SOUTH AUSTRALIA

DEPARTMENT OF MINES AND ENERGY

OPEN FILE ENVELOPE NO. 3377

EL 417, WIRRABARA

PROGRESS AND FINAL REPORTS FOR THE PERIOD
5/9/78 to 4/6/80

Submitted by

CRA Exploration Pty Ltd

1980

ENVELOPE 3377

TENEMENT: EL 417, Wirrabara

TENEMENT HOLDER: CRA Exploration Pty Ltd

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C.R.A. EXPLORATION PTY. LIMITED

FIRST QUARTERLY REPORT, WIRRABARA E.L. 417, SOUTH AUSTRALIA, FOR THE PERIOD 5 SEP 78 TO 4 DEC 78

AUTHOR: A.G. CONNOR

SUBMITTED TO: G.D. KLINGNER

COPIES TO: SOUTH AUSTRALIAN DEPARTMENT OF MINES

DATE: DECEMBER, 1978

C.R.A. EXPLORATION PTY. LIMITED
(INC. IN N.S.W.)
95 COLLINS STREET, MELBOURNE, AUSTRALIA 3001

P.O. BOX 384D
TELEPHONE: 63 0491
TELEGRAMS: "CONRIO"
TELEX AA 30108

13 S W1

23rd January 1979

The Director of Mines,
P.O. Box 151,
EASTWOOD S.A. 5063.

Dear Sir,

EL 417 - WIRRABARA, SOUTH AUSTRALIA
REPORT FOR THE QUARTER ENDED 4TH DECEMBER 1978.

Enclosed is a report by A.G. Connor entitled, "First Quarterly Report, Wirrabara EL 417, South Australia, for the period 5th September 1978 to 4th December 1978".

Results to date are weakly encouraging.

Expenditure for the period ended 30th November 1978, the nearest accounting period, amounted to $8878 comprising:-

Salaries	..	$2774
Wages	..	173
General Supplies	..	947
Vehicles	..	557
Travel & Accommodation	..	352
Contractors	..	1875
Assaying	..	231
General Overheads	..	1969
		$8878

Yours faithfully,

For : J. Collier
General Manager

Enc.

CONTENTS PAGE

1. SUMMARY

The first titleholders in the area, Westchester Mining Corporation, carried out an airborne magnetic, E.M. and radiometric survey during 1970-1972 which delineated several anomalies. These anomalies were the target of all subsequent explorers, but no detailed ground examination was undertaken prior to 1976. M.S. Locke used the airborne geophysical results as the basis for a B.Sc. Hons thesis in 1976 and located an open ended I.P.-resistivity anomaly during ground follow-up of airborne anomalies near the Charlton copper mine. On the basis of this anomaly, C.R.A. Exploration applied for the area and was granted Wirrabara E.L. 417 in September 1978.

During the first quarter, C.R.A. Exploration carried out a small I.P.-resistivity survey which located a conductor. The conductor is parallel to strike, and may be related to carbonaceous shale and sulphide in the Tapley Hill Formation. Earlier explorers have described the mineralisation as discordant. A shallow percussion drillhole is recommended to test the I.P. anomaly and the style of any mineralisation present. The search for kimberlitic rocks will continue.

2. CONCLUSIONS AND RECOMMENDATIONS

The I.P. resistivity survey carried out by C.R.A. Exploration near the Charlton copper mine located a poorly defined conductor. The conductor is 400 m long parallel to strike and is open on all but the south-west side. The depth to the top of the conductor is 50 m or less. An unsuccessful attempt was made to close the anomaly to the northeast. The wide conductive zone is due in part to graphitic shales of the Tapley Hill Formation but is complicated by the effects of powerlines, fences and buildings. Responses due to sulphide mineralisation are interpreted on Line 1100N below 1000E and on Line 1000N below 1025E. Although this anomaly is parallel to strike (NW), the original Cu mineralisation is described as discordant (NE). Other workers have suggested that the mineralisation is controlled by a small fault trending WNW.

Due to lack of exposure, the style, host rocks and controls of the mineralisation cannot be resolved. The only economically attractive target in this area would be stratiform copper mineralisation in shales of the Tapley Hill Formation which is known to contain subeconomic concentrations of copper in other

areas. It is recommended that one rotary percussion hole be drilled to test the style and grade of any mineralisation associated with the basal Tapley Hill Formation. The drill-hole should be designed to test the I.P.-resistivity anomaly on line 1000N at 50 m vertically beneath 1025E. Additional structural data is required before the drillsite is chosen.

Efforts to locate the kimberlitic rock reported by Cultus Pacific N.L. will continue.

3. INTRODUCTION

C.R.A. Exploration applied for an E.L. to cover the Charlton Copper Mine and its interpreted strike extensions on 29th November, 1977. The aim was to follow up an I.P.-resistivity anomaly associated with copper mineralisation reported by M.S. Locke in his B.Sc. Hons thesis at the University of Adelaide. Wirrabara E.L. 417 of 315 sq. km. was granted to C.R.A. Exploration for one year from the 5th September, 1978 with an expenditure commitment of $20,000. The E.L. is centred on Wirrabara and straddles the Main North Road from Gladstone to Melrose. (see Location Plan). Much of the area is under cultivation and there are State Forestry reserves along the eastern portion of the E.L.

This report details all work carried out by previous explorers and C.R.A. Exploration to the 4th December, 1978.

4. PREVIOUS EXPLORATION

4.1 WESTCHESTER MINING CORPORATION PTY. LTD.

From May 1970 to May 1972, the Wirrabara area was held by Westchester Mining Corporation under S.M.L. 426. Westchester contracted McPhar Geophysics to carry out an airborne geophysical survey of the S.M.L. involving 4800 line km. of flying at 130 m mean terrain clearance and approximately 400 m line spacing. Total field magnetic, dual frequency quadrature electromagnetic, tilt angle and field strenth VLF (KEM) and four channel gamma ray spectrometric data were recorded. The results of this

survey are available on open file in the South Australian Mines Department (Env. 1567). There is no documentation of ground follow-up of any E.M., magnetic or radiometric anomalies.

In Wirrabara E.L. 417, a small aeromagnetic anomaly with a coincident E.M. anomaly was found by Westchester approximately 300 m NNE of the Charlton copper mine. This anomaly is defined by one flight line (64E) and is circular with a diameter of 400 m and amplitude of 100 gammas above background. Two elongate aeromagentic anomalies were located 8 km and 10 km SE of Wirrabara (see Plan SAa 232). No interpretation of the aeromagnetic or E.M. anomalies is reported on open file.

4.2 CULTUS PACIFIC N.L.

Geomanagement Pty. Ltd. under contract to Cultus Pacific N.L. and R.R. Kauglaric carried out reconnaissance exploration of the Wirrabara area under E.L. 49 from March 1973 to March 1974. Their exploration program involved ground examination of the aeromagnetic anomalies found by Westchester Mining Corporation, and brief geological reconnaissance of the Adelaidean sediments of the region. No ground geophysics or geochemistry was done over the anomalies. A sample from a kimberlitic dyke found near Bangor was assayed for Cu and described petrographically but was not followed up.

4.3 M.S. LOCKE

Locke used Westchester Mining Corporation's airborne geophysical data as the basis of his B.Sc. Hons thesis at the University of Adelaide in 1976. Locke carried out a fairly detailed interpretation of all the data with follow-up ground magnetic, I.P. and resistivity surveys of selected anomalies, including the coincident magnetic-E.M. anomaly near the Charlton copper mine. The follow-up survey comprised one line of frequency domain I.P., resistivity and magnetic reading paralleling McPhar's original flight line. A dipole-dipole array with 60 m separations was used and measurements were taken for one to four dipole separations.

The results of this survey show a distinct frequency effect and resistivity anomaly spatially separated from a ground magnetic anomaly of 2000 gammas above background, corresponding to the aeromagnetic anomaly. (see plan SAa 233). Locke attributed the possible cause of the I.P.-resistivity anomaly to copper sulphides at an interpreted depth of 30 m and width of 90 m. The depth to the top of the magnetic body was interpreted as 40 m. The associated airborne E.M. anomaly coincides with a region of low resistivity adjacent to the Rocky River. Locke suggested that pyrrhotite may be the cause of the magnetic - E.M. anomaly.

5. C.R.A. EXPLORATION PROGRAM AND RESULTS

Following the aquisition of M.S. Locke's geophysical data on the area, C.R.A. Exploration decided to carry out a small I.P.-resistivity survey to define the anomaly near the Charlton copper mine and, if warranted, drill one or two percussion holes to test the anomaly at depth.

5.1 GEOLOGY

Wirrabara E.L. covers folded sediments of the Adelaidean Geosyncline belonging to the Burra and Umberatana Groups. Outcrop is poor over much of the E.L. with only the resistant quartzite and glacial units exposed. No geological mapping of the area has been attempted, but some outcrops near the Charlton mine were visited in order to measure strike and dip of strata in the vicinity of the geophysical survey area.

Secondary copper mineralisation occurs at the Charlton copper mine and at a locality 2 km SW of Wirrabara (see plan SAa 232). The Charlton mine closed in 1858 and the only remains are a chimney and some scattered azurite and malachite rubble on the surface. The mine is described as having two lodes of azurite as nodular lumps in rough white decomposed feldspar with minor quartz and mica. The lodes are narrow, dip south-east and strike north-east for about 200 m with no apparent structural control. The grade is unknown (Min. Rev. 95: p 88). There is no outcrop

around the mine and no record of the host lithology to mineralisation. A small section of very weathered and leached siltstone and shale is exposed in a scraping next to the main road approximately 500 m north-east of the old chimney. This may be part of the Tindelpina Shale which is a carbonaceous, pyritic shale member of the lower Tapley Hill Formation, immediately overlying glacial sediments of the Yudnamutana Subgroup. This interpretation is consistent with geology as mapped on the Burra 1:250000 sheet. (See plan SAa 232). The Tindelpina Shale Member is known to host stratabound Cu mineralisation around the Mt. Coffin and Copley diapiric structures on the Copley 1:250000 sheet.

According to the Burra geological map, Charlton mine is associated with a small N.W. trending fault, but this interpretation is inconsistent with the reported strike direction of the lodes. Evidence of ? faulting was found in an old quarry 550 m W of the old chimney where NW trending quartz veins with large rhombohedral voids after carbonate intrude the glacial sediments. Copper mineralisation is commonly associated with quartz-siderite veins throughout the Northern Flinders Ranges.

Consequently, there are three possible controls for the mineralisation at the Charlton Mine:

a) stratabound (stratiform) within the Tindelpina Shale.

b) associated with quartz-carbonate veins and faulting, or

c) a combination of the above.

A half day was spent trying to locate the outcrop of kimberlitic rock reported by Cultus Pacific N.L. Three samples of suspected kimberlitic rocks were shown by petrography to be sediments (see Appendix 1).

5.2 GEOCHEMISTRY

The three samples collected during the search for kimberlitic rocks were sent to the Zinc Corporation Ltd. for analysis by AAS. The petrographic descriptions of these samples are contained in Appendix 1.

Sample No.	Pb	Zn	Cu	Ni	Cr	Mn	Ag	in ppm
615965	13	27	130	61	130	250	1	
615966	15	44	580	110	120	760	1	
615967	13	13	260	53	30	510	1	

5.3 GEOPHYSICS

Solo Geophysics and Co. were contracted to carry out a small I.P.-resistivity survey near the Charlton mine with the aim of locating the I.P.-resistivity anomaly found by Locke in 1976. The survey involved 3000 m of readings on three lines using a dipole-dipole array with 50 m spreads. Readings were taken at one to six dipole separations using a McPhar P660 instrument. The locations of these lines and the pseudosections are contained in Appendix 2.

Interpretation of the pseudosections is complicated by fences and powerlines which traverse the area, and water saturated ground. However, there are some responses due to subsurface conductors which are detailed below.

Line	Primary Anomaly	Secondary Anomaly
1100N	1000 E	1000 - 1200 E
1000N	1025 E	1025 - 1400 E
"Chimney"	775 E	Nil

These anomalies show a poorly defined, open ended linear conductor trending north-west for 400 m. The anomaly is adjacent to old mine workings on line 1000 N which suggests that the anomaly may be due to sulphide mineralisation. The anomalous frequency effects obtained over large distances on lines 1000 N and 1100N may be caused by carbonaceous units within the Tindelpina Shale Member. Carbonaceous shales may be the explanation for Locke's interpreted width of 90 m. The lines were extended eastwards in an unsuccessful attempt to reach background levels.

T. E. Mayer
for A.G. CONNOR

REFERENCES

Department of Mines	1951	Mining Review for the half year ended 31 December, 1951. No. 95, p. 88.
Geomanagement Pty. Ltd.	1974	Final Report E.L. 49. S.A.D.M. Open File Env. 2286.
Locke M.S.	1976	Analysis of F400 Airborne E.M. Data and Ground Investigations in the Booleroo-Laura District of South Australia. Unpublished thesis, University of Adelaide. Department of Economic Geology.
Westchester Mining Corp. Pty. Ltd.	1972	Final Report S.M.L. 426 S.A.D.M. Open File Env. 1567

KEYWORDS

Copper, Adelaidean, geochem-rock, geophys-I.P.

LOCATION

Burra SI 54-5
Orroroo SI 54-1

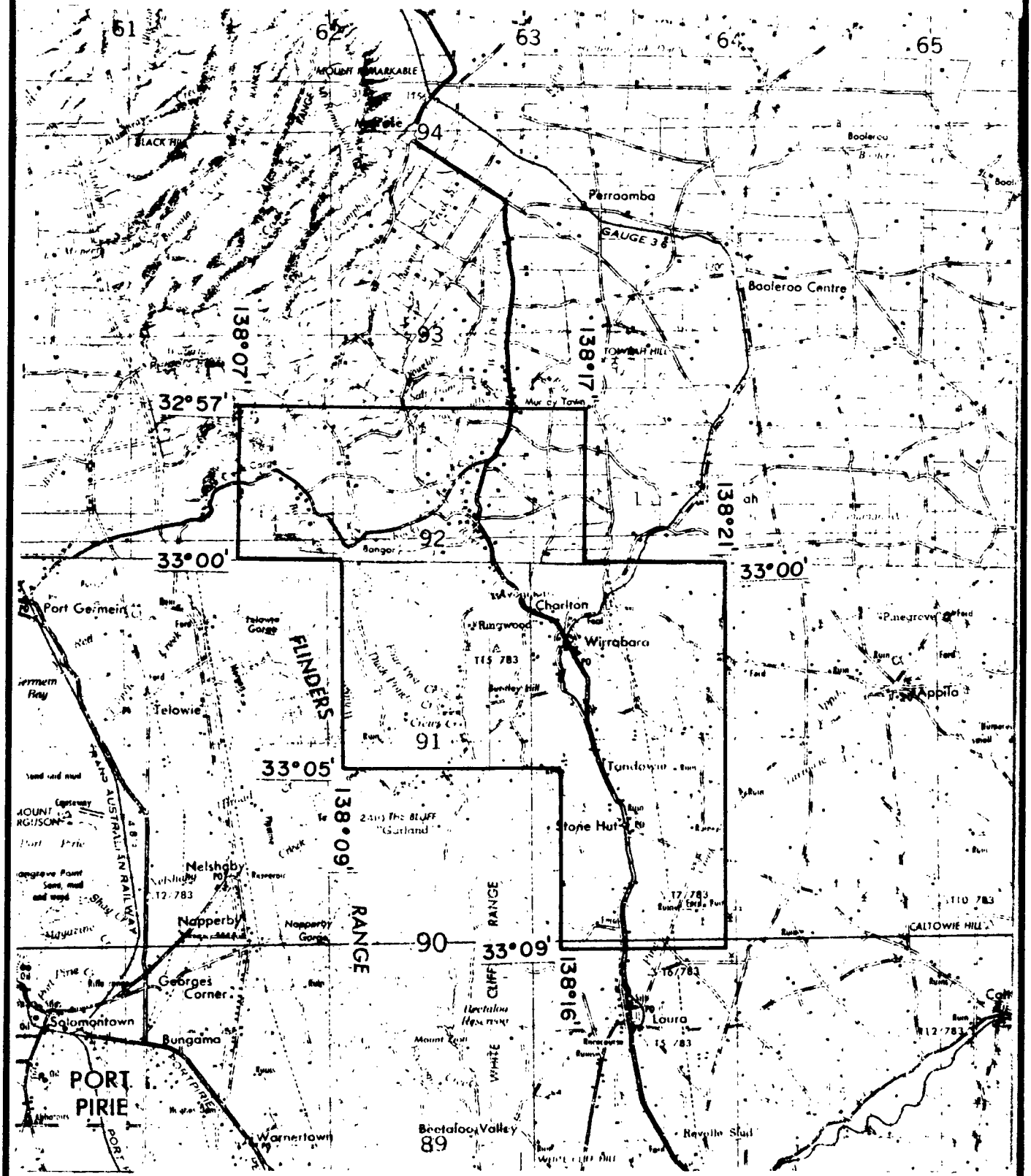
LIST OF PLANS

SAa 135	Location Plan-Wirrabara E.L. 417	1:250,000
SAa 232	Regional Geological Interpretation - Wirrabara E.L. 417	1:250,000
SAa 233	Charlton Copper Mine	1:5000

APPENDICES

APPENDIX 1 Petrographic Descriptions.

APPENDIX 2 Induced Polarization and Resistivity Survey, Wirrabara by Solo Geophysics and Co.



C.R.A. EXPLORATION PTY. LIMITED

LOCATION MAP
WIRRABARA (S.A.) E.L. 417.

SHEET REFERENCES: ORRORO SI 54-1
BURRA SI 54-5

Geologist : A.G.C.	Scale : 1:250,000	Drawn : D.R.W.
Report No: 9454	Date : Nov., 1977	Plan No: SAa 135

INDUCED POLARIZATION AND RESISTIVITY SURVEY

FOR: CRA EXPLORATION PTY.LTD.
AREA: WIRRABARA SOUTH AUST.
E.L. No. ~~359~~ 417
DATE: SEPTEMBER 1978

Sample: 615965; TSC19874

Hand Specimen:

A weathered, pinkish-grey, moderately fine-grained rock which is partly leached and therefore slightly friable. It contains small, dark grey to black flakes which were found to be thin plates of hematite.

Staining with cobaltinitrite shows very minor potash feldspar.

Thin Section:

A visual estimate of the constituents is as follows:

	%
Plagioclase	70-75
Quartz	5-10? (difficult to estimate)
Biotite/chlorite	10-15
Potash feldspar	2- 3
Muscovite	trace
Hematite	1- 3
Tourmaline	trace
Zircon	trace
Apatite	trace
Rutile	trace
Dolomite	trace

The rock is now composed of intergrown feldspar, quartz and biotite with a common grain size of about 0.1 to 0.2 mm and the manner in which at least some of the plagioclase and quartz grains are intergrown suggests that they have not completely recrystallized and some represent detrital grains which now interpenetrate and have become welded. In a few feldspar crystals the outline of a former detrital grain can still be seen defined by a line of very fine-grained opaque material. Some of these detrital feldspar grains were rounded, some were angular. There are also one or two quartz grains with a rounded outlined defined by staining surrounded by an overgrowth of secondary quartz which tends to fill interstices. A few interstices contain turbid, iron oxide-stained clay and it is uncertain whether or not this is original detrital material which has not recrystallized or is a result of weathering.

Biotite flakes 0.2 to 0.5 mm in size are scattered throughout the rock and show a tendency to be subparallel probably to the direction of bedding but some have been deformed and crumpled and most of them show some evidence of alteration to chlorite. Many of the opaque grains (mainly hematite) are also elongate or tabular and about 0.1 to 0.2 mm long and some of these are also orientated in the same direction as the flakes of biotite. There are some irregularly-shaped opaque oxide grains however which show very small overgrowths or protrusions of tiny rutile crystals suggesting that the grains are, or were titaniferous hematite which have partly recrystallized. The general texture and distribution of these opaque oxide grains suggests that they were clastic, detrital grains.

Other heavy mineral grains in this sediment are mainly a few small zircon grains, a few grains of blue and brownish-green tourmaline, a few of rutile and a few of apatite. One crystal of dolomite was found and it is possible that the rock once contained more abundant dolomite which has been leached.

Conclusion:

This is a fine-grained arkose probably originally composed of detrital feldspar, biotite, quartz, minor detrital hematite (some possibly titaniferous)

and a few other heavy mineral grains. Although grains now interpenetrate there has been no extensive recrystallization. It was therefore a very immature sediment.

Sample: 615966; TSC19875

Hand Specimen:
A greenish-grey, moderately fine-grained rock similar in general appearance to sample 615965 but slightly coarser grained and with evidence of more abundant mica.

Staining with cobaltinitrite shows relatively minor potash feldspar.

Thin Section:
A visual estimate of the constituents is as follows:

	%
Biotite/chlorite	50-55
Quartz	20-25
Plagioclase	10-15
Potash feldspar	5-10
Muscovite	2- 3
Hematite	3- 5
Zircon	trace
Tourmaline	trace
Apatite	trace
Garnet?	minute trace
Goethite	trace

This is similar to sample 615965 in that it is composed of intergrown feldspar, quartz and partly altered biotite but it differs in that there are higher proportions of both quartz and biotite and correspondingly less plagioclase and also it is generally coarser grained and the detrital grains do not appear to have been as well sorted.

There are subrounded quartz and feldspar grains 0.2 to about 0.6 mm in size and also a few larger, angular fragments of both quartz and feldspar up to about 1 mm in size. These grains now interpenetrate and have become welded where in contact but many are separated by masses of deformed and altered biotite which is much more abundant than in sample 615965.

Opaque hematite grains are generally larger than in sample 615965 and slightly more abundant. Many are tabular or elongate but some appear subrounded and probably some boundaries have been modified by partial recrystallization. Outgrowths of rutile were found on only a few of these opaque oxide grains. There are very few detrital grains of zircon and tourmaline and only a minute trace of apatite.

The section contains a mass of translucent goethite about 1 mm in size which may have replaced pyrite. This fills interstices and has penetrated along grain boundaries and cleavage planes.

Conclusion:
This is an arkose formed from very immature sediment which differs from sample 615965 in that it is coarser grained and not as well sorted and also it contains more abundant, altered biotite and quartz and correspondingly less feldspar.

Sample: 615967; TSC19876

Hand Specimen:

A greyish-green, fine-grained rock which contains visibly less mica than sample 615966. On the eroded surface the rock can be seen to contain elongate fragments up to 2 cm long of much finer grained, pale green material.

Thin Section:

A visual estimate of the constituents is as follows:

	%
Quartz	35-40
Chlorite, sericite and clay	40-45
Muscovite	5-10
Dolomite	5-10
Feldspar	2- 3
Hematite	2- 3
Zircon	trace
Tourmaline	trace
Rutile	trace

The coarser grained sediment contains quartz, feldspar and muscovite grains with a common grain size of 0.1 to 0.3 mm but there are scattered, larger quartz grains about 0.5 mm in size and up to 0.8 mm. Some of these larger quartz grains are rounded, others appear to be fragments of euhedral crystals. This differs from the two previous samples in that there is very little detrital biotite or chlorite but more abundant muscovite, some of which tends to be subparallel. In places the detrital grains have become welded and interpenetrate to form small aggregates of intergrown quartz, muscovite and feldspar but throughout much of the section interstices between the detrital grains contain variable proportions of dolomite and very fine-grained argillaceous material which includes chlorite and sericite and probably also clay. It is possible that some of this extremely fine-grained argillaceous material could have replaced feldspar grains but this could not be confirmed.

Grains of opaque hematite similar to those in samples 615965 and 615966 and generally 0.1 to 0.3 mm long are scattered throughout the coarser grained sediment and a few of these show outgrowths of tiny rutile crystals. Other heavy mineral grains occur in only trace amounts and include zircon, tourmaline and yellow to orange rutile.

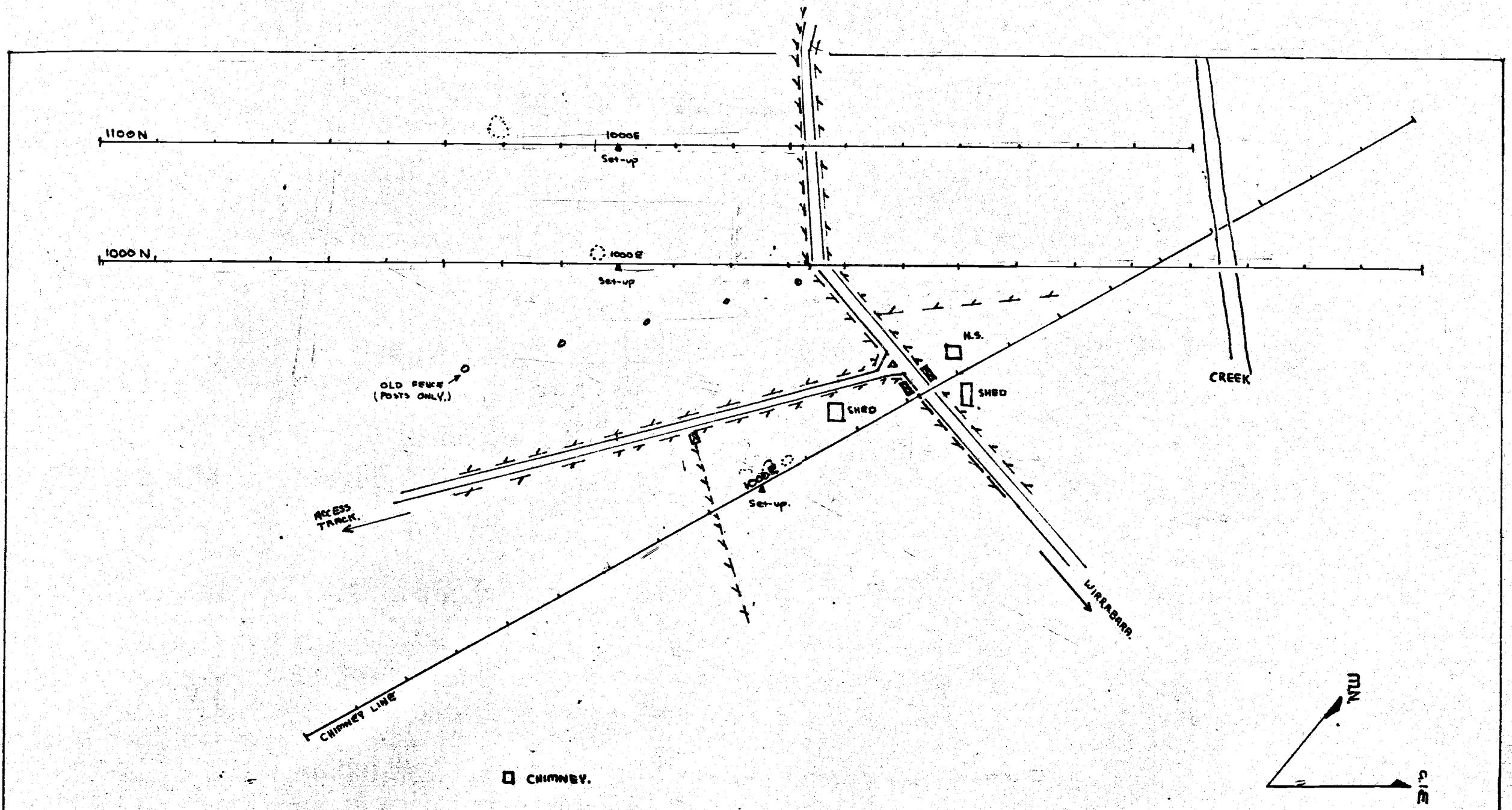
The elongate fragments of finer grained sediment noted in the hand specimen are composed mainly of extremely fine-grained sericite and chlorite±clay similar to that in interstices in the coarser grained sediment. However, in places, finer grained sediment contains very much smaller opaque hematite grains generally about 0.02 to 0.03 mm in size and locally there are minor amounts of dolomite.

In hand specimen there are two pseudomorphs of goethite after pyrite crystals about 3 mm in size but these are not represented in the thin section.

Conclusion:

This is a dolomitic, argillaceous and micaceous sandstone containing reworked fragments of finer grained sediment probably derived from thin layers of mudstone or shale. It would therefore be described as an intraformational breccia.

00020

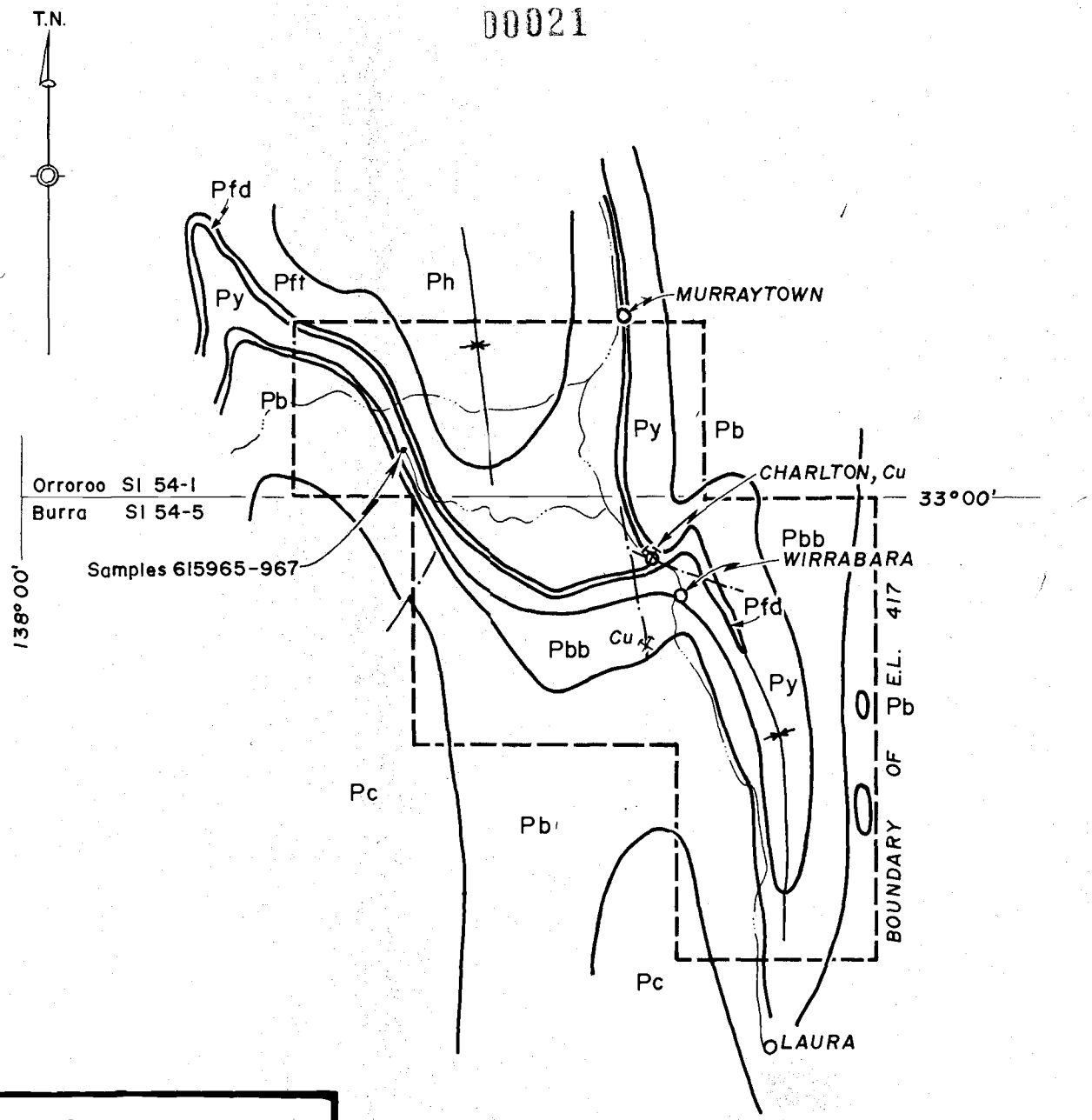


CHARLTON MINE GRID.
WIRRABARA S. AUST.

I.P. and RESISTIVITY SURVEY.

3377-4

00021



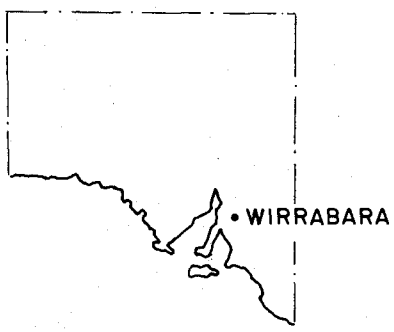
LEGEND

Ph	WILLOCHRA SUB-GROUP.
Pft	TAPLEY HILL FORMATION.
Pfd	TINDELPINA SHALE MEMBER.
Py	YUDNAMATAMA SUB-GROUP.
Pbb	BELAIR SUB-GROUP.
Pb	BURRA GROUP.
Pc	CALLANNA BEDS.

SYNCLINE.

FAULT.

MINE.



SCALE

1 0 5 10 KMS.

C.R.A EXPLORATION PTY. LIMITED.

WIRRABARA (S.A.) E.L. 417.

REGIONAL GEOLOGICAL INTERPRETATION 3377-3

From Mines Dept. 1:250,000 Geological Series.

SHEET REF'S.: ORROROO SI 54-1, BURRA SI 54-5.

GEOL.: A.G.C.	SCALE: 1:250,000.
DRAWN: D.R.W.	REPORT Nº : 9454
DATE : DEC. 1978.	PLAN Nº: SA a 232.

00022

C.R.A. EXPLORATION PTY. LIMITED

REPORT ON WIRRABARA E.L. 417 SOUTH AUSTRALIA, FOR QUARTER ENDING 4TH MARCH, 1979

SECOND QUARTER

AUTHOR: A. G. CONNOR

SUBMITTED TO: D. R. KENNEDY

COPY TO: SOUTH AUSTRALIAN DEPARTMENT OF MINES

DATE: 4TH MARCH, 1979

C.R.A. EXPLORATION PTY. LIMITED
(INC. IN N.S.W.)
95 COLLINS STREET, MELBOURNE, AUSTRALIA 3001

P.O. BOX 384D
TELEPHONE: 63 0491
TELEGRAMS: "CONRIO"
TELEX AA 30108

13S W1

3rd April, 1979.

The Director of Mines,
P.O. Box 151,
EASTWOOD, S.A. 5063

Dear Sir,

E.L. 417 - Wirrabara, South Australia
Report for the Quarter Ended 4th March, 1979

Enclosed is a report by A. G. Connor entitled "Report on Wirrabara E.L. 417, South Australia for Quarter Ending 4th March, 1979 - Second Quarter" dated 4th March, 1979.

Exploration work is continuing on this E.L.

Expenditure for the period ended 28th February, 1979, the nearest accounting period, amounted to $2,576 comprising:

Salaries and Wages	$988
General Supplies	180
Vehicles	290
Travel and Accommodation	88
General Overheads	1,030
	$2,576

Yours faithfully,

for: J. Collier
General Manager

SAF:jm

Encl.

CONTENTS PAGE

1. INTRODUCTION

Wirrabara E.L. 417 of 315 sq.km. is centred on the town of Wirrabara in the South Flinders Ranges, 30 km north-east of Port Pirie.

This report describes work carried out by CRAE during the period 5 December '78 to 4 March '79.

2. WORK DONE

Several attempts to locate the outcrop of kimberlitic rock reported by Cultus Pacific N.L. have been unsuccessful. No samples were collected and the proposed drilling program at the Charlton Mine I.P. anomaly has been postponed until the next quarter.

A. G. CONNOR

KEYWORDS:

Copper, Adelaidean, geophys-I.P., kimberlite

LOCALITY:

Burra SI 54-5, Orroroo SI 54-1

00027

C.R.A. EXPLORATION PTY. LIMITED

THIRD QUARTERLY REPORT ON WIRRABARA E.L. 417

FOR THE PERIOD ENDING 4TH JUNE 1979

AUTHOR: A.G. CONNOR

SUBMITTED TO: D.R. KENNEDY

COPIES TO: SADME
CRAE MELBOURNE

DATE: JUNE 1979

9454

C.R.A. EXPLORATION PTY. LIMITED
(INC. IN N.S.W.)

28th FLOOR, 55 COLLINS STREET, MELBOURNE,
AUSTRALIA 3001

G.P.O. BOX 384D
MELBOURNE, AUSTRALIA 3001
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TELEPHONE: (AREA CODE 03)
SWITCHBOARD: 658 3333
DIRECT LINE: 658

IN REPLY PLEASE QUOTE

13S W1

9th July, 1979.

The Director of Mines,
P.O. Box 151,
EASTWOOD, S.A. 5063

Dear Sir,

E.L. 417 - Wirrabara, South Australia
Report for the Quarter Ended 4th June, 1979

Please find enclosed a report by A. G. Connor entitled "Third Quarterly Report on Wirrabara E.L. 417 for the Period Ending 4th June, 1979" dated June, 1979.

We advise that there has been no change in the status of this E.L.

Expenditure for the period ended 31st May, 1979, the nearest accounting period, amounted to $573 comprising:

Salaries and Wages	$258
General Supplies	50
Vehicles	11
General Overheads	254
	$573

Yours faithfully,

for: J. Collier
General Manager

SAF:jm

Encl.

CONTENTS PAGE

1. INTRODUCTION

Wirrabara E.L. 417 of 315 sq. km. is centred on the town of Wirrabara in the South Flinders Ranges.

Previous work by C.R.A. Exploration consisted of an I.P. survey near the Charlton Mine, and ground reconnaissance of the Bangor area in search of the kimberlitic rock reported by Cultus Pacific N.L.

This report details exploration activity for the three months ending 4th June, 1979.

2. WORK CARRIED OUT

Outcrops near the Charlton Mine were inspected in order to obtain structural data before testing the I.P. anomaly with one percussion drillhole. Finely laminated pyritic shales dipping 35° north-east, crop out in a small quarry 1.5 km north of the I.P. anomaly. These shales are thought to be equivalents of carbonaceous shale found on the Charlton mine dumps.

A proposed section of the percussion drillhole 79WA1 was drawn up (plan SAa 263) and a rig will be available to commence drilling in early July.

A.G. CONNOR

LOCATION

Burra SI 54-5
Orroroo SI 54-1

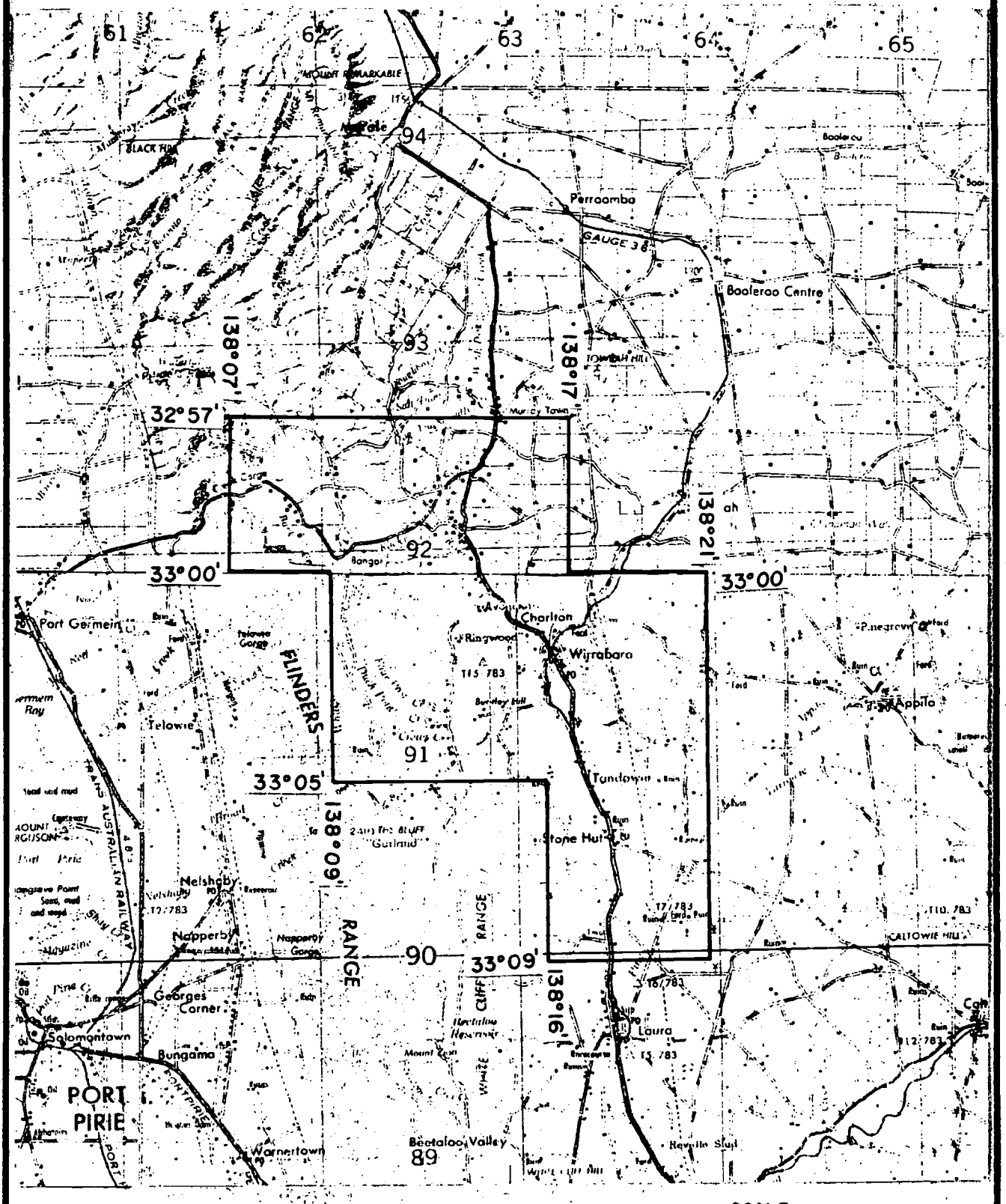
KEYWORDS

Copper, Adelaidean, carbonaceous shale, geophys-I.P., drill-percussion.

LIST OF PLANS

SAa 135	Location Plan - Wirrabara E.L. 417	1:250000
SAa 233	Charlton Copper Mine	1:5000
SAa 263	Cross section Line 1000N Proposed Hole 79WA1	1:1000

00032



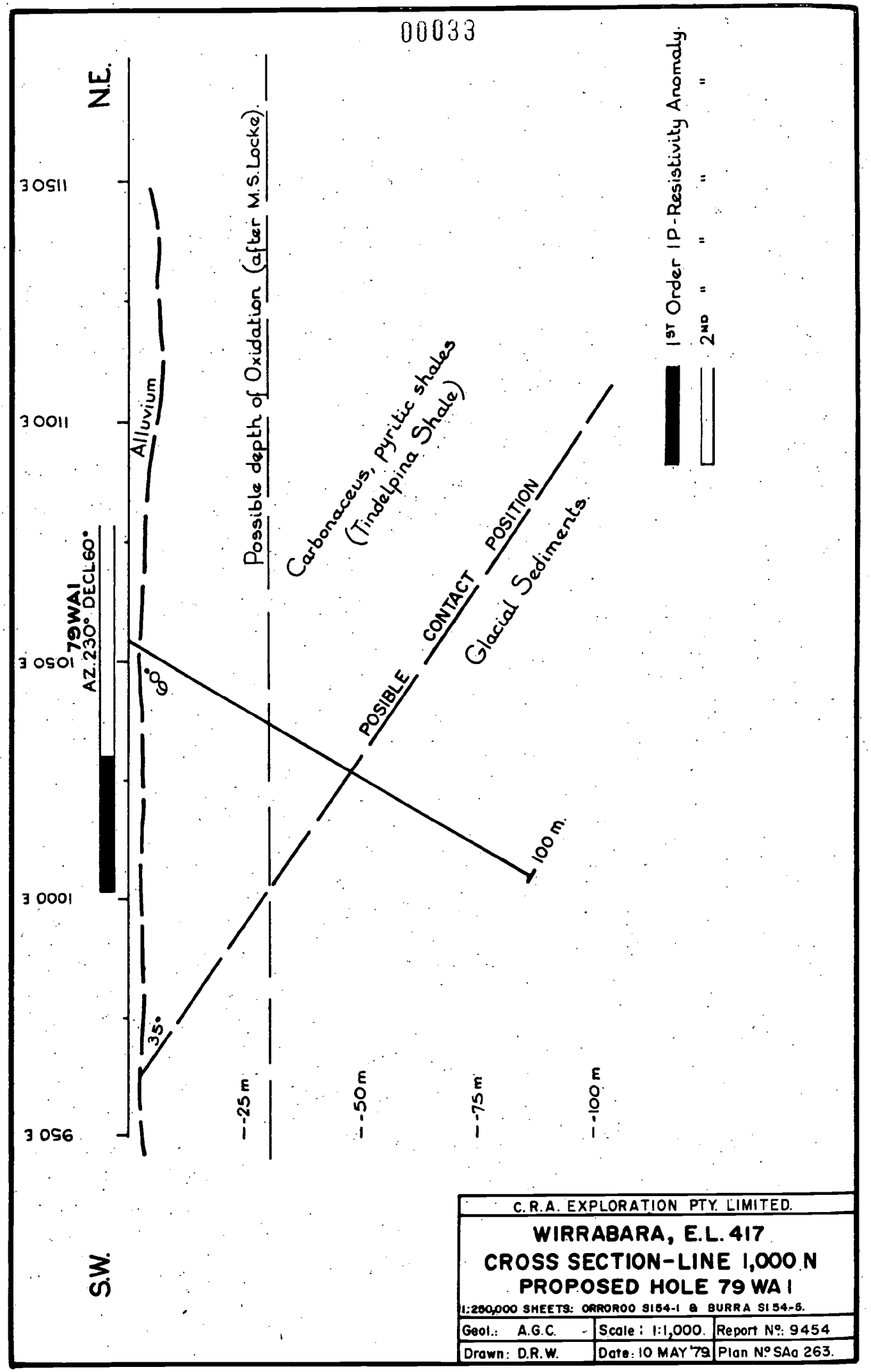
C.R.A. EXPLORATION PTY. LIMITED

LOCATION MAP
WIRRABARA (S.A.) E.L. 417.

SHEET REFERENCES: ORROROO SI 54-1
BURRA SI 54-5

Geologist : A.G.C.	Scale : 1:250,000	Drawn : D.R.W.
Report No: 9454	Date : Nov., 1977	Plan No: SA a 135

00033



C.R.A. EXPLORATION PTY. LIMITED.

WIRRABARA, E.L. 417

CROSS SECTION-LINE 1,000 N

PROPOSED HOLE 79 WA 1

1:250,000 SHEETS: ORROROO SI54-1 & BURRA SI 54-5.

Geol.: A.G.C.	Scale: 1:1,000.	Report No: 9454
Drawn: D.R.W.	Date: 10 MAY '79	Plan No SAa 263.

08034

C.R.A. EXPLORATION PTY. LIMITED

FOURTH QUARTERLY REPORT

ON WIRRABARA E.L. 417

FOR PERIOD ENDING 4.9.1979

AUTHOR: G.J. BUBNER

SUBMITTED TO: D.R. KENNEDY

COPY TO: S.A.D.M.E.
C.R.A.E. LIBRARY

DATE: 11.9.1979

CONTENTS

1. SUMMARY

The I.P. anomaly near the old Charlton copper mine remains untested after four unsuccessful attempts to percussion drill it. A diamond drill hole will be necessary to adequately test the target.

2. INTRODUCTION

E.L. 417 covers an area of 315 square kilometres and is centred on the township of Wirrabara. The E.L. was granted to C.R.A. Exploration Pty. Limited on 4th September 1978, and renewed for a further 12 months from 5th September 1979.

Previous work by C.R.A. Exploration Pty. Limited includes two lines of I.P. geophysics, ground reconnaissance near the old Charlton copper mine, and ground reconnaissance in the Bangor area.

This report describes work carried out in the quarter ending 4.9.1979.

3. WORK CARRIED OUT

A contract was let to Davies Drilling Pty. Ltd. to drill one percussion hole to 100 metres to test the Charlton I.P. anomaly. After four attempts the programme was abandoned due to an excessive influx of water. The drilling is summarized in the following table:

HOLE	COORDINATES	AZIMUTH	INC.	DATE	DEPTH
79WA1	1020N, 1065E	230°	70°	1.8.79	Collapsed at 62 metres; abandoned
79WA2	1025N, 1060E	230°	70°	2.8.79	Influx of water and collapse at 18 metres; abandoned
79WA3	1050N, 1020E	230°	70°	2.8.79	Broken blade bit lost down hole; abandoned at 18 metres
79WA4	1040N, 1020E	-	90°	3.8.79	Influx of water at 50 metres; casing breaks; abandoned.

Ground magnetics was conducted in the vicinity of the I.P. anomaly, and also over an area to the east to locate a large equi-dimensional aeromagnetic anomaly.

4. RESULTS

4.1 DRILLING

The drill holes were sited to test an I.P. anomaly which might represent copper mineralisation at or near an inferred contact between carbonaceous, pyritic shales of the Tindelpina Shale Member and underlying glacial sediments. All four holes were abandoned without intersecting sufficient quantities of polarizable minerals to adequately explain the I.P. anomaly. Details of the drilling is as follows:

Hole 79WA1

0	- 2m	Soil and clay
2	- 10m	Clay and gravels
10	- 30m	Oxidized pencil shales. Water at 26 metres
30	- 62m	Grey to dark grey carbonaceous shale. Minor pyrite.

Hole 79WA2

0	- 10m	Soil, clay and gravel
10	- 12m	Oxidized shale
12	- 18m	Dark grey carbonaceous shale. Minor pyrite. Trace chalcopyrite. Down hole contamination.

Hole 79WA3

0	- 12m	Soil, clay and gravel
12	- 16m	Brown and grey shale
16	- 18m	Grey shale

Hole 79WA4

0	- 18m	Soil, clay and gravel
18	- 20m	Brown shale
20	- 50m	Dark grey carbonaceous shale. Minor pyrite.

Results to date indicate that the pencil shales above the target horizon contain copper values peaking at 260 p.p.m., lead at 60 p.p.m. and zinc at 108 p.p.m. The percussion cuttings were scanned with a four channel spectrometer; no significant readings above background were recorded in any channel.

4.2 MAGNETICS

4.2.1 CHARLTON GRID

Two kilometres of ground magnetometer traversing was conducted in the vicinity of the I.P. traverses. Readings were taken at ten metre intervals on four lines spaced 50 metres apart, using a grid coincident with the I.P. survey grid. (see Plan SAa 294) An Austral PPM-1 magnetometer was used, with the sensor on a two metre staff, and the data has been corrected for drift.

The total field profiles are plotted as plan SAa 295. The profiles are generally flat and fairly noisy, the only outstanding feature being a peculiarly-shaped high-low of 400 gammas on line 1000 metres N. Although this anomaly appears consistent from station to station, short infill lines 20 metres to the north and south failed to define the shape of the anomaly. On the ground it is coincident with a very small creek and an old fence line, and it is suggested the source is either a shallow accumulation of creek debris or a buried man-made object.

4.2.2 NEW GRID

A large dipolar aeromagnetic anomaly was vaguely defined on the ground by one magnetometer traverse conducted by M.S. Locke during his work in the vicinity of the Charlton copper mine. A new grid oriented true north-south/east-west was laid out and 2 500 metres of ground magnetics carried out to more completely define this anomaly. (Plan no. SAa 294). Readings were taken at 20 metre intervals with an Austral PPM-1 magnetometer, the sensor being mounted on a two metre staff. Corrections have been made for drift, and to tie the data in with that on the Charlton grid.

The three profiles are plotted on Plan no. SAa 296. This data serves to verify the approximate shape and location of the anomaly, although more lines are required (1050 metres N and 450 metres E) before adequate data is available to allow quantitative interpretation.

G.J. BUBNER

REFERENCES

Locke, M.S. 1976 Analysis of F400 airborne E.M. Data and Ground Investigations in the Booleroo-Laura District of South Australia. Unpublished B.Sc. (Hons.) thesis, Department of Economic Geology, University of Adelaide.

KEYWORDS

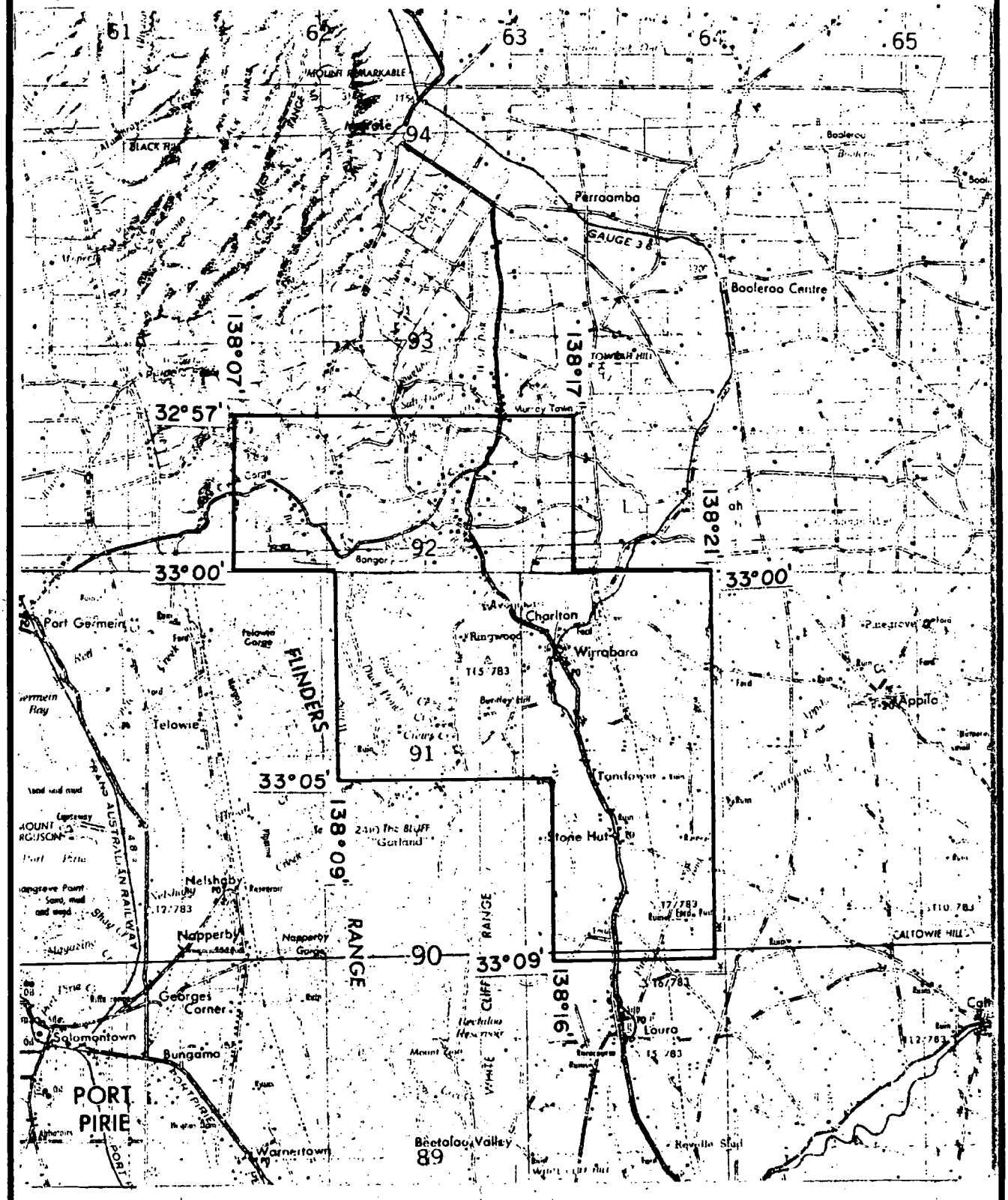
Copper, drill-percussion, Adelaidean, geophys-I.P., geophys-magnetics

LOCATION

Burra SI 54-5
Orroroo SI 54-1

LIST OF PLANS

SAa 135	Location Plan - Wirrabara E.L. 417	1:250 000
SAa 294	Magnetometer traverses - Charlton Grid and New Grid	1: 5 000
SAa 295	Ground Magnetic Profiles - Charlton Grid	1: 2 500
SAa 296	Ground Magnetic Profiles - New Grid	1: 5 000

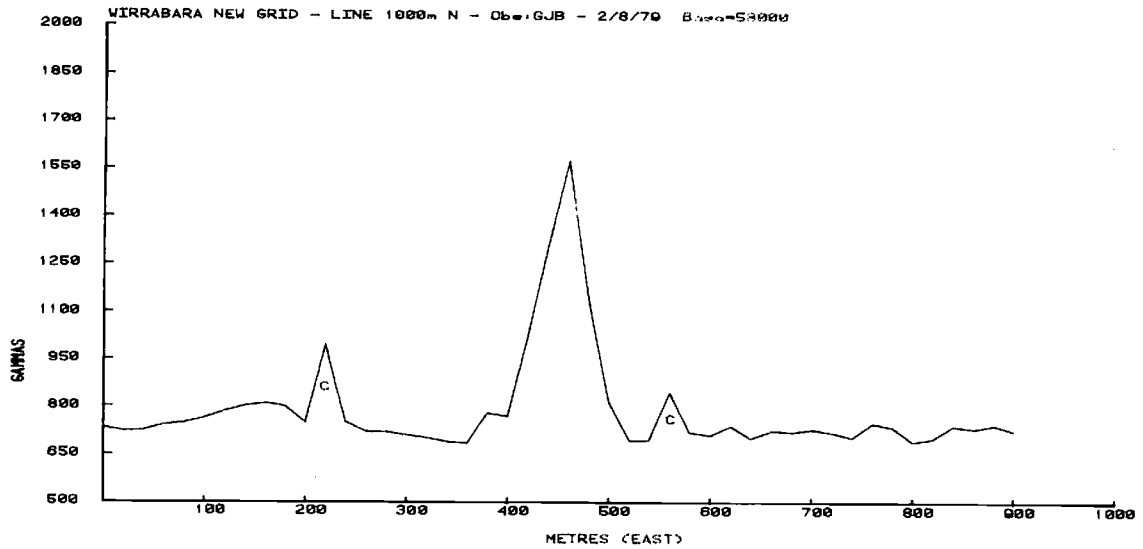


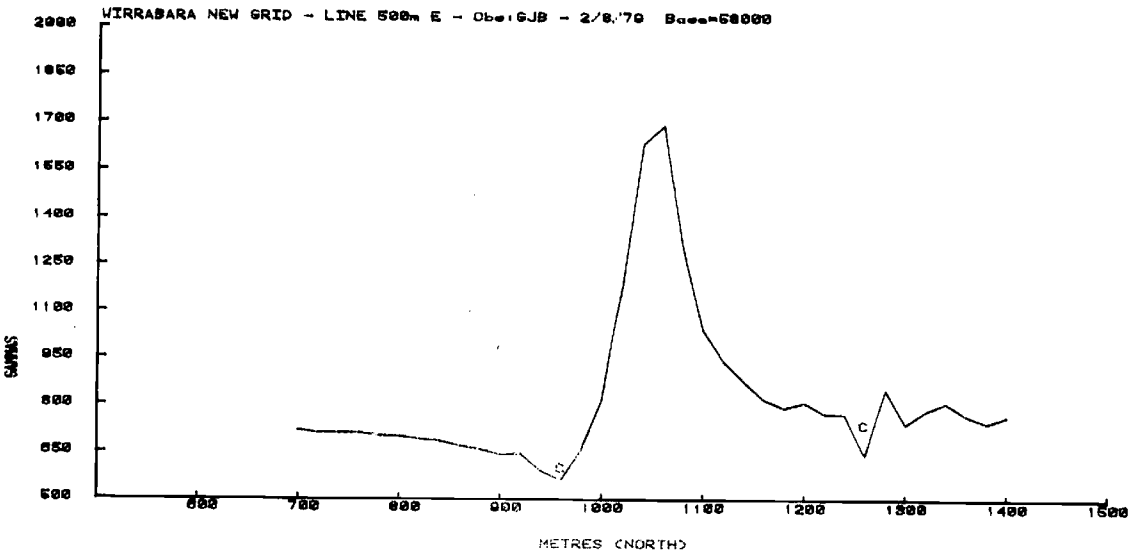
C.R.A. EXPLORATION PTY. LIMITED

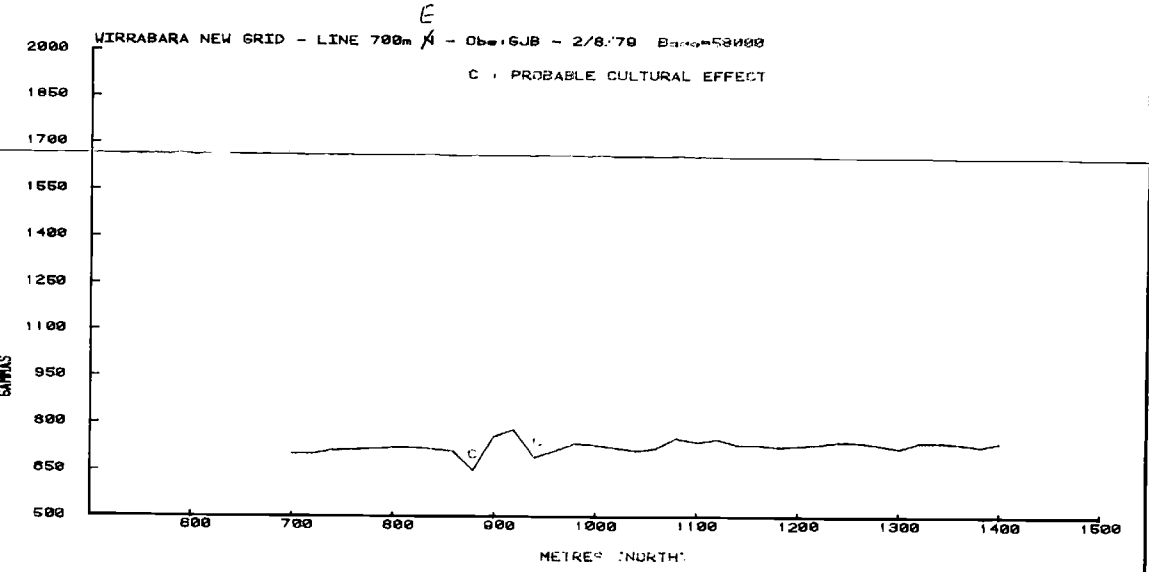
LOCATION MAP
WIRRABARA (S.A.) E.L. 417.

SHEET REFERENCES: ORROROO SI 54-1
BURRA SI 54-5

Geologist : A.G.C.	Scale : 1:250,000	Drawn : D.R.W.
Report No.: 9454	Date : Nov., 1977	Plan No.: SA a 135







SHEET REF.: BURRA SI54-5

C.R.A. EXPLORATION PTY. LTD.

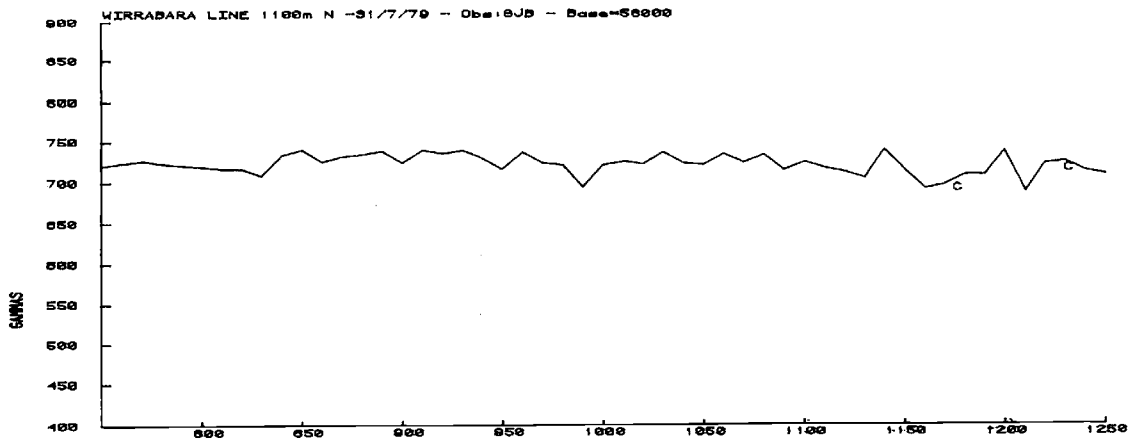
WIRRABARA E.L. 417

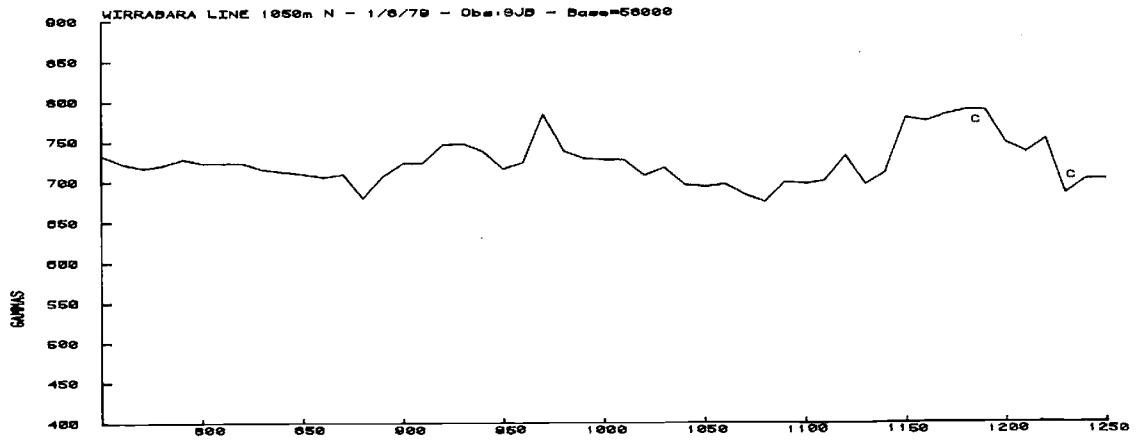
MAGNETIC PROFILES

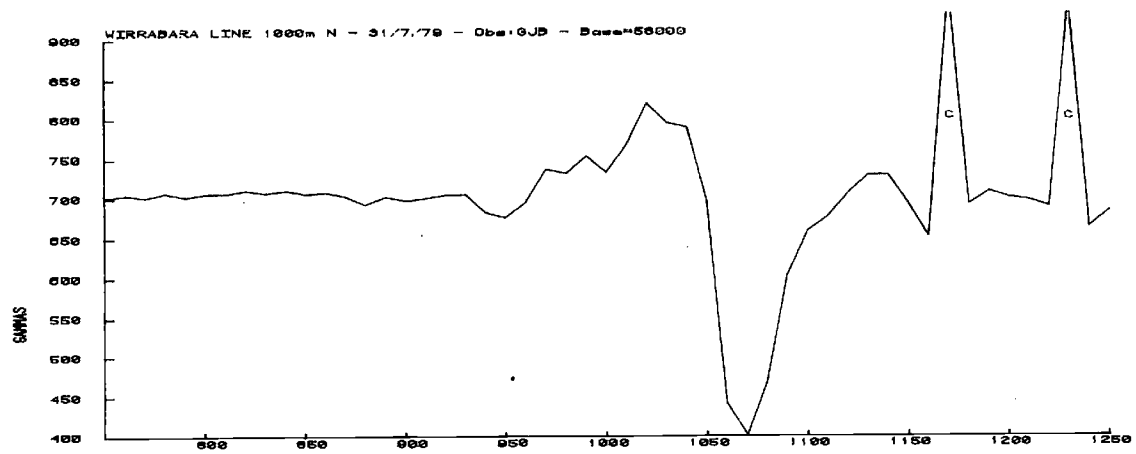
NEW GRID

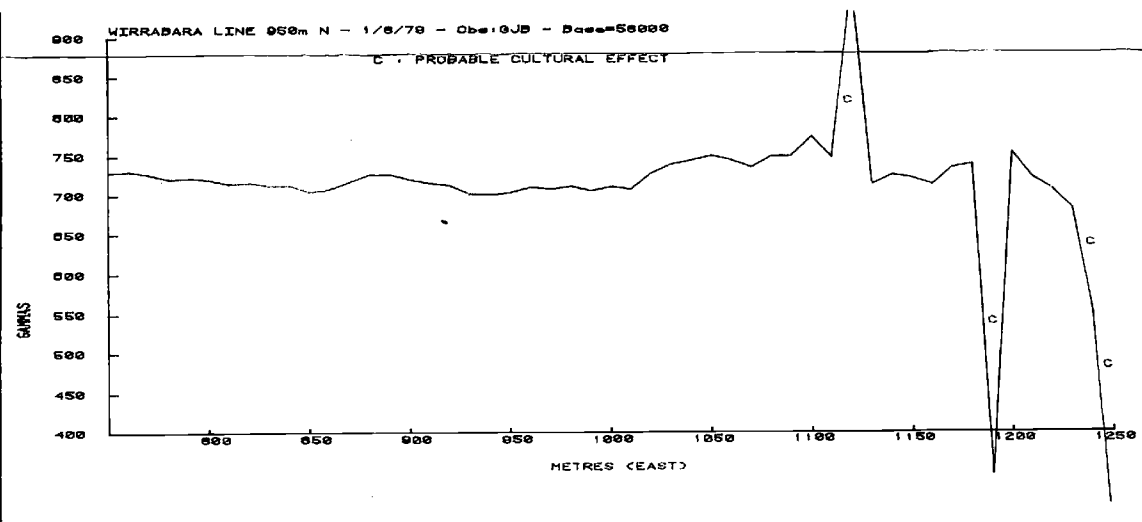
Geophys.: G.J.B. Date: Sept., 1979

Report No.: 9454. Plan No.: 296









SHEET REF.: BURRA SI54-5

C.R.A. EXPLORATION PTY. LTD.

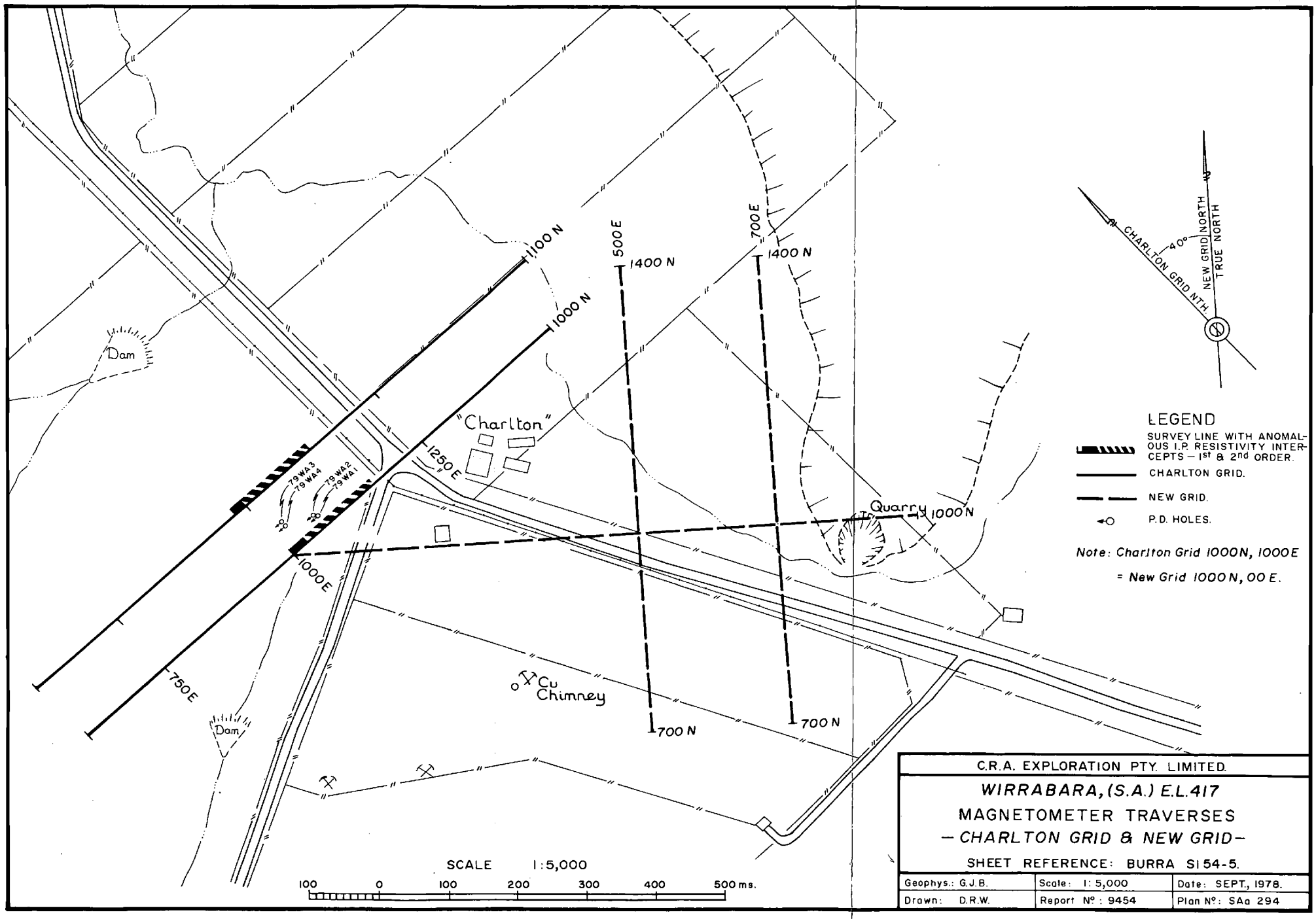
WIRRABARA E.L. 417

MAGNETIC PROFILES

CHARLTON GRID

Geophys.: G.J.B. Date: Sept, 1979.

Report N°: 9454 Plan N°: 295.



C.R.A. EXPLORATION PTY. LIMITED.

WIRRABARA, (S.A.) E.L.417

MAGNETOMETER TRAVERSES

– CHARLTON GRID & NEW GRID –

SHEET REFERENCE: BURRA SI54-5.

Geophys.: G.J.B.	Scale: 1:5,000	Date: SEPT., 1978.
Drawn: D.R.W.	Report Nº: 9454	Plan Nº: SAa 294

00044

C.R.A. EXPLORATION PTY. LTD.

FIFTH QUARTERLY REPORT ON WIRRABARA E.L. 417 FOR THE PERIOD ENDING 4TH DECEMBER 1979.

AUTHOR: D.L. ANDREWS

SUBMITTED TO: D.R. KENNEDY

COPIES TO: S.A.D.M.E.
C.R.A.E. MELBOURNE

DATE: FEBRUARY 6, 1980.

CONTENTS

LOCATION

Burra SI 54-5

Orroroo SI 54-1

KEYWORDS

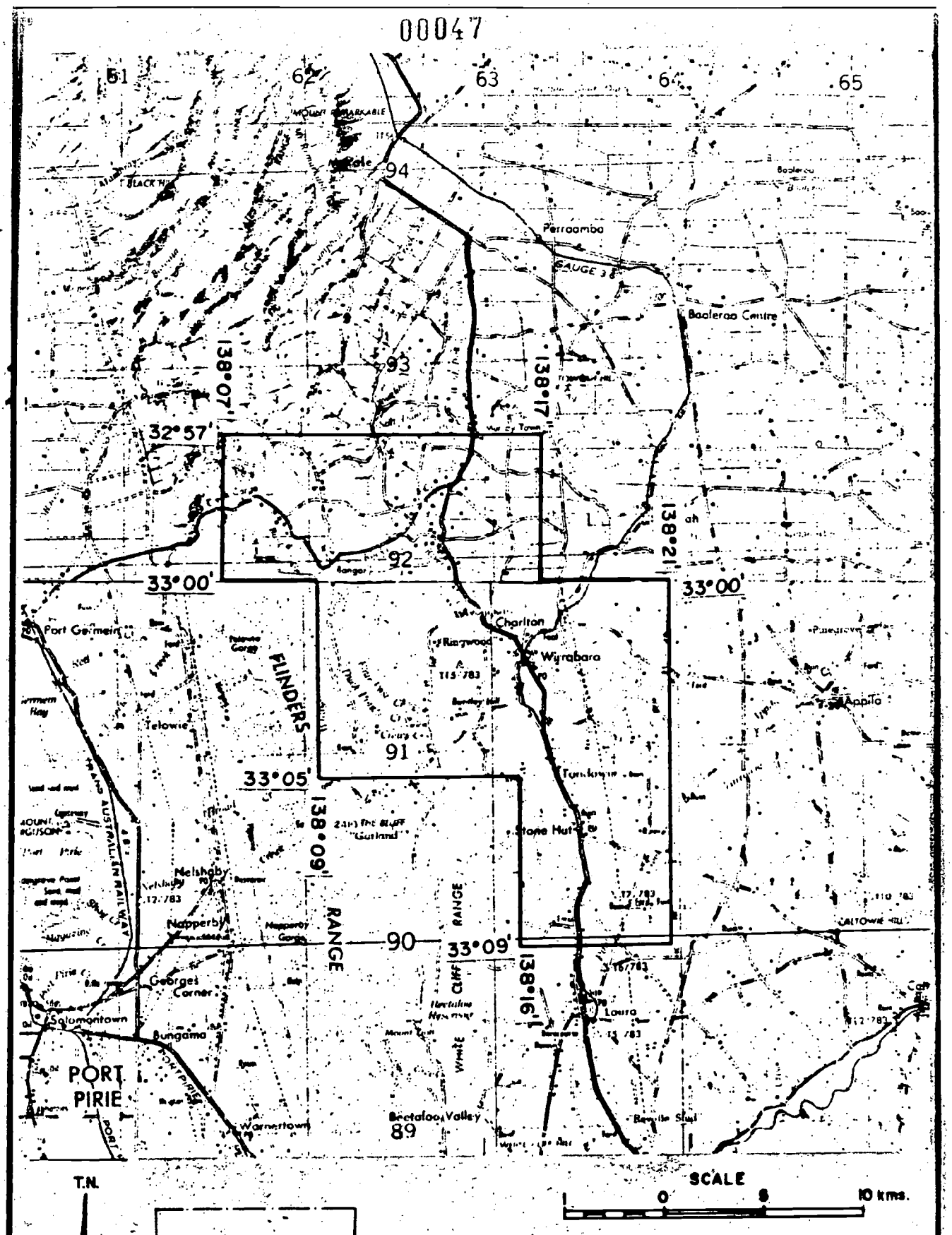
Copper, Adelaidean, geophys-I.P., drill-diamond.

LIST OF PLANS

SAa 135 Location Plan Wirrabara E.L. 417

SAa 233 Charlton Copper Mine

00047



C.R.A. EXPLORATION PTY. LIMITED

LOCATION MAP
WIRRABARA (S.A.) E.L. 417.

SHEET REFERENCES: ORROROO SI 54-1
BURRA SI 54-5

Geologist : A.G.C.	Scale : 1:250,000	Drawn : D.R.W.
Report No: 9464	Date : Nov., 1977	Plan No: SAo 135

1. INTRODUCTION

Wirrabara E.L. 417 is centred on the town of Wirrabara, 30 km. north-east of Port Pirie. The E.L. was granted to C.R.A. Exploration Pty. Ltd. on September 4, 1978 and renewed for a further twelve months from September 5, 1979.

Previous work by C.R.A. Exploration includes four unsuccessful attempts to percussion drill on I.P. anomaly located near the Charlton copper mine.

2. WORK CARRIED OUT

A tender was let for one 150 metre diamond drill hole to test the I.P. anomaly in early December.

No field work was carried out.

D.L. Andrews.

D.L. ANDREWS

00049

C.R.A. EXPLORATION PTY. LIMITED

SIXTH QUARTERLY REPORT

ON WIRRABARA E.L. 417

FOR PERIOD ENDING MARCH 4, 1980.

AUTHOR: D.L. ANDREWS

SUBMITTED TO: D.R. KENNEDY

COPY TO: S.A.D.M.E.

C.R.A.E. LIBRARY

DATE: APRIL 22, 1980.

CONTENTS PAGE

1. SUMMARY

Drilling of an I.P. anomaly near the Charlton copper mine intersected stringers of pyrite and graphite within the Appila Tillite. There were no significant basemetal intersections.

2. INTRODUCTION

Wirrabara E.L. 417 is centred on the town of Wirrabara, 30 km. north-east of Port Pirie. The E.L. was granted to C.R.A. Exploration Pty. Ltd. on September 4, 1978 and renewed for a further twelve months from September 5, 1979.

Previous work by C.R.A. Exploration includes four unsuccessful attempts to percussion drill on I.P. anomaly located near the Charlton copper mine.

3. DRILLING

W.A.D. 5, located approximately 300 W.N.W. of the Charlton copper mine, (Plan SAa 365) intersected stringers of pyrite and graphitic films on fractures from 42 metres to 114 metres within the Appila Tillite. The hole was completed in Willyerpa quartzite.

Table 1.

0 - 9.0m.	Non coring
0.9 - 11.1m.	Weathered tillite. HQ core size.
11.1 - 16.5m.	No recovery. NQ core below 16.5m.
16.5 -114.0m.	Tillite, variable clast composition, frequently grading down to grey siltstone. Base of oxidation 25.9m. Pyrite with accessory chalcopyrite as paper-thin veinlets - maximum development 3%. Trace galena at 70.2m. Graphite content variable.
114.0-119.2m.	Siltstone, grey, no sulfides.
119.2-149.8m.	Tillite as above. Trace pyrite.
149.8-150.1m.	Quartzite. Quartz-feldspar-biotite-talc rock, medium grained, light grey. No sulfides.
	B.O.H. 150.1 metres

Table 1: Summary Log W.A.D. 5

The best base metal intersection was between 73.5 and 74.5 metres where values of copper 640 p.p.m., lead 75 p.p.m. and zinc 40 p.p.m. were recorded.

Assays and logs are presented in Appendix 2.

4. CONCLUSIONS

Pyrite and graphite stringers were responsible for the I.P. anomaly near the Charlton copper mine, with there being no significant basemetal intersections.

for
D.L. ANDREWS

KEYWORDS

Copper, pyrite, Adelaidean, geochem-rock, geophys - I.P., diamond drilling.

LOCATION

Burra SI 54-5

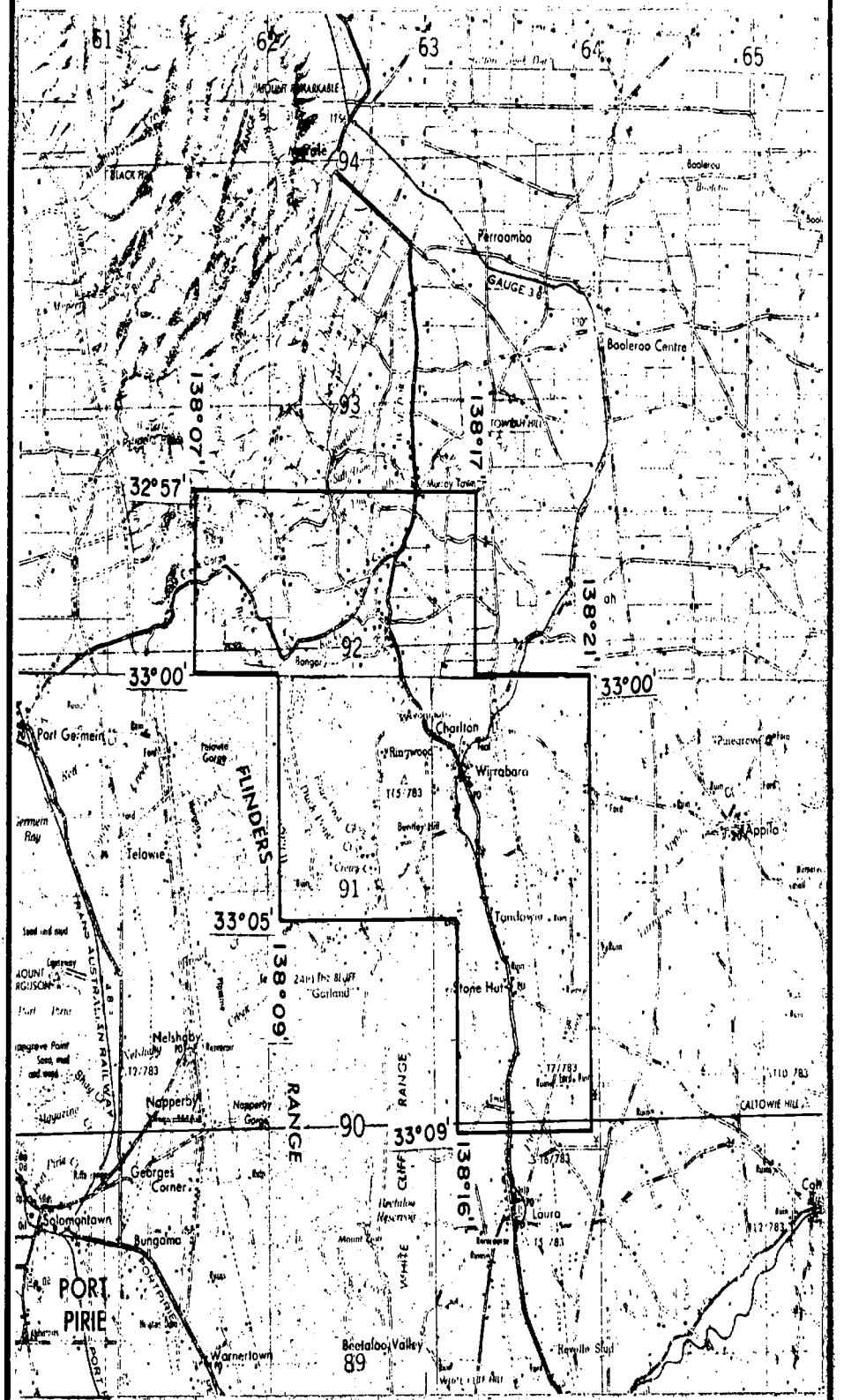
Orroroo SI 54-1

LIST OF PLANS

SAa 135	Location Plan Wirrabara E.L. 417	1:250,000
SAa 294	Charlton grid and New grid	1: 50,000
SAa 365	Cross section W.A.D. 5	1: 750

APPENDIX 1 : Petrographic Descriptions

APPENDIX 11: Drill Logs

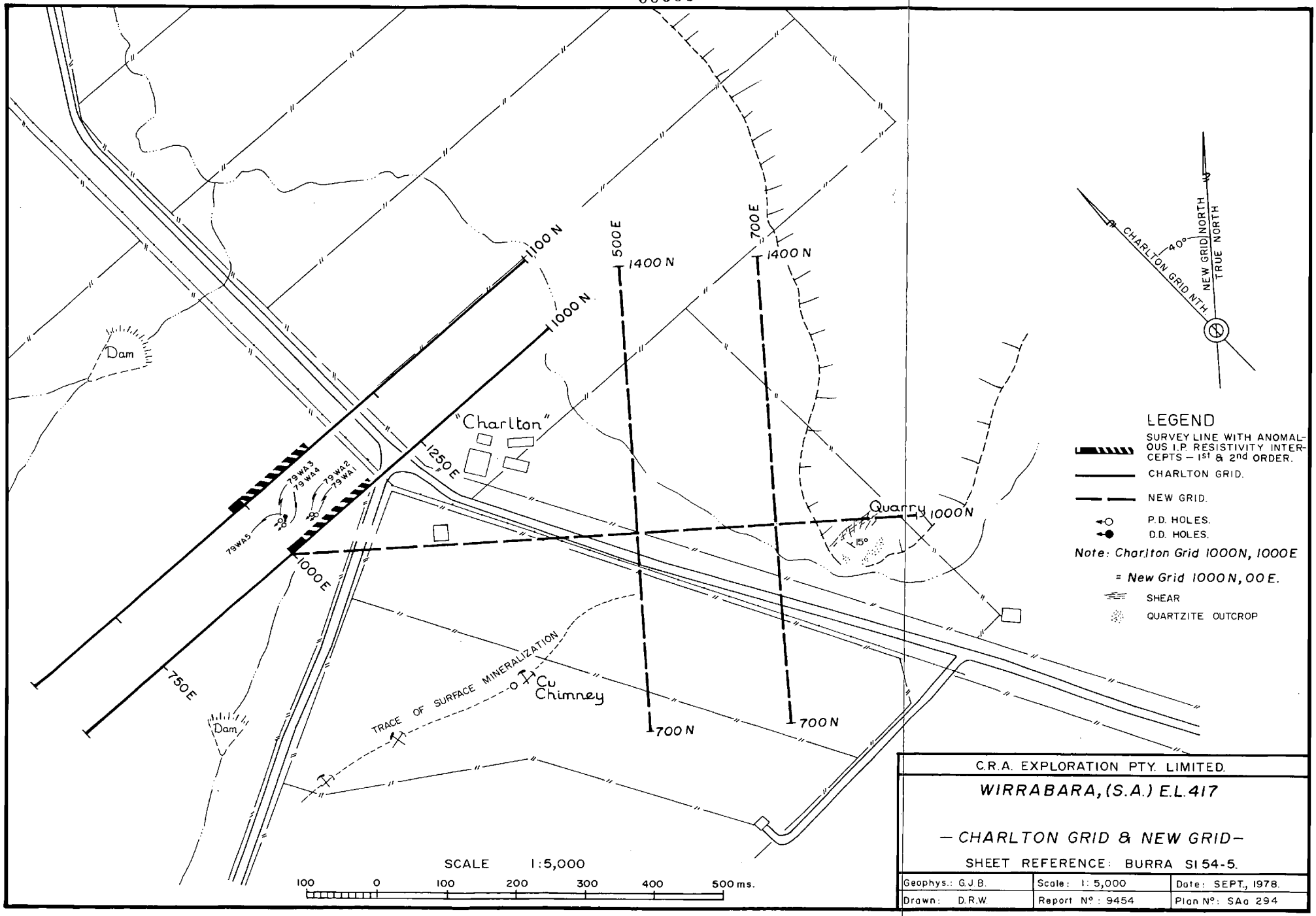


C.R.A. EXPLORATION PTY. LIMITED

LOCATION MAP
WIRRABARA (S.A.) E.L. 417.

SHEET REFERENCES: ORROROO SI 54-1
BURRA SI 54-5

Geologist : A.G.C.	Scale : 1:250,000	Drawn : D.R.W.
Report No: 9454	Date : Nov., 1977.	Plan No: SAa 135



C.R.A. EXPLORATION PTY. LIMITED.

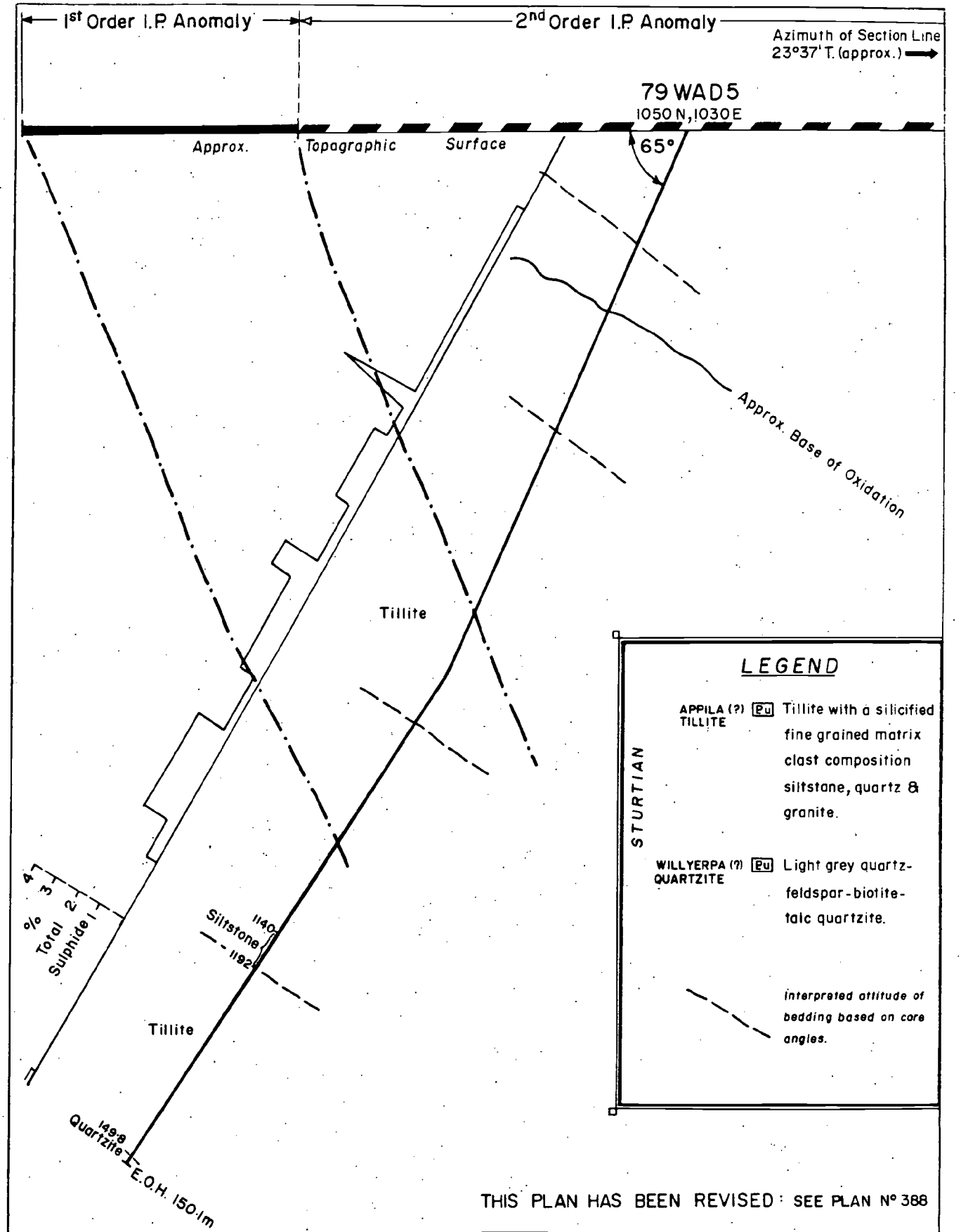
WIRRABARA, (S.A.) E.L.417

— CHARLTON GRID & NEW GRID —

SHEET REFERENCE: BURRA SI 54-5.

Geophys.: G.J.B.	Scale: 1:5,000	Date: SEPT., 1978.
Drawn: D.R.W.	Report No: 9454	Plan No: SAa 294

00056



THIS PLAN HAS BEEN REVISED : SEE PLAN N° 388

C.R.A. EXPLORATION PTY. LIMITED.

WIRRABARA E.L.417
DIAMOND DRILL HOLE 79 WAD 5
CHARLTON MINE AREA

1:250,000 Sheet Ref.: BURRA SI 54-5.

Geol.: D.L.A.	Scale: 1:750
Drawn: D.R.W.	Report N°: 9454.
Date: DEC. '79.	Plan N°: SAa 365.

Sample: 615965; TSC19874

Hand Specimen:

A weathered, pinkish-grey, moderately fine-grained rock which is partly leached and therefore slightly friable. It contains small, dark grey to black flakes which were found to be thin plates of hematite.

Staining with cobaltinitrite shows very minor potash feldspar.

Thin Section:

A visual estimate of the constituents is as follows:

	%
Plagioclase	70-75
Quartz	5-10? (difficult to estimate)
Biotite/chlorite	10-15
Potash feldspar	2- 3
Muscovite	trace
Hematite	1- 3
Tourmaline	trace
Zircon	trace
Apatite	trace
Rutile	trace
Dolomite	trace

The rock is now composed of intergrown feldspar, quartz and biotite with a common grain size of about 0.1 to 0.2 mm and the manner in which at least some of the plagioclase and quartz grains are intergrown suggests that they have not completely recrystallized and some represent detrital grains which now interpenetrate and have become welded. In a few feldspar crystals the outline of a former detrital grain can still be seen defined by a line of very fine-grained opaque material. Some of these detrital feldspar grains were rounded, some were angular. There are also one or two quartz grains with a rounded outlined defined by staining surrounded by an overgrowth of secondary quartz which tends to fill interstices. A few interstices contain turbid, iron oxide-stained clay and it is uncertain whether or not this is original detrital material which has not recrystallized or is a result of weathering.

Biotite flakes 0.2 to 0.5 mm in size are scattered throughout the rock and show a tendency to be subparallel probably to the direction of bedding but some have been deformed and crumpled and most of them show some evidence of alteration to chlorite. Many of the opaque grains (mainly hematite) are also elongate or tabular and about 0.1 to 0.2 mm long and some of these are also orientated in the same direction as the flakes of biotite. There are some irregularly-shaped opaque oxide grains however which show very small overgrowths or protrusions of tiny rutile crystals suggesting that the grains are, or were titaniferous hematite which have partly recrystallized. The general texture and distribution of these opaque oxide grains suggests that they were clastic, detrital grains.

Other heavy mineral grains in this sediment are mainly a few small zircon grains, a few grains of blue and brownish-green tourmaline, a few of rutile and a few of apatite. One crystal of dolomite was found and it is possible that the rock once contained more abundant dolomite which has been leached.

Conclusion:

This is a fine-grained arkose probably originally composed of detrital feldspar, biotite, quartz, minor detrital hematite (some possibly titaniferous

and a few other heavy mineral grains. Although grains now interpenetrate there has been no extensive recrystallization. It was therefore a very immature sediment.

Sample: 615966; TSC19875

Hand Specimen:

A greenish-grey, moderately fine-grained rock similar in general appearance to sample 615965 but slightly coarser grained and with evidence of more abundant mica.

Staining with cobaltinitrite shows relatively minor potash feldspar.

Thin Section:

A visual estimate of the constituents is as follows:

	%
Biotite/chlorite	50-55
Quartz	20-25
Plagioclase	10-15
Potash feldspar	5-10
Muscovite	2- 3
Hematite	3- 5
Zircon	trace
Tourmaline	trace
Apatite	trace
Garnet?	minute trace
Goethite	trace

This is similar to sample 615965 in that it is composed of intergrown feldspar, quartz and partly altered biotite but it differs in that there are higher proportions of both quartz and biotite and correspondingly less plagioclase and also it is generally coarser grained and the detrital grains do not appear to have been as well sorted.

There are subrounded quartz and feldspar grains 0.2 to about 0.6 mm in size and also a few larger, angular fragments of both quartz and feldspar up to about 1 mm in size. These grains now interpenetrate and have become welded where in contact but many are separated by masses of deformed and altered biotite which is much more abundant than in sample 615965.

Opaque hematite grains are generally larger than in sample 615965 and slightly more abundant. Many are tabular or elongate but some appear subrounded and probably some boundaries have been modified by partial recrystallization. Outgrowths of rutile were found on only a few of these opaque oxide grains. There are very few detrital grains of zircon and tourmaline and only a minute trace of apatite.

The section contains a mass of translucent goethite about 1 mm in size which may have replaced pyrite. This fills interstices and has penetrated along grain boundaries and cleavage planes.

Conclusion:

This is an arkose formed from very immature sediment which differs from sample 615965 in that it is coarser grained and not as well sorted and also it contains more abundant, altered biotite and quartz and correspondingly less feldspar.

Sample: 615967; TSC19876

Hand Specimen:

A greyish-green, fine-grained rock which contains visibly less mica than sample 615966. On the eroded surface the rock can be seen to contain elongate fragments up to 2 cm long of much finer grained, pale green material.

Thin Section:

A visual estimate of the constituents is as follows:

	%
Quartz	35-40
Chlorite, sericite and clay	40-45
Muscovite	5-10
Dolomite	5-10
Feldspar	2- 3
Hematite	2- 3
Zircon	trace
Tourmaline	trace
Rutile	trace

The coarser grained sediment contains quartz, feldspar and muscovite grains with a common grain size of 0.1 to 0.3 mm but there are scattered, larger quartz grains about 0.5 mm in size and up to 0.8 mm. Some of these larger quartz grains are rounded, others appear to be fragments of euhedral crystals. This differs from the two previous samples in that there is very little detrital biotite or chlorite but more abundant muscovite, some of which tends to be subparallel. In places the detrital grains have become welded and interpenetrate to form small aggregates of intergrown quartz, muscovite and feldspar but throughout much of the section interstices between the detrital grains contain variable proportions of dolomite and very fine-grained argillaceous material which includes chlorite and sericite and probably also clay. It is possible that some of this extremely fine-grained argillaceous material could have replaced feldspar grains but this could not be confirmed.

Grains of opaque hematite similar to those in samples 615965 and 615966 and generally 0.1 to 0.3 mm long are scattered throughout the coarser grained sediment and a few of these show outgrowths of tiny rutile crystals. Other heavy mineral grains occur in only trace amounts and include zircon, tourmaline and yellow to orange rutile.

The elongate fragments of finer grained sediment noted in the hand specimen are composed mainly of extremely fine-grained sericite and chlorite/clay similar to that in interstices in the coarser grained sediment. However, in places, finer grained sediment contains very much smaller opaque hematite grains generally about 0.02 to 0.03 mm in size and locally there are minor amounts of dolomite.

In hand specimen there are two pseudomorphs of goethite after pyrite crystals about 3 mm in size but these are not represented in the thin section.

Conclusion:

This is a dolomitic, argillaceous and micaceous sandstone containing reworked fragments of finer grained sediment probably derived from thin layers of mudstone or shale. It would therefore be described as an intraformational breccia.

C.R.A. EXPLORATION PTY. LIMITED

PROJECT WIRRABARA

WIRRABARA D.D.H. DRILL CORE LOG

CO-ORDINATES 1050N, 1030E AZIMUTH MN 195° DRILLERS NITSCKE COMMENCED 11 DECEMBER DEPTH 150.1m HOLE No. WAD5

RL COLLAR INCLINATION 65° DRILL TYPE LONGYEAR 38 COMPLETED 18/12/79 CASING LEFT — DPO No(s) 8 0318

DEPTH FROM(M)	DEPTH TO(M)	CORE REC. (M)	CORE SIZE	GRAPHIC LOG	CORE DESCRIPTION	SPECIAL FEATURES WEATH., ALTERATION, FRACTURING VEINING, MINERALIZATION	SAMPLE No.	FROM (M)	TO (M)	REC (M)	ASSAY VALUES Cu	Pb	Zn	Au
0	9.0	-	NQ		NO CORE RECOVERED.									
9.0	11.1				HIGHLY WEATHERED TILLITE, CLASTS IN LIGHT COLOURED SILTY MATRIX CLASTS ARE LARGELY ROUNDED AND HIGHLY OXIDIZED, FRIABLE.	HIGHLY WEATHERED.								
11.1	16.5	-			ORIGINAL CLAST COMPOSITION UNRECOGNIZABLE.									
16.5	21.5	5			GLACIAL TILLITE. SILICIFIED MUDSTONE MATRIX (UP TO 85% MATRIX) WITH BOTH ANGULAR SURROUNDED AND ROUNDED CLASTS. CLASTS COMPOSITION VERY VARIABLE: SHALES, FERRUGINOUS MUDSTONES, QTZ, BASIC FRAGMENTS GRANITE. MAX. SIZE OF CLASTS 20mm, MEAN SIZE 5-10mm. UNIT IS LESS OXIDIZED AT BASE. CLASTS WEAKLY ORIENTATED WITH A CORE TO SO ANGLE OF 70°. SILICEOUS SHALE INTERBED (8cm). NEAR BASE OF TILLITE AT 21.3m.	OXIDIZED, HIGHLY WEATHERED EXTENSIVELY FRACTURED IRIDESCENT Fe OXIDE DEPOSITED ON FRACTURES.								
21.5	23.15	1.6			SILICIFIED LIGHT GREY ZST. POORLY LAMINATED, V. f.gr ± VERY FEW CLASTS PREDOMINATELY ≤ 3mm. HARD. GRADATIONAL TO THE TILLITE.	QTZ VEINING & HEMATITE FILLING FRACTURES @ 22.2m TR. PARTIALLY OXIDIZED Py								
23.15	24.65	1.5			AS ABOVE. SLIGHTLY COARSER GRAINED, CLASTIC FRACTION 1≤ = ≥7% CLASTS ARE VERY FINE GRAINED.	Fe STAINING ON FRACTURES.								
					TILLITE. CLASTS UP TO 25mm. PREDOMINANTLY ≤ 4mm. SHAPE: ROUNDED - ANGULAR. COMPOSITION VARIABLE AS FOR UPPER TILLITE.	C.A. PROB. 65° Fe STAINED QTZ. VEINING ON FRACTURES								
24.65	25.9	1.4			GREY, FINE GRAINED SILICIFIED ZST. NOT LAMINATED. LOW BUT VARIABLE CLAST PROPN PREDOMINANTLY SMALL.	TALC/CHLORITE ALTN ON FRACTURES AS WELL AS Fe STAINING FRESH								
					ASSAY 25.5 - 25.7m.	Py @ 25.65 PAPER THIN QTZ. VEINING (CLEAN).	79161	25.5	25.7	0.2	40	35	30	<0.05
25.9	47.25				GREY LAMINATED SILICIFIED SILTSTONE DARKER UNITS POSS. CARBONACEOUS. FEW TILLITIC INTERBEDS. FINE GRAINED (CLASTS ≤ 3mm) VERY FEW CLASTS DISTRIBUTED THROUGH ZST. BROKEN CORE TO 30.80m. FEW ◻ VUGS/HOLES.	Py FORMS FILM ON SOME FRACTURE PLANES. FRACTURES @ HIGH ∠ TO BEDDING. C.A. 80-90° MINOR QTZ. VEINING.								
					ASSAY: 45.30 → 47.25 m	Py PRESENT ON: BEDDING PLANES.	166	45.30	47.25	1.95	100	20	50	<0.05
					40.5 → 42.6 m	: CHANGES IN DEPOSITION ZST - TILLITE (MICA)	165	40.5	42.6	2.1	250	70	40	<0.05
					38.2 → 39.3 m	: FRACTURES.	164	38.2	39.3	1.1	50	95	100	<0.05
					35.1 → 35.8 m	: CLAST BOUNDARIES.	162	35.1	35.8	0.7	40	170	65	<0.05
					36.0 → 37.5 m	IN PLACES Py IS CONCORDANT	163	36.0	37.5	1.5	50	75	60	<0.05
						GRAPHITE ± QTZ-Py-Cpy @ 42.5m.								

CRAE H7 PLAN No 80-446

SUMMARY AND SPECIAL COMMENTS: NO SIG. MAG. RESPONSE OR RADIOMETRIC ANOMALY

DRILL HOLE IN APPILA TILLITE, NEAR CONTACT ± WILLYERPA QUARTZITE (POSSIBLY IN TILLITIC INTERVAL WITHIN WILLYERPA)

LOGGED BY D.L.A. DATE 14/12/79.

SHEET 1 OF 4

C.R.A. EXPLORATION PTY. LIMITED

WIRRABARA D.D.H. DRILL CORE LOG

PROJECT: WIRRABARA

CO-ORDINATES: 1050N 1030E | AZIMUTH: MN 195° | DRILLERS: NITSCHE | COMMENCED: 11/12/79 | DEPTH: 150·1m | HOLE No.: WAD 5

RL COLLAR: | INCLINATION: 65° | DRILL TYPE: LONGYEAR 38 | COMPLETED: 18/12/79 | CASING LEFT: — | DPO No(s): A·0318

DEPTH FROM(M)	DEPTH TO(M)	CORE REC. (M)	CORE SIZE	GRAPHIC LOG	CORE DESCRIPTION	SPECIAL FEATURES WEATH., ALTERATION, FRACTURING VEINING, MINERALIZATION	SAMPLE No.	FROM (M)	TO (M)	REC (M)	ASSAY VALUES Cu	Pb	Zn	Ag
47·25	51·4	4·1	NQ		VERY FINE GRAINED QUARTZITIC SILTSTONE, POORLY LAMINATED WITH FREQUENT TILLITIC INTERVALS WITH VARIABLE CLAST COMPOSITION: MAFIC, ACID IGNEOUS, CARBONACEOUS SHALES, QUARTZ. TILLITIC INTERVALS EXHIBIT COARSE SORTING, LARGER CLASTS AT BASE OF TILLITIC INTERVALS. CROSS-BEDDING IMMEDIATELY BELOW BASE OF 30mm TILLITIC BANDS, FACING IS UP.	Py:cpy RATIO 6:4 SULPHIDES MAINLY VEIN FILLING AT HIGH ANGLE TO BEDDING. RARE MASSIVE SULPHIDE REPLACEMENT OF CLASTS. SOME Py-cpy ASSOC. WITH RIPPLE MARKS. GRAPHITE LOCALLY. PYRRHOTITE USUALLY PRESENT AS CONCORDANT PAPER THIN INTERVALS.								
					ASSAY: 47·3 - 48·3 m		167	47·3	48·3	1·0	40	80	65	<0.05
					48·95 - 50·0 m		168	48·95	50·0	1·05	100	30	25	<0.05
					50·1 - 51·3 m		169	50·1	51·3	1·2	70	25	30	<0.05
51·4	55·1	3·6			TILLITE. CLAST - MATRIX RATIO VERY VARIABLE MAXIMUM DEVELOPMENT 70:30. LOCALLY GRADES INTO SILICEOUS SILTSTONE. CLAST COMPOSITION AS ABOVE, ANGULAR TO ROUNDED, MAXIMUM SIZE OF CLASTS 4 cm.	RARE CLASTS PARTIALLY REPLACED OR RIMMED BY SULPHIDE. TALC ALTERATION ASSOC. WITH FRACTURES. MINOR QUARTZ VEINING < 2mm THICK.								
					ASSAY: 52·1 - 53·0 m		170	52·1	53·0	0·9	30	10	30	<0.05
					53·6 - 55·1 m		171	53·6	55·1	1·5	35	5	25	<0.05
55·1	58·1	3			DARK FINE GRAINED SILTSTONE, HARD, POORLY DEVELOPED CLEAVAGE. CARBONACEOUS MATERIAL EVENLY DEVELOPED THROUGHOUT SEQUENCE POSSIBLY AS HIGH AS 4%. RARE CLASTS, MAX. SIZE 5 cm. CLEAVAGE AT AN ANGLE OF 60° TO CORE	SULPHIDES < 2% PRESENT AS SELVAGES AROUND CLASTS AND AS PAPER THIN VEINS AT A HIGH ANGLE TO BEDDING.								
					ASSAY: 55·1 - 58·1 m		172	55·1	58·1	3·0	45	25	40	<0.05
58·1	65·5	7·4			TILLITE AS ABOVE, LARGEST CLAST, 22cm, BASAL CONTACT WITH MATRIX LOOKS INTRUSIVE, UPPER CONTACT CLEARLY TILLITE. CARBONACEOUS IN PLACES, PATCHY	TRACE SULPHIDES. QUARTZ VEINING THICKNESS ≤ 5cm								
					ASSAY: 59·1 - 61 m		173	59·1	61·0	1·9	50	45	40	<0.05
65·5	67·7	2·2			FINE GRAINED LAMINATED SILICIFIED SILTSTONE - QUARTZITE LIGHT GREY. CORE TO BEDDING ANGLE ABOUT 90°. MINOR SMALL TILLITIC FRAGMENTS	THIN QUARTZ VEINING. TRACE SULPHIDES ASSOCIATED WITH QUARTZ VEINING.								
					ASSAY: 66·6 - 67·2 m		174	66·5	67·2	0·7	15	15	12	<0.05
67·7	78·9	11·2			LIGHT GREY TILLITIC INTERVAL. CLAST COMPOSITION VARIABLE, GRANITIC CLASTS MORE PREVALENT. SILICIFIED SILTSTONE - QUARTZITE BETWEEN 70·8 - 73·0 m. SOFT SEDIMENT DEFORMATION AT 72·95. SULPHIDES SHOW POSITIVE CORRELATION WITH MINOR CARBONACEOUS INTERVALS	PAPER THIN QUARTZ VEINING. SULPHIDES ASSOCIATED WITH QUARTZ VEINING. Py-cpy AT 72·95m 3% " " 76·0m 4% TRACE GALENA AT 70·2m.								
					ASSAY: 69·9 - 70·9 m		175	69·9	70·9	1·0	65	190	95	<0.05
					72·8 - 73·0 m		176	72·8	73·0	0·2	45	30	35	<0.05
					73·6 - 74·6 m		177	73·6	74·6	1·6	640	25	40	<0.05
					75·0 - 75·4 m		178	75·0	75·4	0·4	140	5	35	<0.05
					75·8 - 76·9 m		179	75·8	76·9	1·1	200	5	40	<0.05

CORE KEPT

SUMMARY AND SPECIAL COMMENTS

LOGGED BY: O.L.A | DATE: 18/12/79

C.R.A. EXPLORATION PTY. LIMITED

PROJECT WIRRABARA 00063

WIRRABARA D.D.H. DRILL CORE LOG

CO-ORDINATES 1050 N 1030 E AZIMUTH MN 195° DRILLERS NITSCHE COMMENCED 11/12/79 DEPTH 150·1m HOLE No. WAD 5

RL COLLAR INCLINATION 65° DRILL TYPE LONGYEAR 38 COMPLETED 18/12/79 CASING LEFT — DPO No(s) 8:0318

DEPTH FROM (M)	DEPTH TO (M)	CORE REC. (M)	CORE SIZE	GRAPHIC LOG	CORE DESCRIPTION	SPECIAL FEATURES WEATH., ALTERATION, FRACTURING VEINING, MINERALIZATION	SAMPLE No.	FROM (M)	TO (M)	REC (M)	Cu	Pb	Zn	Au
78·9	88·7	9·8	NQ		FINE GRAINED TILLITIC SILICIFIED GREY SILTSTONE	QUARTZ - PY - CPY VEINING								
					CLAST % < 5%, SIZE: SMALL - MEDIUM GRANITE CLASTS	PARALLEL TO DRILL CORE								
					BECOMING MORE FREQUENT. SILTSTONE, LAMINATED WITH	MAIN THICKNESS ≤ 4mm.								
					MINOR CROSS BEDDING. CORE ANGLE 85° FACING IS	QUARTZ VEINS CONTAIN APPROX								
					UP. BROKEN CORE FROM 86·0m	10% SULPHIDE	797180	80·4			35	10	40	<0·05
					ASSAY : 80·4 - 83·9 m		797181		83·9	3·5	30	10	35	<0·05
					86·0 - 88·7 m.									
88·7	96·7	8·0			AS ABOVE ALTHOUGH MORE WEATHERED POSSIBLY DUE	EARTHY SPACE FILLING								
					TO SHEARING (NO OTHER EVIDENCE OF DEFORMATION)	ALTERATION LINING CLASTS AND								
					RARE QUARTZ - FELDSPAR - BIOTITE GNEISS CLASTS	FILLING HOLES POSSIBLY AFTER								
					GRAPHITE PRESENT AS A FILM ON FRACTURES	SULPHIDES								
					BROKEN CORE FROM 94·5m.	NO FRESH SULPHIDES.								
					ASSAY : 92·6 - 93·6 m.		183	92·6	93·6	1·0	180	15	45	<0·05
96·7	114	17·1			TILLITIC FINE GRAINED QUARTZITIC SILICIFIED SILTSTONE.	EXTENSIVE QUARTZ VEINING,								
					RARE SMALL CLASTS (MAXIMUM SIZE ≤ 4cm) GENERALLY	VEINS ARE APPROXIMATELY 3mm								
					ANGULAR EXCEPT FOR GRANITIC CLASTS. GRAPHITE	THICK AND SUB PARALLEL								
					PRESENT AS A FILM ON FRACTURE SURFACES. CORE IS	TO CORE HENCE DEVELOPED								
					FRIABLE AT 106·6m 6cm PORPHYRY CLAST AT 106·6m	OVER LENGTHS UP TO 1·5m								
					ASSAY : 96·9 - 97·7 m	PY-CPY 2-3% TALC	184	96·9	97·7	0·8	25	5	25	<0·05
					100·4 - 101·7 m	ALTERATION ASSOCIATED WITH	185	100·4	101·7	1·3	20	5	30	<0·05
					102·6 - 103·2 m	QUARTZ VEINING.	186	102·6	103·2	0·6	30	10	30	<0·05
					103·9 - 105·5 m	CPY RIMMING CLASTS AT	187	103·9	105·5	1·6	10	5	25	<0·05
					107·7 - 108·5 m	108·4m.								
114	119·2	5			SILTSTONE, LESS SILICIFIED THAN ABOVE, WELL DEFINED	3mm THICK QUARTZ VEINING								
					0·5 - 2cm LAMINATIONS. CORE ANGLE APPROXIMATELY	SUB PARALLEL TO CORE.								
					85° VERY FEW CLASTS. SILTSTONE APPROACHES QUARTZITE	NO SULPHIDES.								
					AT BASE. SOFT SEDIMENT STRUCTURE INDICATES									
					FACING IS UP. LOCALLY OXIDIZED.									
					ASSAY : 117·9 - 118·4 m.		188	117·9	118·4	0·5	8	<5	30	<0·05
119·2	146·6	27·4			REPETITION OF ABOVE UNIT WELL LAMINATED, NO	FE STAINED CLASTS								
					SOFT SEDIMENT STRUCTURES. GRADATIONAL TO	BETWEEN 120 - 133m								
					TILLITE BELOW 120·9m. FEWER GRANITIC CLASTS,	3mm THICK QUARTZ VEINS								
					CLASTS ARE SMALL AND ANGULAR.	PARALLEL TO CORE BETWEEN								
					BADLY BROKEN CORE AT 120m, 121m, 130·1m (FRIABLE),	123·9 - 125·6m WITH QUARTZ								
					140·8m	CRYSTALS.								
					GRAPHITE FILM DEVELOPED ON FRACTURES	TRACE PY-CPY AT 125·5m.								
					MATRIX IS FRIABLE AND COARSER GRAINED AT BASE									
					ASSAY : 123·9 - 125·6m		189	123·9	125·6	1·7	190	10	30	<0·05

SUMMARY AND SPECIAL COMMENTS

LOGGED BY D.L.A. DATE 18/12/79

SHEET 3 OF 4

00064

C.R.A. EXPLORATION PTY. LIMITED

PROJECT WIRRABARA

WIRRABARA DDH. DRILL CORE LOG

CO-ORDINATES 1050N, 1030E AZIMUTH MN. 195° DRILLERS NITSCKE COMMENCED 11/12/79 DEPTH 150·1m HOLE No. WRD. 5

RL COLLAR INCLINATION 65° DRILL TYPE LONGYEAR 38 COMPLETED 18/12/79 CASING LEFT DPD No(s) B:0318

DEPTH FROM(M)	DEPTH TO(M)	CORE REC. (M)	CORE SIZE	GRAPHIC LOG	CORE DESCRIPTION	SPECIAL FEATURES WEATH., ALTERATION, FRACTURING VEINING, MINERALIZATION	SAMPLE No.	FROM (M)	TO (M)	REC (M)	ASSAY VALUES Cu	Pb	Zn	Au
146·6	149·8	3·2	NQ		TUFFITE, FEN MEDIUM - LARGE CLASTS MATRIX APPROACHING A QUARTZITE (GRAINSIZE APPROX 0·5mm) CORE ANGLE 80°-85°	TALC ALTERATION ON FRACTURES 1cm THICK QUARTZ VEINING AT 147·5m PARALLEL TO BEDDING								
149·8	150·1	0·3			MEDIUM GRAINED QUARTZITE (QUARTZ - FELDSPAR - BIOTITE - TALC - TRACE PY) NO LAYERING ASSAY 149·9 - 150·1m.	EXTENSIVE TALC ALTERATION ON FRACTURES TRACE SULPHIDE	190	149·9	150·1m	0·2	35	<5	10	4005
					EASTMAN SURVEY AT E.O.H. 150·1m DIP: 56° AZIMUTH: 215° MAGNETIC									

SUMMARY AND SPECIAL COMMENTS

LOGGED BY DLA. DATE 18/12/79

SHEET 4 OF 4

C.R.A. EXPLORATION PTY. LIMITED

SEVENTH QUARTERLY REPORT FOR THE PERIOD ENDING JUNE 4, 1980 AND THE FINAL REPORT ON WIRRABARA E.L. 417, SOUTH AUSTRALIA.

AUTHOR: R.A. MANNING

SUBMITTED TO: D.R. KENNEDY

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DATE: AUGUST 1, 1980.

CONTENTS PAGE

1. SUMMARY

Wirrabara E.L. 417 was taken out to investigate previously untested geophysical anomalies in the Wirrabara area, and a reported kimberlite occurrence at Bangor.

Using data from Westchester Mining Corporation Pty. Ltd.'s airborne survey, M.S. Locke (1976) located an open ended I.P.-resistivity anomaly in close proximity to the Charlton Copper Mine. It was on the basis of this anomaly that C.R.A. Exploration Pty. Limited applied for the area.

Drilling of the I.P. anomaly near the Charlton Copper Mine intersected stringers of pyrite and graphite within the Appila Tillite. There were no significant basemetal intersections.

The reported kimberlite occurrence was not located, and subsequent drilling of a dipolar magnetic anomaly revealed a highly magnetic dolerite intrusion rather than a kimberlite body. The remaining dipolar magnetic anomalies are considered to reflect dolerite intrusions.

2. INTRODUCTION

Wirrabara E.L. 417 is centred on the Wirrabara township, 30 kilometres north-east of Port Pirie. It was granted to C.R.A. Exploration Pty. Limited on September 4, 1978 and renewed for a further 12 months from September 5, 1979.

This report summarizes all the work carried out on the E.L. during the two year period.

3. PREVIOUS EXPLORATION

Prior to C.R.A. Exploration's interest in the area, two other companies had been actively involved in exploration work.

Westchester Mining Corporation Pty. Limited held the Wirrabara area from 1970 to 1972 under S.M.L. 426, and during that time contracted McPhar Geophysics to carry out an airborne geophysical survey. Total field magnetics, dual frequency quadrature electromagnetic, and four channel gamma ray spectrometric data were recorded.

A small aeromagnetic anomaly coincident with an E.M. anomaly was found approximately 300 metres NNE of the Charlton Copper Mine. No ground follow-up of this anomaly was documented.

Cultus Pacific operated in the area under E.L. 49 from March 1973 to March 1974. Exploration involved the follow-up of airborne anomalies found by Westchester and a brief geological reconnaissance of the Adelaidean sediments of the region. No ground geophysics of geochemistry was done over the anomalies. A sample from a kimberlitic dyke found near Bangor was assayed for copper, and described petrographically but was not followed up.

In 1976, M.S. Locke, an Honours student at the University of Adelaide used Westchester Mining Corporation's airborne geophysical data as the basis for his thesis. He undertook a fairly detailed interpretation of all the data with follow-up ground magnetic, I.P. and resistivity surveys of selected anomalies, including the coincident magnetic-E.M. anomaly near the Charlton Copper Mine.

Ground magnetics showed the magnetic anomaly and I.P.-resistivity anomaly were not coincident. Locke's interpretation of the I.P.-resistivity anomaly showed a conductor at a depth of 30 metres and a width of 90 metres. Copper sulphides were suggested as a possible cause of the anomaly.

4. GEOLOGY

Wirrabara E.L. covers folded sediments of the Adelaide Geosyncline belonging to the Burra and Umberatana Groups. Outcrop is poor over much of the E.L. with only the resistant quartzite and glacial units exposed. No geological mapping of the area has been attempted, but some outcrops near the Charlton Mine were visited in order to measure strike and dip of strata in the vicinity of the geophysical survey area.

Secondary copper mineralisation occurs at the Charlton Copper Mine and at a locality two kilometres south-west of Wirrabara (see plan SAa 232). The Charlton Mine closed in 1858 and the only remains are a chimney and some scattered azurite and malachite rubble on the surface. The mine is described as having two lodes of azurite as nodular lumps in rough, white, decomposed feldspar with minor quartz and mica. The lodes are narrow, dip south-east and strike north-east for about 200 metres with no apparent structural control. The grade is unknown (Min. Rev. 95 p 88). There is no outcrop around the mine and no record of the host lithology to mineralisation. A small section of very weathered and leached siltstone and shale is exposed in a scraping next to the main road approximately 500 metres north-east of the old chimney. This may be part of the Tindelpina Shale which is a carbonaceous, pyritic shale member of the lower Tapley Hill Formation, immediately overlying glacial sediments of the Yudnamutana Subgroup. This interpretation is consistent with geology as mapped on the Burra 1:250,000 sheet. The Tindelpina Shale Member is known to host stratabound copper mineralisation around the Mt. Coffin and Copley diapiric structures on the Copley 1:250,000 sheet.

5. WORK DONE

5.1 Geophysics

5.1.1 I.P. Survey

Solo Geophysics and Co. were contracted to carry out a small I.P. survey near the Charlton Mine with the aim of locating the I.P.-resistivity anomaly found by Locke in 1976. The survey involved 3000 metres of reading on three lines using a dipole - dipole array with 50 metre spreads. Readings were taken at one to six dipole separations using a McPhar P660 instrument. The locations of these lines and the pseudosections are contained in Appendix I.

Interpretation of the psuedosections is complicated by fences and powerlines which traverse the area, and water saturated ground. However, there are some responses due to subsurface conductors which are detailed below.

Line	Primary Anomaly	Secondary Anomaly
1100N	1000E	1000-1200E
1000N	1025E	1025-1400E
"Chimney"	775E	Nil

These anomalies show a poorly defined open ended linear conductor trending north-west for 400 metres. The anomaly is adjacent to old mine workings on line 1000N which suggest that the anomaly may be due to sulphide mineralisation. The anomalous percent frequency effects obtained over large distances on lines 1000N and 1100N may be caused by carbonaceous units within the Tindelpina Shale Member. Carbonaceous shales may be the explanation for Locke's interpreted width of 90 metres. The lines were extended eastwards in an attempt to reach background levels.

5.1.2 Magnetics

Charlton Grid

Two kilometres of ground magnetometer traversing was conducted in the vicinity of the I.P. traverses. Readings were taken at ten metre intervals on four lines spaced 50 metres apart, using a grid coincident with the I.P. survey grid (plan SAa 294). An Austral PPM-1 magnetometer was used, with the sensor on a two metre staff. The data has been corrected for drift.

The profiles (plan SAa 295) are generally flat and fairly noisy, the only outstanding feature being a peculiarly shaped high-low of 400 gammas on line 1000mN. Although this anomaly appears consistent from station to station, short infill lines 20 metres to the north and south failed to define the shape of the anomaly. On the ground it is coincident with a small creek and an old fence line, and it is suggested the source is either a shallow accumulation of creek debris or a buried man-made object.

New Grid

A large dipolar aeromagnetic anomaly was vaguely defined on the ground by one magnetometer traverse conducted by M.S. Locke during his work at the Charlton Copper Mine. A new grid oriented true north-south, east-west was laid out and 2500 metres of ground magnetics carried out to more completely define this anomaly. Instruments and operating conditions were identical to those of the Charlton Grid magnetometer traverses. Data obtained (plan SAa 296) verified the approximate shape and location of the anomaly.

The ground magnetometer profile on line 500E was chosen for quantitative interpretation, using computer modelling. Based on a straight sided prism model, the best fit was obtained using an infinitely deep body of dimensions 40 metres by 40 metres at a depth of 35 metres. The best fit susceptibility is found to be 0.35 (SI units). A listing of the modelling parameters and calculated anomaly, plus a plot of observed versus calculated profiles is enclosed in Appendix II.

5.2 Geochemistry

During the search for the kimberlitic dyke reported by Cultus Pacific N.L. three rock samples were collected and despatched to the Zinc Corporation for analysis by A.A.S. The results are tabled below.

Sample No.	Pb	Zn	Cu	Ni	Cr	Mn	Ag	in p.p.m.
615965	13	27	130	61	130	250	1	
615966	15	44	580	110	120	760	1	
615967	13	13	260	53	30	510	1	

Petrographic description of the samples (Appendix III) showed the samples to be sediments.

5.3 Drilling

August, 1979.

Davies Drilling was contracted to drill one percussion hole to 100 metres to test the Charlton I.P.-resistivity anomaly. After four unsuccessful attempts the programme was abandonned.

The holes intersected carbonaceous shales with minor fluvioglacials, and were abandonned without intersecting sufficient quantities of minerals accountable for an anomalous I.P. effect. Drill logs are contained in Appendix IV.

Shales above the target horizon had maximum values of copper 260 p.p.m., lead 60 p.p.m., and zinc 108 p.p.m. Scanning of percussion rock cuttings with a four channel spectrometer showed no significant radiometric anomalies.

December, 1979.

W.A.D. 5, located approximately 300 metres W.N.W. of the Charlton Copper Mine (plan SAa 365), intersected stringers of pyrite and graphitic film on fractures from 42 metres to 114 metres within the Appila Tillite. The hole was completed in Willyerpa Quartzite.

0 - 9.0m	Non coring
9.0 - 11.1m	Weathered tillite. HQ core size
11.1 - 16.5m	No recovery. NQ core below 16.5m
16.5 -114.0m	Tillite, variable clast composition, frequently grading down to grey siltstone. Base of oxidation 25.9m. Pyrite with accessory chalcopyrite as paper-thin veinlets - maximum development 3%. Trace galena at 70.2m. Graphite content variable.
114.0-119.2m	Siltstone, grey, no sulphides.
119.2-149.8m	Tillite as above. Trace pyrite
149.8-150.1m	Quartzite. Quartz-feldspar-biotite-talc rock, medium grained, light grey. No sulphides.

B.O.H. 150.1 metres

Table 1. Summary Log of W.A.D. 5.

The best basemetal intersection was between 73.5 and 74.5 metres where values of copper 640 p.p.m., lead 75 p.p.m. and zinc 40 p.p.m. were recorded.

Assays and logs are presented in Appendix IV.

June, 1980.

A percussion hole, 80WP1, is located on the New Grid alongside the main road (see plan SAa 365). Scanty sulphide mineralisation was intersected in metasediments overlying a dolerite intrusion and in the dolerite. The hole was completed at 100 metres in dolerite. A summarised log is presented below.

0 - 22m	Alluvium
22- 28m	Metasediments? Dark grey quartzitic/siltstone rock fragments. Coarse disseminated pyrite and chalcopyrite (trace amounts).
28-100m	Dolerite. Dark green, chloritised, kaolinised dolerite. Fine to medium grained. Highly magnetic.

Base metal values peaked in the 16 to 18 metre interval where copper values reached 330 p.p.m., lead < 4 p.p.m., zinc 60 p.p.m., nickel 50 p.p.m., gold 0.05 p.p.m. and tungsten 30 p.p.m.

5.4 Kimberlites

Loam and stream gravel samples were taken near topographic and aeromagnetic anomalies looking for kimberlitic indicator minerals. None were found.

6. CONCLUSIONS

Pyrite and graphite stringers are responsible for the I.P. anomaly near the Charlton Copper Mine, with there being no significant basemetal intersections.

Bulls-eye airborne magnetic anomalies result from dolerite intrusive bodies which have a highly magnetic nature.

Rosemary Manning

R.A. MANNING

REFERENCES

Andrews, D.L.	1980	Fifth Quarterly Report On Wirrabara E.L. 417 for the Period Ending December 4, 1979.
	1980	Sixth Quarterly Report On Wirrabara E.L. 417 for the Period Ending March 4, 1980.
Bubner, G.J.	1979	Fourth Quarterly Report On Wirrabara E.L. 417 for the Period Ending September 4, 1979.
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	1979	Third Quarterly Report on Wirrabara E.L. 417 for the Period Ending June 4, 1979.
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Geomanagement Pty. Ltd.	1974	Final Report E.L. 49. S.A.D.M.E. Open File Env. 2286.
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Westchester Mining Corp. Pty. Ltd.	1972	Final Report S.M.L. 426 S.A.D.M.E. Open File Env. 1567.

KEYWORDS

Copper, kimberlite, Proterozoic-Up, assays-drill, drill-diamond, drill-percussion, geophys-I.P., geophys-mag.

00074

LOCATION

Burra SI 54-5

Orroroo SI 54-1

LIST OF PLANS

SAa 135	Location Plan Wirrabara E.L. 417	1:250,000
SAa 232	Regional Geological Interpretation - Wirrabara E.L. 417	1:250,000
SAa 233	Charlton Copper Mine	1:5,000
SAa 263	Cross Section Line 1000N Proposed Hole 79 WA1	1:1,000
SAa 294	Magnetometer Traverses - Charlton Grid and New Grid.	1:5,000
SAa 295	Ground Magnetic Profiles - Charlton Grid	1:2,500
SAa 296	Ground Magnetic Profiles - New Grid	1:5,000
SAa 365	Cross Section W.A.D. 5	1:750

APPENDICES

Appendix I Induced Polarization and Resistivity Survey, Wirrabara, by Solo Geophysics and Co.

Appendix II Ground Magnetic Profiles - New Grid

Appendix III Petrographic Descriptions

Appendix IV Drill Logs

00075

APPENDIX I

Induced Polarization And Resistivity Survey

For: C.R.A. Exploration Pty. Limited

Area: Wirrabara, S.A., E.L. No. 417.

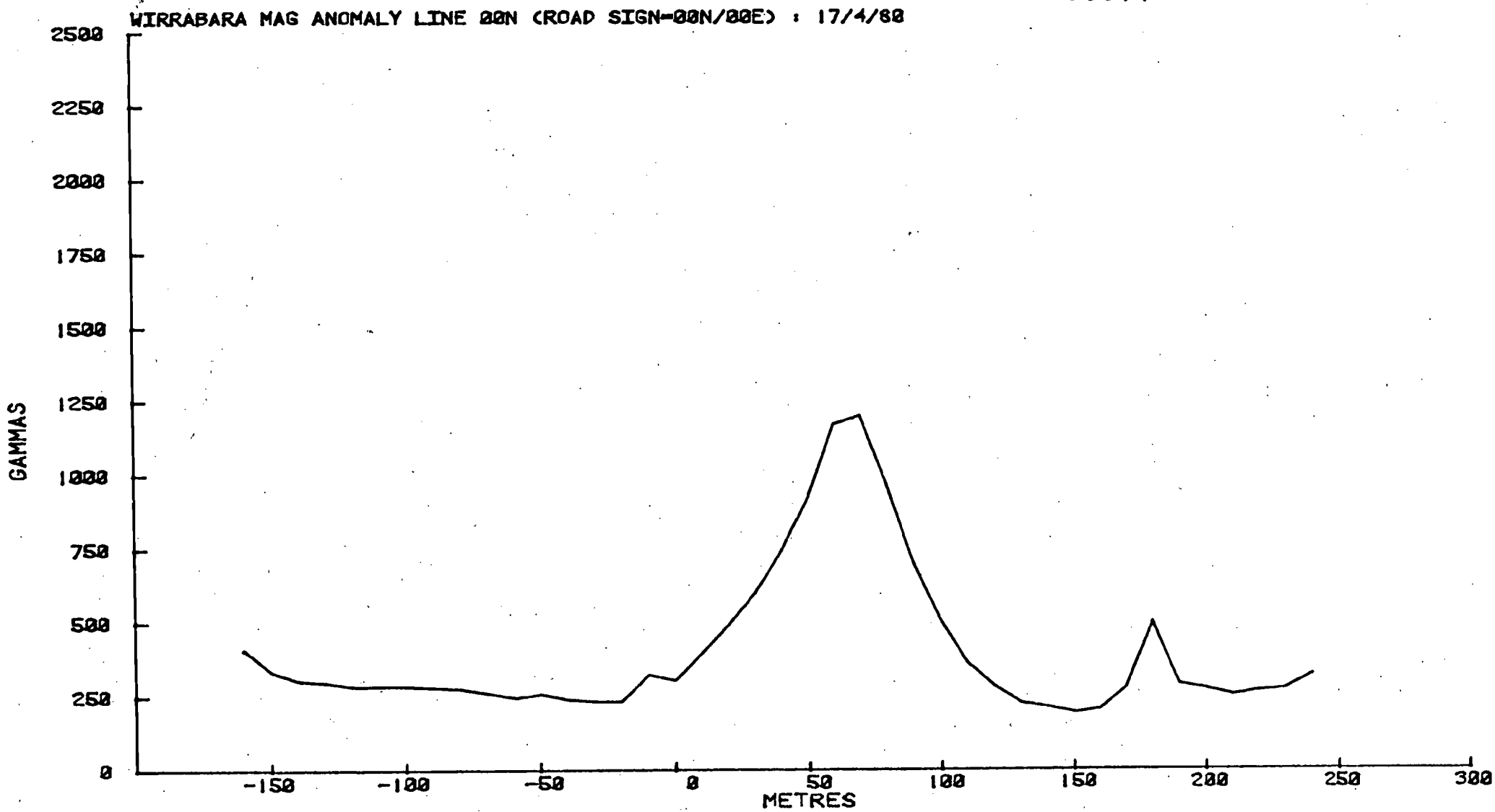
Date: September 1978.

00076

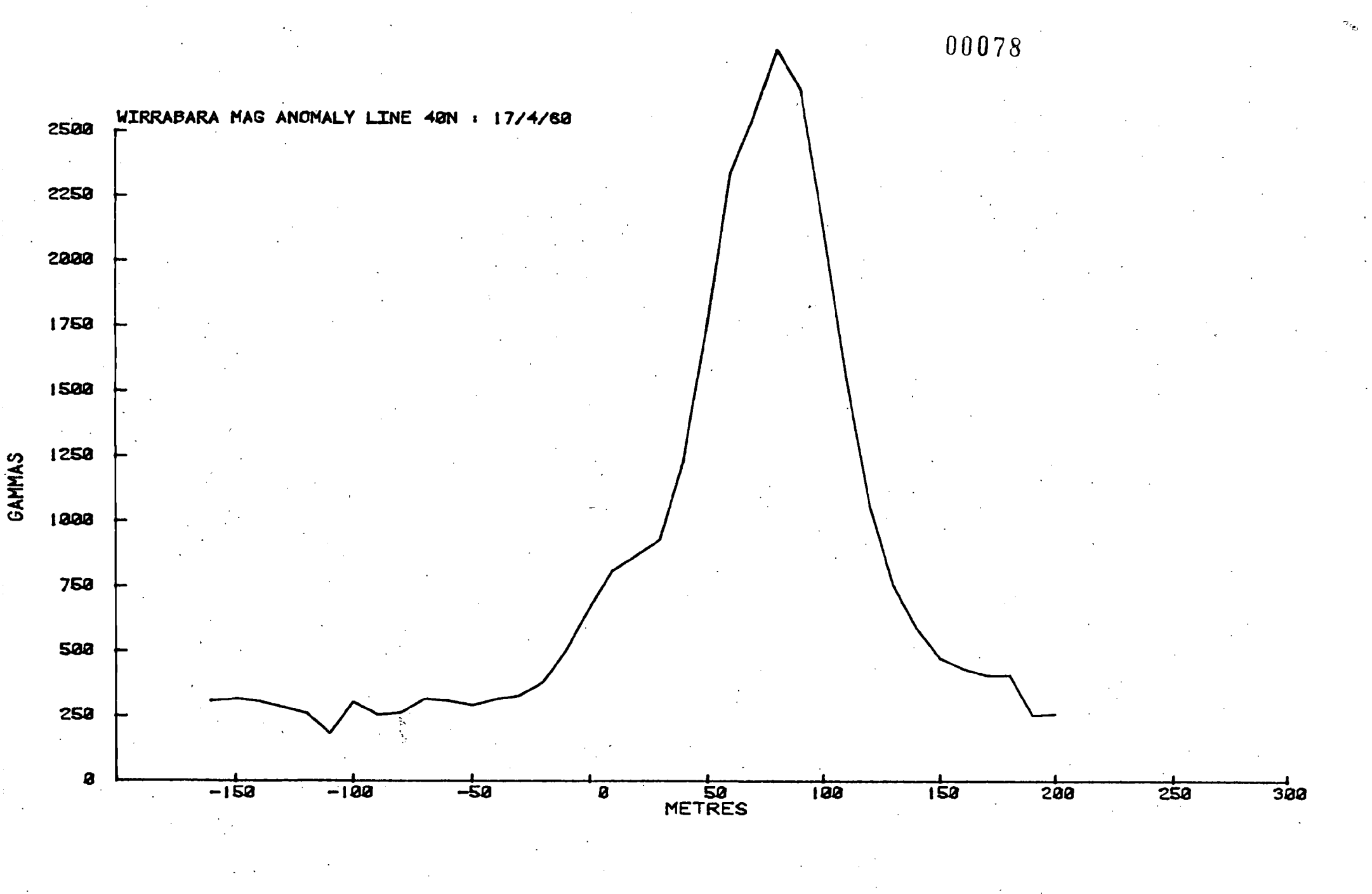
APPENDIX II

Ground Magnetic Profiles - New Grid

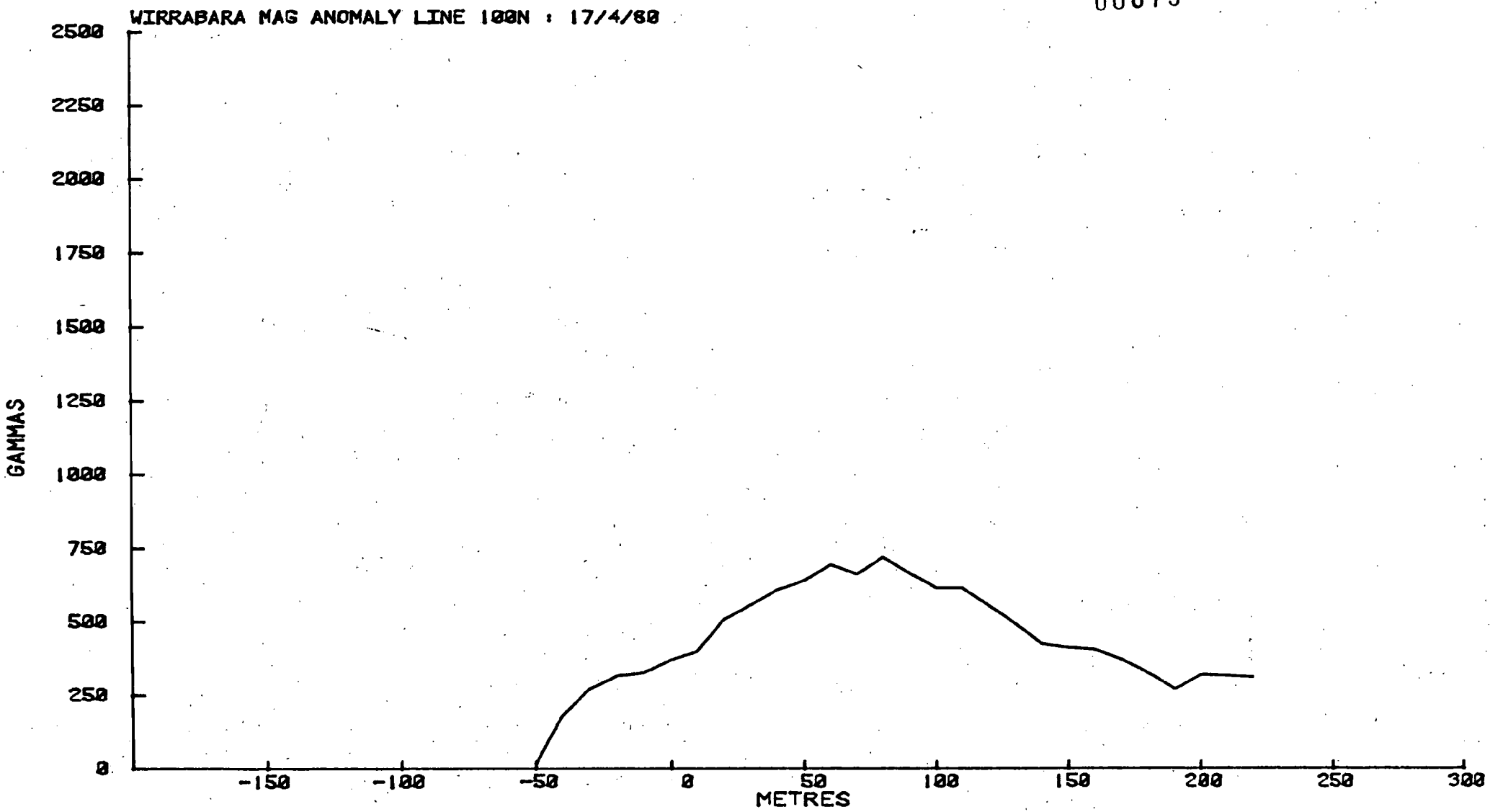
00077


WIRRABARA MAG ANOMALY LINE 00N (ROAD SIGN-00N/00E) : 17/4/80
GAMMAS
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
-150
-100
-50
0
50
100
150
200
250
300
METRES

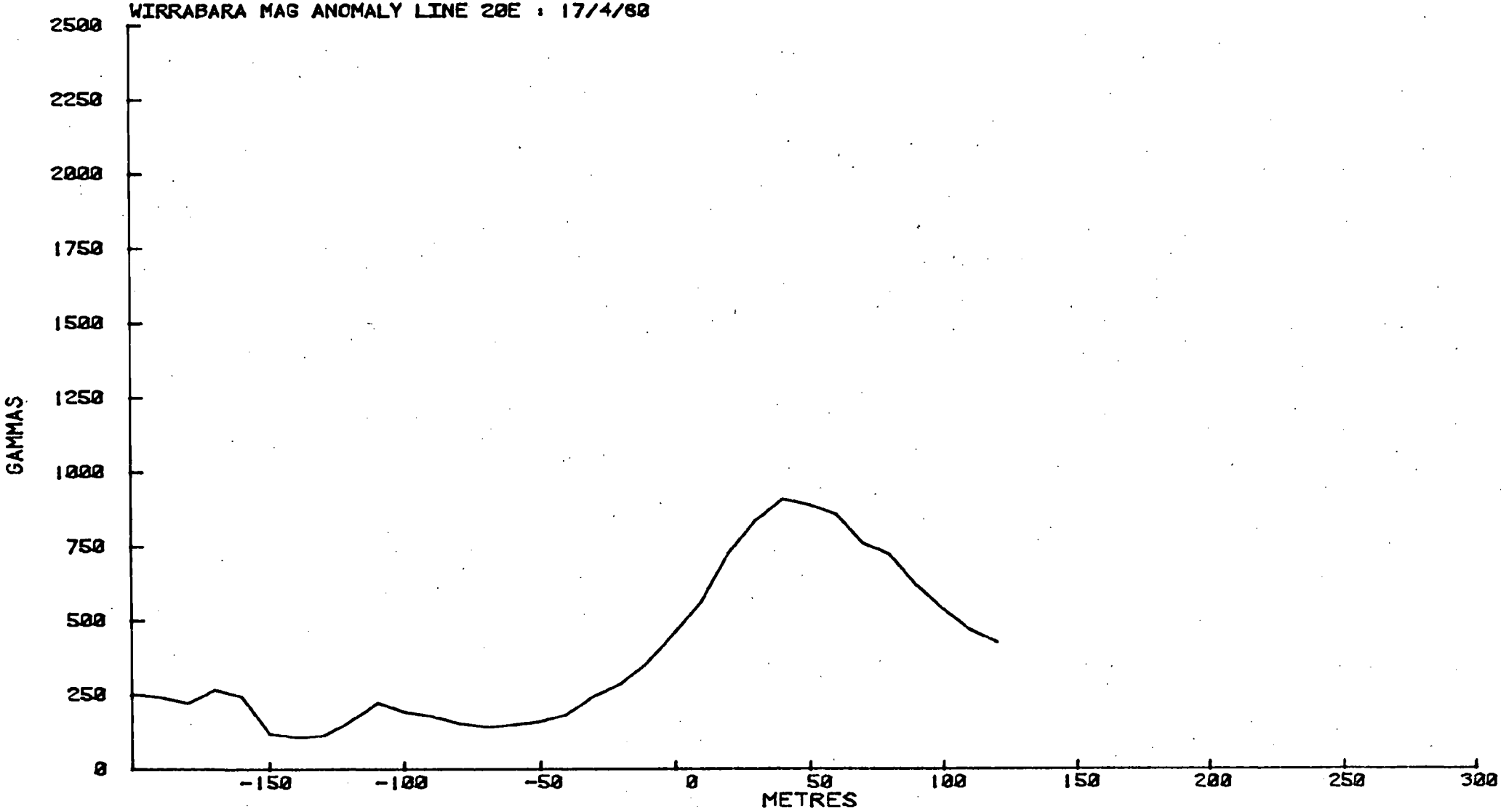
00078

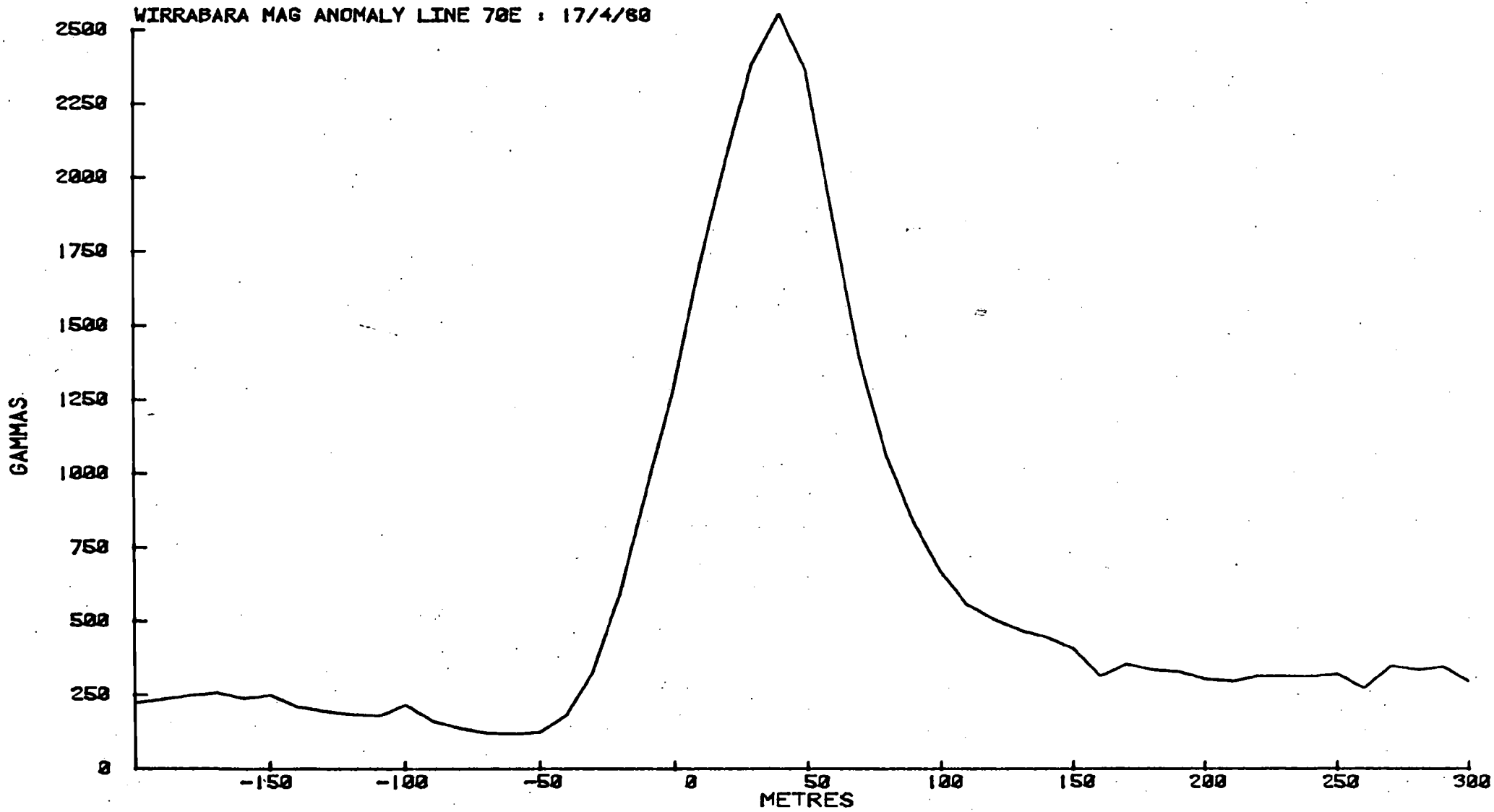

WIRRABARA MAG ANOMALY LINE 40N : 17/4/60
GAMMAS
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
-150
-100
-50
0
50
100
150
200
250
300
METRES

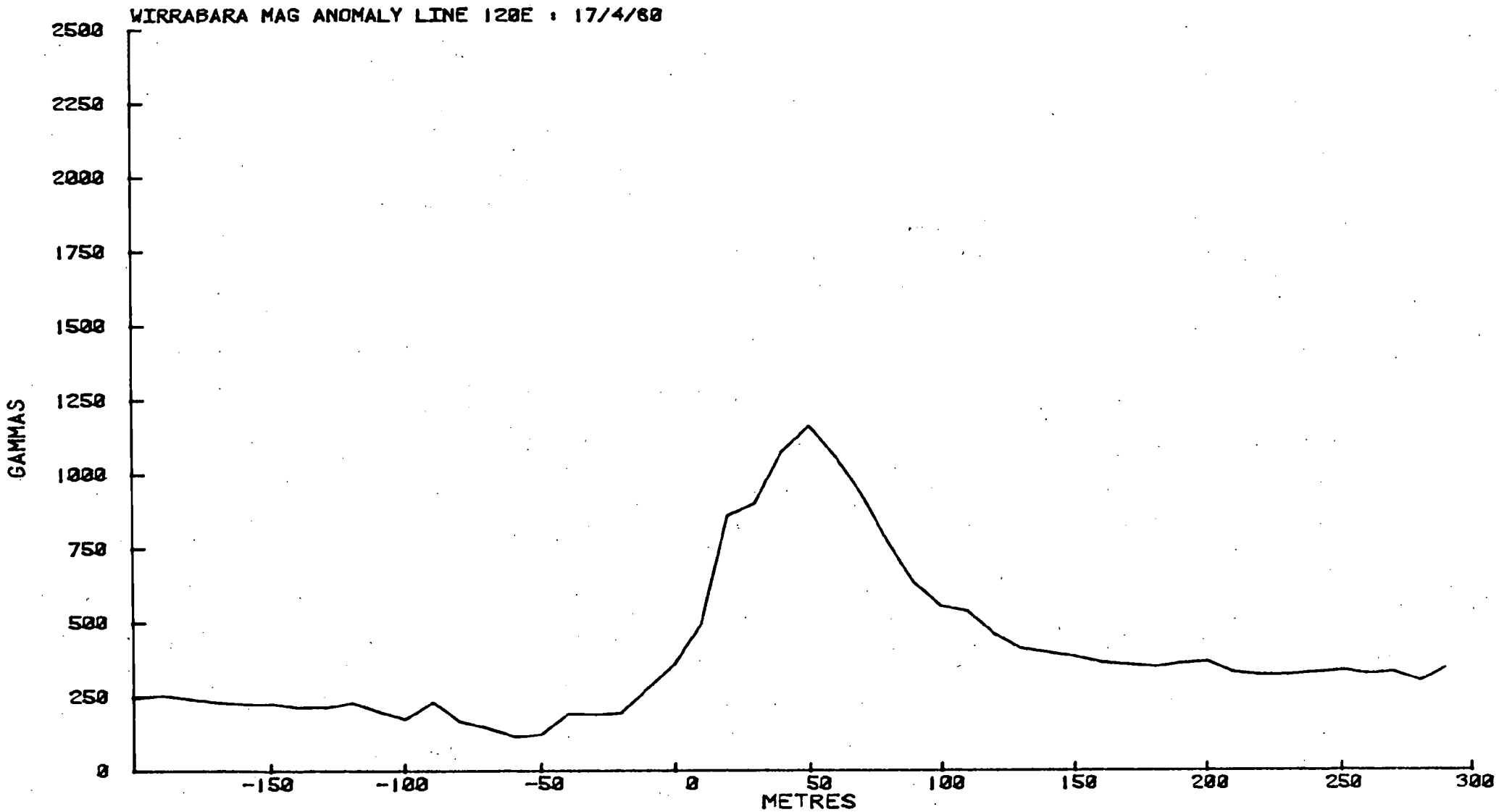
00079


WIRRABARA MAG ANOMALY LINE 100N : 17/4/80
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
GAMMAS
-150
-100
-50
0
50
100
150
200
250
300
METRES

WIRRABARA MAG ANOMALY LINE 20E : 17/4/80




WIRRABARA MAG ANOMALY LINE 70E : 17/4/80
GAMMAS
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
-150
-100
-50
0
50
100
150
200
250
300
METRES


WIRRABARA MAG ANOMALY LINE 120E : 17/4/60
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2250
2000
1750
1500
1250
1000
750
500
250
0
GAMMAS
-150
-100
-50
0
50
100
150
200
250
300
METRES

00083

APPENDIX III

Petrographic Descriptions

00084

Pontifex & Associates Pty. Ltd.

TEL. 332 6744
A.H. 31 3816

26 KENSINGTON ROAD, ROSE PARK
SOUTH AUSTRALIA

P.O. BOX 91, NORWOOD
SOUTH AUSTRALIA 5067

MINERALOGICAL REPORT NO. 2951

16th July, 1980

TO: Mr. D.L. Andrews,
CRA Exploration Pty. Ltd.,
31 Osmond Terrace,
NORWOOD, S.A. 5067

YOUR REFERENCE: Order No. 0344

MATERIAL AND IDENTIFICATION: Drill cuttings samples -
80 UP1, 74 to 76 m (754335)
80 UP1, 98 to 100 m (754342)

WORK REQUESTED: Thin section and description

SAMPLES & SECTIONS: Returned to you with this report

PONTIFEX & ASSOCIATES PTY. LTD.

80WP1, 74 to 76 m : (1) mainly 'leuco-dolerite or gabbro', moderately hydrothermally argillised, silicified, chloritised and carbonated with scattered Fe & Ti oxides, notably rutile, and accessory pyrite;

(754335)

(2) subordinate 'microdolerite' or 'basalt', pervasively argillised, chloritised and carbonated;

(3) subordinate chips of chlorite-carbonate ± chlorite and Ti oxides representing pervasive alteration, also + accessory pyrite;

(4) minor extensively altered tremolite/actinolite rock

About 50% of the rock chips are medium grained, holocrystalline, composed mainly of randomly interlocking, calcic-plagioclase crystals, and minor, finer altered hornblende. This aggregate is altered, with argillised microfissures in the plagioclase; patchy carbonate interstitially, and within plagioclase; small patches of interstitial quartz; and the hornblende is altered to chlorite and green biotite. Minute crystals of rutile occur in numerous clusters, mainly within (?deuteric) quartz. Accessory pyrite and apatite are scattered. The chips may be tentatively identified as 'leuco-dolerite'.

About 25% of the chips have a relict microcrystalline texture characteristic of a microdolerite (?or basalt). This is preserved by a mass of extremely fine clays, chloritic clays and minor carbonate which pervasively replace the original rock. Minor very small crystals of rutile (and/or leucoxene), and of magnetite and pyrite are disseminated; and in some crystals these phases are intergrown.

.../

80WP1 74 to 76 m continued :
754335

About 15% of the chips consist entirely of a secondary, alteration assemblage, with poorly preserved primary texture, or no preserved texture at all. These consist of irregular aggregates, of variable amounts of 'vein' quartz, and/or carbonate, with vague textural relicts of plagioclase and/or (?retrograded) actinolite. Fine rutile and/or leucoxene, also accessory pyrite, are scattered.

About 7% of the chips, consist of turbid, massive, fine actinolite or tremolite rock, partly invaded by quartz; also these carry accessory Fe and Ti oxides and trace pyrite.

80WP1, 91 to 100 m : (754312)

(1) mainly baselt or microdolerite, fairly extensively argillised ± chlorite, carbonate and leaser quartz, disseminated Fe & Ti oxides and trace pyrite;

(2) subordinate fine 'leuco-dolerite', moderate alteration as above, accessory pyrite;

(3) minor chips of hydrothermal carbonate, quartz alteration ± pyrite

The chips in this semple have essentielly the same gross composition as in 754335, but in slightly different relative ebundance.

About 50% of the chios consist of microdolerite (?chilled margin) or possibly of baselt. The intricately interlocking plagioclase microlites are feirly extensively argillised, extremely fine ?pyroxene, rutile and magnetite are dispersed. Irregular small patches of chlorite and carbonate are scattered.

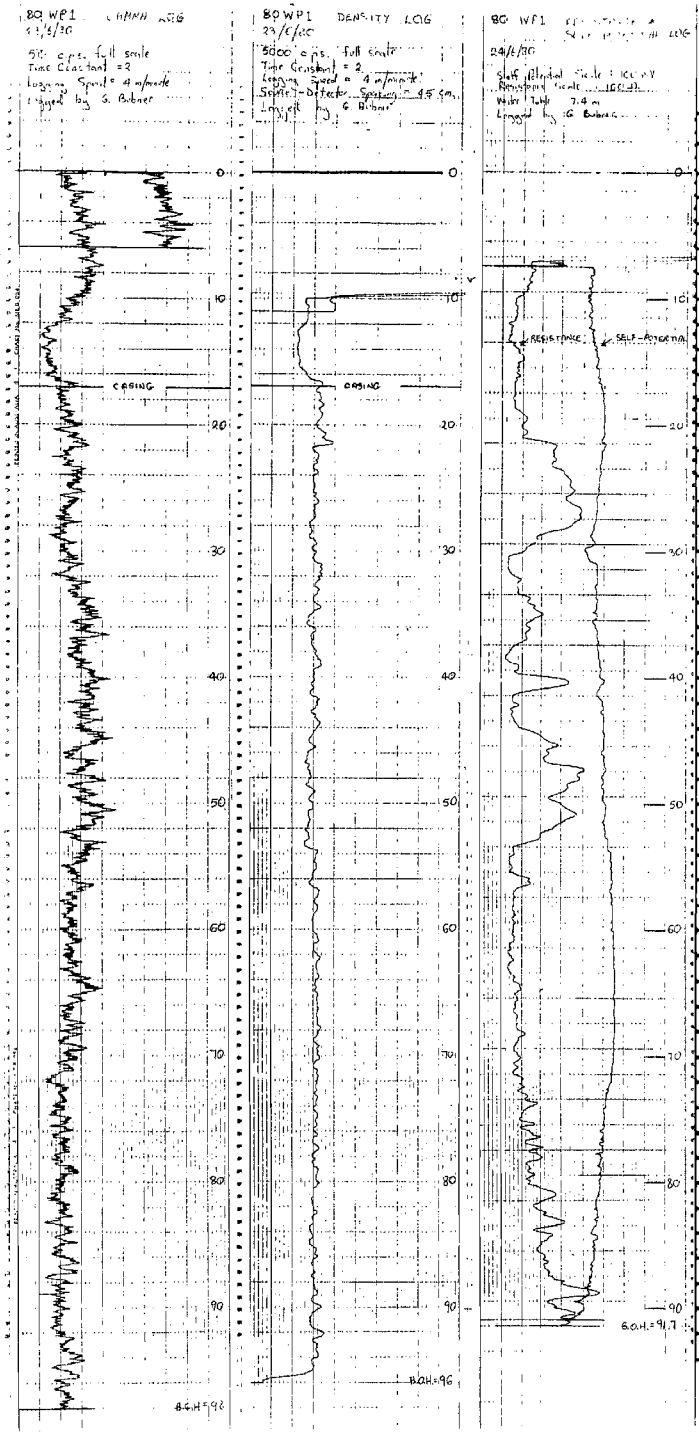
About 30% of the chips consist of a medium sized crystalline aggregate of interlocking plagioclase laths, with minor, patchy, (largely interstitial) carbonate, lesser quartz and chlorite alteration; minor scattered Fe and Ti oxides and pyrite.

The remaining approximately 20% of the chips consist of randomly crystalline quartz and/or carbonate, ± pyrite and Ti oxides, ± relicts of plagioclase and chlorite.

00088

APPENDIX IV

Drill Logs



CRA EXPLORATION PTY LIMITED

PROJECT WIRRABARA 00089

WIRRABARA P.D.H. DRILL CORE LOG

WIRRABARA

CO-ORDINATES 20N/70E MAG. GRID | AZIMUTH – | DRILLERS NITSCHKE

RL COLLAR SURFACE | INCLINATION 90° | DRILL TYPE INGERSOL RAND TM3

COMMENCED 23/6/80 | DEPTH 100m | HOLE No. 80 WP1

COMPLETED 23/6/80 | CASING LEFT – | DPO No(s) B 0504

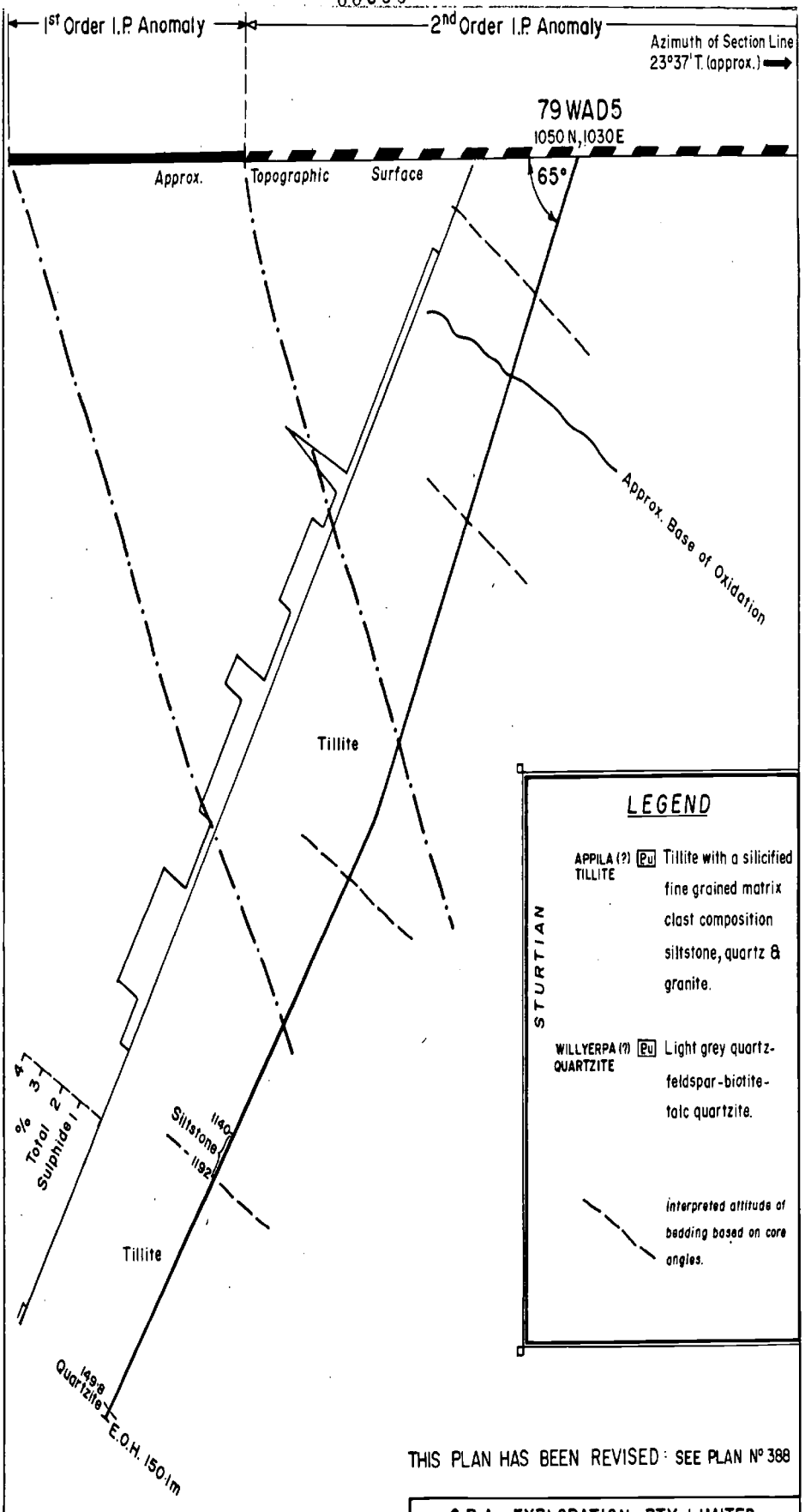
DEPTH FROM(M)	DEPTH TO(M)	REC %	HOLE DIAM.	GRAPHIC LOG	CUTTINGS DESCRIPTION	SPECIAL FEATURES (WEATH., ALTERATION, FRACTURING VEINING, MINERALIZATION)	SAMPLE No.	FROM (M)	TO (M)	CON (%)	ASSAY VALUES (ppm) Cu	Pb	Zn	Ni	Au	W
0	2				Alluvium. Red-brown to grey-brown sandy soil, towards	0.15 S.I. UNITS 0	834286	0	2		70	16	85	36	–	
2	4				base becomes a gritty silt with angular		87	2	4		24	8	16	28	–	
4	6				quartz grains. Kunkar fragments in upper		88	4	6		18	4	16	40	–	
6	8				levels. Some dark rock fragments.	Magnetic	89	6	8		24	<4	10	36	–	
8	10					Susceptibility	834290	8	10		28	<4	26	10	–	
10	12					(cuttings)	91	10	12		30	<4	12	32	–	
12	14						92	12	14		24	<4	10	28	–	
14	16						93	14	16		12	<4	10	40	–	
16	18						94	16	18		120	<4	14	50	–	
18	20						95	18	20		330	<4	60	50	<0.05	30
20	22						96	20	22		50	<4	12	36	–	
22	24				Metasediments? Dark grey-green rock fragments.	Calcite, siderite	97	22	24		145	<4	14	44	–	
24	26				Appear quartzite-like. Coarse, disseminated	veins.	98	24	26		46	<4	18	40	–	
26	28				pyrite and chalcopyrite.		99	26	28		70	<4	14	36	–	
28	30				Dolerite. Very soft, rubbly cuttings. Dark green.	Calcite, siderite	834300	28	30		50	<4	14	44	<0.05	10
30	32				Medium to fine grained.	veins.	1	30	32		190	<4	16	55	–	
32	34				Highly chloritic and kaolinitic.	Hydrothermal	2	32	34		80	<4	28	48	–	
34	36					alteration.	3	34	36		100	<4	20	40	–	
36	38					-chloritised.	4	36	38		24	4	18	28	–	
38	40					Vein quartz.	5	38	40		85	4	20	40	–	
40	42						6	40	42		60	4	18	40	–	
42	44						7	42	44		105	4	28	32	–	
44	46						8	44	46		30	4	18	44	–	
46	48						9	46	48		42	<4	18	86	–	
48	50						834310	48	50		60	<4	22	36	<0.05	15
50	52						11	50	52		18	<4	18	40	–	
52	54						12	52	54		46	<4	18	32	–	
54	56						13	54	56		85	4	20	36	–	
56	58						14	56	58		230	4	20	40	–	
58	60						15	58	60		120	4	20	44	–	
60	62						16	60	62		170	8	20	44	–	
62	64						17	62	64		90	4	16	40	–	
64	66						18	64	66		85	<4	24	44	–	
66	68						19	66	68		110	<4	22	60	–	
68	70						834320	68	70		32	4	20	55	<0.05	<10
70	72						21	70	72		130	<4	20	55	–	
72	74						22	72	74		42	<4	20	32	–	
74	76						23	74	76		105	<4	18	44	–	
76	78						24	76	78		20	<4	18	24	–	
78	80						25	78	80		26	<4	18	36	–	
80	82						26	80	82		14	<4	16	40	–	
82	84						27	82	84		46	<4	16	44	–	
84	86						28	84	86		165	<4	24	60	–	
86	88						29	86	88		120	<4	20	65	–	
88	90						834330	88	90		26	<4	20	65	<0.05	10
90	92						31	90	92		125	<4	18	44	–	
92	94						32	92	94		75	<4	18	60	–	

SUMMARY AND SPECIAL COMMENTS: Dolerite intrusion and overlying metasediments are highly magnetic and thought to account for the magnetic anomaly.

LOGGED BY R.A.MANNING DATE 5/8/80

SHEET 1 OF 2

00090



THIS PLAN HAS BEEN REVISED : SEE PLAN Nº 388

C.R.A. EXPLORATION PTY. LIMITED.

WIRRABARA E.L.417
DIAMOND DRILL HOLE 79 WAD 5
CHARLTON MINE AREA

1:250,000 Sheet Ref.: BURRA SI 54-5.

Geol.: D.L.A.	Scale: 1:750
Drawn: D.R.W.	Report Nº: 9454.
Date: DEC. '79.	Plan Nº: SAa 365.

00091

CRA EXPLORATION PTY LIMITED

PROJECT WIRRABARA

WIRRABARA P.D.H. DRILL CORE LOG

CO-ORDINATES 20 N/70 E WIRRABARA MAG. GRID AZIMUTH – DRILLERS NITSCHKE

RL COLLAR SURFACE INCLINATION 90° DRILL TYPE INGERSOL RAND TM3

COMMENCED 23/6/80 DEPTH 100 M HOLE No. 80 WP1

COMPLETED 23/6/80 CASING LEFT _____ DPO No(s) B 0504

DEPTH FROM(M)	DEPTH TO(M)	REC %	HOLE DIAM	GRAPHIC LOG	CUTTINGS DESCRIPTION	SPECIAL FEATURES (WEATH., ALTERATION, FRACTURING, VEINING, MINERALIZATION)	SAMPLE No.	FROM (M)	TO (M)	CON (%)	ASSAY VALUES (ppm) Cu	Pb	Zn	Ni	Au	W
94	96				Dolerite. - as before.		834333	94	96		20	<4	16	50	-	
96	98				Samples are harder and fresher than		34	96	98		85	<4	50	48	-	
98	100				previously.		35	98	100		16	4	12	48	<0.05	<10

0.15 S.I. UNITS 0

Magnetic Susceptibility. (cuttings)

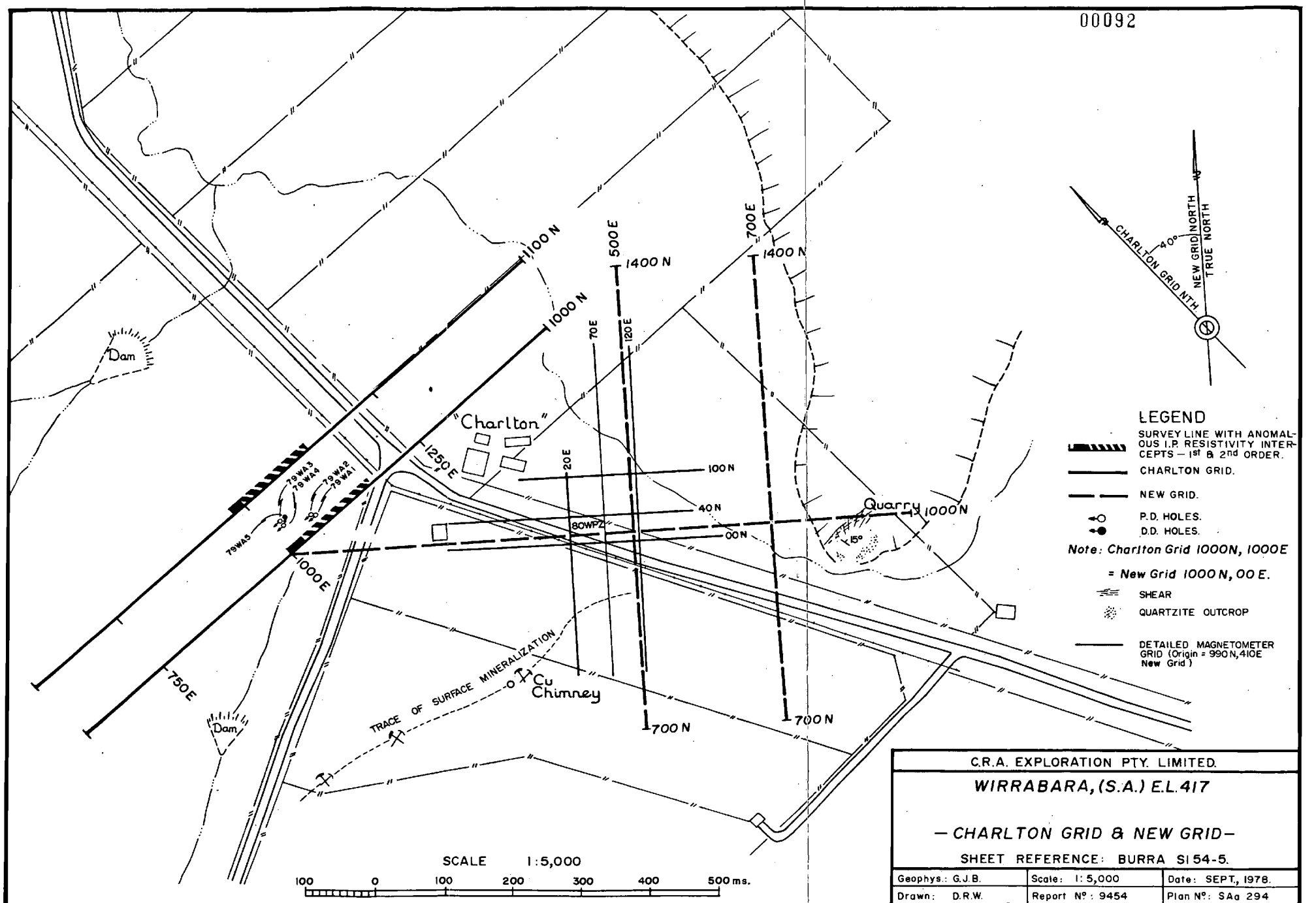
SUMMARY AND SPECIAL COMMENTS Dolerite intrusion is highly magnetic and thought to be responsible for the magnetic anomaly.

LOGGED BY R.A.MANNING DATE 5/8/80

SHEET 2 OF 2

CRAE 117
PLAN No M 446

00092



C.R.A. EXPLORATION PTY. LIMITED.

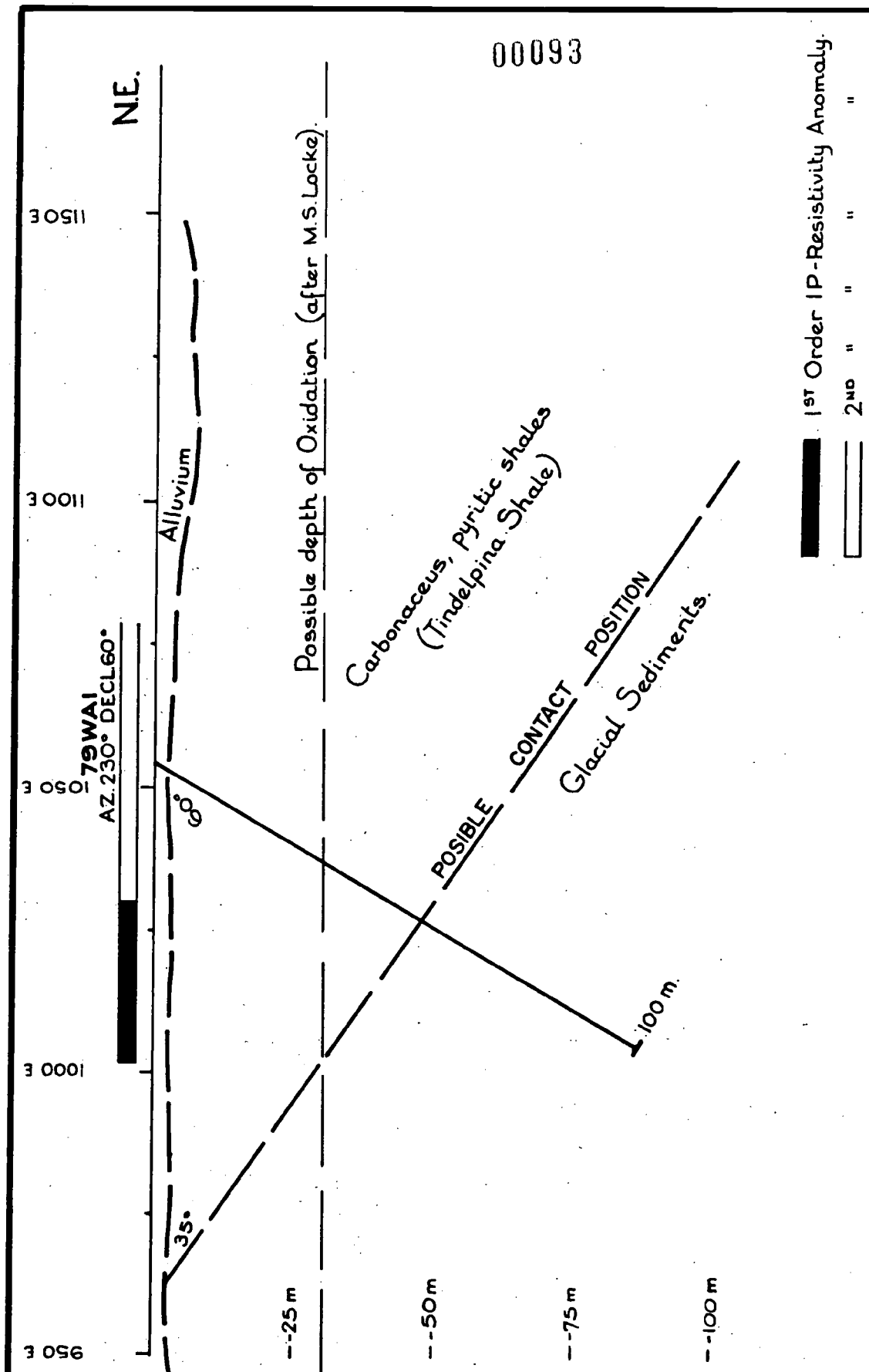
WIRRABARA, (S.A.) E.L. 417

— CHARLTON GRID & NEW GRID —

SHEET REFERENCE: BURRA SI 54-5.

Geophys.: G.J.B.	Scale: 1:5,000	Date: SEPT., 1978.
Drawn: D.R.W.	Report Nº: 9454	Plan Nº: SAa 294

00093



C.R.A. EXPLORATION PTY. LIMITED.

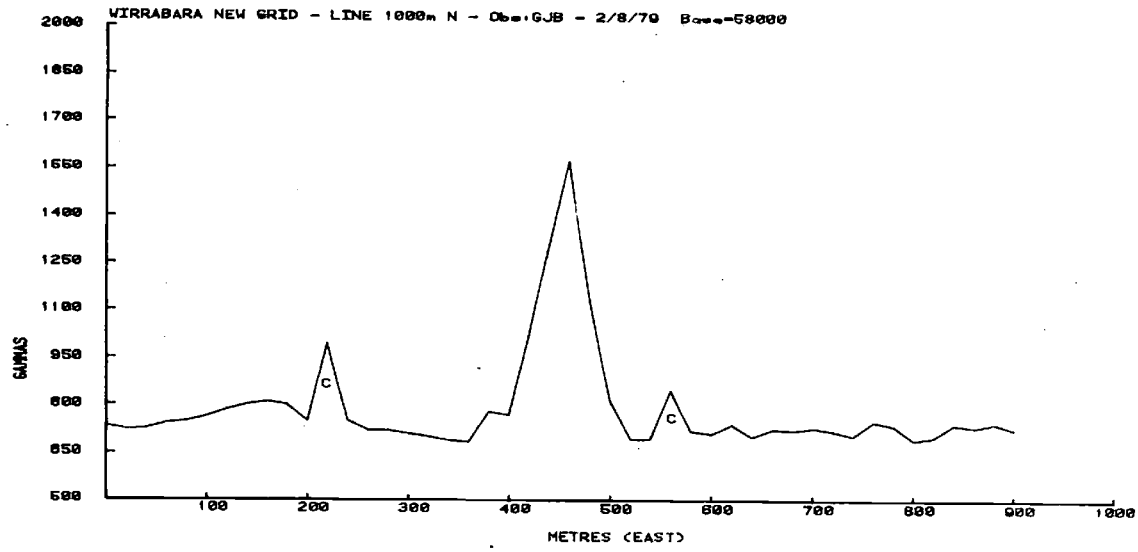
WIRRABARA, E.L. 417

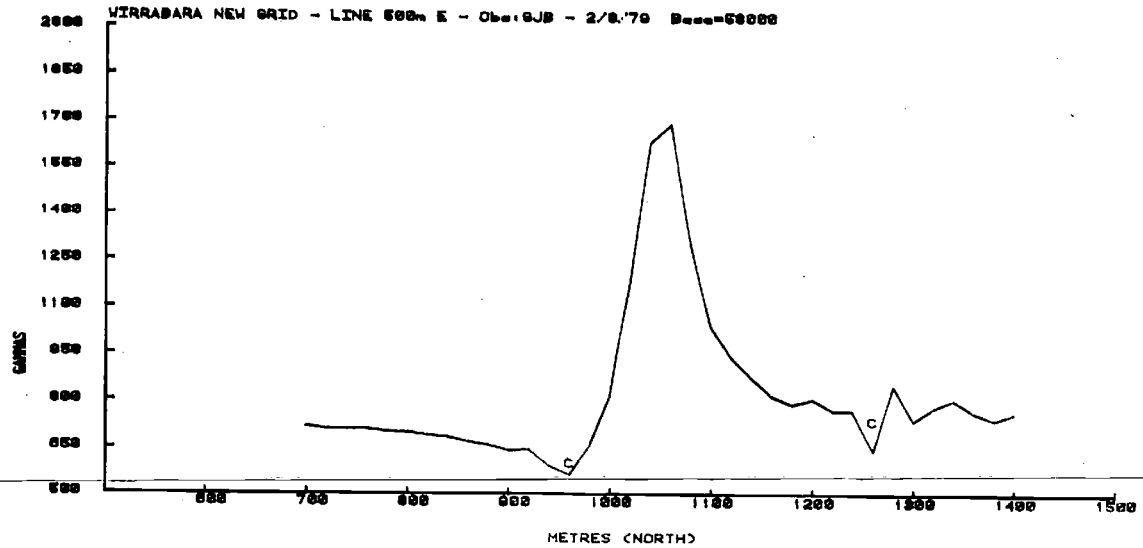
CROSS SECTION-LINE 1,000 N

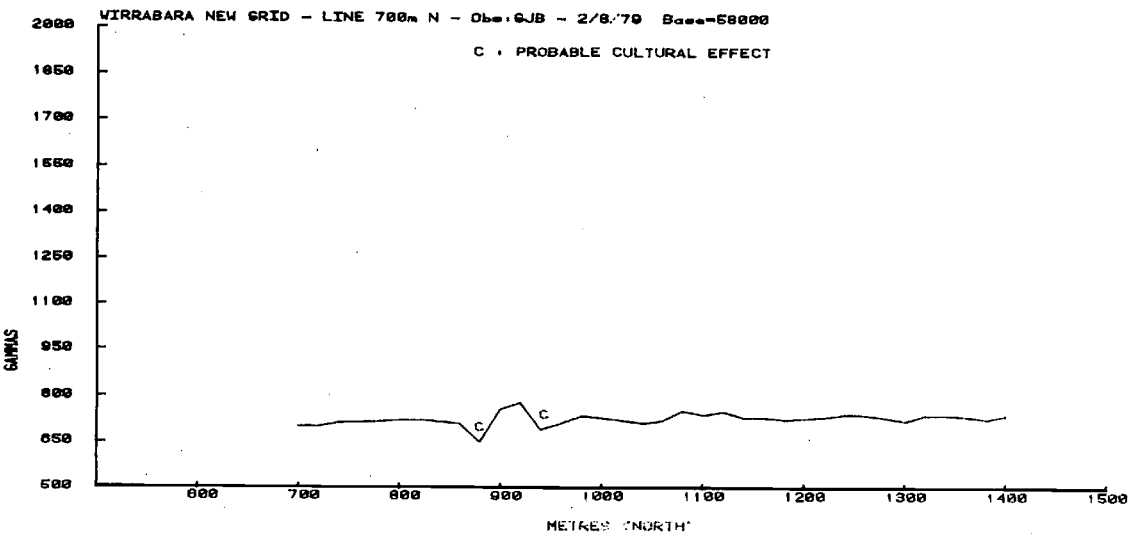
PROPOSED HOLE 79 WA 1

1:250,000 SHEETS: ORRORO SI54-1 & BURRA SI54-5.

Geol.: A.G.C.	Scale: 1:1,000.	Report No: 945
Drawn: D.R.W.	Date: 10 MAY '79	Plan No SAa 26







SHEET REF.: BURRA SI 54-5

C.R.A. EXPLORATION PTY. LTD.

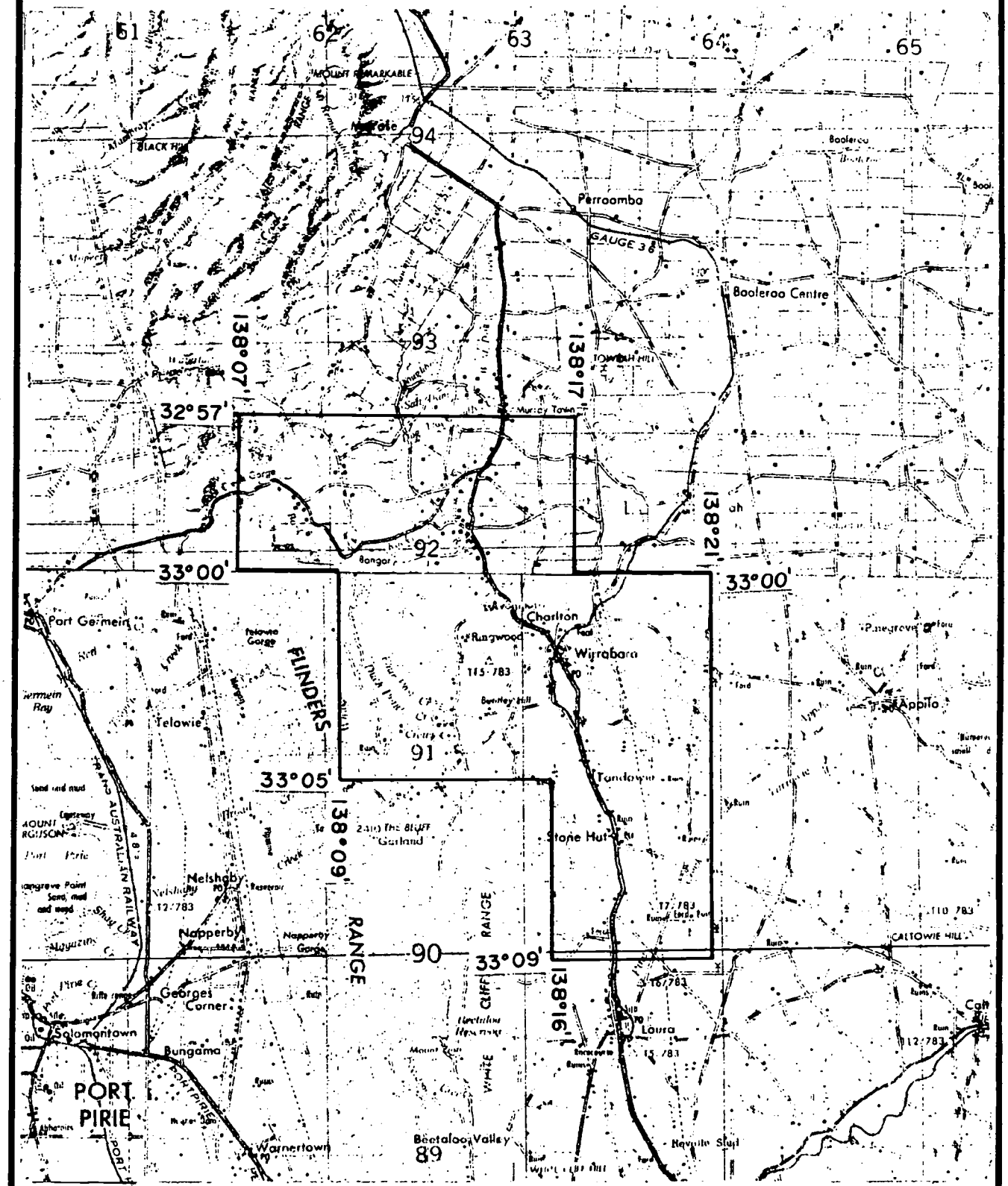
WIRRABARA E.L. 417

MAGNETIC PROFILES

NEW GRID

Geophys.: G.J.B. Date: Sept., 1979.

Report No.: 9454. Plan No.: 296



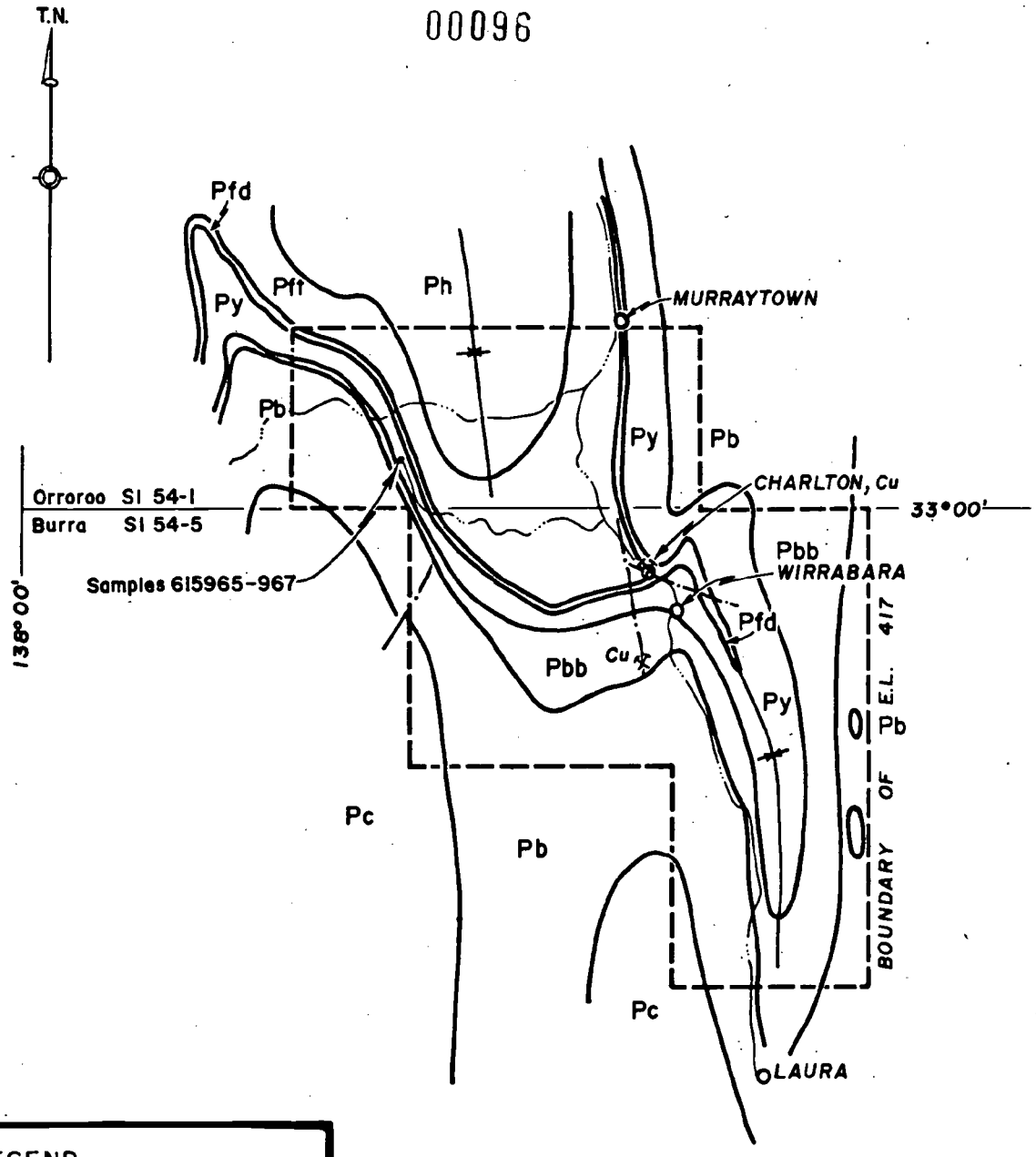
C.R.A. EXPLORATION PTY. LIMITED

LOCATION MAP
WIRRABARA (S.A.) E.L. 417.

SHEET REFERENCES: ORRORO0 SI 54-1
BURRA SI 54-5

Geologist : A.G.C.	Scale : 1:250,000	Drawn : D.R.W.
Report No: 9454	Date : Nov., 1977.	Plan No.: SA a 135

00096



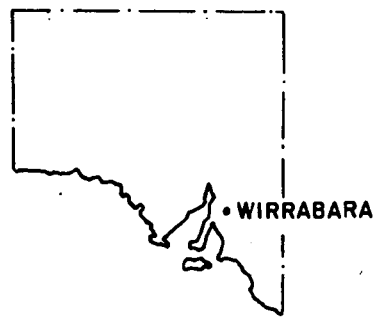
LEGEND

Ph	WILLOCHRA SUB-GROUP.
Pff	TAPLEY HILL FORMATION.
Pfd	TINDELPINA SHALE MEMBER.
Py	YUDNAMATAMA SUB-GROUP.
Pbb	BELAIR SUB-GROUP.
Pb	BURRA GROUP.
Pc	CALLANNA BEDS.

SYNCLINE.

FAULT.

MINE.



SCALE

1 0 5 10 KMS.

C.R.A EXPLORATION PTY. LIMITED.

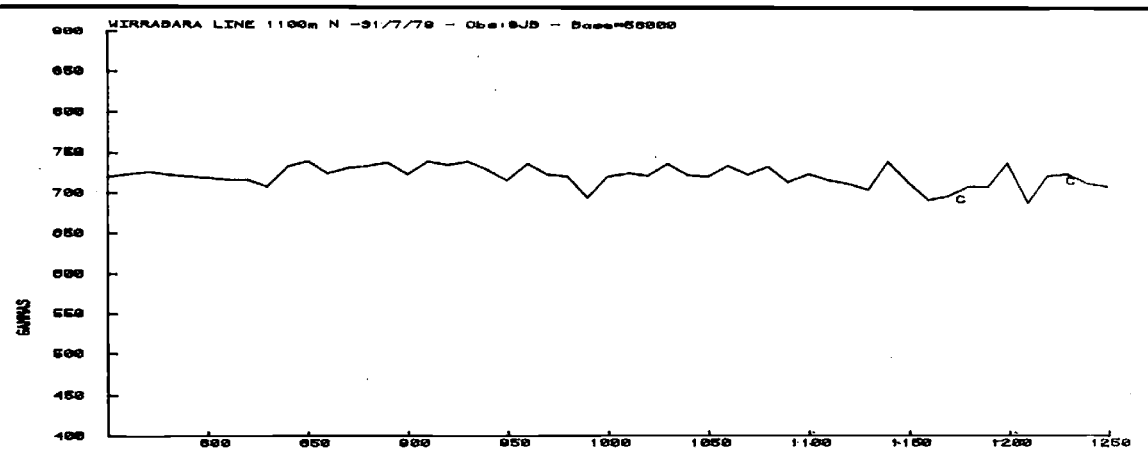
WIRRABARA (S.A.) E.L. 417.

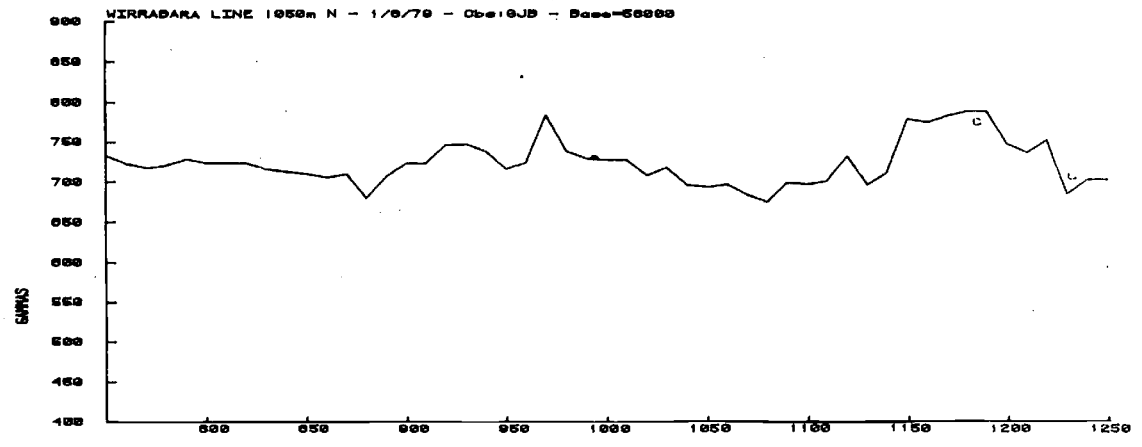
REGIONAL GEOLOGICAL INTERPRETATION

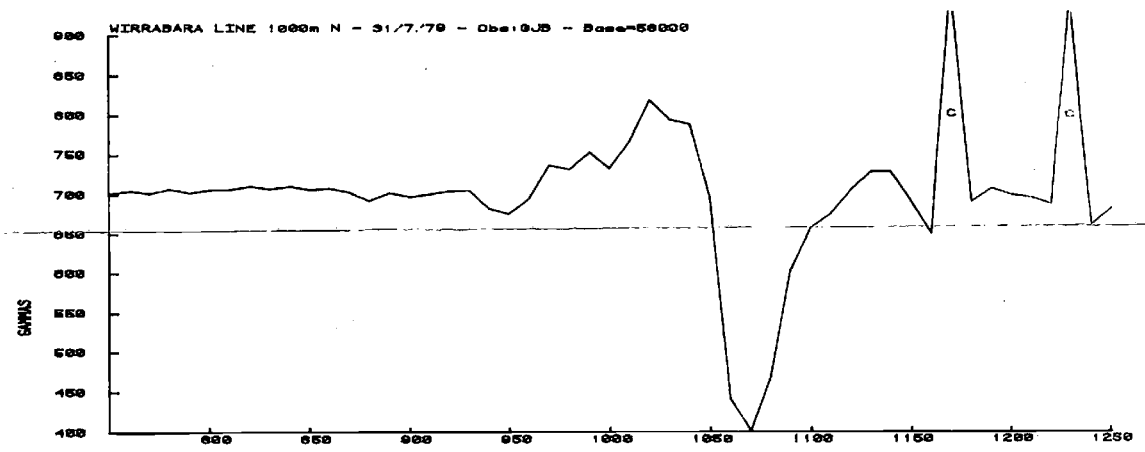
From Mines Dept. 1:250,000 Geological Series.

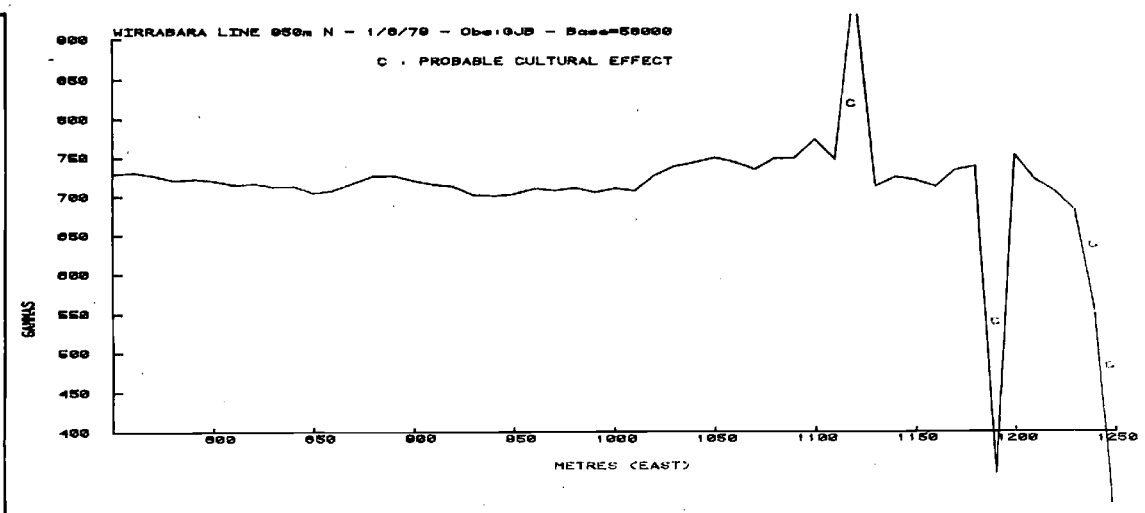
SHEET REF'S.: ORROROO SI 54-1, BURRA SI 54-5.

GEOL.: A.G.C.	SCALE: 1:250,000.
DRAWN: D.R.W.	REPORT Nº : 9454
DATE : DEC. 1978.	PLAN Nº: SAa 232.









SHEET REF: BURRA SI54-5

C.R.A. EXPLORATION PTY. LTD.

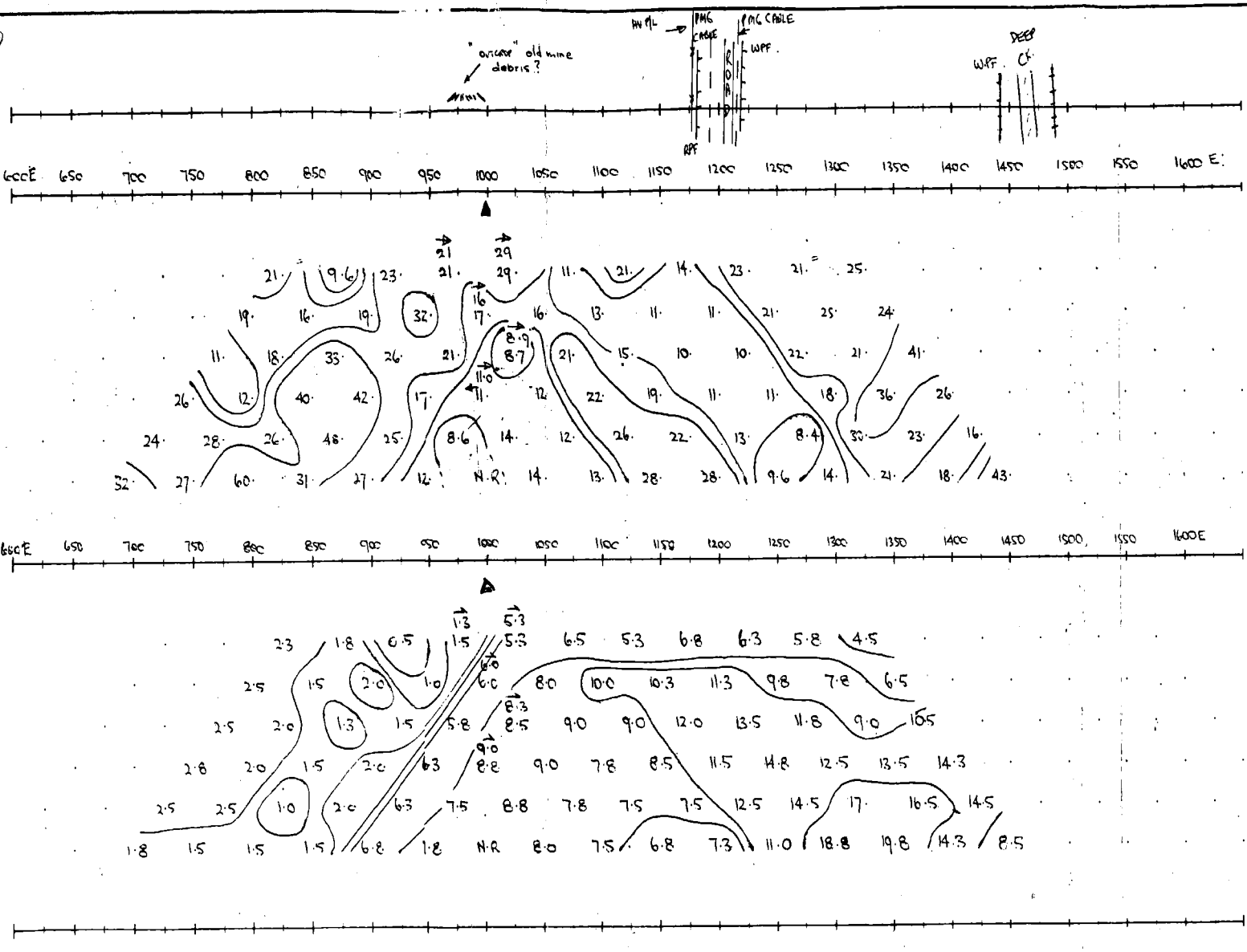
WIRRABARA E.L. 417

MAGNETIC PROFILES

CHARLTON GRID

Geophys.: G.J.B. Date: Sept, 1979.

Report No. 9454 Plan No. 295.



SOLO GEOPHYSICS AND CO.

INDUCED POLARIZATION & RESISTIVITY SURVEY

CLIENT C.R.A

AREA WIRRABARA

GRID "CHARLTON MINE"

LINE 1000 N Brg 50°/230°

ARRAY DIPOLE-DIPOLE

DIPOLE SPREAD 50 METRES

FREQUENCIES .25 + 0.3 Hz

TRANSMITTER TYPE MCPHAR P660

RECEIVER TYPE MCPHAR P660

ELECTRODE TYPE FOIL

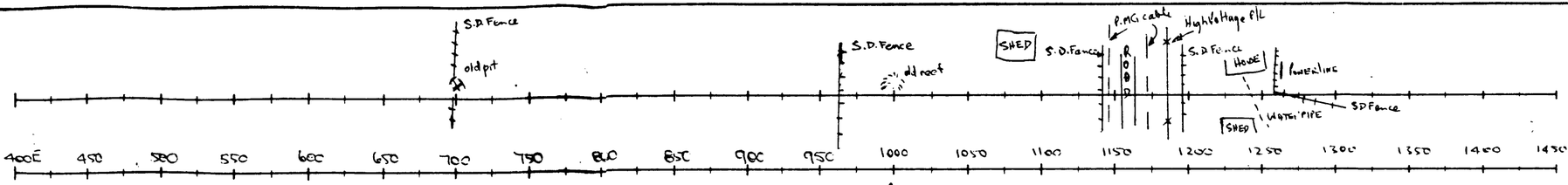
SURVEYOR Brian Pan

DATE OF SURVEY 7-9-78

PLOTTED BY

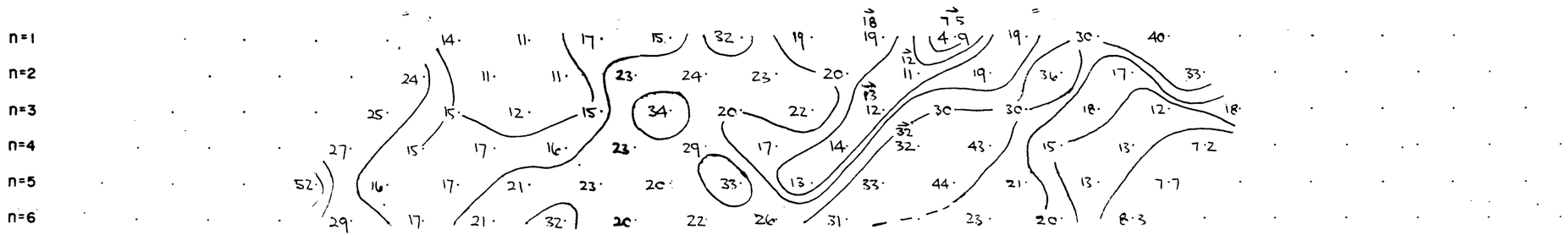
COMMENTS

3377-1

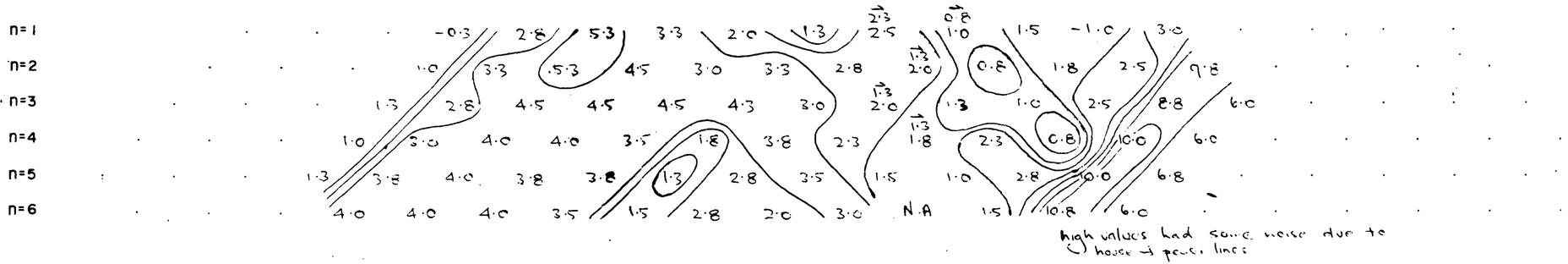


Culture Plan

Apparent Resistivity (ohm-m)



Percentage Frequency Effect



high values had some noise due to (?) house + power lines

SOLO GEOPHYSICS AND CO.

INDUCED POLARIZATION & RESISTIVITY SURVEY

CLIENT CRA

AREA "CHARLTON MINE"

GRID WIRRABARA

LINE CHIMNEY LINE

ARRAY DIPOLE-DIPOLE

DIPOLE SPREAD 50 METRES

FREQUENCIES 2.5 | 0.3 Hz

TRANSMITTER TYPE MCPHAR P660

RECEIVER TYPE MCPHAR R600

ELECTRODE TYPE FOIL

SURVEYOR [illegible]

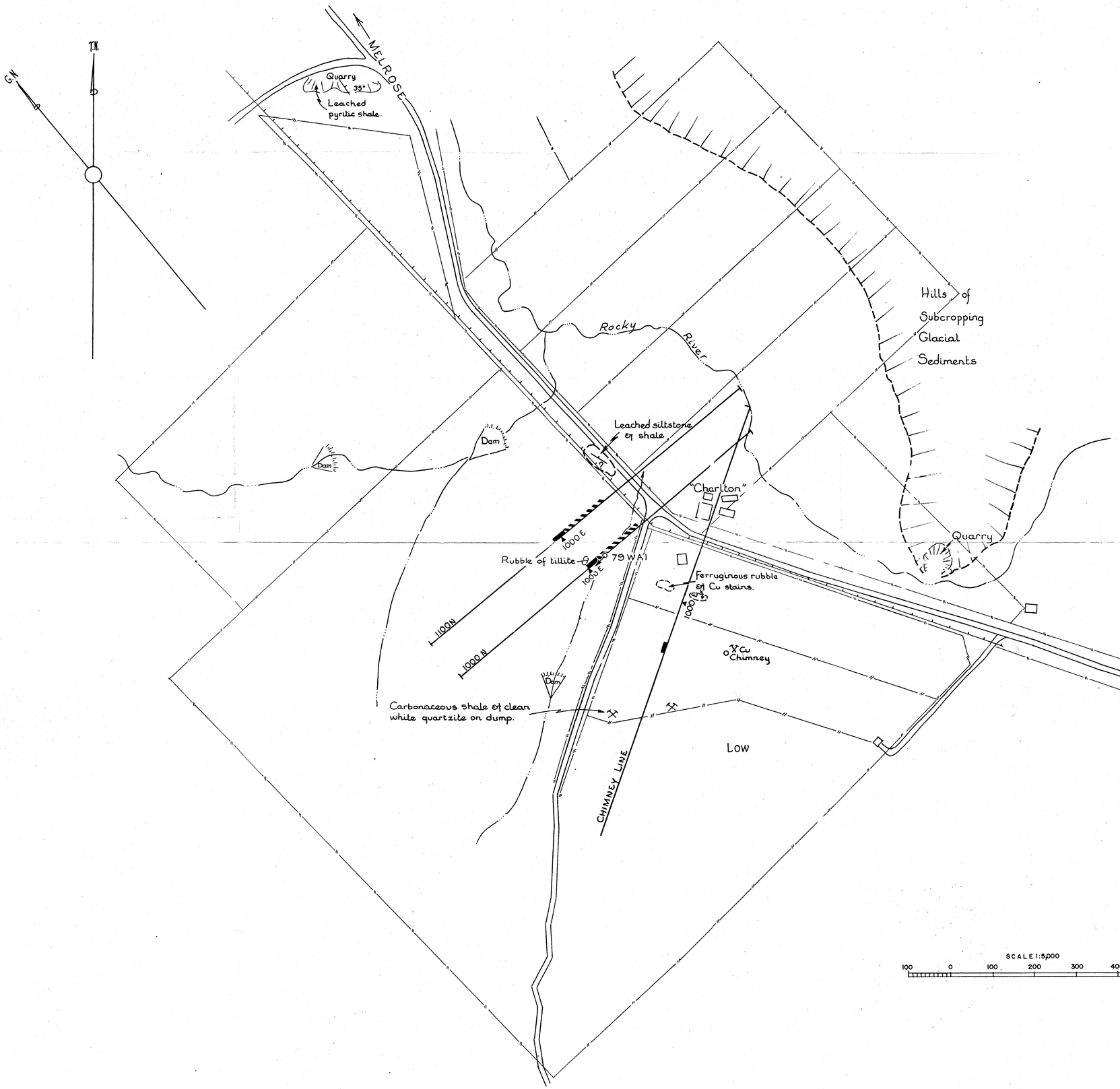
DATE OF SURVEY 9.3.78

PLOTTED BY [illegible]

3377-2

COMMENTS

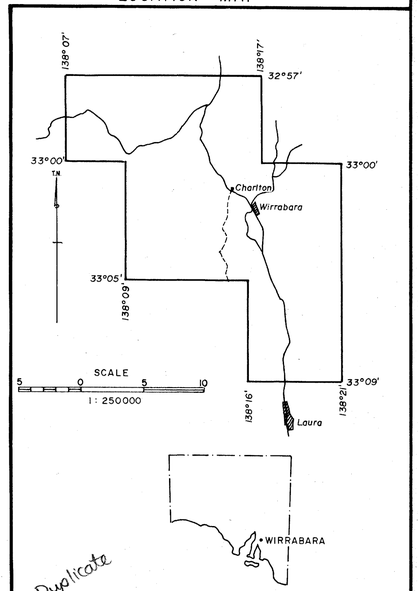
PADDOCK VERY WET WITH



LEGEND

- Pit.
- Outcrop boundary.
- Dip ef Strike.
- Aeromagnetic contours (Westchester Mining Corp.).
- Survey line with anomalous I.P. resistivity intercepts - 1st and 2nd order.
- Building.
- River/creek.
- Road.
- Fence.
- Power Line.

LOCATION MAP



Duplicate

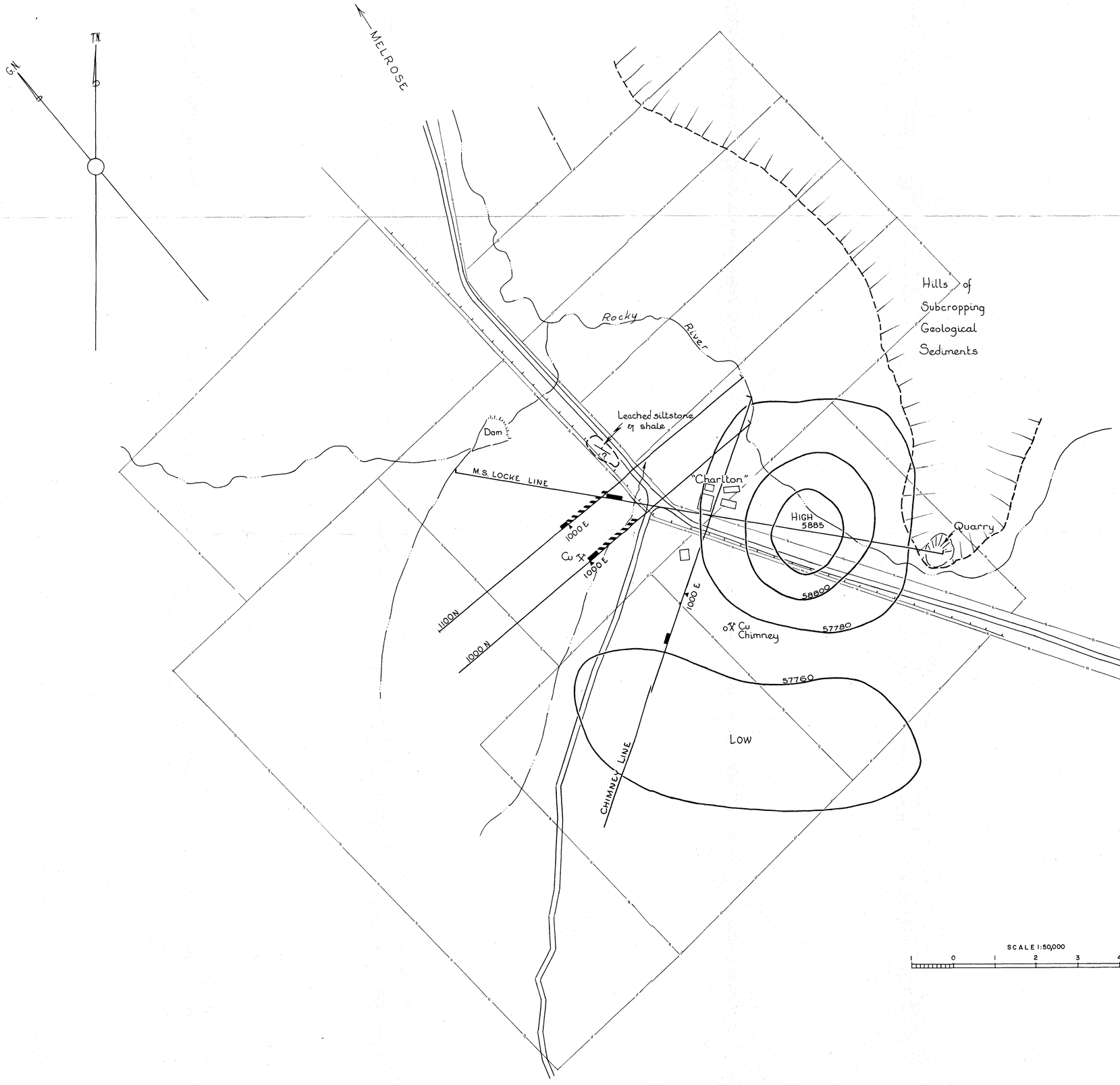
C.R.A. EXPLORATION PTY. LIMITED.

WIRRABARA, (S.A.) E.L.417

CHARLTON COPPER MINE

SHEET REFERENCE: BURRA SI 54-5. 3377-1

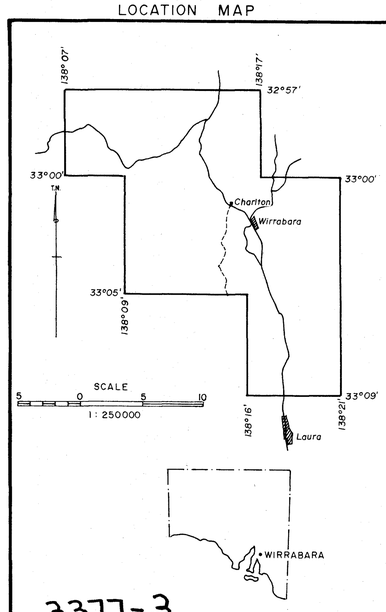
Geol.: A.G.C.	Scale: 1:5,000	Date: DEC., 1978.
Drawn: D.R.W.	Report Nº: 9454	Plan Nº: SAg 233.



LEGEND

- Pit.
- Outcrop boundary.
- Dip & Strike.
- Aeromagnetic contours (Westchester Mining Corp.).
- Survey line with anomalous I.P. resistivity intercepts - 1st and 2nd order.
- Building.
- River/creek.
- Road.
- Fence.
- Power Line.

LOCATION MAP



3377-3

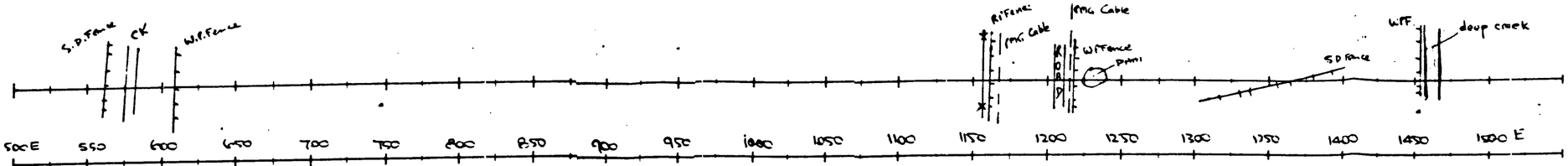
C.R.A. EXPLORATION PTY. LIMITED.

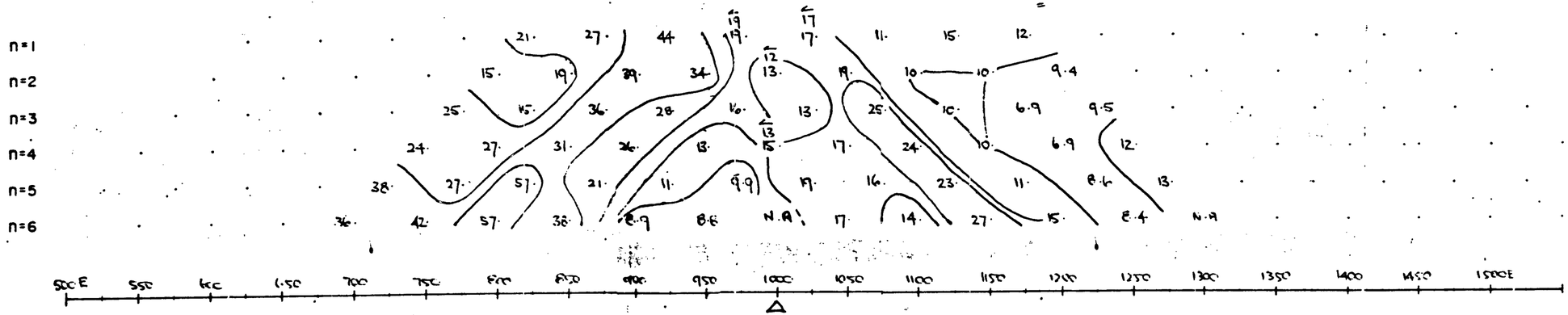
WIRRABARA, (S.A.) EL.417

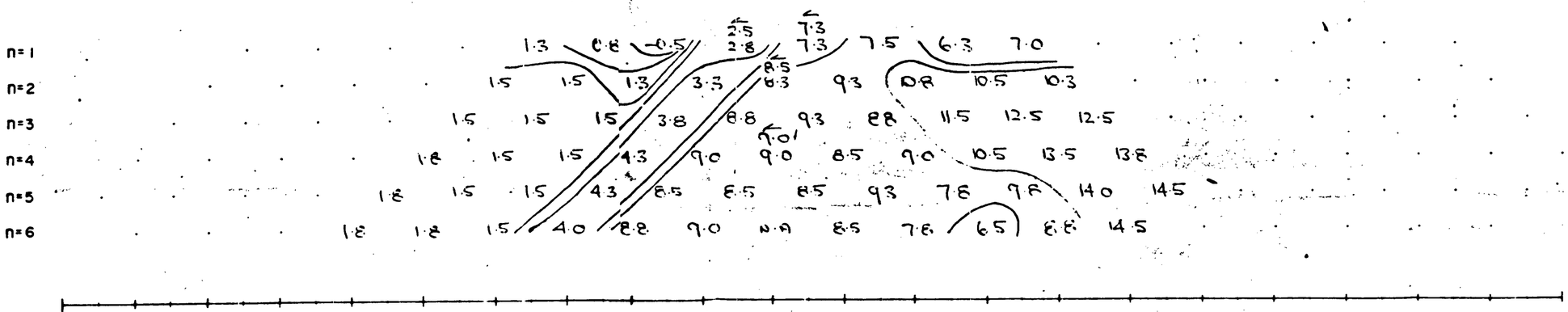
CHARLTON COPPER MINE

SHEET REFERENCE: BURRA SI 54-5.

Geol:	A.G.C.	Scale: 1:50,000	Date: DEC., 1978.
Drawn:	D.R.W.	Report Nº: 9454	Plan Nº: SAa 233.







Culture Plan

Apparent Resistivity (ohm-m)

Percentage Frequency Effect

SOLO GEOPHYSICS AND CO.

INDUCED POLARIZATION & RESISTIVITY SURVEY

CLIENT C.R.A.

AREA WIRRABARA

GRID "CHARLTON MINE"

LINE 1100 N Bas. 50°/230°

ARRAY DIPOLE - DIPOLE

DIPOLE SPREAD 50 m.

FREQUENCIES 2.5 & 0.3 Hz

TRANSMITTER TYPE McPhar P660

RECEIVER TYPE McPhar P660

ELECTRODE TYPE Foil

SURVEYOR Brian Rees

DATE OF SURVEY 8-9-76

PLOTTED BY

3377-4

COMMENTS Paddock like a rice-paddy area very wet after rain