
	Coarse + Medium Grained Transparent QUARTZ + White FELDSPATHIC SAND – very clean	50 m					
		60 m					
MT. TOONDINA FORMATION ≈ 7,000 g.p.h. >5000 p.p.m.	As Above + Dark Grey – Black Shale Fragments						
	Equal quantities of medium – Coarse Grained SAND as above + Dark Grey Crumbly Shale + Clay						
	Dark Grey – Black SHALE + Clay with Sand contamination? from above	70 m					
	Medium Grey Weathered SHALE + CLAY becoming medium-light grey						
	As Above + Medium Grained Transparent Clean QUARTZ SAND – contamination?						
	Medium Grey SHALE + minor Clean transparent QUARTZ SAND	80 m					
	Medium – Dark Grey SHALE + Clay + Minor Medium Grained Transparent Clean Sand – (Contamination?)						
	Shale + Clay as above + equal quantities of Fine – Medium Grained QUARTZ SAND						
	Medium – Light Grey SHALE + CLAY + Equal quantities of Fine – Medium Grained Transparent + QUARTZ SAND Increasing quantity of sand	90 m					
	Medium Grey Fissile SHALE + Medium Grained Transparent QUARTZ SAND (contamination)	100 m					
	Medium Grey Fissile SHALE						
		110 m					
	Dark Grey – Black Carbonaceous Fissile SHALY SILTSTONE						

BOTTOM OF HOLE 117m

DRILL TYPE: Schramm — DATE DRILLED: 18th MAY 1975

DRILLER: BILSTON — LOGGED: B.J.U.

SCALE 1:500 — DRG Nº HS 3621

PROJECT: ARKARINGA BASIN — AUSTRALIAN SELECTION (PTY) LTD — HOLE Nº MU-11 032

LOG OF PERCUSSION DRILL HOLE

PROSPECT: MURLOCOPPIE COAL — R.L. COLLAR: .....

LOCATION: ..... — WARRINA 1:250,000 CO-ORDS: 314/414/ — INCLINATION: 90° — DIRECTION: —

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
	BULLDOG SHALE: Buff Weathered Fissile SHALE	10 m					
	BULLDOG SHALE: Dark Grey – Black SILTSTONE						
WATER TABLE >100ft below surface	ALGEBUCKINA SANDSTONE — CADNA-OWIE FORMATION: Fine Grained Transparent QUARTZ SAND + minor above; Medium Grained Transparent QUARTZ + minor FELDSPATHIC SAND	20 m					
	As Above but coarse grained						
	Medium Grained Transparent QUARTZ + minor white FELDSPATHIC SAND + Buff Clay			<5	35	55	Pb 65
	Medium – Coarse Grained Transparent QUARTZ + minor FELDSPATHIC SAND + minor black flint	30 m					
	Fine – Medium Grained Transparent QUARTZ + minor white FELDSPATHIC SAND + buff Clay + scoriaceous rhyolitic tuff?	40 m					
	Medium – Coarse Grained Transparent QUARTZ SAND						
	Fine Grained Transparent QUARTZ + minor black (carbonaceous?) SAND						
	Medium Grained Transparent QUARTZ SAND						
	Coarse Grained Transparent QUARTZ + minor FELDSPATHIC SAND						
	Medium – Fine Grained Above	50 m					
	Fine Grained Above						
	Fine–Medium Grained Transparent QUARTZ + minor FELDSPATHIC SAND						
	Medium – Coarse Grained transparent QUARTZ + minor white FELDSPATHIC SAND + minor mica	60 m					
	Fine Grained Above						
	As Above + Dark Grey SHALE + minor pyrite						
FLOW @ 3,000 g.p.h. > 5,000 p.p.m.	MT. TOONDINA FORMATION: Dark Grey Weathered Greasy SHALE	70 m					
	Light Grey-Green, Fissile, Fresh SHALE	80 m					
		90 m					
		100 m					
		110 m					

BOTTOM OF HOLE 117m.

DRILL TYPE: Schramm — DATE DRILLED: 19th May 1975

DRILLER: D. BILSTON — LOGGED: B.J.U.

SCALE 1:500 — DRG Nº AS 3622

AUSTRALIAN SELECTION (PTY) LTD

LOG OF PERCUSSION DRILL HOLE

HOLE Nº MU-12 033

PROJECT: ARKARINGA BASIN

PROSPECT: MURLOCCOPPIE COAL

LOCATION: .....

MURLOCCOPPIE 1:250,000

CO-ORDS: 2715 . . 4394

R.L. COLLAR: .....

INCLINATION: 90°

DIRECTION: —

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
	Brown Soil + Rubble						
	Medium Grey weathered SHALE + Gypsum + White Aphanitic Quartzite						
	Dark Grey Blocky Shale + Gypsum	10 m					
	Dark Grey – Black Fresh Fissile SHALE	20 m					
	Becoming Silty SHALE	30 m					
	Fine – Medium Grained Transparent QUARTZ SAND + Grey Shale (contamination? from above)	40 m					
	Medium + Coarse Grained Transparent + Translucent Quartz SAND						+ Very minor black earthy coal.
	Medium Grained Transparent QUARTZ + White FELDSPATHIC SAND	50 m					+ Shale (contamination?)
	Fine Grained Transparent + Translucent QUARTZ + minor White FELDSPATHIC SAND + muscovite + muscovite	60 m					
	Medium – Coarse Grained Transparent + Translucent Quartz + minor White FELDSPATHIC SAND + minor MUSCOVITE	70 m					
	As Above Fine – Medium Grained	80 m					
	Medium – Coarse Grained Transparent + Translucent Quartz + minor Feldspathic SAND.						
	Fine Grained Transparent QUARTZ SAND + White Clay + minor Framboidal Pyrite Becoming very fine grained	90 m					
	Medium – Coarse Grained Very Clean Transparent QUARTZ SAND + considerable contamination	100 m					
	As Above + Dark Grey Fissile SHALY SILTSTONE						
	Dark Grey Fissile SHALY – SILTSTONE	110 m					
	As Above + Fine Grained QUARTZ SAND — minor Quartz SAND — equal quantities of SAND + SHALE						

TOP OF HOLE CAVED IN SO NO MEASUREMENT OF STATIC WATER TABLE MADE

BULLDOG SHALE

CADNI-OWIE FORMATION

3800ppm

4000ppm

ALGEBUCKINA SANDSTONE

3800ppm

MT TOONDINA FORMATION

FLOW @ 3-4,000gph.

DRILL TYPE: Schramm

DRILLER: BILSTON

DATE DRILLED: 20th MAY 1975

LOGGED: B.S.U.

SCALE 1:500

DRG Nº AS 5023

PROJECT: ARKARINGA BASIN

AUSTRALIAN SELECTION (PTY) LTD

LOG OF PERCUSSION DRILL HOLE

HOLE Nº MU-15 034

PROSPECT: MURLOOCOPPIE COAL

R.L. COLLAR: ....

MURLOOCOPPIE 1:250,000

INCLINATION: 90°

LOCATION: ....

CO-ORDS: 7809 ... 4407 ....

DIRECTION: ....

WATER CUT	Formation	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	Cu (ppm)	Zn (ppm)	REMARKS
	BULLDOG SHALE	Buff Soil + Gypsum						
		Light Brown – Buff Blocky SHALE						
		Dark Grey Blocky SHALE						
			10 m					
		Becoming Fresher + More Fissile						
		Bluey-Steel Grey Fissile Shaly-SILTSTONE + Thin Bed of white Aphanitic Quartzite						
			20 m					
	CADNA-OWIE FORMATION	Medium – Coarse Grained Transparent QUARTZ + minor FELDSPATHIC SAND + minor shale contamination from above						
		+ very minor porphyritic scoriaceous rhyolitic tuff	30 m					
		As above + considerable Black Resinous Woody Crumbly Coal						
		As Above + Light Grey SANDY SILTSTONE						
		As Above + Mid – Dark Grey Blue Grey SHALE						
		Medium – Coarse Transparent QUARTZ + White FELDSPATHIC SAND + very minor muscovite	40 m					
		+ minor muscovite						
			50 m					180 ft of casing lowered for pastoral bore.
		1-2m Black Crumbly Woody Weak Coal						
		1m Black Woody Coal	60 m					
		1 Black Dull Woody Blocky Crumbly, Weak Coal						
Flow ≈ 6,000gph 5,000ppm	ALGEBUCKINA SANDSTONE ?	Medium – Coarse Transparent Quartz + White FELDSPATHIC SAND with Buff Clay	70 m					
		Coarse Grained Transparent QUARTZ + White FELDSPATHIC SAND						
		As Above – medium grained						
		Medium – Coarse Grained Transparent QUARTZ + minor FELDSPATHIC SAND						
			80 m					
		Coarse Grained Transparent QUARTZ + Minor FELDSPATHIC SAND						
		As Above – Med – Fine – Coarse Grained						
		Medium – Coarse Grained Transparent QUARTZ + FELDSPATHIC SAND + Dull Weak Woody Coal	90 m					
		Medium – Coarse Grained Transparent QUARTZ + FELDSPATHIC SAND.						
	MT TOONDINA	Light Grey Fissile SHALY SILTSTONE + Medium – coarse Grained Transparent Quartz + Feldspathic SAND.						
			100 m					
			110 m					

DRILL TYPE: Schramm

DATE DRILLED: 21st MAY 1975

DRILLER: D. BILSTON

LOGGED: BJO

SCALE 1:500

DRG Nº AS 5605

PROJECT: ARKARINGA BASIN — AUSTRALIAN SELECTION (PTY) LTD

LOG OF PERCUSSION DRILL HOLE

HOLE Nº | MU-14 035

PROSPECT: MURLOOCOPPIE COAL — MURLOOCOPPIE 1:250,000

R.L. COLLAR: .....

LOCATION: ..... CO-ORDS: 2827 4277 AS FOR MU-1

INCLINATION: 90°

DIRECTION: —

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
	BULOOG SHALE: Brown Grey Weathered SHALE + Calcareous Fossil Fragments						
	Steel-Grey-Brown Weathered SHALE						
	Dark Blue-Grey Silty SHALE						
	CADNA-OWIE FORMATION: Medium Grained Transparent QUARTZ + minor White Feldspathic SAND + minor above	10 m					
	As Above but Fine Grained						
	Fine-Medium Grained Transparent Quartz + minor White Feldspathic SAND + minor muscovite						
	Medium + Coarse Grained Transparent QUARTZ + White Feldspathic SAND + grey minor SHALY SILTSTONE; + very minor muscovite	20m					
	Fine Grained White Quartz SAND + Light Grey Clay	30m					
	Medium-Coarse Grained Transparent + White QUARTZ + White Feldspathic SAND + White Clay						
	Medium-Coarse Grained Transparent + White QUARTZ + White Feldspathic SAND Very clean						
	Becoming fine-medium-coarse grained	40m					
	As Above + Medium Grey Shaly Siltstone						
	As Above - predominantly Shaly-Siltstone	50m					
	Coarse-Fine Grained Transparent + White QUARTZ SAND - Very Clean						
	As Above + Very minor green-grey zoriegaenes TUFF						
	Medium-Fine Grained QUARTZ SAND + White Clay						
	Fine Grained QUARTZ SAND						
	Fine-Medium Grained Transparent Quartz + minor White Feldspathic SAND	60m					
	As Above + equal quantities of mid grey SHALY SILTSTONE						
	Fine Grained Transparent QUARTZ SAND	70m					
	ALGEBUCKINA SANDSTONE: Very Fine Grained Transparent QUARTZ SAND + Light Brown Clay						
	As Above + Light Grey Fissile Shale + brown clay; + extremely minor flakes of carbon	80m					
	Grey Shaly Siltstone + very fine grained Transparent QUARTZ SAND						
	MT TOONDINA FORMATION: Light Grey Fissile SHALE + Brown Clay + minor Fine Grained SAND	90m					
	Light Grey Fissile SHALE + Brown Clay + Calcareous Fossil Fragments	100m					
	FOR WATER INFORMATION SEE MU-1	110m					

Flow at Bottom of Hole 5-6,000 gph

DRILL TYPE: Schramm — DATE DRILLED: 23/5/75

DRILLER: D. BIGSTON — LOGGED: B.J.U.

SCALE | 1:500 — DRG Nº | AS 5626

036

AUSTRALIAN SELECTION (PTY) LIMITED

MURLOOCOPPIE COAL PROSPECT

Exploration Licence 184 South Australia

Final Report, August 1975.

AUSTRALIAN SELECTION (PTY) LIMITED

MURLOOCOPPIE COAL PROSPECT

Exploration Licence 184 South Australia

Final Report, August 1975.

C O N T E N T S

FIGURES

038

Fig. No.	Title	Plan No.
1	Locality Plan E.L. 184 Scale 1:2,000,000	
2	Structural Plan Arckaringa Basin Scale 1:2,500,000	
3	Access, Topographic and Drill Hole Plan Murloocoppie Coal Prospect Scale 1:250,000	
4	Composite Idealised Stratigraphic Section of Arckaringa Basin. (after Townsend)	
5	Murloocoppie Coal Prospect - Contours top Permian and Base Bulldog Shale Scale 1:250,000	
6	Murloocoppie Coal Prospect - Thickness, Contour Cadnaowie and Algebuckina Formations. Scale 1:100,000	

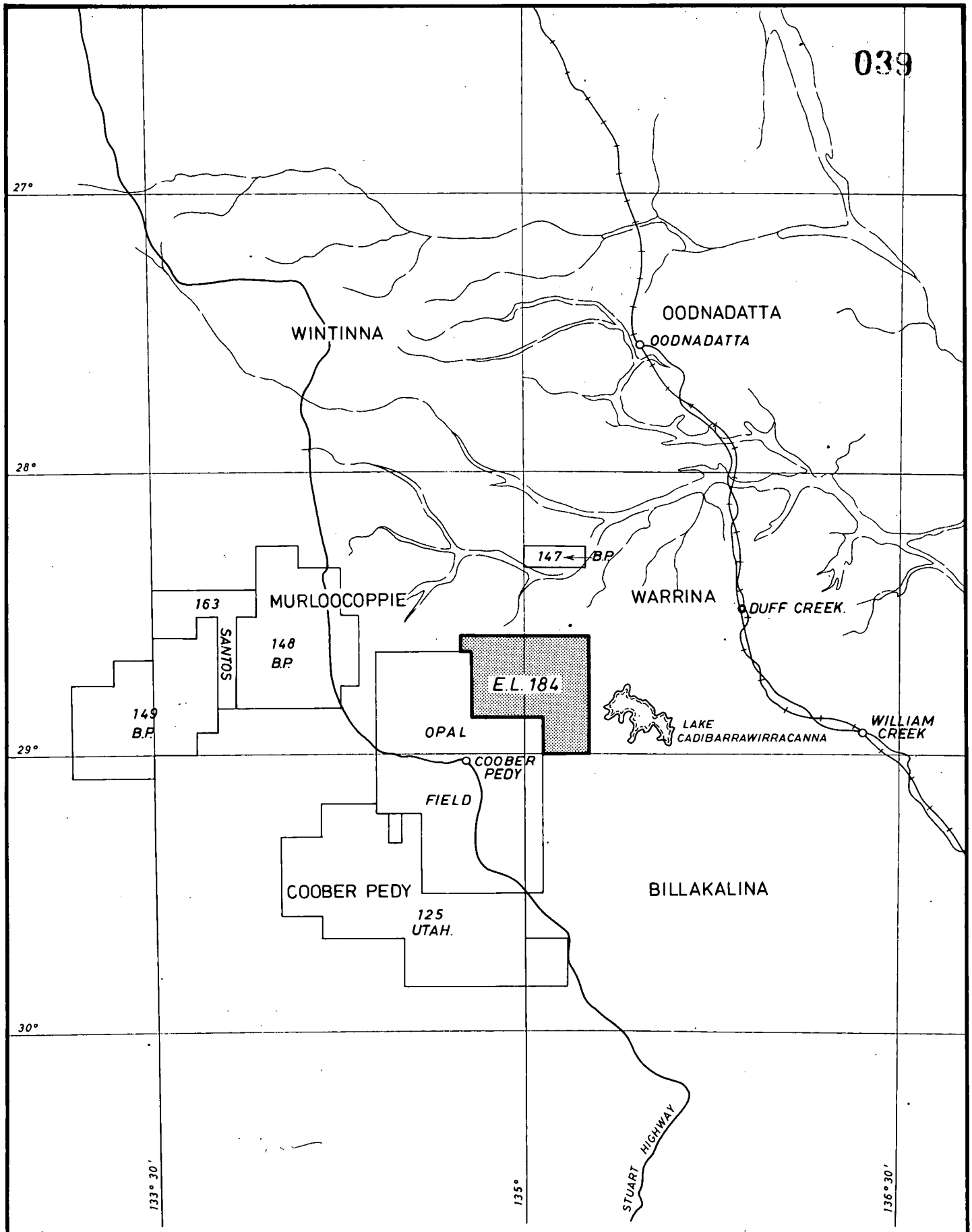
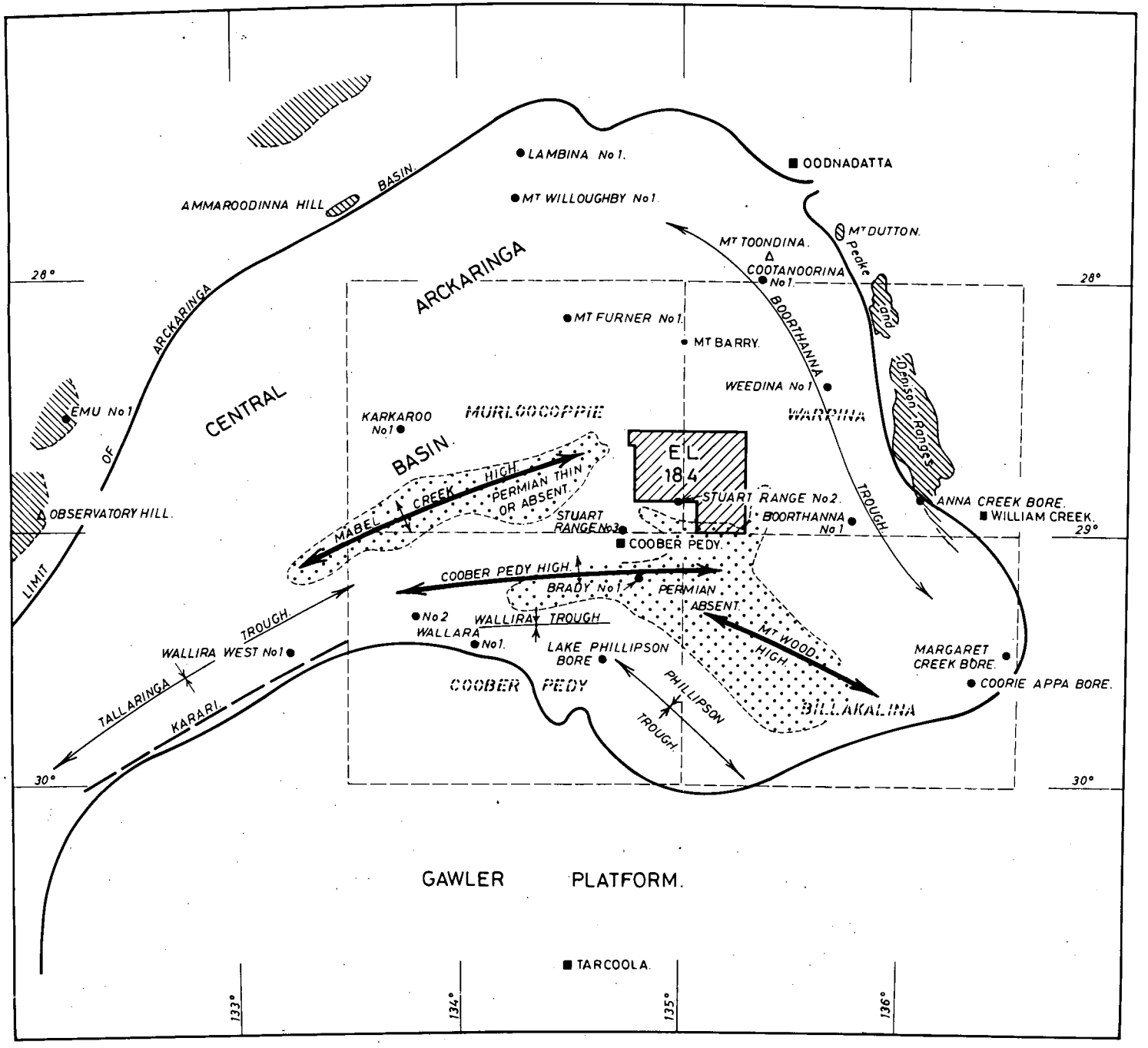


FIGURE 1.

AUSTRALIAN SELECTION (PTY) LTD.
LOCALITY PLAN OF E.L. 184
20th JUNE 1975

AS 5633



LEGEND.

1:250,000 ATLAS SHEET AREA. _____ MURL.

ROTARY DRILL HOLE _____ ● EMU No 1

TRIG. STATION _____ △

PRE PERMIAN OUTCROP _____

PERMIAN THIN OR ABSENT. _____

FAULT. _____

KILOMETRES
0 50 100
SCALE
1:2,500,000

AUSTRALIAN SELECTION (PTY) LTD
STRUCTURAL GEOLOGICAL PLAN
ARCKARINGA BASIN.
EL 184
FIG 2. AS 5692

040

28° 30'
28° 35'
28° 38'
28° 52'
29° 00'
134° 45'
134° 47'
135° 00'
135° 15'
135° 16'

MT DERAGUMABULA.

MU-4 Klb - 40 Klc - +16 Jua - Plt -

MU-3 Klb - 42 Klc - 28 Jua - 36 Plt - +44

MU-12 Klb - 36 Klc - 52 Jua - 12 Plt - 28

MU-13 Klb - 26 Klc - 44 Jua - 24 Plt - +6

MU-2 Klb - 14 Klc - 34 Juc - 32 Plt - +31

MU-1 Klb - 8 Klc - 64
MU-14 Jua - 16 Plt - +15

MU-5 Klb - 8 Klc - 46 Jua - 12 Plt - +29

MU-6 Klb - 8 Klc - 40 Jua - 16 Plt - +28

MU-10 Klb - 6 Klc - } 58 Jua - Plt - +53

MU-8 Klb - 8 Klc - 56 Jua - 20 Plt - +24

MU-9 Klc - 52 Jua - 13 Pt - +14

MU-11 Klb - 18 Klc - } 40 Jua - Plt - +55

MU-7 Klb - 64 Klc - 32 Jua - 12 Pt - +10

STUART RANGE No 2 Klb - 18 Klc - } 64 Jua - Plt - 228

SABRINA BORE (approx) Klb - 60 Plt - 5 Pt - +16

STUART RANGE No1 Klb - 64 Klc - 72 Plt - +78

STUART RANGE No 3

COOBER PEDY

TO WILLIAM CREEK.

GIDDI GIDDINNA CREEK.

LAKE CADIBARRAWIRRACANNA.

WOOLGELIMA CREEK.

VERMIN PROOF FENCE

STUART RANGE

5 0 5 10 KILOMETRES

SCALE - 1: 250,000

LEGEND

- ROTARY PERCUSSION DRILL HOLE
- PERMIAN JURASSIC CRETACEOUS
  - Klb - BULLDOG SHALE
  - Klc - CADNAOWIE FORMATION
  - Jua - ALGEBUCKINA SANDSTONE
  - Plt - MOUNT TOONDINA FORMATION
- PROT
  - Pt - GRANITE

MU 1. Klb 8. THICKNESS OF EACH UNIT IN METRES.

ENV 2556[redacted]-5

FIGURE 3.

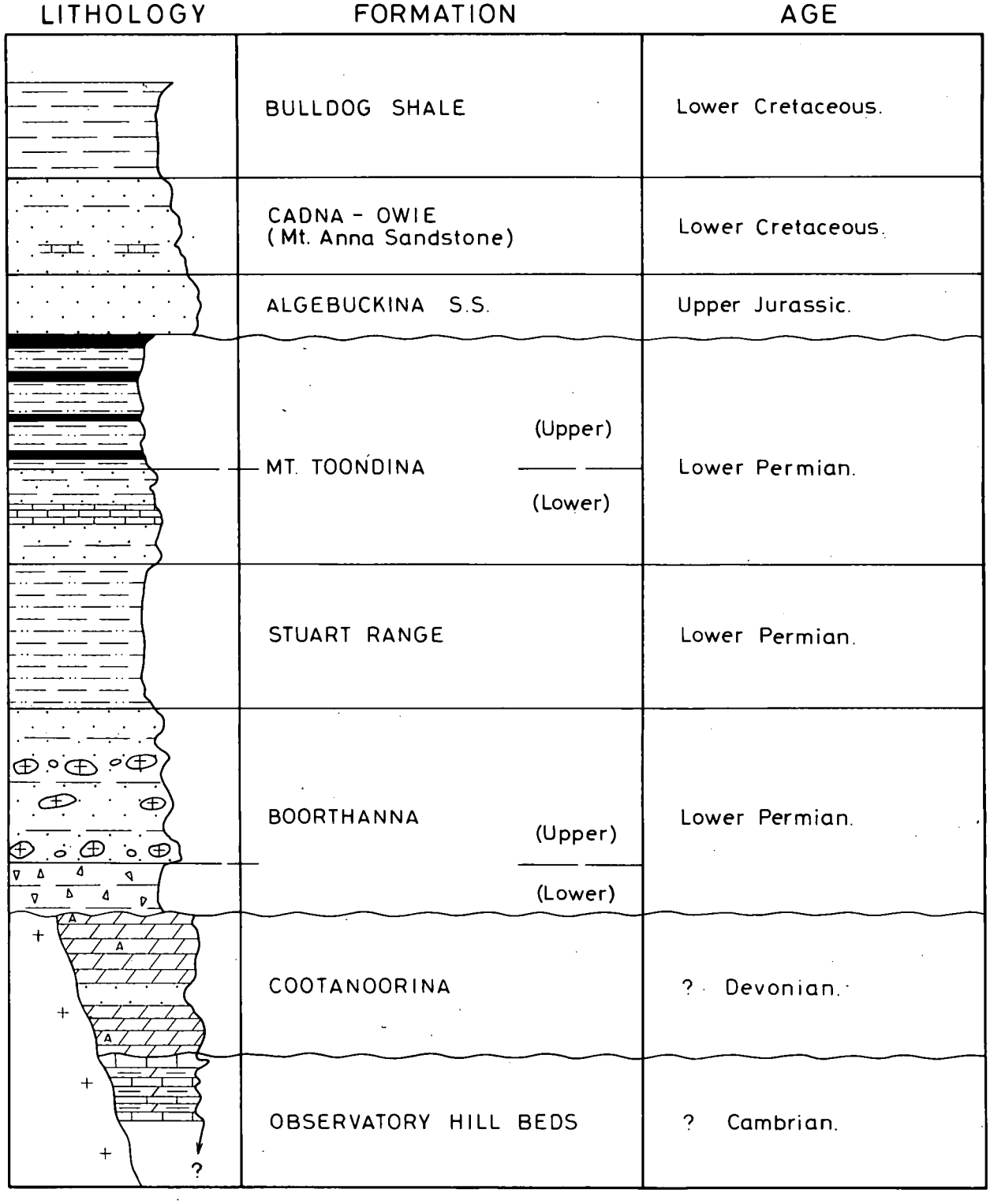
AUSTRALIAN SELECTION (PTY) LTD.

MURLOOCOPPIE COAL PROSPECT

E.L.184

ACCESS, TOPOGRAPHIC AND DRILL HOLE PLAN.

Revisions.	Date.			Date
		Compiled by:	M.G.M	June '75
		Drawn by:	M.G.M.	" "
		Traced by:	E.M.S	" "
		Checked by:		
		PLAN NUMBER	A.S. 5610	

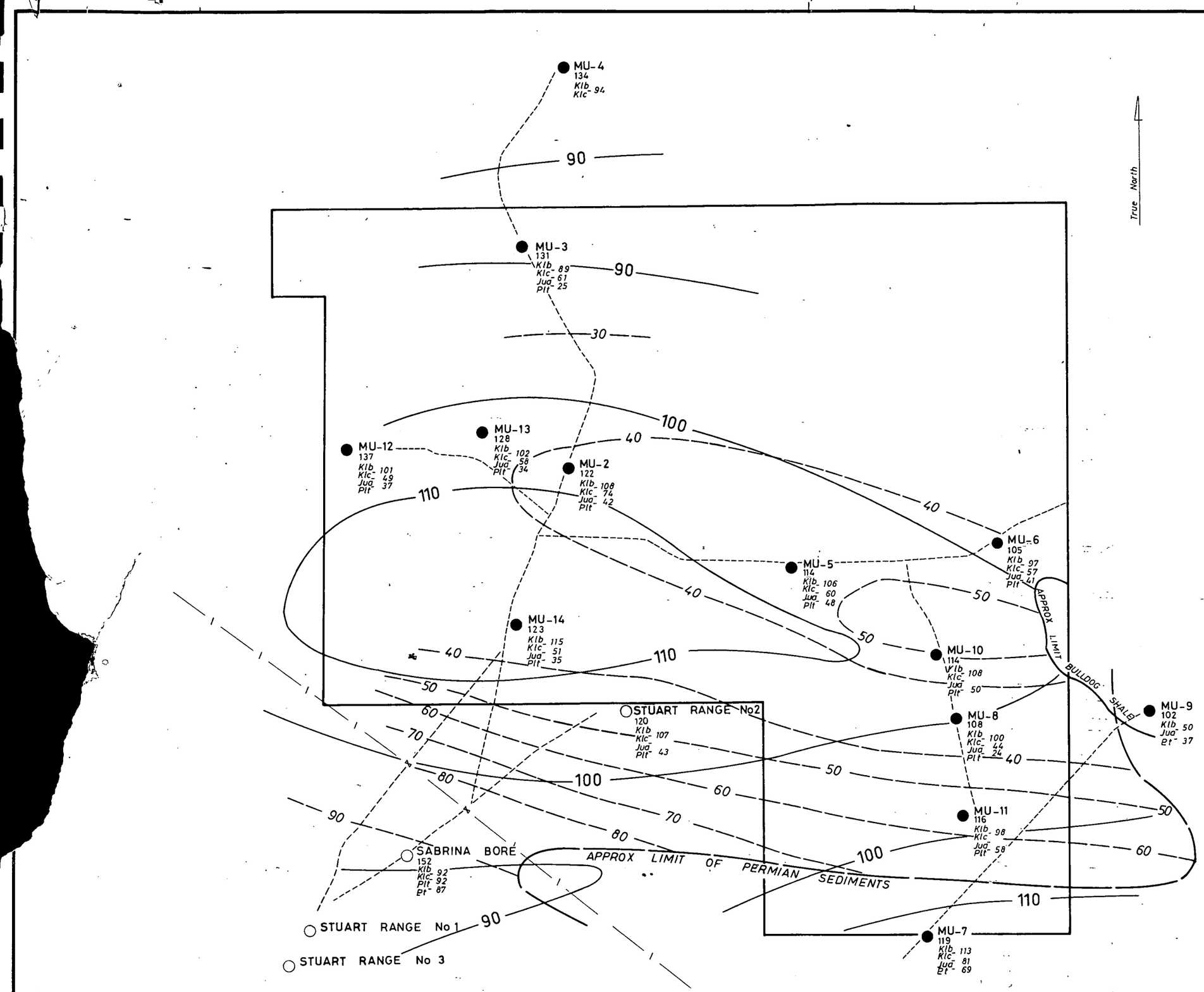


Shale.
Sandstone.
Coal.
Siltstone, Silty Shale.
Dolomite.
Limestone.
Diamictite.
Granite.
A Anhydrite.
Boulders & pebbles (granitic).

COMPOSITE IDEALISED SECTION OF ARCKARINGA BASIN.

AFTER I.J.TOWNSEND 24 JAN.'73.

AS 5693 FIG. 4.



Height datum M.S.L. Adelaide converted to metres from regional gravity station heights by dept mines S.A. Barometric accuracy ± 5 metres.

LEGEND

- MU-6 / 105 / Klb- 97 — Rotary percussion drill hole; Approx height hole collar (metres) above M.S.L; Approx height (metres) above M.S.L. of contact between units.
- Klb — Bulldog Shale
- CRETACEOUS: Klc — Cadnaowie Formation
- JURASSIC: Jua — Algebuckina Sandstone
- PERMIAN: Plt — Mount Toondina Formation
- PRE-€: Et — Granite
- 100 — Contours of base bulldog shale top of cadnaowie formation
- 100 — Contours of top of permian in metres

ENV 2556 [redacted]-6

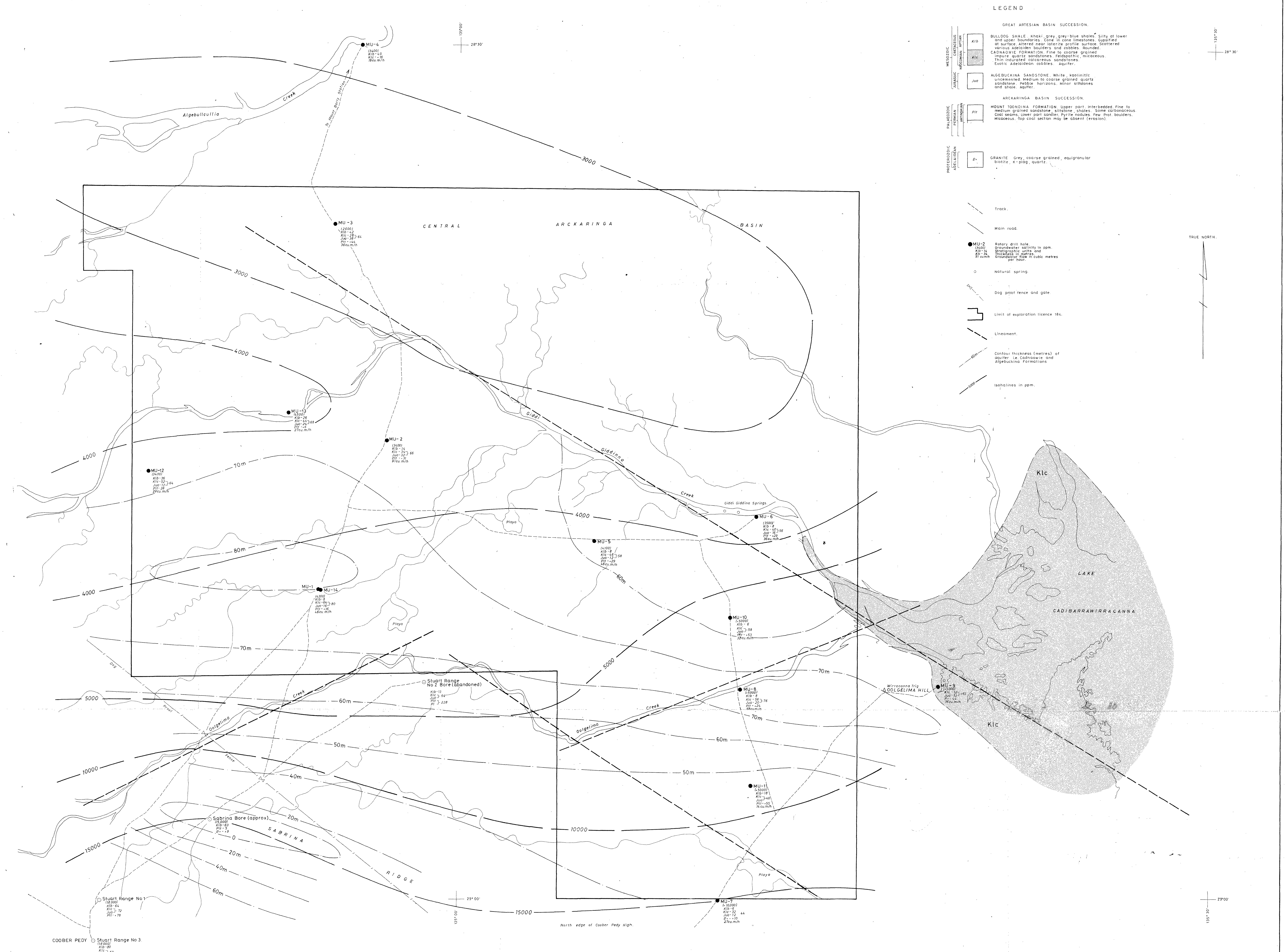
FIGURE 5.

AUSTRALIAN SELECTION (PTY) LTD.

E.L. 184

DRILL LEVELS AND CONTOURS ON TOP OF PERMIAN AND BASE BULLDOG SHALE

Revisions.	Date.			Date.
		Compiled by:	M.G.M.	June '75
		Drawn by:	M.G.M.	" "
		Traced by:	S.J.S.	
		Checked by:		
		PLAN NUMBER: A.S. 5632.		



ENV 2556[redacted]-7

FIGURE 6.

AUSTRALIAN SELECTION (PTY) LTD.

GEOLOGICAL PLAN E.L. 184

GIDDI GIDDINA BASIN
AQUIFER THICKNESS AND ISOHALINES.
(MURLOOCOPPIE COAL PROSPECT
ARCKARINGA BASIN)

Revisions	Date			Date
		Compiled by:	M.G.M.	May '75
		Drawn by:	M.G.M.	May '75
		Traced by:	K.J.C.	July '75
		Checked by:		
		PLAN NUMBER:	A.S. 5631	

1. INTRODUCTION

Exploration Licence 184 was applied for by Australian Selection (Pty) Limited as part of a programme to locate coal deposits amenable to open pit operation in the Arckaringa Basin South Australia. (Figure 1). Since early times coal has been known to exist in the Arckaringa Basin. In 1905 at Lake Phillipson (Fig. 2) a water bore to 988 metres intersected, between 50 and 143 metres in depth, a number of black bituminous coals ranging in thickness from 0.3 metres to 8.7 metres.

At Mt.Toondina (Figure 2) five coal seams are exposed in a circular piercement structure and total 11 metres thick over a stratigraphic interval of about 80 metres.

Following announcement of a proposal to re-route the Pt. Augusta-Alice Springs railway through Tarcoola, Utah Development Company took up exploration areas centred over the known shallow Lake Phillipson coal occurrence. Utah have located ten seams in an area of over 200 square kilometres at less than 200 metres below surface. To date over 2,000 million tons of steaming coal, amenable to open pitting, have been proved. (E.N. Milligan).

Mapping by the S.A. Geological Survey, on the Murlo-ocoppie 1:250,000 sheet area, during 1974, indicated the presence of an anticlinal structure in Mezosoic

rocks on the eastern boundary of the sheet. An E.L. to cover most of this structure, was applied for by Australian Selection (Pty) Limited on 4th December, 1974, on the premise that possible coal bearing rocks may be at shallow depth, centrally within the structure.

E.L. 184 was granted on 2nd March, 1975, current for 1 year.

1.1 Location and Access

Exploration Licence 184, the Murloocoppie Coal Prospect, covers an area of 1789km^2 centred about 40 kilometers north-east of Coober Pedy and 750 km N.N.W. from Adelaide. The exact position is shown on Fig. 1. The area is mainly within the pastoral block of Mt. Barry station with a small portion of the east side being within Anna Creek Station. This latter portion is also within the Woomera Prohibited area.

The land carries very little vegetation (no trees at all) and no sheep are run on this area.

Negotiations were successfully concluded with Weapons Research Establishment to allow access onto the Prohibited area during the period of exploration.

Existing roads in the area were confined to:-

(i) the Coober Pedy-William Creek road,

(ii) the Coober Pedy-Mt. Barry track,

(iii) the dog proof fence which cuts the bottom portion of the block (see Figure 3); a rough track

is located next to it.

(iv) a track that had apparently been recently graded from Duff Creek Railway Station to Weedina Waterhole and thence to Giddi Giddinna Springs.

(v) an old disused track which passes from Coober Pedy to the abandoned Stuart Range No. 2 bore on Oolgelima Creek.

Indications were that existing tracks would be difficult to negotiate with heavy vehicles. However, this was not the case and even 25 tonne vehicles could negotiate these tracks with ease. The crust or virgin ground was soft and friable, making the first pass difficult. However,once the ground was flattened, access was relatively easy.

1.2 Physiography and Climate

The licence area is located to the east of the Stuart Ranges, which is the divide between drainage toward Lake Phillipson to the south-west and Lake Cadibarra-wirracanna to the east. The eastern side of the range is a line of breakaway country where the laterite profile developed during the Tertiary on Cretaceous units, has been stripped away. In fact, the area of the exploration licence has been stripped completely of its laterite profile and Bulldog Shale outcrops directly with no soil at all present. The surface is literally bare of vegetation and flat, rounded boulders

are randomly scattered over the khaki, dark grey clay-shale surface. These boulders consist of silcrete pebbles left from deflation of the top of the laterite profile and well rounded reworked Permian glacial erratics. The erratics are composed of rocks of Proterozoic age. In places the silcrete boulders form extensive sinuous areas which may indicate the position of ancient drainage channels; e.g. an east-west area through Mt. Derangumabula.

Rainfall is irregular and low (120mm/annum) and either seeps quickly into the deeply cracked clay surface, moves into near circular salinas to percolate downwards (or evaporate) or flows along shallow sinuous clay filled drainage channels to Lake Cadibarrawirracanna. Two main drainages, "Giddi Giddinna Creek" and "Oolgelima Creek", are present. Surface waters are confined to a few mud pools in drainage channels after heavy rains and several natural springs on the edge of Lake Cadibarrawirracanna. Examples being Giddi Giddina springs and Oolgelima springs.

Although gypsum veins are common throughout the top ten metres of the Cretaceous Shales and widely scattered over the land surface, no salt crusts have developed in any of the salinas. This being apparently related to the quick ingress of surface water to subsurface.

2. REGIONAL GEOLOGICAL SETTING

Government drilling, in conjunction with private oil exploration wells, has defined reasonably accurately the Arckaringa Basin.

This is an intracratonic Permian sedimentary basin of about 80,000 square kilometres, located west of the Peake and Denison Ranges and centred at about 134°30' longitude and 28°30' latitude. See Fig. 2.

The basin is composed of a number of marginal troughs (grabens or half grabens) surrounding a central area of shallow basement. The troughs are:- the Boorthana Trough in the east, the Tallaringa Trough in the south-west, the Wallira and Phillipson Troughs in the south and the Wintinna Trough to the north-west. See Figure 2.

The northwest portions of the basin are overlain by Mesozoic sediments of the Great Artesian Basin and the whole by a thin veneer of Cainozoic alluvium and soils.

The basin sequence of Early Permian rocks is relatively well known from deep drill hole information (see Figure 4). The oldest and basal unit is the Boorthana Formation which consists essentially of conglomerates and sandstones. Overlying this is the Stuart Range Formation of marine shale, while the uppermost unit is the Mt. Toondina Formation (Townsend and Ludbrook, 1975).

The Mt. Toondina Formation (Fretag, 1965) is the unit throughout the Arckaringa Basin within which the coal seams are found (see Figure 4). The unit is 330 metres thick in the type section and consists of an upper section (170 metres) of grey carbonaceous shales, coals and interbedded grey sandstones, siltstones and sandy shales. The lower section is sandier and less carbonaceous. In places the coal bearing section has been eroded away.

The Mt. Toondina Formation was deposited in non-marine lagoons and swamps with intermittent deposition of fluvial sands.

Unconformably overlying the Permian in the north-west of the Arckaringa basin is a series of Jurassic-Cretaceous units which are of particular interest since they cover the Mt. Toondina Beds in the Murloo-coppie Anticline (Exploration Licence area).

The basal unit is the Upper Jurassic Algebuckina Sand-stone. Overlying is the Lower Cretaceous Cadnaowie Formation which is generally represented by its upper-most member, the Mount Anna Sandstones Member. This is then overlain by the Lower Cretaceous Bulldog Shale (marine).

3. EXPLORATION

3.1 Company & Government Exploration

Exploration in the Arckaringa Basin had been mainly for oil up until several years ago. As the potentially oil bearing zones are close to the coal bearing sections (i.e. the upper Mt. Toondina Formation) oil exploration results are extremely useful in the search for coal.

Between 1969 and 1971 the South Australian Department of Mines completed seven stratigraphic wells (see Figure 2) most of which intersected coal seams. Cootanoonina No. 1 intersected 14 seams of coal from 10 centimetres to 2 metres thick between 190 metres and 350 metres depth. In Karkaro No. 1 a 1 metre and a 2 metre coal seam were penetrated between 70 and 74 metres while Mt. Furner No. 1 intersected 5 seams, 1 metre to 3 metres thick between 130 and 170 metres vertical depth. Oxymin Boorthana No. 1 also intersected coal seams but thinner than those in Cootanoonina No. 1 (Holmes, 1970).

Reports of exploration on formerly held Exploration Licences listed as follows, provided helpful background data:-

E.L. 148 & 149 - BP - (current) and W of E.L. 184.

E.L. 163 - Santos - (current) and W of E.L. 184.

E.L. 147 - BP - to the north of E.L. 184 (current).

E.L. 15 & 39 - Oilmin - (relinquished) N and N.W. E.L. 184

E.L. 104 - Shell - (relinquished) S.E. of E.L. 184.

E.L. 108 - Shell - (relinquished) N.E. of E.L. 184.

No significant shallow coal intersections were made in the relinquished areas. In Oilmin's areas to the north-west of E.L. 184 coal of low rank was intersected in Cretaceous sediments. The coal is not of economic significance.

3.2 Drilling

A truck-mounted Schramm rotary-percussion rig with its own compressor was used. This rig has a hydraulic pull-down with a rotary top drive enabling the amount of bit pressure to be varied from 0-14 tonnes. The rig was equipped for rotary air drilling and a water pump and tanker supplied for rotary water circulation drilling.

The rig was also supplied with a PW conventional core barrel equipped with either a diamond bit or a bit with "tungsten" inserts.

A total of fourteen holes was drilled for a total length of 1,362 metres. Several cores were attempted in holes MU-2 and MU-4 of which two were successful after a minor problem with the core lifter was e limated.

No water circulation drilling was attempted since an adequate sample return was gained in most holes. High water flows were intersected in almost all holes. This created some problems with fine clays often being washed

away. However, a careful scrutiny of operations at all times indicated an accurate assessment of rock type. Coal was intersected in a number of holes; generally in the Cretaceous Cadnaowie Formation. The only method of coal collection was to run the water through a sieve. Retention of finer coal particles occurred in the sample buckets around the hole collar, while coarser lumps floated out and onto the sieves.

Samples were collected in buckets at the drill collar over two metre intervals. These samples were placed in rows on the ground near to the drill site. The samples were then logged individually under a binocular microscope, then sampled using Kraft envelopes for storage.

When coal was intersected the exact depth was noted and both bucket and sieve samples taken over a two metre interval. Only a rough estimate of coal seam thickness and quality was possible. However, even 0.05 metre seams of coal could be recognised and seams of better than 1 metre thickness gave good samples at surface. Only where seams were thicker than 0.5 metres did the water return become brown or discoloured; e.g. MU-2, MU-3 and MU-13.

Proterozoic granite was intersected in holes MU-7 and MU-9. In hole MU-7 blades were exchanged for a hammer drill and rotary percussion continued from 53 metres to 60 metres. In MU-9 the hole was carried to the limit of penetration by rotary blades.

.../10

Rotary Percussion Drilling Statistics

Hole No. (MU)	Map Coords		Total Depth	Date Drilling Commenced	Comments
1	2827	4277+	59	29.4.75	Abandoned-high water flows
2	2868	4382+	111	30.4.75	1m coal in Mt. Toondina at 84 metres
3	2838	4534+	150	2.5.75	1m coal in Cadnaowie
4	2860	4660+	56	4.5.75	Didn't reach Mt. Toondina
5	3024	4315	95	5.5.75	No Coal
6	3164	4329	82	6.5.75	No Coal
7	3115	4060	60	15.5.75	Granite
8	3136	4207	108	16.5.75	No Coal
9	3257	4210	65	17.5.75	Granite
10	3124	4252	117	18.5.75	No Coal
11	3141	4141	117	19.5.75	No Coal
12	2715	4394+	128	20.5.75	No Coal
13	2809	4402+	100	21.5.75	1-3m coal Cadnaowie
14	2827	4277+	114	23.5.75	No Coal

Total Advance 1,362 metres

+ Murloocoppie 1:250,000 Atlas Sheet - remainder Warrinna 1:250,000 Atlas Sheet

High water flows often washed outside the collar casing and created large holes around the collar. Disposal of water was also a problem. Often sites were chosen on stream banks and water flowed for several hundred metres along the permeable deeply cracked stream beds. Volumes of greater than 500 cubic metres were generally pumped from the hole during drilling operations.

4. GEOLOGY OF E.L. 184

4.1 Stratigraphy

The stratigraphy encountered during drilling of E.L. 184 was similar to that elsewhere in the Arckaringa Basin with only minor differences.

Mt. Toondina Formation was intersected in ten holes; the depth below surface varied from 62 to 106 metres averaging 81 metres. The deepest penetration into Mt. Toondina Formation was 66 metres in MU-11 and averaged 30 metres. The sediments of this unit varied little throughout the licence area and also varied little with depth. It appears that in most cases the top coal bearing section of the Mt. Toondina Formation has been eroded away. This indicates Post Permian uplift centred around basement highs. In general the sediments were grey silty shales carrying up to 10% fine carbonaceous fragments. Thin siltstones and sands were present often associated with thin coal fragments. A few thin pyrite nodulèr zones were intersected; e.g. MU-5. The shales were well bedded and relatively fissile. Garnet tended to be a prominent accessory in holes MU-2, MU-3 and MU-14.

Mesozoic sediments were encountered in all drill holes from surface to the Mt. Toondina Formation. In general Bulldog Shale occurred on Cadnaowie Formation with Algebuckina sandstone beneath. In some areas Bulldog Shale was absent and Cadnaowie Formation outcropped.

The Aegebuckina Sandstone is the basal unit on the Permian and is of Upper Jurassic Age. This unit is the main aquifer for the Great Artesian Basin, and, similarly, is the main aquifer in this area.

The Aegebuckina Sandstone has been recognised in most drill holes and can be equated to the Mt. Furner No. 1 section (105-132.5m - Townsend, 1973).

The unit is generally coarse to medium grained quartz sands with some coarser pebble bands. A core taken from MU-2, at 60 metres depth, showed coarse cross bedded, well graded, unconsolidated kaolinitic sands. The core could not be preserved.

The Cadnaowie Formation is often difficult to diffentiate from the Algebuckina Sandstone in rotary chips. Both are coarse to medium grained, relatively unconsolidated sands with minor fine sand, silts and silty shale layers. The Cadnaowie Formation has thin undurated calcarenite bands near the top in the northern part of the lease (MU-4), similar to those intersected in Mt. Furner No. 1. Coarse grits, with round pebbles of pitted porphyritic rhyolite are common at the top of the unit and may equate to the Mt. Anna Sandstone unit.

Together these units are about 60 metres thick.

Bulldog Shale overlies the Cadnaowie Formation and is again of Cretaceous Age. At the base of the Bulldog Shale is a more silty member which, though only a few metres thick, can be recognised over most of the area. This equates to the un-named Transition Member of Ludbrook in the Stuart Range No. 3 Bore. Thin calcarenties with cone-in-cone structure are common to this interval, but do occur elsewhere in the overlying section. This unit consists generally of khaki, black to grey carbonaceous shales.

The Bulldog Shale outcrops over wide areas. Where the Tertiary laterite profile is present (e.g. the opal workings at Coober Pedy) it is a pale brown to off white silty claystone. However, where the laterite has been stripped, which is the case over most of the Exploration Licence, the shales are khaki, dark grey, soft and contain abundant gypsum veins. Cadnaowie Formation outcrops around Lake Cadibarrawirracanna, and to the east as a strip parallel to the Peake and Denison Ranges. This area is typified by sand dunes and salinas; with springs near the outcrop edge of the Cadnaowie with the Bulldog Shale.

4.2 Structure

Drilling has shown two basement highs: one under Sabrina Bore extending southeast, the other under Lake Cadibarrawirracanna and extending south; both joining the Mt. Woods high. The high passing under Sabrina

Bore has been termed the "Sabrina Ridge". In all cases the highs consist of granite, or granite gneiss, showing weathered surfaces which rapidly become solid rock and fresh in depth.

Preliminary work indicates the Permian unconformable surface and later units dip towards the north from the "high" at the south edge of the Exploration Licence. However, interpretation is hampered by lack of accurate levelling. A weak, broad anticline may be present as shown by the base of the Bulldog Shale (see Figure 6). However, the top of the Permian is much more complex. A low is present almost directly beneath the Cretaceous anticlinal structure and this is both the thickest and the deepest part of the Cretaceous sediments. That is, the deepest part of the basin has suffered some uplift. Figure 6 shows the thickness of the Algebuckina and Cadnaowie units together.

Several lineaments have been noted. One passes along a W.S.W. branch of Oolgelima Creek to the N.W. of Sabrina Bore. The Sabrina Ridge appears to be affected by this feature and becomes less pronounced on the northern side. The lineament lines up with the Karari Fault mapped to the S.W. A similar lineament parallels Giddi Giddinna Creek and the southern edge of Lake Cadibarrawirracanna.

4.3 Hydrogeology

Large volumes of brackish water have been located in the Algebuckina and Cadnaowie coarse sand units. This groundwater sub-basin of the Great Artesian Basin has been described in detail in report by Mason (1975) and will not be further discussed here.

4.4 Coal

Carbonaceous fragments were intersected in almost all holes from the Cretaceous Cadnaowie to the Permian Mt. Toondina Formation. However, coal seam intersections were confined to MU-1, MU-2, MU-3, MU-8, MU-9 and MU-13.

Coal in the Mt. Toondina Formation was confined to MU-3 (less than 50mm seams below 125 metres) and MU-2, where a metre seam was intersected from 81.5 to 82.5 metres; a 0.2m seam at 86.5 metres, and seven 50mm seams were intersected down to 101 metres. Below this the sediments were not carbonaceous. Petrographic analysis of coal from the interval 84-86 metres indicated the coal was principally vitrinite with sub-ordinate amounts of granite and inertinite. The coal was low rank with an estimated violarite matter of 55%, calorific value of 12,500 (Btu/lb) and low ash content. Details appear in Appendix 2.

The metre intersection in MU-2 was the only Permian intersection of note. This intersection is

surrounded by barren holes MU-13, MU-14, MU-3, MU-4, MU-5 and Stuart Range No. 2. Therefore, the possibility of an economic development of coal is confined to the northeast, where drilling indicates the Permian is greater than 100 metres below surface.

Coal in the Cadnaowie Formation was much more common and widespread. Intersections included:

MU- 1	minor seam at 41 metres
MU- 3	1 metre seam 42-43 metres 4 0.05 to 0.2 metre seams 43-47 metres few minor seams down to 66 metres
MU- 8	minor seams 66 to 80 metres; possibly in the Jurassic Algebuckina Sandstone
MU- 9	minor seam 30-52 metres
MU-13	0.5 metre seam 28-29 metres 1 to 2 metre seam 56-58 metres 1 metre seam 59-60 metres 0.5 metre seam 66-67 metres minor seam 88-89 metres, probably in the Jurassic Algebuckina Sandstone

Of these, the intersections in MU-3 and MU-13 were significant. These may in fact be the same horizon and continuous. However, the minor intersections in MU-1 was not repeated in MU-14 and indicates a lack of continuity of coal seams in the Cadnaowie unit.

Coal has previously been intersected in the Cadnaowie by Oilmin further to the north. The quality was poor, as is the case in this area.

Three samples from MU-13 were submitted to Robertson Research for analysis. See Appendix II. Intervals

tested were from 32-34 metres, 56-58 metres and 59-60 metres. All samples were similar being almost entirely composed of vitrinite, low rank, an estimated 55% volatile matter, caloritic value of 12,400 Btu/lb and of low ash content.

5. CONCLUSIONS

The top of the Mt. Toondina Formation varies from 62 to 106 metres below surface generally becoming deeper to the north.

Coal was intersected in the Mt. Toondina Formation only as a 1 metre seam in MU-2. Surrounding holes indicate that the intersection is of no economic significance.

Coal was intersected in MU-3 and MU-13 in the Cretaceous Cadnaowie unit. This suggests a significant area underlain by coal greater than 1 metre thick. However, the quality is poor and no economic deposit is considered present.

There is little chance of significant coal deposits near the perimeter of E.L. 184.

6. RECOMMENDATION

No further work is warranted.

M. G. MASON
SENIOR GEOLOGIST

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APPENDIX I

ROTARY DRILL LOGS MU-1 to MU-14

PROJECT: ARKARINGA BASIN — AUSTRALIAN SELECTION (PTY) LTD — HOLE Nº MU-1

LOG OF PERCUSSION DRILL HOLE

PROSPECT: MURLOOCOPPIE COAL — Murlooccoppie 1:250,000 Sheet.

R.L. COLLAR: .....

LOCATION: 26km NNE Coober Pedy — MAP CO-ORDS: 2827...4277 — 061 — INCLINATION: -90° — DIRECTION: -

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
1 May 75	CADNAOWIE FORMATION - Cone in cone limestone - some Ferruginous zones. Bulldog CLAYSTONE 10% f-m.g. Sand 15% mica. 70% clay. grey, minor brown. HW-CW becoming khaki. Some sandy clay bands, clay siltstone. 35% silt. As above.						20% gypsum veins. Uncemented
	CLAY SAND - Grey 45% m.g rounded quartz 15% mica. Rest clay. 15% mica. 65% m.g. quartz. 2% green mineral? - Grey.	10 m					5% pyrite.
	SAND v. pale grey 90% F-c.g. quartz c.g. subrounded F-m.g rounded. ← Water Cut. 2-5% mica minor clay						2% pyrite 5% black ~~hornblende~~? (carbon)
① Samples 5600ppm							2% pyrite 1% black ~~hornblende~~ (carbon)
							2% carbonaceous Fragments
		20 m					
	COARSE SAND - v. pale grey minor mica & clay. 15% m.g sand Rest c.g. subangular quartz.						
② 3000ppm 4900ppm	SAND - light grey. 60% m.g. rounded quartz 5% pyrite. minor tourmaline, 10% clay bands. 5% mica Rest clay. Thin coal seam.						5% F.g. Fragments coal mat'l to sandstone
	Cadnaowie Formation. COARSE SAND - v. pale grey. 30% c.g. subangular quartz. Minor clay & silt. Rest F-m.g. subrounded quartz.	30 m					1% F.g. coal Frag. 3% clay pieces
	10% c.g. quartz. Rest F-m.g.						5% Kaolin m.g. sand
	minor tourmaline, pyrite, Feldspar. 15% clay silt with coal Fragments	40 m					10% Kaolin
↑ 7000ppm.	10% coal lumps - woody. (Seam)						
	30% Fine sandstone with 20% F.g coal Fragments - detrital 2% pyrite.						30% m.g. coal Fragments 1-3cm interlayers with Fine sandstone coal being washed away.
	Fine Sandstone - 30% Feldspar minor clay 10% mica Rest quartz. Subangular. 5% F.g. detrital coal.						5% Kaolin sandstone
	20% F.g. sandstone 30% detrital coal						Contamination due to high water inflows.
③ 10,000ppm. 14800ppm.	COARSE SAND - white. 60% c.g. subangular v. minor clay Rest m.g. quartz	50 m					
	10% coal Fine sandstone & 10% clay bands minor pyrite						
	becoming m.g. sandstone. v. minor coal & pyrite.						
	END OF HOLE 59 METRES	60 m					
	60 Ft steel 5" casing lost in hole.	70 m					
		80 m					
		90 m					
		100 m					
		110 m					

DRILL TYPE: Schramm — DATE DRILLED: 20 April - 30 April. 1975

DRILLER: D. BINSTON — LOGGED: M. Mason

SCALE 1:500 — DRG Nº AS611

PROJECT: ARCKARINGA BASIN

PROSPECT: MURLOOCOPPIE COAL

LOCATION 37km NNE Coober Pedy.

AUSTRALIAN SELECTION (PTY) LTD

LOG OF PERCUSSION DRILL HOLE

Murlooccopie 1:250,000 sheet.

MAP CO-ORDS: 2868 4382

HOLE Nº MU-2

R.L. COLLAR: .....

062 INCLINATION: -90°

DIRECTION: -

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm) Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
Water Cut ↓ 2 May 75	CLAY khaki high plasticity. 35% silt quartz 15% mica. Rest clay.					10% gypsum veins.
Bulldog Shale.	15% silty sandstone dark grey 5-10% pyrite 20% F.g quartz 15% mica. 3% tourmaline. Rest clay	10 m				45% cone in cone limestone brown. 2% F.g. detrital coal.
8000gph Sample 3900ppm ①	COARSE SANDSTONE - v. pale grey. 35% c.g. subangular quartz, minor porphyry pebbles, minor clay, 2% pyrite, 10% silt. Rest f-m.g. subrounded quartz uncemented					some sections pyritic cemented as nodules
Cadnaowie	25% silty sandstone with 10% f-m.g. coal lenses and fragments	20 m				minor coal fragments. minor kaolin
	minor sandy siltstone					
	15% c.g. subangular quartz	30 m				
14000gph ↓ ② 3800ppm	Algebuckina Sandstone	40 m				Amount of contamination not known.
	5% shale & silt bands shale - carbonaceous green-grey to dark grey. 35% quartz silt.	50 m				
CORE	uncemented. v. vague bedding 10-50mm thick. minor carbonaceous fragments. 50% core loss.	60 m				
	5% yellow brown F.g. cemented sandstone.	70 m				
	MEDIUM GRAINED SANDSTONE					
MOUNT TOONDINA BEDS CORE LOST	10% silty sandstone with 5% heavy minerals 2-3% including garnet - distinctive	80 m				2% coal detrital fragments
	COAL SEAM - black, layered - subresinous. probably about 1m thick.					coal seam 0.2m
	Black shales and sandy silts relative amounts not known. Rest garnet sand - grey. 10% c.g. 25% m.g. 20% silt angular quartz, minor mica, pyrite. 2% coal fragments 2% garnet poorly sorted.	90 m		10% amg coal fragments		0.05m. 0.05m. 0.05m. 0.2m. 0.05m. 0.05m. Estimated thickness - exact position not known
	SILTSTONE - 45% quartz silt 5% mica 3% coal f.g. fragments, minor pyrite Rest clay 20% m.g. sand layers grey. 2% garnet					
	SILTSTONE - grey f.g. 55% f.g. quartz silt. 2% pyrite 5% mica 5% m-c.g. quartz Rest clay - some shale & sand layers 2% garnet.	100 m				
+20,000 gph ↓	SILTSTONE - dark grey 50% f.g. silt quartz 20% m.g. quartz 2% garnet 5% mica 2% pyrite 5% carbon fragments Rest clay. v. poorly sorted v. vague 5-10mm layering. 10% mica 25% clay	110 m				
	END OF HOLE 111metres.					

DRILL TYPE: Schramm

DRILLER: D. BLASTON

DATE DRILLED: 30 April - 2 May 1975

LOGGED: M. Mason.

SCALE 1:500

DRG Nº 25562

PROJECT: ARCKARINGA BASIN — AUSTRALIAN SELECTION (PTY) LTD

LOG OF PERCUSSION DRILL HOLE

HOLE Nº MU-3

PROSPECT: MURLOOCOPPIE COAL — Murloocoppie 1:250,000 Sheet.

R.L. COLLAR: .....

LOCATION: 48 Km NNE Coober Pedy — MAP CO-ORDS: 2838 453A — 063 INCLINATION: -90° DIRECTION: —

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
4 May 1975	KHAKI CLAY F.g. 30% rounded quartz silt.. 20% mica. Rest clay. high plasticity moderate swelling. vague layering. 2% carbon Fragments.	10m					5% 100mm gypsum veins
	Grey & Khaki - 40% vague layering grey clay. 10% silt quartz. 30% mica Rest clay.						
	BLACK CLAY F.g. 30% mica 5% carbon Fragments Rest clay 5% quartz silt 2% u.F.g. pyrite. vague Foliation	20m					
	gradational boundary.	30m					
	CLAY - Dark green-grey. F.g. 15% silt quartz. 3% tourmaline 2% F.g. pyrite 3% carbon Fragments. 20% F-m.g. mica. Some Feldspar Rest clay	40m					
	SAND - pale grey - m.g quartz pyrite nodules - coarse mica						50mm coal seam.
	COAL SEAM 1.0 metre. - brown black						
2000gph Cut	SILT-SAND - pale grey Rest F.g. C.g. 30% - 40% m.g. 10% c.g. mica. 50 - 150mm coal seams (about 4) minor pyrite mica Coal seam 0.1m thick						Water return brown relatively hard to drill brown return calc. cemented sand with pyrite.
Water sample ① 3500ppm water	15% siltstone layers 10% m.g. coal Fragments SILTY SAND 40% m.g rounded quartz, 10% m.g mica rest silt, clay & carbonate 20% c.g. coal Fragments	50m					
	COARSE SAND - pale grey 50% c.g. minor silt, clay, mica, pyrite thin coal seam 58m. minor kaolin cement.						5% massive green shale.
	Coal Seam 0.2m 5% sand silt with carbon Fragments.	60m					thin 10mm coal seams.
	Sand becoming m.g. only 15% c.g. 20% thin massive dark grey green shales possibly carbonaceous.						50mm coal seam
	FINE SAND v. pale grey well sorted 90% F.g. sand. 5% m.g. muscovite minor Silt kaolin. 5% green shale.						50mm coal seam
	MEDIUM SAND - pale grey 15% c.g. minor silt kaoli- (CO_3 - ?) 5% m.g. muscovite 5% carbonaceous shale layers. well sorted.	70m					minor coal
④ 2900 ppm	becoming coarser & less well sorted	80m					10% kaolin cemented fine sand.
8000gph	20% carbonaceous shale.						minor coal
	coarser well sorted angular minor muscovite 5% carb. shale.	90m					
ALGEBUCKINA SANDSTONE	FINE SAND - v. pale grey well sorted subrounded 80% F-m.g. sand minor kaolin & silt. 5% c-m.g. muscovite						Few m.g. bright coal grains.
		100m					
⑤ 2900ppm MT TOONDINA	COARSE SAND 1% garnet. 30% c.g. Rest m.g. quartz. minor coal. angular.						
	SILTY SAND - grey. 40% F.g. subrounded quartz. 2% garnet 2% F.g. coal fragments minor pyrite. poorly sorted. 25% silt Rest clay. v. minor garnet 1% rutile tourmaline	110m					minor carbonaceous shale.

DRILL TYPE: Schramm — DATE DRILLED: 2nd May 1975

DRILLER: D. BINSTON — LOGGED: M. Mason

SCALE 1:500 — DRG Nº MS 56/3

AUSTRALIAN SELECTION (PTY) LTD

LOG OF PERCUSSION DRILL HOLE

PROJECT: ARCKARINGA BASIN

PROSPECT: MURLOOCOPPIE COAL

LOCATION: 48km NNE Coober Pedy

Murloocoppie 1:250,000 sheet

MAP CO-ORDS: 2838 4534

064

HOLE No: MU-3

R.L. COLLAR: ....

INCLINATION: -90°

DIRECTION: ....

WATER CUT		DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	Cu (ppm)	Zn (ppm)	REMARKS
8000gph (4) 2900ppm.	Mount Toondina Formation.	SANDY SILTSTONE - grey 25% F-m.g. angular quartz. 20% carbonaceous shale Fragments. 2-5% m.g. grains bright coal. 40% silt. 5% mica Rust clay. minor pyrite Few garnet.	120m					10% coal Frag. little carb. shale. 20% F.g. sands with thin lamellae of coal.
								50mm coal seam.
		10% anisotropic Fe chlorite.						50mm coal seam.
		5-10% coal grains. zone pyrite spheres up to 50mm diameter.	130m					
		5% coal in thin lamellae.						
		5% coal grains						
		5% coal lamellae						
			140m					
		END OF HOLE 150 metres	150m					
			160m					
			170m					
			180m					
			190m					
			200m					
			210m					
			220m					
			230m					

DRILL TYPE: Schramm

DATE DRILLED: 2 & 3rd May 1975

DRILLER: D. BIASTON

LOGGED: M. Mason.

SCALE 1:500

DRG. No. A6 5614

AUSTRALIAN SELECTION (PTY) LTD

LOG OF PERCUSSION DRILL HOLE

HOLE Nº MU-4

PROJECT: ARCKARINGA BASIN

PROSPECT MURLOOCOPPIE COAL

LOCATION 55 km NNE Coober Pedy · MAP CO-ORDS: 2860 4660

R.L. COLLAR: .....

065 INCLINATION: -90°

DIRECTION: -

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
4 May 75	CLAY SOIL - Red brown.						10% gypsum.
	CLAY KHAKI. - F.g. 20% rounded silt. minor m.g. quartz. 10% muscovite. Rest clay.						
	— — — grey brown — — —	10 m					
SHALE	CARBUNACEOUS SHALE - black f-g. 10% graphite 15% mica Rest clay. 5% pyrite	20 m					0.1m hard band.
BULL DOG	SANDY SILTSTONE - pale grey 10% m-g. 50% F-g quartz, tourmaline, mica etc	30 m					
	LIMESTONE - pale brown - massive - indurated						
	SILTY CLAY - 25-30% silt - 10-20% mica 5% pyrite. minor graphite Rest clay.						
MOUNT ANNA	COARSE SAND. - OPP white 30% c-g rounded quartz. 15% F-g. muscovite Rest clay. minor pyrite, tourmaline, graphite Pnags.	40 m					30% silty clay
CADNAOWIE	SAND 20% m-g. 50% F-g. minor pyrite & mica, coal grains. Rest clay. Few thin grey shale layers & siltstone						
	0.1 m coal seam. indurated. buff 40% sand	50 m					0.4m calc arenite.
	CORE 80% loss. — SAND - medium gr. 30% silt 2% mica. 3% coal fragments 15-30% clay 10% c-g. Rest m-g						calcareous calcareous
	0.2m. calc F-g. arenite minor thin coal layers 1-3mm.						
	END OF HOLE - 56 metres.	60 m					
		70 m					
	Cased to 30 metres & equipped for pastoral bore by Mt Barry Station.	80 m					
		90 m					
		100 m					
		110 m					

4000 gph · 4100 ppm water @ 2000 gph cut
@ 3800 ppm

DRILL TYPE: Schramm

DATE DRILLED: 4 May 1975

DRILLER: D. BINSTON

LOGGED: M. Mason

SCALE 1:500

DRG Nº AS 5615

PROJECT: ARCKARINGA BASIN

AUSTRALIAN SELECTION (PTY) LTD

LOG OF PERCUSSION DRILL HOLE

HOLE Nº MU-5

PROSPECT: MURLOOCOPPIE COAL — Warrina 1:250,000 Sheet

R.L. COLLAR: .....

LOCATION 40km NE Coober Pedy. MAP CO-ORDS: 3024 4315

INCLINATION: −90°

066 DIRECTION: −

WATER CUT	DESCRIPTION		DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
	BULLDOG SHALE	CLAY Khaki & dark grey. F.g. 20% silt quartz 5-10% mica Rest clay.						
		dark grey. 5% graphitic 30% silty						
	Mt Anna Sandstone	SANDY SILTSTONE grey. 10% m.g. quartz						
7 May 75 → water out		SAND - light grey 80% m.g. ac.g sub rounded quartz minor mica silt rest clay 50mm coal seam bright 10% silt 10% clay	10 m					
4600ppm ①		SAND - grey. 70% m.g sand minor pyrite etc some c.g. layers also silt layers. Feldspathic.						some carbonaceous layers.
		Feldspathic. Minor pebbles pinked green weathered porphyry.	20 m					
10,000 gph. 4600ppm. ②	CADNAOWIE FORMATION	SAND - 80% F-m.g. sub rounded quartz minor Feldspar, mica, pyrite, silt & clay. minor sandy siltstone layers	30 m					
			40 m					
		5% 5mm coal seams	50 m					
	ALGEBUCKINA SANDSTONE	SAND - m.g. 20% kaolin matrix. 70% m.g. angular quartz. No Feldspar some opalitic quartz. Minor coal, pyrite, silt.	60 m					
	MOUNT TOONDINNA FORMATION	SILTSTONE - grey 15% F-m.g. quartz subrounded minor pyrite. 18% Mica. 55% silt. 6% graphite. Rest clay.	70 m					
10,000 gph. 4600ppm. ③		5% m.g. sand 25% clay.	80 m					
			90 m					50mm calcarenite lens with pyrite nodule calcarenite.
		END OF HOLE 95 metres.	100 m					
			110 m					

DRILL TYPE: Schramm

DRILLER: D. BILSTON

DATE DRILLED: 5-6th May 1975

LOGGED: M. MASON

SCALE 1:500

DRG Nº AS 5616

PROJECT: ARCKARINGA BASIN — AUSTRALIAN SELECTION (PTY) LTD — HOLE Nº MU-6

LOG OF PERCUSSION DRILL HOLE

PROSPECT: MURLOOCOPPIE COAL — Warrina 1:250,000 sheet — R.L. COLLAR: ....

067 — INCLINATION: -90°

LOCATION: 15km NW Oolgelima Hill — MAP CO-ORDS: 3164 . 4329 .... — DIRECTION: ....

WATER CUT	FORMATION	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	Cu (ppm)	Zn (ppm)	REMARKS
1 (M)	BULLDOG SHALE	CLAY - khaki - 20% silt. 20% mica. high plasticity. Rest clay						20% c.g. sand.
① 4100 ppm Water Cut	MT ANNA SANDSTONE	COARSE SAND - pale grey. Minor mica, silt, clay. 20% f.g. 20% m.g. 25% c.g. quartz. Also few porphyry pebbles.	10 m					50mm coal seam
5000 ppm	CADNA-OWIE FORMATION	SAND - pale grey. Minor silt, clay, pyrite, mica. 10% c.g. 20% m.g. 50% f.g. quartz. Feldspar common subrounded.	20 m					
② 4000 ppm	CADNA-OWIE FORMATION	COARSE SAND - pale grey. minor pyrite, silt, clay, mica. 30% c.g. 30% m.g. 10% f.g. quartz. Feldspar. 50mm coal seam	30 m, 40 m					
8000 ppm	ALGEBUCKINA SANDSTONE	COARSE SAND pale grey. minor pyrite, silt. 10% kaolin. 40% c.g. 20% m.g. 10% f.g. quartz. Some opaline.	50 m, 60 m					
③ 3900 ppm	MT TOONDINNA FORMATION	SILTSTONE - grey. 15% f-m.g. subangular quartz 55% silt 10% mica minor pyrite. 5% carbonaceous f.g. pieces. Rest clay.	70 m, 80 m					
		END OF HOLE 82 metres.	90 m, 100 m, 110 m					

DRILL TYPE: Schramm — DATE DRILLED: 6-7 May 1975

DRILLER: D. BILSTON — LOGGED: M. Mason

SCALE 1:500 — DRG Nº AS 5617

AUSTRALIAN SELECTION (PTY) LTD

PROJECT: ARCKARINGA BASIN

LOG OF PERCUSSION DRILL HOLE

HOLE Nº MV-7

PROSPECT: MURLOO COPPIE COAL

R.L. COLLAR: .....

068 INCLINATION: -90°

LOCATION: ..... CO-ORDS: .....

DIRECTION: —

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
	BULLDOG SHALE: CLAY - khaki. 25% silt minor m.g. sand, 15% mica. Rest clay.						50% gypsum 20% gypsum
	CADNAOWIE FORMATION: SAND - pale yellow. 20% c.g. 45% m.g. Rest F.g. angular quartz 5% Feldspar	10 m					
	SAND - v. pale yellow. 10% mica. Minor slay. 20% silt. Some Feldspar 10% c-m.g. Rest c.g. sub angular quartz.						
Water cut →	COARSE SAND. yellow. 35% c.g. 30% m.g. minor silt clay & mica Rest F.g sand. Subangular. Iron oxide coated surfaces. Limit of oxidation?	20m					
6030gph	MEDIUM SAND. white. 5% mica. subangular. 35% m.g. minor c.g. Rest F.g. quartz. 10% white Feldspar.	30m					
	ALGEBUCKINA SANDSTONE: MEDIUM SAND - white. minor mica. 10-20% Kaolin. 60% F.g. Rest m.g. subangular quartz. Minor opaline quartz	40m					
	PROTEROZOIC: GRANITE grey m.g. 30% biotite 30% quartz (grey-blue) & 30% feldspar. equigranular.	50m		30	45	230	35% sand as above. Pb 40
	END OF HOLE 60m.	60m					
		70m					
		80m					
		90m					
		100m					
		110m					

DRILL TYPE: Schramm

DATE DRILLED: 15-16th May 1975

DRILLER: D. BILSTON

LOGGED: M. Mason

SCALE 1:500

DRG Nº AS 5618

PROJECT: ARKARINGA BASIN — AUSTRALIAN SELECTION (PTY) LTD — HOLE No. MU-8

LOG OF PERCUSSION DRILL HOLE

PROSPECT: MURLOOCOPPIE COAL — R.L. COLLAR: .....

WARRINA SHEET 1:250,000 — INCLINATION: 90°

LOCATION: ..... CO-ORDS: 3136 ... 4207 — 069 DIRECTION: —

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
17/5/75	BULLDOG SHALE: Medium Grey Fissile Fresh SHALE CLAYSTONE						
	Medium Grey SILTSTONE						
	CADNA-OWIE FORMATION: Medium-Coarse Grained Transparent QUARTZ + minor white FELDSPATHIC SAND	10 m					
	Medium-Fine Grained Transparent QUARTZ + minor white FELDSPATHIC SAND						
	Medium-Coarse Grained Transparent QUARTZ + minor white FELDSPATHIC SAND + Medium Grey Poorly Sorted Argillaceous Sediment + V. minor pyrite	20 m					
	+ minor Siltstone						
	As Above + Black Carbonaceous Shale + minor Muscovite						
	Medium + Fine Grained Transparent QUARTZ + minor FELDSPATHIC SAND	30 m					
	Fine Grained Transparent QUARTZ + minor FELDSPATHIC SAND + white SANDY SILTSTONE	40 m					
	Medium Grained Very Clean Transparent QUARTZ SAND + minor spherulitic pyrite						
	Medium + Coarse Grained Transparent QUARTZ + minor FELDSPATHIC SAND	50 m					
	+ minor spherulitic pyrite						
		60 m					
	+ minor pyrite						
WATER FLOW 15,000g.p.h. SALINITY > 5,000ppm.	ALGEBUCKINA SANDSTONE: Fine Grained Light Grey QUARTZ SAND + very minor very fine grained coal fragments + minor fine grained coal fragments + minor mica + 5% medium-coarse grained fragments of black sooty coal + minor muscovite	70 m					
	+ minor soft brown-black crumbly coal						
	+ 5-10% pyrite	80 m					
	+ Medium Grey Shaly Siltstone						
	MT. TOONDINA FORMATION: Medium Grey Crumbly SHALY SILTSTONE - very little sample	90 m					
	Dark Grey Graphitic Crumbly SHALY SILTSTONE	100 m					
	+ minor pyrite						
	+ muscovite						
	+ muscovite + minor very fine grained fragment of coal						
		110 m					

DRILL TYPE: Schramm — DATE DRILLED: 16th MAY 1975

DRILLER: BILSTON — LOGGED: B.J.V.

SCALE 1:500 — DRG No. AS 5619

PROJECT: ARKARINGA BASIN — AUSTRALIAN SELECTION (PTY) LTD — HOLE Nº MU-9

LOG OF PERCUSSION DRILL HOLE

PROSPECT: MURLOOCOPPIE COAL — R.L. COLLAR: .....

LOCATION: ..... CO-ORDS: WARRINA 1:250,000 3257 4210 — 070 — INCLINATION: 90° — DIRECTION: —

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
	Buff Dust + Gypsum						
	Buff + Yellow Medium Grained Weathered Clayey SANDSTONE						
	becoming less weathered & less clayey	10 m					
	As Above + minor grey SHALE + pink fine Grained SANDSTONE						
18/5/75	Coarse Grained Transparent, Medium Grained Yellow QUARTZ SAND + minor white FELDSPATHIC SAND						
	As Above + Light Grey SANDY SILTSTONE	20 m					
	Medium + Coarse Grained Transparent QUARTZ SAND + minor FELDSPATHIC SAND – very clean						
	Fine + Medium Grained Transparent QUARTZ + minor white FELDSPATHIC SAND – very clean						
	+ very minor friable black coal	30 m					
	+ 5–7% Friable Black coal						
	As Above + 20% Medium Grey SANDY SILTSTONE + minor black friable coal						
	Fine–Medium Grained Transparent QUARTZ + minor White FELDSPATHIC SAND + 2% black coal						
	+ very minor black coal	40 m					
	+ minor very friable black coal						
	Fine Grained Transparent QUARTZ + minor white FELDSPATHIC SAND + very minor black coal						
	Fine–Medium Grained Transparent QUARTZ + minor white FELDSPATHIC SAND						
	As Above + 15% Black Graphitic Shale						
	Fine Grained Transparent QUARTZ SAND + minor muscovite	50 m					
	+ minor black friable coal						
	Fine–Medium Grained Transparent QUARTZ SAND + minor black friable coal						
	Fine–Medium–Coarse Grained Transparent QUARTZ SAND + Medium–Dark Grey Graphitic SHALE	60 m					5% interstitial pyrite
	Fine–Medium Grained Transparent QUARTZ SAND + Medium–Dark Grey Graphitic SHALE						+ unconformity
	GRANITE – grey. C.g. 40% quartz 30% felds. Rare biotite. (clays due to weathering						
	BOTTOM OF HOLE 65m.	70 m					
		80 m					
		90 m					
		100 m					
		110 m					

ESTIMATED WATER FLOW 8 pogph. >5000 ppm

CADNA-OWIE FORMATION

PROT ALGEBUCHINA SANDSTONE

DRILL TYPE: Schramm — DATE DRILLED: 17th MAY 1975

DRILLER: BILSTON — LOGGED: B.J.U.

SCALE 1:500 — DRG Nº AS 5000

PROJECT: ARKARINGA BASIN — AUSTRALIAN SELECTION (PTY) LTD

LOG OF PERCUSSION DRILL HOLE

HOLE Nº MU-10

PROSPECT: MURLOOCOPPIE COAL

RL COLLAR: 071

INCLINATION: 90°

LOCATION: ..... CO-ORDS: WARRINA SHEET 1:250,000 3124 4252

DIRECTION: —

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
BULLDOG SHALE	Dark Grey – Black Fissile SHALE + Gypsum						
CADNA-OWIE FORMATION ≈ 5,000 gph. >5,000ppm	Mid-Grey SANDY-SILTSTONE with Carbonaceous Matrix	10 m					
	Medium – Coarse Grained Clean Transparent QUARTZ SAND + very minor pyrite + coal						
	Medium – Fine Grained Clean – Transparent QUARTZ SAND + Buff Clay	20 m					
	Medium Grained Clean Transparent QUARTZ + White FELDSPATHIC SAND						
	Coarse + Medium Grained Very Clean Transparent QUARTZ + White FELDSPATHIC SAND	30 m					
	Medium – Fine Very Clean Transparent QUARTZ + White FELDSPATHIC SAND	40 m					
	Coarse + Medium Grained Transparent QUARTZ + White FELDSPATHIC SAND – very clean	50 m					
		60 m					
MT. TOONDINA FORMATION ≈ 7,000 gph. >5,000 gph.	As Above + Dark Grey – Black Shale Fragments						
	Equal Quantities of Medium – Coarse Grained SAND as above + Dark Grey Crumbly Shale + Clay						
	Dark Grey – Black SHALE + Clay with Sand Contamination? from above	70 m					
	Medium Grey Weathered SHALE + CLAY becoming medium-light grey						
	As Above + Medium Grained Transparent Clean QUARTZ SAND – contamination?						
	Medium Grey SHALE + minor Clean transparent QUARTZ SAND	80 m					
	Medium – Dark Grey SHALE + Clay + Minor Medium Grained Transparent Clean Sand – (Contamination?)						
	Shale + Clay as above + equal quantities of Fine – Medium Grained QUARTZ SAND						
	Medium – Light Grey SHALE + CLAY + Equal quantities of Fine – Medium Grained Transparent QUARTZ SAND	90 m					
	Increasing quantity of sand						
	Medium Grey Fissile SHALE + Medium Grained Transparent QUARTZ SAND (contamination?)	100 m					
	Medium Grey Fissile SHALE						
		110 m					
	Dark Grey – Black Carbonaceous Fissile SHALY SILTSTONE						

BOTTOM OF HOLE 117m

DRILL TYPE: Schramm

DATE DRILLED: 18th MAY 1975

DRILLER: BILSTON

LOGGED: B.J.U.

SCALE 1:500

DRG Nº AS 5621

AUSTRALIAN SELECTION (PTY) LTD

LOG OF PERCUSSION DRILL HOLE

HOLE Nº MU-11

PROJECT: ARKARINGA BASIN

PROSPECT: MURLOOCOPPIE COAL

LOCATION: .....

WARRINA 1:250,000 072

CO-ORDS: 314/ 414/

R.L. COLLAR: .....

INCLINATION: 90°

DIRECTION: —

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
	BULLDOG SHALE: Buff Weathered Fissile SHALE	10 m					
	BULLDOG SHALE: Dark Grey - Black SILTSTONE						
WATER TABLE >100ft below surface	ALGEBUCKINA SANDSTONE — CADNA-OWIE FORMATION: Fine Grained Transparent QUARTZ SAND + minor above; Medium Grained Transparent QUARTZ + minor FELDSPATHIC SAND	20 m					
	As Above but coarse grained						
	Medium Grained Transparent QUARTZ + minor white FELDSPATHIC SAND; +Buff Clay	30 m		<5	35	55	Pb 65
	Medium - Coarse Grained Transparent QUARTZ + minor FELDSPATHIC SAND; +minor black flint						
	Fine - Medium Grained Transparent QUARTZ + minor white FELDSPATHIC SAND; +buff Clay; +scoriaceous rhyolitic tuff?	40 m					
	Medium - Coarse Grained Transparent QUARTZ SAND						
	Fine Grained Transparent QUARTZ SAND + minor shale (contamination)						
	Medium Grained Transparent QUARTZ SAND						
	Coarse Grained Transparent QUARTZ + minor FELDSPATHIC SAND						
	Medium - Fine Grained Above	50 m					
	Fine Grained Above						
	Fine - Medium Grained Transparent QUARTZ + minor FELDSPATHIC SAND						
	Medium - Coarse Grained transparent QUARTZ + minor white FELDSPATHIC SAND; +minor mica	60 m					
	Fine Grained Above						
	As Above + Dark Grey SHALE + minor pyrite						
FLOW @ 3,000 g.p.h. >5,000 p.p.m.	MT. TOONDINA FORMATION: Dark Grey Weathered Greasy SHALE	70 m					
	Light Grey-Green, Fissile, Fresh SHALE	80 m					
		90 m					
		100 m					
		110 m					

BOTTOM OF HOLE 117m.

DRILL TYPE: Schramm

DRILLER: P. BILSTON

DATE DRILLED: 19th May 1975

LOGGED: B.J.U.

SCALE 1:500

DRG Nº AS 5622

PROJECT: ARKARINGA BASIN — AUSTRALIAN SELECTION (PTY) LTD

LOG OF PERCUSSION DRILL HOLE

HOLE Nº MU-12

PROSPECT: MURLOOCOPPIE COAL

R.L. COLLAR: .....

LOCATION: ..... CO-ORDS: MURLOOCOPPIE 1:250,000. 2715 . 4394

073 INCLINATION: 90°

DIRECTION: —

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
	Brown Soil + Rubble						
	Medium Grey weathered SHALE + Gypsum + White Aphanitic Quartzite						
	Dark Grey Blocky Shale + Gypsum	10 m					
	Dark Grey – Black fresh Fissile SHALE Becoming SILTY SHALE	20 m, 30 m					
	Fine – Medium Grained Transparent QUARTZ SAND + Grey Shale (contamination? from above)	40 m					
	Medium + Coarse Grained Transparent + Translucent Quartz SAND						+ Very minor black earthy coal.
	Medium Grained Transparent QUARTZ + White FELDSPATHIC SAND	50 m					+ Shale (contamination?)
	Fine Grained Transparent + Translucent QUARTZ + minor White FELDSPATHIC SAND + muscovite + muscovite	60 m					
	Medium – Coarse Grained Transparent + Translucent Quartz + minor White FELDSPATHIC SAND + minor MUSCOVITE	70 m					
	As Above Fine – Medium Grained	80 m					
	Medium – Coarse Grained Transparent + Translucent Quartz + minor Feldspathic SAND.						
	Fine Grained Transparent QUARTZ SAND + White Clay + minor Framboidal Pyrite Becoming very fine grained	90 m					
	Medium – Coarse Grained Very Clean Transparent QUARTZ SAND + considerable contamination						
	As Above + Dark Grey Fissile SHALY SILTSTONE	100 m					
	Dark Grey Fissile SHALY-SILTSTONE						
	As Above + Fine Grained QUARTZ SAND + minor Quartz SAND + equal quantities of SAND + SHALE	110 m					

TOP OF HOLE CAVED IN SO NO MEASUREMENT OF STATIC WATER TABLE MADE

BULLDOG SHALE

CADNA-OWIE FORMATION — 3,800 ppm — 4000 ppm

ALGEBUCKINA SANDSTONE — 3800 ppm

MT TOONDINA FORMATION — FLOW @ 3-4,000 gph.

DRILL TYPE: Schramm

DATE DRILLED: 20th MAY 1975

DRILLER: BILSTON

LOGGED: B.J.U.

SCALE 1:500

DRG Nº AS 5623.

AUSTRALIAN SELECTION (PTY) LTD

PROJECT: ARKARINGA BASIN — LOG OF PERCUSSION DRILL HOLE — HOLE Nº MU-12

PROSPECT: MURLOOCOPPIE COAL — MURLOOCOPPIE 1:250,000 074 — R.L. COLLAR:

LOCATION: — CO-ORDS: 2715 4394 — INCLINATION: 90° — DIRECTION: —

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
Flow 5,000 gpl 3800 ppm	MT. TOONDINA FORMATION: Dark Grey Fissile SHALY-SILTSTONE + minor Fine Grained QUARTZ SAND (contamination)	120m					
	MT. TOONDINA FORMATION: Dark Grey Fissile SHALY-SILTSTONE						
	BOTTOM OF HOLE 128m	130m					
		140m					
		150m					
		160m					
		170m					
		180m					
		190m					
		200m					
		210m					
		220m					
		230m					

DRILL TYPE: Schramm — DATE DRILLED: 20th MAY 1975

DRILLER: BILSTON — LOGGED: B.J.U.

SCALE 1:500 — DRG Nº AS 5604

PROJECT: ARKARINGA BASIN — AUSTRALIAN SELECTION (PTY) LTD — HOLE Nº MU-13

LOG OF PERCUSSION DRILL HOLE

PROSPECT: MURLOOCOPPIE COAL — R.L. COLLAR: .....

075 — INCLINATION: 90°

LOCATION: ..... — MURLOOCOPPIE 1:250,000 CO-ORDS: 2809 4402 — DIRECTION: —

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
	BULLOO SHALE						
	Buff Soil + Gypsum						
	Light Brown – Buff Blocky SHALE						
	Dark Grey Blocky SHALE						
	Becoming Fresher + More Fissile	10 m					
	Bluey-Steel Grey Fissile Shaly-SILTSTONE + Thin Bed of white Aphanitic Quartzite	20 m					
	CADNA-OWIE FORMATION						
	Medium – Coarse Grained Transparent QUARTZ + minor FELDSPATHIC SAND + minor shale contamination from above + very minor porphyritic SCORIACEOUS rhyolite tuff	30 m					
	As Above – considerable Black Resinous Woody Crumbly Coal						
	As Above + Light Grey SANDY SILTSTONE						
	As Above + Mid – Dark Grey Blue Grey SHALE						
	Medium – Coarse Transparent QUARTZ + White FELDSPATHIC SAND + very minor MUSCOVITE	40 m					
	+ minor MUSCOVITE	50 m					180 ft of casing lowered for pastoral bore.
	1-2m Black Crumbly Woody Weak Coal						
	1m Black Woody Coal	60 m					
	+ Black Dull Woody Blocky Crumbly Weak COAL						
	ALGEBUCKINA SANDSTONE ?	70 m					
	Medium – Coarse Transparent Quartz + White FELDSPATHIC SAND with Buff Clay						
	Coarse Grained Transparent QUARTZ + White FELDSPATHIC SAND						
	As Above – medium grained						
	Medium – Coarse Grained Transparent QUARTZ + minor FELDSPATHIC SAND.	80 m					
	Coarse Grained Transparent QUARTZ + Minor FELDSPATHIC SAND						
	As Above – Med – Fine – Coarse Grained						
	Medium – Coarse Grained Transparent QUARTZ + FELDSPATHIC SAND + Dull Weak Woody Coal	90 m					
	Medium – Coarse Grained Transparent QUARTZ + FELDSPATHIC SAND.						
	MT TOONINA						
	Light Grey Fissile SHALY SILTSTONE + Medium – Coarse Grained Transparent Quartz + Feldspathic SAND.	100 m					
		110 m					

Flows ≈ 6,000 gph 5,000 ppm

DRILL TYPE: Schramm — DATE DRILLED: 21ST MAY 1975

DRILLER: D. BILSTON — LOGGED: BJU

SCALE 1:500 — DRG Nº AS 5605

PROJECT: ARKARINGA BASIN — AUSTRALIAN SELECTION (PTY) LTD — HOLE Nº MU-14

LOG OF PERCUSSION DRILL HOLE

PROSPECT: MURLOOCOPPIE COAL — MURLOOCOPPIE 1:250,000 — 076 — R.L. COLLAR: — INCLINATION: 90°

LOCATION: — CO-ORDS: 2827 4277 As FOR MU-1 — DIRECTION: —

WATER CUT	DESCRIPTION	DEPTH METRES	LOG	GEOCHEM (ppm)	GEOCHEM Cu (ppm)	GEOCHEM Zn (ppm)	REMARKS
	BULDOG SHALE: Brown Grey Weathered SHALE + Calcareous Fossil Fragments						
	BULDOG SHALE: Steel-Grey-Brown Weathered SHALE						
	BULDOG SHALE: Dark Blue-Grey Silty SHALE						
	CADNA-OWIE FORMATION: Medium Grained Transparent QUARTZ + minor White Feldspathic SAND + minor above	10 m					
	CADNA-OWIE FORMATION: As Above but Fine Grained						
	CADNA-OWIE FORMATION: Fine-Medium Grained Transparent Quartz + minor White Feldspathic SAND + minor muscovite						
	CADNA-OWIE FORMATION: Medium + Coarse Grained Transparent QUARTZ - White Feldspathic SAND + grey minor SHALY SILTSTONE + very minor muscovite	20 m					
	CADNA-OWIE FORMATION: Fine Grained White Quartz SAND + Light Grey Clay	30 m					
	CADNA-OWIE FORMATION: Medium-Coarse Grained Transparent + White QUARTZ + White Feldspathic SAND + White Clay						
	CADNA-OWIE FORMATION: Medium-Coarse Grained Transparent + White QUARTZ + White Feldspathic SAND Very clean Becoming fine-medium-coarse grained	40 m					
	CADNA-OWIE FORMATION: As Above + Medium Grey Shaly Siltstone						
	CADNA-OWIE FORMATION: As Above - predominantly Shaly-Siltstone	50 m					
	CADNA-OWIE FORMATION: Coarse-Fine Grained Transparent + White QUARTZ SAND - Very Clean						
	CADNA-OWIE FORMATION: As Above + Very minor green-grey TUFFACEOUS						
	CADNA-OWIE FORMATION: Medium-Fine Grained QUARTZ SAND + White Clay						
	CADNA-OWIE FORMATION: Fine Grained QUARTZ SAND	60 m					
	CADNA-OWIE FORMATION: Fine-Medium Grained Transparent Quartz + minor White Feldspathic SAND.						
	CADNA-OWIE FORMATION: As Above + equal quantities of mid grey SHALY SILTSTONE	70 m					
	CADNA-OWIE FORMATION: Fine Grained Transparent QUARTZ SAND						
	ALGEBUCKINA SANDSTONE: Very Fine Grained Transparent QUARTZ SAND + Light Brown Clay						
	ALGEBUCKINA SANDSTONE: As Above + Light Grey Fissile Shale + brown clay + extremely minor flakes of carbon	80 m					
	ALGEBUCKINA SANDSTONE: Grey Shaly Siltstone + very fine grained Transparent QUARTZ SAND.						
Flows at Bottom of Hole @ 5-6,000 gph	MT TOONDINA FORMATION: Light Grey Fissile SHALE + Brown Clay + minor Fine Grained SAND	90 m					
	MT TOONDINA FORMATION: Light Grey Fissile SHALE + Brown Clay + Calcareous Fossil Fragments.	100 m					
	FOR WATER INFORMATION SEE MU-1	110 m					

DRILL TYPE: Schramm — DATE DRILLED: 23/5/75

DRILLER: D. BILSTON — LOGGED: B.J.U.

SCALE 1:500 — DRG Nº AS 5626

APPENDIX II

PETROGRAPHIC ANALYSIS OF COAL SAMPLES FROM MU-2 AND MU-13

APPENDIX 11.

ROBERTSON RESEARCH (AUSTRALIA) PTY. LIMITED

MEMORANDUM NO. 793

PROJECT NO. 756/9714/6A/6C

RESULTS OF PETROGRAPHIC ANALYSIS AND PHYSICAL AND CHEMICAL ANALYSIS OF FOUR PERCUSSION DRILL HOLE SAMPLES SUBMITTED BY AUSTRALIAN SELECTION (PTY.) LIMITED

1. INTRODUCTION:

Four percussion drill hole samples were submitted to Robertson Research (Australia) Pty. Limited by Australian Selection (Pty.) Limited for coal petrographic analysis. The four percussion drill hole samples are from the Murloocoppie area; they are as follows:-

(1) Sample A462811; borehole MU-2 (84-86 metres)
(2) Sample A636341; borehole MU-13 (32-34 metres)
(3) Sample A636342; borehole MU-13 (56-58 metres)
(4) Sample A636343; borehole MU-13 (59-60 metres)

As a result of discussions between the client and Mr. R.C. Driver (Senior Coal Geologist, Robertson Research (Australia) Pty. Limited), the following work was carried out on the four samples.

(1) Petrographic analysis, involving the determination of mean maximum reflectance in oil ($\bar{R}_o$ max. %) of vitrinite and maceral analysis.

(2) Preparation of a 1.50 S.G. float fraction for each sample.

(3) Proximate analysis and determination of total sulphur content and calorific value for the 1.50 S.G. float fraction of sample A636343.

2. RESULTS OF THE PETROGRAPHIC ANALYSIS OF THE COAL SAMPLES:

A polished particulate coal mount was prepared from a representative portion of each of the coal samples.

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TABLE I: RESULTS OF PETROGRAPHIC ANALYSIS OF THE COAL SAMPLES

MACERAL	A462811	A636341	A636342	A636343
Vitrinite Resinous Vitrinite	64.2% 10.5%	The coal consists almost entirely of vitrinite, principally in the form of the huminite macerals humotelinite and humocollinite.		
Total Vitrinite	74.7%			
Sporinite Resinite Cutinite	10.2% 1.3% trace	Trace to very minor amounts	Trace to very minor amounts	
Total Exinite	11.5%	Very minor amounts	Trace to very minor amounts	
Fusinite Semifusinite High-Reflectance Macrinite High-Reflectance Inertodetrinite Low-Reflectance Macrinite Low-Reflectance Inertodetrinite Fine (Granular) Micrinite	0.2% 5.2% 0.8% 1.0% 1.0% 2.0% 0.7%	Inertinite macerals were not observed in coal samples A636341, A636342 and A636343.		
Total Inertinite	10.9%			
Quartz Carbonate Clay Minerals Sulphide	0.2% - 2.5% 0.2%	Minor amounts, Trace to very minor amounts	Trace to very minor amounts of limonite after iron oxide.	Very minor amounts.
Total Mineral Matter	2.9%	Minor amounts	Trace to very minor amounts	Very minor amounts.
Large Inertinite Macerals Small Inertinite Macerals High-Reflectance Inertinite Low-Reflectance Inertinite	5.4% 5.5% 2.0% 8.9%			
(Vitrinite + Exinite)% (m.m.f.)	88.8%	100%	100%	100%
REFLECTANCE DATA				
$\bar{R}_o$ Max.% Vitrinite	0.39%	0.35%	0.32%	$\bar{R}_o$Max.% of vitrinite in A636343 very similar to that of vitrinite in A636342
Range of R_o Max% values	0.35-0.43%	0.32-0.41%	0.30-0.35%	

A few oval, cellular, inertinite bodies, resembling sclerotia (fungal resting spores), are present in the coal. The absence of well-defined polygonal cell structure, combined with the distinctly vesicular nature of these bodies, and the presence of thick massive margins with cracks ("kerfs") suggest that these bodies are fusinized resin bodies and, therefore, not of fungal origin.

The principal mineral matter component is a very fine-grained brownish clay mineral which occurs as fine lenses and partings in the sporinite-rich microlithotypes, i.e. clarite (E), clarite (V) and sporinite-rich duroclarite. Traces of quartz and pyrite are also present in the coal.

In terms of microlithotypes (maceral associations) the coal appears to consist primarily of vitrite, clarite (V), clarite (E) and duroclarite. Semifusite, clarodurite and vitrinertite (V) constitute subordinate microlithotypes in the coal. Traces of liptite, in the form of sporite and resinite, and durite (E) are observed in the coal.

B. SAMPLE A636341:

In polished particulate coal mount the sample is observed to consist almost entirely of vitrinite. The vitrinite is present as the huminite macerals humotelinite (texto-ulminite and eu-ulminite) and humocollinite (bank gelinite and gelinite cell-infilling material). The partially-gelified, texto-ulminite exhibits clear botanical structures, including delicate structures on the cell walls.

Some of the vitrinite cell lumens are infilled with yellowish-orange to reddish-brown resin which typically contains occlusions of bright yellow, gas bubbles. There is some evidence of suberinization (resin impregnation) of the vitrinite. Traces of sporinite are present.

The mineral matter component consists essentially of fine-grained, brownish clay mineral. Disseminated, fine-grained, framboidal pyrite and limonite after sulphide are present in trace to very minor amounts.

C. SAMPLE A636342:

In polished particulate coal mount the sample is observed to consist almost entirely of vitrinite similar to that observed in sample A636341. Some of the vitrinite cell lumens are infilled with resin.

Trace to very minor amounts of limonite are present in the coal as a replacement of iron oxide.

D. SAMPLE A636343:

In polished particulate coal mount the sample is observed to consist almost entirely of vitrinite similar to that observed in samples A636341 and A636343.

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Some of the vitrinite cell lumens are infilled with gelinite (pseudo-phlobaphenite) or porous, in part suberinized, gelinite. Some of the gelinitic infilling material has a higher reflectance than the surrounding humotelinite. It is possible that this gelinitic material is derived from tanin-like substances (phlobaphenite?)

Very minor amounts of disseminated, fine-grained, framboidal pyrite are present in the coal; a few euhedral/subhedral cubic pyrite grains are also observed to be present in the coal.

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In all four coal samples the huminite macerals exhibits shrinkage cracks ("gel" fissures) which are characteristic of vitrinite in low rank coals.

The petrographic composition of the four coal samples, as represented by the polished particulate coal mounts, indicates that they are probably not of Permian age.

The high content of reactive macerals, (vitrinite + exinite)% (m.m.f.) in sample A462811, in particular the high content of exinite, suggests a Mesozoic or Tertiary age. The high content of sporinite and absence of characteristic forms of sclerotinite (fungal remains), i.e. sclerotia (fungal resting spores) and teleutospores (fungal propagation spores), is, perhaps, indicative of a Mesozoic rather than a Tertiary coal. The latter typically contain characteristic forms of sclerotinite and resinite and suberinite usually constitute the principal exinite maceral components.

Reference to *Cook (1975), indicates that Cretaceous coals from Queensland and West Australian sedimentary basins tend to be rich in inertinite and tend to contain a low proportion of exinite. Judging from the summary of petrographic features of Mesozoic coals presented by Cook (ibid); sample A462811 resembles the vitrinite-rich Triassic coals of the Ipswish District or the Jurassic Walloon coals.

Samples A636341, A636342 and A636343 could be Mesozoic or Tertiary in age since there are no diagnostic features present in these coals to assist in assessing their age.

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Extrapolation of data presented by **Bennett and Taylor (1970) permit the prediction of the following tentative values for physical and chemical properties of the four coal samples, based on the petrographic parameters, vitrinite reflectance (R_o Max. %) and reactive maceral content (vitrinite + exinite % on a mineral matter free basis).

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*A.C. Cook (1975) "Thespatial and temporal variation of the type and rank of Australian coals", Paper IV, Australian Black Coal Symposium, A.I.M.M. Wollongong, 1975.

**A.J.R. Bennett and G.H. Taylor (1970) "A petrographic basis for classifying Australian coals". Proc. Aust.I.M.M. 233, 1 - 5.

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Sample Number	Values Predicted on the basis of petrographic parameters		
	Volatile Matter % (d.m.m.f.)	Calorific Value (Btu/lb) (d.m.m.f.)	Crucible Swelling Index
A462811	55%	12,500 -12,600	0 - ½
A636341 A636342 A636343	55 - 56%	12,400	½ - 1 (?)

The predictions refer to normal coals. For perhydrous coals, i.e. coals rich in exinite macerals and/or resinous vitrinite, the predicted values are likely to be somewhat lower than the measured values.

3. PHYSICAL AND CHEMICAL ANALYSIS OF THE COAL SAMPLES:

A representative portion of each of the coal samples was split out and crushed to -1"/+½". The crushed coal was placed in a perchloroethylene/white spirit mixture of 1.50 specific gravity and a 1.50 S.G. float fraction and a 1.50 S.G. sink fraction obtained. The proportions of "floats" and "sinks" at 1.50 specific gravity for each of the coal samples are presented in table II.

TABLE II: PROPORTION OF "FLOATS" AND "SINKS" AT 1.50 SPECIFIC GRAVITY:

Sample Number	Borehole	Depth	1.50 S.G. Float Fraction	1.50 S.G. Sink Fraction
A462811	MU - 2	84-86m	96.1%	3.9%
A636341	MU -13	32-34m	90.1%	9.9%
A636342	MU -13	56-58m	96.0%	4.0%
A636343	MU -13	59-60m	98.0%	2.0%

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The results presented in table II indicate that the coal samples possess a relatively low ash content.

The results of the proximate analysis and determination of total sulphur content and calorific value for sample A636343 are presented in table III.

Table IV summarizes the classification of the coal according to various systems of classification; Mott's classification yields the most useful form of classification for this rank of coal.

4. GENERAL COMMENTS:

On the basis of their low-rank, none of the four coal samples appear to represent coal that would be of any application in the direct manufacture of coke. However, it is possible that the coal samples could represent coal which may find application as a thermal coal (steam-raising coal) or as a raw material for conversion to liquid or gaseous hydrocarbon products.

Further testwork will be necessary in order to ascertain whether the coal in the Murloocoppie area is likely to be suitable for either of the abovementioned applications. It should be noted that this testwork will need to be carried out on fresh borehole samples, as solid core material, and will involve some sophisticated and, hence, relatively expensive forms of analysis.

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TABLE III: RESULTS OF PHYSICAL AND CHEMICAL ANALYSIS OF SAMPLE A636343

ANALYSIS	RESULTS OF ANALYSIS EXPRESSED IN TERMS OF VARIOUS BASES:			
(1) PROXIMATE ANALYSIS	AIR DRIED BASIS:	DRY BASIS:	DRY ASH-FREE	DRY MINERAL MATTER FREE BASIS:
Moisture	45.1%	-	-	-
Ash	5.9%	10.8%	-	-
Volatile Matter	26.8%	48.8%	54.7%	54.6%
Fixed Carbon	22.2%	40.4%	45.3%	45.4%
(2) TOTAL SULPHUR CONTENT:	0.79%	1.44%	-	-
Fuel Ratio	$\frac{\text{Fixed Carbon \%}}{\text{Volatile Matter \%}} = 0.83$			

(3) CALORIFIC VALUE:	AIR DRIED BASIS	DRY BASIS	MOIST, ASH FREE BASIS	MOIST MINERAL MATTER FREE BASIS	DRY, ASH-FREE BASIS	DRY, MINERAL MATTER FREE BASIS
Btu/lb	6,170	11,239	6,557	6,629	12,592	12,862
K.Cal.	3,428	6,244	3,643	3,683	6,996	7,146
MJ/Kgm	14.4	26.2	15.3	15.5	29.4	30.0

TABLE IV: CLASSIFICATION OF COAL SPECIMEN

SYSTEM	PARAMETERS	CLASSIFICATION
International Classification of Hard Coals by type.	CV (m.a.f.) 6,557 Btu/lb. VM (d.a.f.) 54.7%	CV (m.a.f.) is less than 10,260 Btu/lb; therefore, coal is classified as a Soft Coal.
International Classification of Soft Coals	Total Moisture (a.f.) *47.9% Tar Yield (d.a.f.) n.d.	Class 13 - 14 Group -
N.C.B. Classification	VM (d.m.m.f.) 54.6% Gray-King Coke Type #A	Non-coking, High-volatile Coal. Class 902.
A.S.T.M. Classification	Fixed Carbon (d.m.m.f.) 45.4% VM (d.m.m.f.) 54.6% CV (m.m.m.f.) 6,629 Btu/lb.	Lignite IV. 1
Mott's Classification	CV (d.m.m.f.) 12,862 Btu/lb. VM (d.m.m.f.) 54.6%	Perhydrous Lignite B.1
Fuel Ratio Classification (A.S. No. P.S. 3 - 1929)	Fuel Ratio 0.83 Moisture (a.d.) 45.1% Ash Content (d.b.) 10.8%	Lignite/Brown Coal E.13 (c)
Classification for Australian Hard Coal (A.S. K184 - 1969)	CV (m.a.f.) 6,557 Btu/lb. CV (d.a.f.) 11,239 Btu/lb.	CV (m.a.f.) less than 10,260 Btu/lb., i.e. CV (d.a.f.) less than 11,650 Btu/lb.; therefore, coal is classified as a Soft Coal.

CV = Calorific Value
VM = Volatile Matter
a.d. = air dried basis; d.b. = dry basis; a.f. = ash-free basis;
m.a.f. = moist, ash-free basis, d.a.f. = dry ash-free basis;
m.m.m.f. = moist, mineral-matter-free basis;
d.m.m.f. = dry, mineral-matter-free basis
n.d. = no data available

*This values is the air dried moisture figure on an ash-free basis; the as-mined moisture value (ash-free) is probably in excess of this figure.

#The coal is assumed to be non-caking.

APPENDIX III

EXPENDITURE REPORT

MURLOOCOPPIE COAL E.L. 184

FINANCIAL REPORT

Total Expenditure is as follows

Geological Survey	Salaries - Field	5,688	
	Salaries - Drafting	540	
	Maps & Aerial Photos	102	
	Sample Bags	220	
	Plan Reproduction	118	
	External Consulting	606	
	External Assaying	683	7,957.00
Logistics	Field Support	3,703	
	Transport	2,101	
	Equipment Repairs	54	
	Mines Dept. Rental	895	6,753.00
Drilling	Percussion Drilling	9,206	9,206.00
Depreciation	Drill Equipment	776	
	Exploration Equipment Including Vehicles and Office	358	1,134.00
Administration Costs - Port Augusta			
	Salaries	670	
	Office Maintenance (Includes power, phone etc.)	304	974.00
Other Costs	We maintain an Office at 32 Main Street, Port Augusta as a base for operations within South Australia. Most of our administration costs are generated in Kalgoorlie and Perth. We therefore make application to have these costs included and deemed applicable.		2,387.00
	Total Expenditure		$28,411.00

P. R. GRAHAM
OFFICE MANAGER