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EL 612 AND EL 1008

BULL CREEK

PROGRESS AND FINAL REPORTS FOR THE PERIOD 21/3/80 TO 6/3/85

Submitted by

CRA Exploration Pty Ltd
1985

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PRIMARY INDUSTRIES AND RESOURCES SA

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TENEMENT HOLDER: C.R.A. Exploration Pty. Ltd.

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E.L. 1008 Env. 3832

Transparencies of aerial magnetic survey data over this area and associated tenements are held in transparency cylinder TC 6188 (1-6) as listed below.

TC	SURVEY	PLAN NUMBERS					
		Contours	No.	Flight Path	No.	Stacked Profiles	No.
6188/1	KANMANTOO AREA	3670-3677	8	3678-3685	8	3686-3695	10
6188/2	KANMANTOO EXTENSION (BULL CREEK)	3634-3636	3	3637-3639	3	3640, 3641, 3643	3
6188/3	MURRAY BRIDGE	3915-3920, 3759	7	3932-3942	11	3921-3931	11
6188/4	NARRUNG	3817-3823	7	3824-3830	7	4030-4036	7
6188/5	FLORIETON NORTH	3943-3946	4	3951-3954	4	3947-3950	4
6188/6	FLORIETON SOUTH	3697-3701	5	3702-3710	9	3711-3719	9
			34		42		44

Tapes of the above surveys are held by Geophysics Branch, SADME.

000003

C.R.A. EXPLORATION PTY. LIMITED

FIRST QUARTERLY REPORT ON THE
BULL CREEK E.L. 612
FOR THE PERIOD ENDING 20TH JUNE 1980

AUTHOR: K.J.A. WILLS

SUBMITTED TO: D.R. KENNEDY

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C.R.A.E. LIBRARY

DATE: 18TH JULY, 1980

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1. SUMMARY AND CONCLUSIONS

Work in the first quarter has consisted of carrying out a study of the E.L.'s gold potential and the planning and commencement of a stream sediment survey. The gold potential of the E.L. is thought to be low apart from gold produced as a by-product of base metal mining. Reassaying of a diamond drill hole at the Mt. Monster Mine did not reveal any gold determinations above detection.

An orientation geochemical survey suggested that the minus 10 plus 20 mesh fraction should be assayed for base metals and a panned concentrate sample for gold, tin, tungsten and uranium. Data from an airborne magnetic survey is available but has not yet been fully interpreted.

2. INTRODUCTION

An Exploration Licence Application for an area of 469 square kilometres in the Bull Creek vicinity (Plan SAa 303) was made on 24th September, 1979. The application was granted as E.L. 612 on 21st March, 1980.

The application was made as an extension of C.R.A. Exploration's regional search for base metal mineralisation in the Kanmantoo Trough. Parts of the E.L. had been previously held by C.R.A. Exploration as E.L. 318 (Strathalbyn) and E.L. 320 (Woodchester).

Work on these E.L.'s is summarised in two reports by D.O. Mason (1978a, 1978b). This report deals with our reasons for reapplying for this area and the work carried out in the first quarter to 20th June, 1980.

3. RECOMMENDATIONS

1. A stream sediment survey should be carried out over the Cambrian outcrop of the Bull Creek E.L.

2. A sample density of 0.5 to 1.0 samples per square kilometre should be used.

3. Minus 10 plus 20 mesh and panned concentrate samples should be collected at each site.

4. Further work should be dependant on the results of this survey.

4. PROPOSED PROGRAMME

Recent work by the gossan research team of C.R.A. Exploration's research group led to the conclusion that outcropping base metal mineralisation in the Kanmantoo Trough may not develop a significant geochemical anomaly.

The area of the Macclesfield syncline was thought to be particularly significant for structural reasons and the presence of minor copper and arsenic anomalies outlined by the S.A.D.M.E. (Morris, 1974). The area covering this structure was applied for as the Bull Creek E.L.A. with the intention of systematically drill testing the outcrop of Nairne Pyrite Horizon for blind mineralisation.

Since our original application some doubt has been cast on the validity of the above conclusions. Accordingly we are carrying out a stream sediment survey to integrate with results from our recently flown airborne magnetic survey. It is now proposed to initially assess all geochemical and magnetic anomalies before moving to test blind targets.

5. AIRBORNE MAGNETIC SURVEY

An airborne magnetic survey was carried out in late 1979 as part of our regional Kanmantoo Trough airborne survey. This data is now available but has not yet been interpreted. This will be carried out in the coming months and the basic data and an interpretation will appear in a future quarterly report.

6. STREAM SEDIMENT SURVEY

As no systematic coverage of the whole E.L. is available it was decided to collect this basic data before attempting further drilling. An orientation survey has been carried out elsewhere in the Kanmantoo Trough. This concluded that as previously the -10+20 mesh B.S.S. fraction gave best results (see Mason, 1979) for base metals and panned concentrates gave best results for tin, tungsten, uranium and gold. Accordingly, these two sample types are being collected at each site. Most sample sites have been chosen and an overall sample density of about 0.8 samples per square kilometre is being used. Some results will be available for the next quarterly report, but no overall assessment will be made until the survey is complete.

7. GOLD STUDY

A field and literature study of the gold potential of the Bull Creek E.L. was carried out during the quarter. The main gold producers in the E.L. have been the Mt. Monster, Strathalbyn and Wheal Ellen Mines. The later two mines had high gold contents in base metal gossans but size potential is limited and they are virtually worked out.

The Blackfellows Creek Goldfield did produce some reef gold but the reefs are small and consist of haematite-rich vein quartz. Most production came from alluvial workings. The Mt. Monster Mine was explored in the late 1960's by Australian Development N.L. They drilled one diamond drill hole but did not assay over its entire length. This hole was relocated at the S.A.D.M.E. core library and 69 samples assayed for a variety of elements.

The position of samples is shown on Plan SAa 465 and assays are listed in Appendix I. As no gold was reported above detection, the gold potential of the area is thought to be low. Other samples from the Mt. Monster area failed to produce encouraging results.

Our overall assessment of the gold potential of the E.L. is not encouraging and it is though that the best potential is as a by-product of base metal mining. Nevertheless, gold is being determined on panned concentrates during the drainage survey and it is possible that some fine gold has been previously overlooked.

K.J.A. WILLS

REFERENCES

Author	Date	Title
Mason, D.O.	1978a	Final Report on Strathalbyn E.L. 318 C.R.A.E. Report 9020
Mason, D.O.	1978b	Final Report on Woodchester E.L. 320 C.R.A.E. Report 9019.
Mason, D.O.	1979	First Quarterly Report for Kanmantoo E.L. 467 for period ending 25.7.79. C.R.A.E. Report 8775
Morris, B.J.	1974	A regional soil sampling of Kanmantoo Group metasediments Mount Barker to Cape Jervis. S.A. Min. Res. Rev. No. 141

LOCATION

Barker SI 54-13 1:250 000 map sheet

KEYWORDS

Lead, copper, gold, geochem-drainage, airborne geophys-mag, Kanmantoo Trough.

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Plan No.	Title	Scale
SAa 303	Bull Creek E.L. 612 Location Map	1:250 000
SAa 465	Bull Creek E.L. 612 Mt. Monster Core Log Drilled by Australian Development N.L.	1: 200

APPENDIX I

Mt. Monster Diamond Drill Hole Intervals and assays.

APPENDIX I

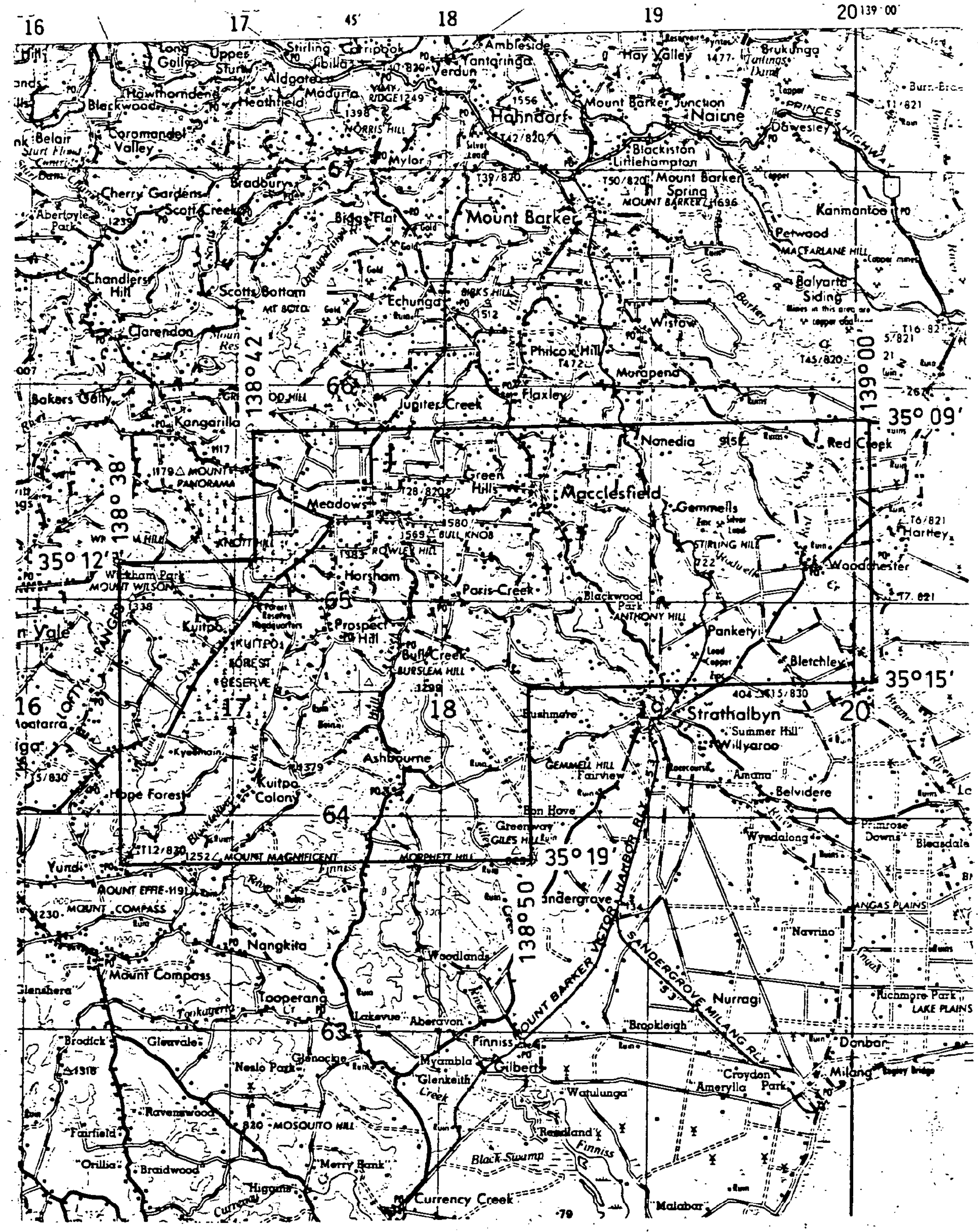
Mt. Monster Diamond Drill Hole Intervals and Assays.

Mount Monster Core DDH #1

Sample Number	Interval (m) From	Interval (m) To	Pb	Zn	Cu	Co	Ni	Fe	Mn	Cr	Bi	Mo	As	Sn	W	Sb	U	Ag	Au	Lithology
300901	1.5	1.9	10	22		5	5	1.3%	15	<10	<10	<1	45	8	<10	4	4	<1	<0.05	
902	4.0	4.1	<5	5	270	5	5	1.2%	20	<10	<10	<1	25	4	<10	<4	<4	<1	<0.05	
903	4.5	4.9	10	8	145	5	<5	7520	15	<10	<10	<1	45	10	<10	<4	<4	<1	<0.05	
904	5.6	5.8	10	12	20	<5	5	6500	25	<10	<10	<1	<20	8	10	8	<4	<1	<0.05	
905	7.9	8.1	<5	70	5	10	10	7.5%	220	<10	<10	<1	<20	<4	<10	<4	4	<1	<0.05	Aldgate Sandstone
906	9.1	9.9	10	15	15	5	5	5300	45	<10	<10	<1	<20	6	<10	<4	<4	<1	<0.05	
907	10.7	10.9	10	15	8	5	5	1.1%	110	<10	<10	<1	<20	<4	<10	<4	<4	<1	<0.05	
908	13.1	13.7	10	15	80	10	10	1.7%	35	<10	<10	2	20	6	10	<4	<4	<1	<0.05	
909	14.9	15.0	55	330	5	15	30	4.2%	360	15	<10	<1	<20	<4	<10	<4	6	<1	<0.05	unconformity
910	16.2	16.3	15	290	15	15	35	4.3%	370	15	<10	<1	<20	<4	<10	<4	8	<1	<0.05	
911	17.1	17.2	30	250	12	25	40	4.2%	600	10	<10	1	<20	4	<10	<4	6	<1	<0.05	
912	18.3	18.4	85	270	28	20	40	2.6%	280	10	<10	1	<20	<4	<10	6	6	<1	<0.05	Phyllonite - qtz
913	18.9	19.0	48	180	45	20	20	3.3%	340	<10	<10	<1	<20	<4	<10	<4	22	<1	<0.05	
914	20.7	20.9	70	490	55	20	30	5.9%	960	15	<10	<1	<20	<4	<10	14	6	1	<0.05	Chl, sericite, graphite
915	22.0	22.1	120	1100	150	15	30	2.6%	330	10	<10	3	50	4	<10	<4	12	<1	<0.05	Thin films of sulphide
916	24.1	24.2	18	610	48	45	150	3.0%	430	10	<10	6	30	4	<10	<4	6	<1	<0.05	on schistosity planes
917	25.6	25.7	25	360	45	30	70	4.4%	480	10	<10	1	45	<4	<10	8	8	<1	<0.05	
918	30.2	30.3	25	300	42	25	45	3.5%	410	10	<10	17	<20	<4	<10	<4	4	<1	<0.05	Biotite granitic
919	31.4	31.5	25	200	35	30	45	3.5%	330	10	<10	2	25	<4	<10	<4	10	<1	<0.05	gneiss and foliated
920	32.9	33.0	35	240	12	20	25	2.3%	480	<10	<10	1	30	<4	<10	<4	20	<1	<0.05	pegmatite
921	35.?	35.6	60	430	55	40	95	2.0%	340	<10	<10	1	<20	<4	<10	4	10	<1	<0.05	
922	37	37.5	30	230	10	15	30	4.2%	450	15	<10	2	<20	<4	15	<4	10	<1	<0.05	
923	38.4	38.6	28	400	35	35	75	5.1%	680	15	<10	75	<20	<4	<10	<4	12	<1	<0.05	Fine grained, graphitic
924	39.9	40	40	380	170	50	110	4.3%	550	<10	<10	4	<20	<4	15	<4	6	<1	<0.05	qtz-mica gneiss.
925	40.4	40.6	32	210	8	15	40	2.6%	480	<10	<10	4	<20	<4	<10	<4	8	<1	<0.05	
926	40.9	41	20	490	90	35	70	5.9%	760	20	<10	7	<20	6	<10	12	6	<1	<0.05	
927	41.2	41.3	12	150	290	60	110	5.4%	400	10	<10	10	<20	4	<10	8	10	<1	<0.05	
928	42.1	42.2	25	470	210	40	75	5.4%	730	20	<10	7	<20	<4	<10	<4	10	<1	<0.05	Shear Zone.
929	42.7	42.9	15	170	280	45	85	4.7%	520	10	<10	6	<20	<4	<10	<4	10	<1	<0.05	
930	45.4	45.5	25	1000	70	30	110	3.9%	340	10	<10	1	20	4	<10	<4	8	<1	<0.05	
931	46.5	46.6	300	1200	260	45	110	4.4%	310	10	<10	7	110	4	<10	6	4	<1	<0.05	Phyllonite with
932	48.0	48.2	65	420	55	45	85	5.7%	400	10	<10	9	<20	<4	<10	8	14	<1	<0.05	pegmatites and
933	49.6	49.9	15	140	150	40	70	4.4%	320	10	<10	1	<20	<4	<10	<4	<4	<1	<0.05	disseminated
934	51.5	51.6	20	500	120	35	60	5.8%	420	25	<10	3	<20	<4	<10	<4	6	<1	<0.05	sulphides
935	55.0	55.1	20	120	12	15	25	3.5%	240	10	<10	1	<20	<4	<10	<4	4	<1	<0.05	

Sample Number	Interval From	Interval To	Pb	Zn	Cu	Co	Ni	Fe	Mn	Cr	Bi	Mo	As	Sn	W	Sb	U	Ag	Au	Lithology
800936	53.6	53.7	30	150	50	30	55	4.2%	370	10	<10	1	<20	<4	<10	4	6	<1	<0.05	
937	54.5	54.6	50	210	40	30	50	3.8%	340	10	<10	1	<20	<4	<10	10	6	<1	<0.05	
938	55.4	55.6	25	85	18	20	25	3.1%	390	<10	<10	1	20	<4	<10	<4	14	<1	<0.05	Sillimanite-garnet
939	56.9	57.1	40	580	15	60	100	3.7%	290	10	<10	1	<20	<4	10	4	14	<1	<0.05	gneiss.
940	58.6	58.7	28	130	75	30	60	4.6%	330	10	<10	2	<20	<4	<10	<4	4	<1	<0.05	
941	60.6	60.9	32	95	70	40	80	5.0%	510	10	<10	3	<20	<4	<10	4	4	<1	<0.05	
942	62.3	62.4	60	100	65	25	45	3.4%	170	<10	<10	2	<20	6	<10	<4	16	<1	<0.05	chl. graphite schist
943	63.4	63.5	15	290	5	15	20	5.0%	590	10	<10	1	<20	<4	<10	4	8	<1	<0.05	
944	64.5	64.6	18	160	2	15	15	6.1%	1050	15	<10	<1	<20	<4	<10	6	4	<1	<0.05	
945	65.2	65.3	5	120	<2	15	20	4.4%	550	10	<10	1	<20	6	<10	6	6	<1	<0.05	
946	67.9	68	19	290	30	20	20	3.2%	410	<10	<10	3	<20	<4	10	4	8	<1	<0.05	
947	68.3	68.4	32	110	30	20	30	3.1%	250	10	<10	1	<20	8	15	4	6	<1	<0.05	Fissile chlorite-
948	69.8	69.9	18	180	10	20	25	4.4%	230	10	<10	<1	<20	8	<10	<4	6	<1	<0.05	sericite-garnet
949	70.3	70.5	38	170	65	45	85	6.7%	430	15	<10	3	<20	6	<10	<4	16	<1	<0.05	schist.
950	72.2	72.3	38	220	75	25	50	4.6%	260	10	<10	1	<20	<4	15	<4	6	<1	<0.05	
951	74.3	74.4	38	140	35	20	35	5.0%	270	15	<10	3	<20	4	<10	<4	8	<1	<0.05	
952	77.4	77.5	50	210	25	15	35	4.4%	540	<10	<10	1	<20	<4	10	<4	6	<1	<0.05	
953	79.2	19.3	45	130	125	35	80	6.7%	860	10	<10	1	<20	<4	<10	<4	8	<1	<0.05	
954	81.7	81.8	38	210	35	20	35	4.6%	450	10	<10	1	<20	4	<10	<4	12	<1	<0.05	
955	84.1	84.2	40	240	55	20	40	4.8%	480	10	<10	7	<20	6	<10	6	6	<1	<0.05	
956	85.2	85.3	20	180	20	15	30	4.0%	420	<10	<10	1	<20	<4	10	<4	12	<1	<0.05	
957	86.6	86.7	35	150	55	20	35	4.5%	580	<10	<10	1	25	4	<10	4	8	<1	<0.05	
958	88.8	89.2	120	250	440	25	45	6.0%	1600	<10	<10	<1	140	4	<10	<4	6	<1	<0.05	
959	89.6	89.7	240	800	110	15	45	5.6%	670	10	<10	1	<20	6	<10	6	8	<1	<0.05	
960	91.0	91.2	590	300	5200	170	150	20.3%	1050	<10	<10	<1	20	<4	<10	36	6	<1	0.05	
961	91.6	91.7	45	350	22	25	20	16.7%	1650	<10	<10	<1	<20	8	20	<4	<4	<1	<0.05	shear Zone.
962	92.2	92.4	8	290	65	50	30	16.4%	860	<10	<10	<1	<20	4	<10	6	<4	<1	<0.05	
963	92.8	92.9	120	210	6100	150	200	17.8%	1450	<10	<10	1	<20	<4	<10	85	4	16	<0.05	
964	93.4	93.5	20	240	150	50	20	14.2%	1350	<10	<10	<1	<20	4	<10	6	4	<1	<0.05	Dolerite Dyke.
965	94	94.5	45	200	160	20	15	2.2%	310	<10	<10	<1	<20	4	10	<4	10	<1	<0.05	
966	95.1	95.2	15	75	20	15	30	4.5%	560	<10	<10	<1	<20	<4	<10	<4	4	<1	<0.05	
967	96.5	96.6	42	210	120	25	60	5.2%	530	10	<10	<1	<20	<4	<10	<4	4	<1	<0.05	chlorite-sericite-
968	97.7	97.8	10	120	25	15	30	3.9%	320	10	<10	1	<20	<4	<10	<4	6	<1	<0.05	garnet gneiss
969	98.8	98.9	14	170	55	20	35	4.8%	260	10	<10	<1	<20	<4	<10	<4	8	<1	<0.05	

End of Hole.



C.R.A. EXPLORATION PTY. LIMITED.		
BULL CREEK, E.L. 612		
LOCATION MAP		
1:250,000 Sheet Ref.: BARKER SI54-13.		
Geol.: K.J.W.	Date: 24-9-79	Drawn: D.R.W.
Report Nº: 10149	Scale 1:250,000	Plan Nº: SAa 303

000013

C.R.A. EXPLORATION PTY. LIMITED

SECOND QUARTERLY REPORT ON
BULL CREEK E.L. 612, SOUTH AUSTRALIA
FOR THE PERIOD ENDING 20TH SEPTEMBER, 1980

SUBMITTED BY: .... (K.J.A. WILLS)
ACCEPTED BY: .... (D.R. KENNEDY)
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CONTENTS

1. SUMMARY

A drainage survey is nearly complete and 229 of 260 planned sites have been sampled. Assays have been returned and plotting and interpretation is in progress. Maximum assays obtained to date are 790 p.p.m. lead, 570 p.p.m. zinc and 810 p.p.m. copper. From a brief inspection of data seven first-order anomalies have been highlighted and more dense sampling upstream of these is in progress.

2. INTRODUCTION

An Exploration Licence Application for an area of 469 square kilometres in the Bull Creek vicinity (Plan SAa 303) was made on 24th September, 1979. The application was granted as E.L. 612 on 21st March, 1980. Exploration during the first quarter of tenure is described by Wills (1980). Exploration during the second quarter is described in this report. As a stream sediment survey is still being carried out, this report is basically on progress and fuller details with maps and sample ledgers will be given in a future report.

3. STREAM SEDIMENT SURVEY

The drainage survey over E.L. 612 is part of a larger survey being carried out over C.R.A.'s Exploration licences which cover Kanmantoo Group Metasediment outcrop on the Barker 1:250 000 sheet. The survey commenced in mid July 1980 and 260 sites at a density of one per 0.7km^2 were planned in the Bull Creek E.L. To date 229 sites have been sampled, 19 sites have yet to be taken and 12 sites have been found unsuitable due mainly to cultural contamination such as ploughed in creeks.

At each site a -10+20 mesh heavy mineral concentrate sample has been collected and assayed for lead, zinc, copper and iron and a panned concentrate sample collected and assayed for tin, tungsten, uranium and gold. Results for the 229 samples mentioned above are now available but plotting and interpretation is still in progress. This work should be completed during the next quarter.

The maximum assays returned to date for each element on different samples are listed below:

Pb	-	790 p.p.m.
Zn	-	570 p.p.m.
Cu	-	810 p.p.m.
Fe	-	40.1%
Sn	-	75 p.p.m.
W	-	100 p.p.m.
U	-	12 p.p.m.
Au	-	0.30 p.p.m.

The significance of these concentrations is not yet fully understood. Preliminary 'eyeballing' of assays has resulted in the selection of seven first order anomalies and higher density sampling upstream of these sites has begun. At this stage assays of over 200 p.p.m. lead or copper and over 400 p.p.m. zinc are thought to be significant.

4. VISITS TO OLD MINES

Recent work elsewhere in South Australia has highlighted the importance of revisiting old mines and prospects in the Kanmantoo Trough. Accordingly visits and exploration history compilation are planned for the Wheal Ellen, Strathalbyn and Glenalbyn Mines in the Bull Creek E.L.

K.J.A. WILLS

REFERENCES

Author	Date	Title
Wills, K.J.A.	1980	First Quarterly Report on the Bull Creek E.L. 612 for the period ending 20th June, 1980. C.R.A.E Report 10149

LOCATION

Barker SI 54 - 13 1:250 000 Map Sheet.

KEYWORDS

Copper, lead, zinc, geochem-drainage, Kanmantoo Trough

LIST OF ATTACHMENTS

Plan No.	Title	Scale
SAa 303	Bull Creek E.L. Location Map	1:250 000

1

000018

C.R.A. EXPLORATION PTY. LIMITED

THIRD QUARTERLY REPORT ON BULL CREEK E.L. 612, SOUTH AUSTRALIA FOR THE PERIOD ENDING 20TH DECEMBER, 1980

AUTHORS: K.J.A. WILLS AND I.A. COOK

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DATE: 11TH FEBRUARY, 1981

SUBMITTED BY: K Wills

ACCEPTED BY: [signature]

CONTENTS PAGE

1. SUMMARY AND CONCLUSIONS

A stream sediment survey covering 325 square kilometres of Kanmantoo Group outcrop has been carried out. Two hundred samples at a density of one sample per 0.7 square kilometres were collected. Field data, assays and maps are presented. The maximum assays returned for lead zinc and copper are 790, 570 and 220 p.p.m. respectively. Six anomalies have been chosen for initial follow-up.

A detailed interpretation of the 1979 airborne magnetic survey data is in progress. It is intended to concentrate on prospective stratigraphic horizons other than the Nairne Pyrite Horizon in our 1981 exploration programme.

2. INTRODUCTION

An Exploration Licence Application for an area of 469 square kilometres in the Bull Creek vicinity (Plan SAa 303) was made on 24th September, 1979. The application was granted as E.L. 612 on 21st March, 1980. Previous exploration has been described in the two quarterly reports listed in the references. Exploration during the third quarter is described in this report.

3. RECOMMENDATIONS

1. Anomalies generated by the 1980 drainage survey should be followed up by more closely spaced sampling.

2. We should try to identify metal sources for drill testing as directly as possible and try to avoid extensive and time consuming soil sampling.

3. Particular attention should be paid to the Wheal Ellen-Strathalbyn Mine Zone and the Milendella Limestone stratigraphic horizon.

4. STREAM SEDIMENT SURVEY

A drainage survey over the Kanmantoo Group outcrop of the Bull Creek E.L. 612 has been carried out. A total of 200 sites have been sampled at an average density of one sample per 0.65 square kilometres. Fifty eight sites proved unsuitable for sampling due mainly to cultural contamination such as ploughed in creeks.

At each site a -10+20 mesh heavy mineral concentrate has been collected and assayed for lead, zinc, copper and iron. Sites were chosen to maximise the concentration of heavy minerals. The concentrate was collected by hand jigging of several kilograms of sediment in a 50 centimetre diameter wooden rimmed screen, and after throwing on a plastic sheet the eye was hand picked for assay.

Also at each site a panned concentrate was collected and assayed for tin, tungsten, uranium and gold. The final weights of each panned concentrate were measured so that an idea of the relative concentration could be obtained.

Field data and assays are given in computer compatible format in Appendix I.

The samples were submitted to the laboratory (COMLABS) as several jobs and control samples were resubmitted at a ratio of 1 control to 19 survey samples. The reproducibility of assays for different jobs is shown on Table 1 and is quite acceptable.

The maximum assays returned from the original survey away from mineralisation and for different samples are:

Element	Concentration in p.p.m.
lead	790
zinc	570
copper	220
iron	33.6%
tin	75
tungsten	140
uranium	12
gold	0.8

Results have been plotted on 1:50,000 scale sheets and are given with sample number location maps as Plans SAa 570, 575, 592, 593, 595, 596, 597, 677, 679.

The significance of these concentrations is not yet fully understood, but from our orientation work assays of over 200 p.p.m. lead or copper and over 400 p.p.m. zinc are thought to be significant and are being followed up. Six anomalies which satisfy this criteria have been chosen for follow up.

5. PROSPECTIVE HORIZONS

Reassessment of our work in the Kanmantoo Trough has led to the conclusion that we have been placing too much emphasis on exploration of the Nairne Pyrite Horizon. Other horizons of regional significance with concentrations of stratabound base-metal mineralisation are:

1. The Glenalbyn - Strathalbyn - Wheal Ellen - Aclare Zone. This zone is about 2000 metres stratigraphically higher than the Nairne Pyrite horizon and is obviously the locus of significant syngenetic base-metal mineralisation.

2. The Royal Keyneton - Mt. Rhine - Kanappa Mine Zone.
This zone approximates to the position of the Milandella Limestone Member which is present between Macclesfield and Burslem Hill in the Bull Creek E.L.

These two zones will be examined in greater detail during our work on the Bull Creek E.L.

6. AIRBORNE MAGNETICS INTERPRETATION

Data from our 1979 airborne magnetic survey are currently being interpreted by a senior consultant geophysicist. Preliminary results suggest that a number of stratigraphic horizons can be traced by their magnetic signature and in places, differences from the mapped geology are present. It is hoped that at least some anomalies will justify percussion drill testing later in 1981.

KJ Wills for.

K.J.A WILLS I.A. COOK

REFERENCES

Bull Creek E.L. 612 C.R.A.E. Reports 10149.

Author	Date	Title
Wills, K.J.A.	18.7.80	First Quarterly Report for the period ending 20th June, 1980.
Wills, K.J.A.	3.11.80	Second Quarterly Report for the period ending 20th September, 1980.

LOCATION

Barker SI 54-13 1:250 000 Map Sheet.

KEYWORDS

Copper, lead, zinc, tin, tungsten, uranium, gold, geochem-drainage, Kanmantoo Trough.

LIST OF ATTACHMENTS

Table 1 - 1980 Kanmantoo Trough Drainage Survey Control Samples.

Appendix I

Bull Creek E.L. 612, 1980 Drainage Survey Field Data and Assays.

Plan No.	Title	Scale
SAa 303	Bull Creek E.L. Location Map	1:250,000
SAa 575	Echunga Sheet Sample Sites	1:50,000
SAa 596	Echunga Sheet Lead, Zinc, Copper, Results	1:50,000
SAa 597	Echunga Sheet Tin, Tungsten, Gold Results	1:50,000
SAa 595	Milang Sheet Sample Sites	1:50,000
SAa 679	Milang Sheet Lead, Zinc, Copper Results	1:50,000
SAa 677	Milang Sheet Tin, Tungsten, Gold Results	1:50,000
SAa 570	Wilunga Sheet Sample Sites	1:50,000
SAa 592	Wilunga Sheet Lead, Zinc, Copper Results	1:50,000
SAa 593	Wilunga Sheet Tin, Tungsten, Gold Results	1:50,000

TABLE 1

1980 KANMANTOO TROUGH DRAINAGE SURVEY CONTROL SAMPLES

TABLE 1 — 1980 KANMANTOO TROUGH DRAINAGE SURVEY

CONTROL SAMPLES

ALL ASSAYS IN P.P.M. EXCEPT IRON IN PERCENT

D.P.O.	Pb	Zn	Cu	Fe	Sn	W	U	Au
Control Sample 797421								
0291					<4	< 10	6	3.0
0291					<4	< 10	<4	3.5
0292					<4	< 10	<4	3.4
0292					<4	< 10	4	3.3
0296					<4	< 10	6	3.4
0296					4	< 10	4	3.6
0296					16	< 10	4	2.0
0406					<4	< 10	6	2.50
0409					<4	10	6	2.2
Average Assay					-	-	-	2.9
Maximum Variation					-	-	-	31%
Control Sample 833148								
0296					<4	420	<4	<0.05
0296					6	420	8	<0.05
0296					8	510	<4	<0.05
0406					<4	590	<4	0.05
Average Assay					-	485	-	-
Maximum Variation					-	22%	-	-
Control Sample 797422								
0291					<4	20	55	0.60
0291					<4	< 10	50	0.65
0291					<4	20	55	0.60
0292					<4	< 10	55	0.65
0292					6	15	60	0.65
0296					6	< 10	55	<0.05
0296					<4	< 10	48	<0.05
0406					<4	10	55	0.70
Average Assay					-	-	48	-
Maximum Variation					-	-	25%	-
Control Sample 797423								
0291	38	80	30	5.8				
0291	40	90	38	6.25				
0291	40	90	34	6.4				
0292	32	85	36	5.30				
0292	34	85	32	5.20				
0296	38	90	30	5.85				
0296	34	75	30	5.60				
0296	36	85	28	6.05				
0406	32	90	18	5.6				
0409	38	75	36	5.56				
Average Assay	36	85	31	5.76				
Maximum Variation %	11%	11%	42%	9%				
Control Sample 833955								
0291	350	55	65	11.0	<4	< 10	<4	<0.05
0291	320	55	50	12.9	8	< 10	4	<0.05
0292	330	50	44	9.9	14	20	<4	<0.05
0292	280	50	65	8.30				
0296	330	55	40	10				
0296	320	34	36	10.4				
0296	310	50	42	10.7				
0406	310	50	30	10.0				
Average Assay	319	50	47	10	-	-	-	-
Maximum Variation %	12%	32%	36%	24%	-	-	-	-
Control Sample 833963								
0291	18	40	210	3.65				
0291	20	40	214	3.85				
0292	16	36	210	3.45				
0296	16	40	240	3.60				
0296	22	8	270	3.65				
0406	18	38	220	3.55				
Average Assay	18	34	227	3.63				
Maximum Variation %	22%	77%	19%	6%				

APPENDIX I

BULL CREEK E.L. 612

1980 DRAINAGE SURVEY

FIELD DATA AND ASSAYS

KEY TO KANMANTOO 1980 DRAINAGE SURVEY FIELD DATA SHEET

SAMPLE LOCATION

Sample Number   C.R.A.E. 6 figure number for sand sample.

East, North (A.M.G. Ref.)   Australian Metric Grid Reference in metres

SAMPLE DESCRIPTION

%Gravel, %Sand, %Clay (Size Distribution)   percentage of gravel, sand and clay in the sample site.

RK1, RK2, RK3 (Rock Types)   One major and up to two minor lithologies observed in the sample - others in observations.

1. Gossan
2. Ironstone
3. Unknown
4. Quartz-vein type
5. Mica Schist
6. Feldspar Schist
7. Garnet Schist
8. Staurolite/andalusite Schist
9. Sericite/chlorite Schist
10. Meta-shale (incl. phyllite)
11. Meta sandstone or arkose
12. Meta greywacke
13. Meta conglomerate
14. Meta calcareous rocks
15. Meta acid volcanics
16. Meta basic volcanics
17. Pegmatite
18. Granite
19. Dolerite
20. Laterite
21. Gneiss
22. Limestone
23. Amphibolite
24. Calcrete
25.
26.
27.
28.
29.
30.

PAN CON

Pan con wt (P.C. Wt)   Panned concentrate weight in grams.

SITE DESCRIPTION

Formation according to following list

1. Milendella limestone member
2. Strangway Hill Formation
3. Inman Hill Formation
4. Karinya Shale Member
5. Nairne Pyrite Member
6. Tungkillo Marble Member
7. Unnamed Carbonaceous and pyritic schists
8. Brukunga Formation
9. Brown Hill Greywacke member
10. Metamorphics e.g. Rathgen gneiss
11. Granitic intrusives
12. Basic intrusives
13. Hawker Group and equivalents
14. Adelaidean
15. Permian
16. Tertiary sediments
17. Tertiary Laterite
18.

CRK/TYP (Type of Creek)   Based on catchment area.

1. catchment area >20km^2
2. catchment area 10-20km^2
3. catchment area 5-10km^2
4. catchment area 2-5km^2
5. catchment area <2km^2

Site/R (Site Rating)   as for normal gravel sampling

1. Good
2. Moderate to Good
3. Moderate
4. Poor to Moderate
5. Poor
6. Unsatisfactory

Bedrock   Main bedrock lithology according to rock type list above. If unknown record 3.

Contam (Contamination)   if observed or known in catchment area

1. No apparent contamination
2. Urban e.g. Houses, tracks, rubbish
3. Roads, tracks and Railways
4. Metalliferous Mine, workings or tailings in catchment area
5. Rubbish (man made) if separate from 2.
6. Agricultural e.g. fertilisers, cattle yards, heavy cultivation
7. Animal faeces or remains
8. Natural dilution from banks of creek
9. Earth movements e.g. dams, new roads, stone quarries etc.

E.L. (Exploration Licence)

1. Kanmantoo
2. Callington
3. Brukunga
4. Bull Creek
5. Milang
6. Out of E.L.

Elements assayed for

Lead (Pb), Zinc (Zn), Copper (Cu), Iron (Fe), Tin (Sn), Tungsten (W), Uranium (U), Gold (Au),

All assays in parts per million except Iron, in percent

Numbers coded -1234.567 indicates no information

SAMPLE NO.	EAST	NORTH	%GR	%SAND	%CLAY	RK1	RK2	RK3	PANCONWT	FORMTION	CRK/TYP	SITE/R
833116	314800.00	6104900.00	5.000	15.000	80.000	4.000	2.000	-1234.567	160.000	8.000	1.000	6.000
833117	314700.00	6104800.00	5.000	20.000	75.000	4.000	2.000	-1234.567	110.000	8.000	5.000	6.000
833118	315200.00	6104200.00	30.000	40.000	30.000	4.000	2.000	9.000	180.000	8.000	1.000	2.000
833119	314800.00	6106100.00	30.000	45.000	25.000	12.000	9.000	4.000	110.000	9.000	3.000	4.000
833120	314900.00	6106100.00	35.000	40.000	25.000	4.000	5.000	-1234.567	100.000	9.000	1.000	3.000
833121	314300.00	6106700.00	30.000	50.000	20.000	5.000	4.000	-1234.567	110.000	9.000	4.000	5.000
833122	314000.00	6105800.00	30.000	45.000	25.000	4.000	5.000	2.000	130.000	9.000	5.000	4.000
833123	312800.00	6106400.00	35.000	40.000	25.000	5.000	4.000	2.000	90.000	9.000	4.000	3.000
833124	313300.00	6106200.00	35.000	35.000	30.000	5.000	2.000	4.000	150.000	9.000	4.000	5.000
833125	315800.00	6104700.00	10.000	20.000	70.000	12.000	5.000	4.000	100.000	9.000	5.000	6.000
833126	314800.00	6103400.00	5.000	50.000	45.000	4.000	12.000	5.000	190.000	9.000	4.000	6.000
833127	314800.00	6102900.00	1.000	30.000	69.000	4.000	-1234.567	-1234.567	80.000	9.000	1.000	6.000
833128	316400.00	6100900.00	10.000	10.000	80.000	5.000	11.000	4.000	120.000	9.000	5.000	4.000
833129	316400.00	6100800.00	35.000	25.000	40.000	11.000	4.000	5.000	140.000	9.000	1.000	3.000
833130	317200.00	6100500.00	35.000	40.000	25.000	4.000	11.000	-1234.567	150.000	9.000	1.000	3.000
833131	316900.00	6099000.00	20.000	60.000	20.000	4.000	12.000	11.000	90.000	8.000	1.000	5.000
833132	315200.00	6102300.00	15.000	35.000	50.000	11.000	4.000	-1234.567	160.000	9.000	1.000	5.000
833133	316400.00	6101800.00	35.000	30.000	35.000	4.000	11.000	-1234.567	100.000	9.000	1.000	4.000
833135	317500.00	6105200.00	30.000	40.000	30.000	5.000	4.000	-1234.567	100.000	18.000	5.000	6.000
833136	317800.00	6105900.00	15.000	25.000	60.000	4.000	11.000	20.000	100.000	18.000	5.000	5.000
833137	314500.00	6102500.00	40.000	25.000	35.000	4.000	11.000	20.000	110.000	9.000	1.000	2.000
833138	314000.00	6102700.00	25.000	20.000	55.000	4.000	11.000	5.000	130.000	9.000	3.000	5.000
833139	313500.00	6102700.00	35.000	30.000	35.000	4.000	11.000	5.000	150.000	9.000	1.000	3.000
833140	312600.00	6102500.00	25.000	30.000	45.000	5.000	11.000	4.000	140.000	9.000	3.000	6.000
833141	312800.00	6102400.00	30.000	40.000	30.000	4.000	12.000	20.000	100.000	9.000	1.000	5.000
833142	312400.00	6100900.00	5.000	20.000	75.000	4.000	20.000	-1234.567	100.000	9.000	4.000	6.000
833143	311500.00	6104300.00	20.000	20.000	60.000	4.000	5.000	-1234.567	130.000	9.000	5.000	4.000
833144	311400.00	6104400.00	20.000	10.000	70.000	5.000	12.000	4.000	110.000	9.000	5.000	5.000
833145	310600.00	6103800.00	10.000	10.000	80.000	5.000	4.000	-1234.567	150.000	9.000	1.000	6.000
833146	311100.00	6103100.00	25.000	15.000	60.000	12.000	4.000	-1234.567	190.000	9.000	1.000	5.000
833147	311900.00	6102500.00	40.000	40.000	20.000	4.000	12.000	2.000	110.000	9.000	1.000	2.000
833169	310900.00	6103200.00	20.000	20.000	60.000	7.000	4.000	1.000	150.000	9.000	5.000	5.000
833170	309500.00	6106200.00	30.000	10.000	60.000	4.000	5.000	-1234.567	200.000	8.000	4.000	5.000
833171	310300.00	6106100.00	5.000	10.000	85.000	5.000	4.000	-1234.567	150.000	8.000	3.000	5.000
833172	310800.00	6107400.00	40.000	35.000	25.000	5.000	4.000	2.000	220.000	8.000	2.000	3.000
833173	311000.00	6107400.00	25.000	30.000	45.000	4.000	2.000	12.000	140.000	8.000	5.000	3.000
833174	310600.00	6106800.00	20.000	20.000	60.000	12.000	4.000	-1234.567	130.000	8.000	3.000	4.000
833176	310500.00	6106300.00	35.000	35.000	30.000	4.000	5.000	2.000	190.000	8.000	2.000	3.000
833177	310200.00	6105400.00	60.000	20.000	20.000	12.000	5.000	4.000	100.000	8.000	2.000	5.000
833178	309700.00	6104000.00	30.000	35.000	35.000	4.000	2.000	12.000	210.000	8.000	2.000	3.000
833179	309600.00	6104100.00	30.000	10.000	60.000	12.000	4.000	2.000	130.000	8.000	4.000	5.000
833180	309800.00	6104800.00	40.000	35.000	25.000	4.000	2.000	8.000	160.000	8.000	2.000	3.000
833181	312300.00	6105500.00	5.000	15.000	80.000	4.000	5.000	-1234.567	130.000	9.000	4.000	6.000
833182	312800.00	6105000.00	40.000	30.000	30.000	4.000	11.000	-1234.567	110.000	9.000	4.000	5.000
833183	312900.00	6104900.00	10.000	15.000	75.000	11.000	4.000	-1234.567	80.000	9.000	5.000	6.000
833184	313800.00	6104200.00	30.000	25.000	45.000	4.000	2.000	11.000	160.000	9.000	3.000	3.000
833185	313400.00	6103700.00	35.000	30.000	35.000	12.000	10.000	4.000	180.000	9.000	4.000	3.000
833186	312100.00	6104800.00	40.000	30.000	30.000	4.000	2.000	12.000	130.000	9.000	4.000	2.000
833187	312100.00	6103400.00	10.000	20.000	70.000	4.000	12.000	-1234.567	110.000	9.000	3.000	6.000
833192	307100.00	6108000.00	30.000	30.000	40.000	4.000	5.000	2.000	140.000	8.000	5.000	5.000
833193	307500.00	6107300.00	30.000	35.000	35.000	4.000	2.000	11.000	150.000	8.000	4.000	4.000
833194	309000.00	6107600.00	30.000	40.000	30.000	11.000	4.000	2.000	100.000	8.000	4.000	4.000
833196	311500.00	6105500.00	20.000	40.000	40.000	4.000	2.000	11.000	130.000	9.000	5.000	2.000
833197	309500.00	6098200.00	30.000	40.000	30.000	11.000	2.000	4.000	160.000	9.000	3.000	4.000
833198	309800.00	6100200.00	5.000	20.000	75.000	4.000	2.000	-1234.567	90.000	8.000	5.000	5.000
833199	309600.00	6099700.00	15.000	20.000	65.000	4.000	2.000	5.000	130.000	8.000	3.000	5.000
833200	308600.00	6100100.00	25.000	30.000	45.000	11.000	5.000	4.000	120.000	8.000	3.000	3.000
833201	308300.00	6101000.00	10.000	20.000	70.000	2.000	4.000	-1234.567	170.000	8.000	4.000	5.000
833202	308800.00	6101600.00	35.000	35.000	30.000	20.000	4.000	12.000	230.000	8.000	5.000	2.000
833203	308200.00	6102400.00	40.000	20.000	40.000	12.000	4.000	-1234.567	170.000	8.000	4.000	2.000

SAMPLE NO.	BEDROCK	CONTAM	EL	PB	ZN	CU	FE	SN	W	U	AU
833116	9.00	2.00	4.000	14.000	30.000	20.000	2.800	10.000	5.000	2.000	0.030
833117	5.00	2.00	4.000	65.000	65.000	30.000	4.600	2.000	5.000	2.000	0.030
833118	9.00	1.00	4.000	34.000	30.000	18.000	4.150	6.000	5.000	2.000	0.030
833119	12.00	2.00	4.000	14.000	26.000	18.000	3.750	6.000	10.000	2.000	0.030
833120	12.00	1.00	4.000	12.000	20.000	10.000	2.850	4.000	15.000	6.000	0.030
833121	5.00	1.00	4.000	22.000	32.000	34.000	8.200	2.000	10.000	2.000	0.030
833122	12.00	1.00	4.000	26.000	42.000	28.000	5.750	8.000	30.000	2.000	0.030
833123	5.00	2.00	4.000	14.000	22.000	12.000	3.650	6.000	55.000	2.000	0.030
833124	5.00	1.00	4.000	10.000	18.000	16.000	4.350	2.000	25.000	4.000	0.030
833125	5.00	9.00	4.000	18.000	26.000	10.000	3.600	12.000	5.000	2.000	0.030
833126	5.00	1.00	4.000	22.000	40.000	12.000	3.000	8.000	10.000	6.000	0.030
833127	3.00	9.00	4.000	14.000	34.000	12.000	2.550	2.000	5.000	2.000	0.030
833128	11.00	2.00	4.000	790.000	570.000	48.000	12.000	2.000	5.000	2.000	0.030
833129	11.00	1.00	4.000	105.000	430.000	20.000	4.800	6.000	5.000	2.000	0.030
833130	11.00	1.00	4.000	14.000	46.000	2.000	2.150	6.000	35.000	2.000	0.030
833131	12.00	1.00	4.000	2.000	55.000	2.000	1.020	2.000	15.000	4.000	0.030
833132	3.00	2.00	4.000	22.000	90.000	4.000	1.400	10.000	15.000	2.000	0.030
833133	11.00	7.00	4.000	6.000	34.000	2.000	0.730	2.000	5.000	2.000	0.030
833135	12.00	6.00	4.000	16.000	55.000	18.000	3.000	4.000	10.000	2.000	0.030
833136	3.00	6.00	4.000	70.000	85.000	18.000	7.200	2.000	5.000	2.000	0.030
833137	5.00	1.00	4.000	30.000	105.000	8.000	2.700	2.000	20.000	6.000	0.030
833138	11.00	1.00	4.000	22.000	70.000	20.000	3.900	2.000	5.000	2.000	0.030
833139	11.00	1.00	4.000	46.000	185.000	6.000	1.720	2.000	60.000	2.000	0.030
833140	5.00	8.00	4.000	12.000	40.000	16.000	2.650	2.000	15.000	2.000	0.030
833141	12.00	3.00	4.000	240.000	195.000	4.000	1.300	4.000	100.000	2.000	0.030
833142	3.00	6.00	4.000	26.000	24.000	22.000	4.000	4.000	5.000	2.000	0.030
833143	5.00	1.00	4.000	12.000	20.000	20.000	4.050	30.000	5.000	2.000	0.030
833144	5.00	4.00	4.000	10.000	40.000	70.000	4.850	4.000	5.000	6.000	0.030
833145	5.00	1.00	4.000	250.000	80.000	50.000	4.350	2.000	5.000	2.000	0.030
833146	11.00	4.00	4.000	260.000	360.000	10.000	1.600	6.000	10.000	2.000	0.030
833147	12.00	4.00	4.000	210.000	220.000	8.000	3.000	2.000	90.000	2.000	0.050
833169	7.00	4.00	4.000	570.000	800.000	6100.000	14.500	10.000	20.000	2.000	0.300
833170	5.00	1.00	4.000	14.000	40.000	220.000	3.000	4.000	5.000	2.000	0.030
833171	12.00	2.00	4.000	26.000	44.000	20.000	2.150	4.000	5.000	2.000	0.030
833172	12.00	1.00	4.000	24.000	28.000	34.000	8.600	12.000	5.000	2.000	0.030
833173	12.00	1.00	4.000	110.000	195.000	42.000	16.400	2.000	15.000	2.000	0.030
833174	12.00	1.00	4.000	30.000	120.000	40.000	7.550	4.000	5.000	2.000	0.800
833176	12.00	1.00	4.000	30.000	38.000	20.000	9.700	6.000	15.000	2.000	0.030
833177	12.00	1.00	4.000	32.000	40.000	18.000	5.000	2.000	5.000	2.000	0.030
833178	12.00	1.00	4.000	4.000	32.000	12.000	2.300	8.000	5.000	2.000	0.030
833179	12.00	1.00	4.000	12.000	48.000	26.000	3.900	2.000	5.000	2.000	0.030
833180	12.00	1.00	4.000	24.000	36.000	12.000	6.400	2.000	5.000	2.000	0.030
833181	5.00	7.00	4.000	30.000	24.000	65.000	1.450	4.000	10.000	2.000	0.030
833182	11.00	2.00	4.000	12.000	36.000	20.000	2.700	2.000	20.000	2.000	0.030
833183	11.00	2.00	4.000	22.000	38.000	10.000	0.600	8.000	5.000	2.000	0.030
833184	11.00	6.00	4.000	14.000	34.000	18.000	2.950	2.000	5.000	2.000	0.030
833185	12.00	1.00	4.000	12.000	30.000	20.000	4.450	4.000	5.000	2.000	0.030
833186	12.00	9.00	4.000	20.000	26.000	60.000	8.300	2.000	140.000	2.000	0.030
833187	12.00	1.00	4.000	32.000	50.000	24.000	2.650	6.000	5.000	4.000	0.030
833192	11.00	1.00	4.000	8.000	22.000	16.000	3.000	4.000	5.000	2.000	0.030
833193	3.00	1.00	4.000	12.000	20.000	10.000	4.800	10.000	10.000	4.000	0.030
833194	12.00	1.00	4.000	175.000	200.000	75.000	25.800	2.000	10.000	2.000	0.030
833196	11.00	1.00	4.000	16.000	24.000	28.000	4.600	4.000	10.000	2.000	0.030
833197	3.00	4.00	4.000	80.000	50.000	38.000	3.750	10.000	5.000	2.000	0.030
833198	12.00	7.00	4.000	34.000	56.000	28.000	3.900	2.000	5.000	2.000	0.030
833199	12.00	2.00	4.000	30.000	40.000	22.000	3.450	10.000	10.000	2.000	0.030
833200	5.00	1.00	4.000	22.000	46.000	18.000	5.500	4.000	5.000	2.000	0.030
833201	12.00	1.00	4.000	24.000	36.000	16.000	3.100	6.000	5.000	2.000	0.030
833202	12.00	1.00	4.000	150.000	50.000	18.000	9.700	2.000	5.000	2.000	0.030
833203	12.00	1.00	4.000	75.000	1000.000	26.000	8.500	14.000	10.000	6.000	0.030

SAMPLE NO.	EAST	NORTH	%GR	%SAND	%CLAY	RK1	RK2	RK3	PANCONWT	FORMTION	CRK/TYP	SITE/R
833204	310100.00	6108600.00	60.000	30.000	10.000	12.000	4.000	-1234.567	160.000	8.000	3.000	2.000
833205	312400.00	6107000.00	25.000	30.000	45.000	5.000	4.000	2.000	220.000	8.000	5.000	2.000
833206	308400.00	6098900.00	30.000	25.000	45.000	12.000	4.000	11.000	140.000	8.000	4.000	3.000
833207	308900.00	6100900.00	35.000	35.000	30.000	4.000	2.000	12.000	170.000	8.000	4.000	1.000
833208	310300.00	6101300.00	15.000	30.000	55.000	4.000	20.000	-1234.567	140.000	9.000	5.000	5.000
833209	310800.00	6097600.00	5.000	30.000	65.000	4.000	2.000	-1234.567	130.000	9.000	4.000	5.000
833210	310800.00	6097400.00	5.000	10.000	85.000	2.000	4.000	-1234.567	160.000	9.000	5.000	6.000
833211	314600.00	6100500.00	10.000	15.000	75.000	2.000	4.000	-1234.567	180.000	9.000	5.000	5.000
833212	317900.00	6100800.00	25.000	35.000	40.000	2.000	4.000	12.000	150.000	9.000	5.000	4.000
833213	308400.00	6103500.00	35.000	20.000	45.000	12.000	5.000	4.000	220.000	8.000	4.000	5.000
833214	311200.00	6101800.00	35.000	35.000	30.000	4.000	2.000	20.000	160.000	9.000	4.000	4.000
833216	304500.00	6104100.00	30.000	35.000	35.000	4.000	2.000	-1234.567	160.000	3.000	4.000	4.000
833217	305100.00	6104000.00	35.000	50.000	15.000	4.000	12.000	2.000	150.000	3.000	3.000	3.000
833218	304500.00	6103500.00	5.000	20.000	75.000	2.000	-1234.567	-1234.567	140.000	3.000	5.000	6.000
833219	305100.00	6102900.00	50.000	40.000	10.000	11.000	4.000	2.000	160.000	3.000	2.000	3.000
833220	302400.00	6101800.00	35.000	30.000	35.000	11.000	4.000	20.000	170.000	2.000	3.000	3.000
833221	301100.00	6102500.00	35.000	25.000	40.000	4.000	11.000	5.000	140.000	2.000	3.000	4.000
833222	299400.00	6101400.00	30.000	40.000	30.000	4.000	11.000	-1234.567	180.000	3.000	4.000	4.000
833223	300500.00	6099400.00	20.000	30.000	50.000	4.000	12.000	11.000	120.000	2.000	5.000	5.000
833224	306000.00	6107100.00	40.000	45.000	15.000	4.000	2.000	-1234.567	190.000	3.000	4.000	2.000
833225	305000.00	6106800.00	30.000	45.000	25.000	4.000	2.000	11.000	240.000	3.000	4.000	3.000
833226	306700.00	6106800.00	15.000	40.000	45.000	4.000	2.000	-1234.567	180.000	8.000	5.000	4.000
833227	307900.00	6102900.00	30.000	30.000	40.000	5.000	4.000	11.000	150.000	8.000	5.000	5.000
833228	303900.00	6101800.00	40.000	45.000	15.000	4.000	2.000	5.000	240.000	3.000	2.000	4.000
833229	306100.00	6097300.00	35.000	45.000	20.000	4.000	5.000	11.000	220.000	8.000	3.000	3.000
833254	297400.00	6089700.00	35.000	30.000	35.000	4.000	11.000	-1234.567	240.000	8.000	1.000	4.000
833255	297900.00	6090500.00	15.000	30.000	55.000	4.000	20.000	2.000	200.000	8.000	5.000	5.000
833256	297800.00	6090800.00	5.000	20.000	75.000	4.000	2.000	-1234.567	220.000	8.000	5.000	6.000
833257	296700.00	6090500.00	35.000	40.000	25.000	4.000	11.000	2.000	190.000	8.000	1.000	4.000
833258	296700.00	6090600.00	40.000	20.000	40.000	11.000	4.000	5.000	230.000	8.000	1.000	5.000
833259	296000.00	6091800.00	35.000	30.000	35.000	11.000	4.000	-1234.567	160.000	15.000	1.000	3.000
833261	296800.00	6094400.00	35.000	10.000	55.000	10.000	4.000	11.000	130.000	8.000	3.000	6.000
833262	296400.00	6094900.00	30.000	40.000	30.000	10.000	4.000	-1234.567	170.000	8.000	4.000	5.000
833263	297400.00	6095500.00	40.000	30.000	30.000	11.000	10.000	4.000	210.000	8.000	5.000	3.000
833264	299900.00	6095600.00	40.000	30.000	30.000	11.000	10.000	4.000	150.000	8.000	3.000	2.000
833266	299200.00	6094600.00	30.000	20.000	50.000	11.000	2.000	10.000	200.000	8.000	4.000	4.000
833267	296900.00	6093000.00	30.000	25.000	45.000	11.000	24.000	4.000	200.000	15.000	5.000	5.000
833268	299400.00	6093200.00	30.000	30.000	40.000	2.000	11.000	4.000	200.000	15.000	3.000	5.000
833269	299700.00	6093800.00	35.000	35.000	30.000	2.000	4.000	5.000	160.000	8.000	4.000	6.000
833270	200700.00	6089900.00	35.000	40.000	25.000	5.000	4.000	12.000	200.000	15.000	2.000	4.000
833271	297000.00	6093800.00	45.000	35.000	20.000	11.000	4.000	-1234.567	110.000	8.000	1.000	3.000
833272	296400.00	6093100.00	30.000	45.000	25.000	11.000	5.000	4.000	260.000	15.000	4.000	4.000
833274	302800.00	6092800.00	30.000	20.000	50.000	4.000	5.000	2.000	240.000	8.000	5.000	4.000
833275	300200.00	6092400.00	20.000	50.000	30.000	4.000	2.000	12.000	200.000	15.000	3.000	5.000
833276	300400.00	6092400.00	30.000	40.000	30.000	4.000	2.000	11.000	210.000	15.000	4.000	5.000
833277	300200.00	6091200.00	5.000	75.000	20.000	4.000	11.000	-1234.567	210.000	15.000	2.000	6.000
833281	301800.00	6095100.00	30.000	30.000	40.000	4.000	5.000	-1234.567	190.000	8.000	3.000	5.000
833282	300200.00	6095900.00	10.000	40.000	50.000	4.000	5.000	2.000	200.000	8.000	3.000	5.000
833284	302800.00	6095500.00	0.000	20.000	80.000	4.000	-1234.567	-1234.567	110.000	8.000	4.000	6.000
833292	296100.00	6087100.00	25.000	50.000	25.000	4.000	10.000	12.000	180.000	8.000	1.000	4.000
833339	307200.00	6101400.00	5.000	20.000	75.000	12.000	3.000	-1234.567	160.000	8.000	5.000	5.000
833341	307500.00	6101500.00	40.000	30.000	30.000	12.000	4.000	2.000	160.000	3.000	4.000	3.000
833342	307800.00	6101800.00	30.000	40.000	30.000	12.000	2.000	4.000	200.000	3.000	4.000	4.000
833343	307900.00	6100000.00	40.000	40.000	20.000	12.000	4.000	2.000	140.000	3.000	4.000	4.000
833344	307300.00	6099600.00	50.000	35.000	15.000	12.000	4.000	2.000	170.000	3.000	5.000	3.000
833345	304400.00	6100800.00	30.000	30.000	40.000	12.000	5.000	4.000	150.000	3.000	1.000	3.000
833346	305000.00	6101000.00	20.000	30.000	50.000	12.000	4.000	2.000	210.000	3.000	1.000	4.000
833347	304400.00	6099700.00	5.000	40.000	55.000	12.000	3.000	3.000	90.000	3.000	5.000	6.000
833348	304500.00	6099500.00	55.000	40.000	5.000	9.000	4.000	2.000	240.000	3.000	1.000	2.000
833349	308100.00	6098200.00	20.000	30.000	50.000	12.000	4.000	2.000	200.000	3.000	4.000	5.000

SAMPLE NO.	BEDROCK	CONTAM	EL	PB	ZN	CU	FE	SN	W	U	AU
833204	11.00	1.00	4.000	105.000	34.000	10.000	5.250	4.000	5.000	2.000	0.030
833205	5.00	1.00	4.000	20.000	55.000	22.000	4.150	2.000	40.000	2.000	0.030
833206	3.00	1.00	4.000	60.000	42.000	20.000	6.800	8.000	5.000	2.000	0.030
833207	5.00	1.00	4.000	80.000	42.000	16.000	5.450	2.000	10.000	2.000	0.030
833208	3.00	5.00	4.000	20.000	24.000	44.000	4.900	4.000	5.000	2.000	0.030
833209	3.00	9.00	4.000	95.000	44.000	12.000	26.500	12.000	15.000	6.000	0.030
833210	3.00	8.00	4.000	230.000	100.000	16.000	30.600	4.000	5.000	2.000	0.030
833211	24.00	8.00	4.000	95.000	70.000	12.000	24.500	4.000	5.000	2.000	0.030
833212	12.00	1.00	4.000	55.000	80.000	14.000	10.500	12.000	10.000	2.000	0.030
833213	12.00	2.00	4.000	46.000	50.000	18.000	9.100	4.000	5.000	2.000	0.030
833214	11.00	1.00	4.000	60.000	30.000	40.000	15.000	4.000	10.000	2.000	0.030
833216	3.00	3.00	4.000	24.000	16.000	16.000	8.350	2.000	5.000	2.000	0.030
833217	8.00	6.00	4.000	6.000	18.000	10.000	3.600	2.000	15.000	2.000	0.030
833218	11.00	1.00	4.000	26.000	30.000	18.000	6.450	2.000	5.000	2.000	0.030
833219	11.00	1.00	4.000	14.000	22.000	10.000	4.450	4.000	20.000	2.000	0.030
833220	12.00	3.00	4.000	100.000	14.000	12.000	33.600	2.000	5.000	2.000	0.030
833221	11.00	1.00	4.000	65.000	18.000	24.000	19.300	2.000	15.000	2.000	0.030
833222	11.00	3.00	4.000	120.000	28.000	16.000	32.500	10.000	5.000	2.000	0.030
833223	11.00	9.00	4.000	180.000	24.000	26.000	13.000	2.000	5.000	4.000	0.030
833224	8.00	1.00	4.000	6.000	16.000	8.000	1.800	14.000	5.000	2.000	0.030
833225	3.00	2.00	4.000	24.000	40.000	14.000	6.150	10.000	15.000	2.000	0.030
833226	3.00	1.00	4.000	38.000	14.000	28.000	16.400	2.000	5.000	2.000	0.030
833227	11.00	8.00	4.000	22.000	30.000	28.000	5.850	2.000	5.000	2.000	0.030
833228	11.00	1.00	4.000	14.000	34.000	8.000	3.450	12.000	40.000	6.000	0.030
833229	12.00	1.00	4.000	18.000	12.000	110.000	2.400	6.000	5.000	2.000	0.030
833254	11.00	3.00	4.000	12.000	8.000	6.000	1.950	6.000	15.000	10.000	0.030
833255	3.00	1.00	4.000	55.000	6.000	8.000	12.100	2.000	5.000	2.000	0.030
833256	11.00	1.00	4.000	12.000	1.000	4.000	1.350	4.000	5.000	2.000	0.030
833257	12.00	1.00	4.000	12.000	4.000	4.000	1.300	8.000	5.000	8.000	0.030
833258	11.00	1.00	4.000	22.000	24.000	8.000	1.500	8.000	15.000	2.000	0.030
833259	3.00	1.00	4.000	20.000	34.000	8.000	1.700	2.000	5.000	2.000	0.030
833261	10.00	8.00	4.000	36.000	55.000	60.000	3.800	8.000	5.000	2.000	0.030
833262	10.00	9.00	4.000	290.000	350.000	36.000	9.900	2.000	5.000	2.000	0.030
833263	11.00	9.00	4.000	55.000	185.000	30.000	4.950	4.000	5.000	2.000	0.030
833264	12.00	1.00	4.000	80.000	60.000	24.000	10.800	2.000	5.000	2.000	0.030
833266	12.00	1.00	4.000	65.000	80.000	26.000	4.800	4.000	5.000	2.000	0.030
833267	3.00	9.00	4.000	60.000	22.000	10.000	9.600	20.000	5.000	2.000	0.030
833268	3.00	1.00	4.000	65.000	20.000	16.000	6.400	2.000	5.000	2.000	0.030
833269	3.00	1.00	4.000	90.000	64.000	28.000	7.700	2.000	5.000	4.000	0.030
833270	12.00	1.00	4.000	32.000	30.000	10.000	2.400	4.000	5.000	2.000	0.030
833271	11.00	1.00	4.000	44.000	95.000	220.000	3.000	4.000	5.000	2.000	0.030
833272	11.00	1.00	4.000	24.000	46.000	12.000	3.500	50.000	5.000	2.000	0.030
833274	11.00	1.00	4.000	60.000	30.000	12.000	7.000	6.000	5.000	2.000	0.050
833275	12.00	1.00	4.000	20.000	12.000	10.000	3.850	2.000	5.000	2.000	0.050
833276	11.00	1.00	4.000	36.000	26.000	10.000	4.600	24.000	5.000	2.000	0.100
833277	11.00	1.00	4.000	20.000	22.000	38.000	2.800	10.000	5.000	2.000	0.050
833281	5.00	1.00	4.000	30.000	50.000	12.000	5.400	16.000	5.000	2.000	0.030
833282	5.00	1.00	4.000	28.000	30.000	14.000	5.200	6.000	5.000	2.000	0.030
833284	5.00	1.00	4.000	50.000	50.000	18.000	3.650	8.000	5.000	2.000	0.030
833292	12.00	1.00	4.000	6.000	2.000	0.490	5.000	8.000	5.000	2.000	0.030
833339	12.00	9.00	4.000	10.000	20.000	10.000	3.100	10.000	5.000	6.000	0.030
833341	12.00	1.00	4.000	6.000	14.000	10.000	2.500	4.000	15.000	2.000	0.030
833342	12.00	2.00	4.000	42.000	32.000	14.000	19.200	10.000	10.000	8.000	0.030
833343	12.00	7.00	4.000	125.000	48.000	26.000	19.600	18.000	5.000	10.000	0.030
833344	12.00	1.00	4.000	80.000	24.000	22.000	16.000	2.000	5.000	6.000	0.030
833345	12.00	1.00	4.000	8.000	34.000	6.000	2.400	4.000	5.000	2.000	0.030
833346	12.00	7.00	4.000	14.000	48.000	14.000	2.850	2.000	25.000	2.000	0.030
833347	12.00	8.00	4.000	28.000	60.000	26.000	5.250	4.000	5.000	2.000	0.030
833348	9.00	1.00	4.000	22.000	30.000	20.000	1.960	2.000	60.000	8.000	0.030
833349	3.00	2.00	4.000	140.000	26.000	14.000	4.800	6.000	15.000	2.000	0.030

SAMPLE NO.	EAST	NORTH	%GR	%SAND	%CLAY	RK1	RK2	RK3	PANCONWT	FORMTION	CRK/TYP	SITE/R
833350	307800.00	6098900.00	15.000	40.000	45.000	12.000	4.000	3.000	180.000	3.000	4.000	4.000
833351	305500.00	6100200.00	5.000	25.000	70.000	12.000	4.000	3.000	150.000	3.000	5.000	6.000
833352	307300.00	6097900.00	60.000	35.000	5.000	12.000	4.000	2.000	190.000	3.000	1.000	3.000
833353	305200.00	6097800.00	10.000	50.000	40.000	12.000	4.000	3.000	170.000	3.000	5.000	6.000
833354	305300.00	6098400.00	40.000	40.000	20.000	12.000	4.000	2.000	210.000	3.000	2.000	3.000
833355	305300.00	6101600.00	15.000	35.000	50.000	12.000	4.000	2.000	180.000	3.000	5.000	5.000
833356	305000.00	6101800.00	40.000	40.000	20.000	12.000	2.000	4.000	220.000	3.000	2.000	3.000
833357	306700.00	6101900.00	25.000	35.000	40.000	12.000	4.000	2.000	170.000	3.000	5.000	4.000
833358	306900.00	6102300.00	30.000	35.000	35.000	12.000	4.000	2.000	180.000	3.000	5.000	3.000
833359	307400.00	6102600.00	40.000	35.000	25.000	12.000	4.000	2.000	130.000	3.000	4.000	3.000
833361	307300.00	6101000.00	40.000	40.000	20.000	12.000	4.000	2.000	190.000	3.000	5.000	4.000
833362	306900.00	6100600.00	30.000	40.000	30.000	12.000	4.000	2.000	220.000	8.000	5.000	4.000
833363	305500.00	6104600.00	10.000	10.000	80.000	12.000	4.000	-1234.567	80.000	8.000	5.000	6.000
833364	305700.00	6104800.00	50.000	40.000	10.000	12.000	2.000	4.000	190.000	8.000	2.000	4.000
833365	305900.00	6105400.00	50.000	40.000	10.000	12.000	2.000	4.000	220.000	8.000	5.000	4.000
833366	306100.00	6105500.00	40.000	30.000	30.000	12.000	2.000	4.000	250.000	8.000	4.000	4.000
833367	306100.00	6105600.00	40.000	50.000	10.000	5.000	2.000	4.000	310.000	3.000	2.000	4.000
833368	304700.00	6105300.00	25.000	30.000	45.000	4.000	2.000	5.000	180.000	3.000	5.000	6.000
833369	305800.00	6108300.00	10.000	30.000	60.000	12.000	4.000	2.000	130.000	3.000	5.000	6.000
833370	305600.00	6108300.00	20.000	35.000	45.000	4.000	2.000	-1234.567	190.000	8.000	4.000	6.000
833371	305100.00	6108300.00	10.000	15.000	75.000	4.000	2.000	-1234.567	180.000	3.000	5.000	6.000
833372	303500.00	6099900.00	30.000	40.000	30.000	12.000	4.000	2.000	200.000	3.000	2.000	4.000
833373	303100.00	6100200.00	30.000	40.000	30.000	12.000	4.000	2.000	230.000	3.000	2.000	3.000
833374	302500.00	6100500.00	60.000	25.000	15.000	4.000	2.000	-1234.567	180.000	3.000	2.000	5.000
833375	303200.00	6100500.00	30.000	60.000	10.000	4.000	3.000	-1234.567	180.000	8.000	3.000	3.000
833376	302700.00	6100700.00	5.000	5.000	90.000	20.000	4.000	2.000	80.000	8.000	5.000	6.000
833377	301600.00	6100300.00	40.000	45.000	15.000	4.000	2.000	-1234.567	200.000	8.000	2.000	5.000
833378	301600.00	6099400.00	15.000	20.000	65.000	4.000	2.000	-1234.567	180.000	8.000	5.000	6.000
833379	300400.00	6101100.00	15.000	30.000	55.000	4.000	2.000	-1234.567	180.000	8.000	5.000	6.000
833381	306700.00	6098600.00	40.000	40.000	20.000	4.000	2.000	7.000	190.000	3.000	5.000	4.000
833382	306500.00	6098600.00	60.000	35.000	5.000	4.000	2.000	3.000	140.000	3.000	1.000	3.000
833383	305800.00	6098800.00	55.000	40.000	5.000	4.000	2.000	8.000	200.000	3.000	1.000	3.000
833384	304500.00	6098300.00	30.000	40.000	30.000	4.000	2.000	-1234.567	180.000	3.000	5.000	5.000
833385	298800.00	6099100.00	15.000	20.000	65.000	4.000	-1234.567	-1234.567	150.000	8.000	5.000	4.000
833386	301300.00	6098200.00	35.000	45.000	20.000	4.000	20.000	1.000	180.000	3.000	4.000	4.000
833387	300200.00	6098600.00	35.000	45.000	20.000	4.000	20.000	2.000	170.000	3.000	5.000	5.000
833388	299300.00	6097500.00	10.000	30.000	60.000	4.000	20.000	2.000	160.000	3.000	5.000	6.000
833389	299300.00	6100800.00	5.000	5.000	90.000	4.000	-1234.567	-1234.567	180.000	3.000	5.000	6.000
833390	299200.00	6100900.00	5.000	5.000	90.000	20.000	4.000	3.000	160.000	8.000	5.000	6.000
833391	301900.00	6101000.00	15.000	20.000	65.000	20.000	-1234.567	-1234.567	180.000	8.000	5.000	5.000
833392	299600.00	6103200.00	30.000	40.000	30.000	20.000	2.000	4.000	220.000	8.000	5.000	5.000
833393	302600.00	6107000.00	20.000	10.000	70.000	20.000	4.000	2.000	150.000	8.000	4.000	5.000
833394	302500.00	6107000.00	10.000	5.000	85.000	4.000	20.000	2.000	140.000	3.000	5.000	6.000
833395	300500.00	6104800.00	60.000	30.000	10.000	20.000	2.000	4.000	180.000	3.000	4.000	4.000
833396	301300.00	6105600.00	30.000	35.000	35.000	2.000	20.000	4.000	170.000	3.000	4.000	5.000
833397	301800.00	6105700.00	50.000	40.000	10.000	20.000	2.000	4.000	220.000	3.000	2.000	4.000
833398	300400.00	6102800.00	40.000	40.000	20.000	20.000	4.000	2.000	120.000	3.000	5.000	5.000
833399	300300.00	6102700.00	10.000	10.000	80.000	20.000	4.000	2.000	110.000	3.000	5.000	6.000
833401	302300.00	6103400.00	15.000	30.000	55.000	2.000	4.000	8.000	160.000	3.000	5.000	5.000
833402	301900.00	6103500.00	30.000	30.000	40.000	20.000	4.000	2.000	140.000	3.000	5.000	5.000
833403	303000.00	6103000.00	50.000	30.000	20.000	20.000	2.000	4.000	100.000	3.000	4.000	3.000
833404	302900.00	6104400.00	30.000	25.000	45.000	20.000	4.000	2.000	140.000	3.000	1.000	5.000
833405	302800.00	6104300.00	5.000	10.000	85.000	20.000	2.000	4.000	150.000	3.000	5.000	6.000
833406	303500.00	6104100.00	30.000	25.000	45.000	2.000	4.000	20.000	110.000	3.000	1.000	5.000
833521	323100.00	6113300.00	25.000	45.000	30.000	20.000	4.000	2.000	200.000	8.000	5.000	5.000
833522	322800.00	6112700.00	15.000	55.000	30.000	20.000	4.000	-1234.567	180.000	8.000	5.000	5.000
833523	288700.00	6090800.00	40.000	50.000	10.000	5.000	4.000	2.000	160.000	19.000	2.000	3.000
833524	290800.00	6094100.00	40.000	50.000	10.000	4.000	20.000	2.000	170.000	19.000	4.000	3.000
833525	290900.00	6092400.00	35.000	45.000	20.000	4.000	5.000	20.000	150.000	9.000	4.000	3.000
833526	290000.00	6092700.00	40.000	50.000	10.000	4.000	2.000	20.000	100.000	19.000	4.000	3.000

SAMPLE NO.	BEDROCK	CONTAM	EL	PB	ZN	CU	FE	SN	W	U	AU
833350	12.00	7.00	4.000	26.000	20.000	14.000	3.700	2.000	5.000	6.000	0.030
833351	12.00	9.00	4.000	22.000	26.000	8.000	3.350	4.000	5.000	4.000	0.030
833352	12.00	1.00	4.000	6.000	22.000	2.000	1.190	2.000	40.000	2.000	0.030
833353	12.00	2.00	4.000	32.000	110.000	26.000	4.500	2.000	5.000	2.000	0.030
833354	12.00	1.00	4.000	32.000	30.000	12.000	4.800	2.000	5.000	2.000	0.030
833355	12.00	9.00	4.000	20.000	40.000	24.000	4.200	2.000	5.000	4.000	0.030
833356	12.00	1.00	4.000	2.000	30.000	175.000	1.850	2.000	10.000	2.000	0.030
833357	12.00	1.00	4.000	36.000	28.000	16.000	10.800	4.000	15.000	8.000	0.030
833358	12.00	9.00	4.000	16.000	12.000	14.000	5.800	2.000	5.000	4.000	0.030
833359	12.00	7.00	4.000	730.000	16.000	12.000	4.350	2.000	5.000	2.000	0.030
833361	12.00	1.00	4.000	85.000	14.000	24.000	33.000	6.000	10.000	4.000	0.030
833362	12.00	9.00	4.000	210.000	36.000	55.000	13.400	6.000	5.000	6.000	0.030
833363	12.00	9.00	4.000	12.000	36.000	20.000	5.950	2.000	5.000	4.000	0.030
833364	12.00	7.00	4.000	80.000	26.000	8.000	3.250	55.000	20.000	2.000	0.030
833365	12.00	1.00	4.000	16.000	26.000	8.000	6.650	6.000	15.000	2.000	0.030
833366	12.00	7.00	4.000	6.000	24.000	10.000	2.900	6.000	5.000	4.000	0.030
833367	5.00	1.00	4.000	2.000	18.000	2.000	1.310	2.000	15.000	6.000	0.030
833368	3.00	9.00	4.000	18.000	24.000	8.000	6.650	6.000	15.000	2.000	0.030
833369	12.00	9.00	4.000	6.000	14.000	10.000	4.200	2.000	10.000	2.000	0.030
833370	3.00	9.00	4.000	2.000	14.000	4.000	2.100	2.000	10.000	6.000	0.030
833371	3.00	9.00	4.000	24.000	42.000	36.000	11.800	2.000	5.000	2.000	0.030
833372	12.00	1.00	4.000	430.000	36.000	12.000	3.900	6.000	5.000	2.000	0.030
833373	12.00	1.00	4.000	430.000	65.000	28.000	40.100	2.000	5.000	2.000	0.030
833374	3.00	7.00	4.000	195.000	24.000	12.000	21.800	2.000	5.000	2.000	0.030
833375	12.00	9.00	4.000	90.000	65.000	20.000	11.200	2.000	5.000	2.000	0.030
833376	3.00	8.00	4.000	140.000	135.000	28.000	14.400	2.000	5.000	2.000	0.030
833377	3.00	5.00	4.000	135.000	34.000	18.000	22.100	2.000	5.000	2.000	0.030
833378	3.00	9.00	4.000	165.000	38.000	14.000	15.700	6.000	10.000	2.000	0.030
833379	3.00	9.00	4.000	175.000	22.000	24.000	18.700	2.000	5.000	2.000	0.030
833381	12.00	1.00	4.000	12.000	16.000	2.000	1.450	2.000	5.000	2.000	0.030
833382	12.00	1.00	4.000	4.000	24.000	4.000	2.750	2.000	10.000	2.000	0.030
833383	12.00	1.00	4.000	4.000	22.000	10.000	3.150	2.000	35.000	8.000	0.030
833384	3.00	8.00	4.000	18.000	8.000	4.000	3.500	4.000	5.000	2.000	0.030
833385	4.00	1.00	4.000	140.000	60.000	10.000	32.700	2.000	10.000	2.000	0.030
833386	12.00	8.00	4.000	130.000	60.000	18.000	20.300	2.000	5.000	2.000	0.030
833387	12.00	2.00	4.000	760.000	195.000	34.000	22.500	75.000	10.000	2.000	0.030
833388	3.00	7.00	4.000	135.000	20.000	16.000	18.700	2.000	5.000	2.000	0.030
833389	3.00	6.00	4.000	75.000	60.000	20.000	18.200	6.000	5.000	2.000	0.030
833390	3.00	3.00	4.000	40.000	26.000	10.000	8.400	2.000	5.000	2.000	0.030
833391	3.00	9.00	4.000	135.000	42.000	14.000	26.200	4.000	5.000	2.000	0.030
833392	3.00	9.00	4.000	80.000	24.000	14.000	31.300	2.000	5.000	2.000	0.030
833393	12.00	7.00	4.000	80.000	44.000	22.000	10.400	12.000	10.000	2.000	0.030
833394	3.00	7.00	4.000	34.000	160.000	20.000	11.400	2.000	5.000	2.000	0.030
833395	3.00	8.00	4.000	100.000	28.000	20.000	26.000	2.000	5.000	8.000	0.030
833396	3.00	8.00	4.000	115.000	38.000	12.000	39.600	2.000	10.000	2.000	0.030
833397	3.00	2.00	4.000	110.000	34.000	24.000	40.500	10.000	10.000	4.000	0.030
833398	3.00	3.00	4.000	130.000	280.000	22.000	25.500	22.000	5.000	2.000	0.030
833399	3.00	9.00	4.000	130.000	42.000	30.000	31.100	16.000	5.000	2.000	0.030
833401	3.00	7.00	4.000	26.000	36.000	14.000	4.200	10.000	20.000	6.000	0.030
833402	3.00	9.00	4.000	115.000	24.000	22.000	24.000	2.000	5.000	4.000	0.030
833403	12.00	1.00	4.000	95.000	125.000	22.000	17.400	12.000	5.000	2.000	0.030
833404	12.00	9.00	4.000	46.000	20.000	10.000	18.000	10.000	15.000	2.000	0.030
833405	12.00	6.00	4.000	32.000	22.000	10.000	7.250	4.000	5.000	2.000	0.030
833406	3.00	2.00	4.000	200.000	38.000	30.000	1.450	32.000	5.000	2.000	0.030
833521	3.00	7.00	4.000	38.000	115.000	24.000	6.500	2.000	5.000	4.000	0.030
833522	3.00	5.00	4.000	26.000	70.000	24.000	4.050	10.000	5.000	2.000	0.030
833523	3.00	3.00	4.000	14.000	22.000	36.000	5.950	14.000	15.000	4.000	0.030
833524	3.00	3.00	4.000	28.000	16.000	10.000	12.800	2.000	10.000	2.000	0.030
833525	5.00	7.00	4.000	22.000	26.000	12.000	5.650	2.000	5.000	2.000	0.030
833526	3.00	7.00	4.000	240.000	14.000	14.000	7.500	20.000	45.000	12.000	0.030

SAMPLE NO.	EAST	NORTH	%GR	%SAND	%CLAY	RK1	RK2	RK3	PANCONWT	FORMTION	CRK/TYP	SITE/R
833527	289900.00	6091900.00	50.000	30.000	20.000	4.000	12.000	-1234.567	170.000	19.000	5.000	4.000
833528	293300.00	6093700.00	40.000	30.000	30.000	4.000	20.000	2.000	160.000	19.000	4.000	4.000
833529	293300.00	6093900.00	25.000	35.000	40.000	4.000	20.000	-1234.567	180.000	19.000	5.000	5.000
833530	294500.00	6094800.00	25.000	35.000	40.000	4.000	5.000	20.000	120.000	19.000	3.000	5.000
833531	294500.00	6095000.00	35.000	35.000	30.000	12.000	4.000	20.000	110.000	19.000	5.000	4.000
833532	291200.00	6090000.00	20.000	40.000	40.000	11.000	20.000	4.000	90.000	9.000	4.000	3.000
833546	292800.00	6090600.00	40.000	35.000	25.000	11.000	20.000	2.000	110.000	9.000	5.000	4.000
833548	287400.00	6090400.00	30.000	60.000	10.000	4.000	20.000	2.000	140.000	19.000	2.000	3.000
833552	293900.00	6092300.00	15.000	45.000	40.000	11.000	4.000	2.000	90.000	19.000	4.000	4.000
833553	294000.00	6091000.00	15.000	50.000	35.000	20.000	4.000	11.000	100.000	9.000	4.000	3.000
833554	293800.00	6090900.00	15.000	25.000	50.000	20.000	4.000	11.000	40.000	9.000	4.000	3.000
833555	295300.00	6090700.00	25.000	35.000	40.000	20.000	11.000	2.000	110.000	9.000	3.000	3.000
833556	294700.00	6089700.00	10.000	54.000	40.000	4.000	20.000	11.000	110.000	9.000	4.000	5.000
833557	296100.00	6094800.00	20.000	30.000	50.000	20.000	4.000	2.000	120.000	9.000	3.000	5.000
833558	295600.00	6092100.00	10.000	35.000	55.000	20.000	4.000	2.000	120.000	9.000	4.000	5.000
833559	297000.00	6093700.00	35.000	50.000	15.000	4.000	2.000	12.000	190.000	9.000	4.000	1.000
833561	297700.00	6093900.00	30.000	40.000	30.000	20.000	4.000	2.000	110.000	8.000	4.000	5.000
833562	297800.00	6093800.00	20.000	30.000	50.000	20.000	4.000	2.000	150.000	8.000	4.000	5.000
833563	298800.00	6094400.00	25.000	45.000	20.000	20.000	4.000	-1234.567	120.000	8.000	5.000	5.000
833564	305900.00	6092800.00	25.000	25.000	50.000	20.000	11.000	4.000	110.000	8.000	4.000	6.000

SAMPLE NO.	BEDROCK	CONTAM	EL	PB	ZN	CU	FE	SN	W	U	AU
833527	3.00	4.00	4.000	65.000	85.000	18.000	4.700	2.000	10.000	2.000	0.030
833528	3.00	9.00	4.000	48.000	22.000	10.000	29.500	2.000	5.000	2.000	0.030
833529	3.00	5.00	4.000	210.000	100.000	28.000	5.900	175.000	10.000	2.000	0.030
833530	3.00	5.00	4.000	14.000	30.000	18.000	4.150	10.000	5.000	4.000	0.030
833531	12.00	5.00	4.000	60.000	70.000	75.000	3.550	175.000	5.000	2.000	0.030
833532	11.00	7.00	4.000	4.000	10.000	2.000	1.650	2.000	10.000	2.000	0.030
833546	11.00	9.00	4.000	42.000	14.000	8.000	13.100	2.000	5.000	6.000	0.050
833548	3.00	4.00	4.000	8.000	10.000	6.000	5.700	14.000	10.000	2.000	0.030
833552	11.00	9.00	4.000	50.000	26.000	8.000	17.500	2.000	15.000	2.000	0.100
833553	11.00	9.00	4.000	28.000	28.000	6.000	8.700	6.000	5.000	4.000	0.030
833554	11.00	9.00	4.000	12.000	16.000	4.000	4.550	2.000	5.000	2.000	0.050
833555	11.00	9.00	4.000	14.000	18.000	6.000	5.950	2.000	10.000	2.000	0.030
833556	3.00	8.00	4.000	30.000	60.000	6.000	6.300	2.000	5.000	4.000	0.030
833557	3.00	5.00	4.000	50.000	180.000	18.000	3.500	34.000	5.000	2.000	0.030
833558	3.00	9.00	4.000	42.000	70.000	10.000	7.700	10.000	5.000	2.000	0.030
833559	12.00	9.00	4.000	26.000	32.000	12.000	2.600	20.000	5.000	6.000	0.030
833561	3.00	9.00	4.000	55.000	38.000	12.000	4.700	2.000	5.000	2.000	0.030
833562	3.00	9.00	4.000	6.000	6.000	2.000	1.300	2.000	5.000	2.000	0.030
833563	3.00	9.00	4.000	14.000	6.000	4.000	2.350	2.000	5.000	2.000	0.030
833564	3.00	9.00	4.000	60.000	30.000	10.000	2.400	6.000	5.000	2.000	0.030

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C.R.A. EXPLORATION PTY. LIMITED

FOURTH QUARTERLY REPORT ON BULL CREEK E.L. 612, SOUTH AUSTRALIA FOR THE PERIOD ENDING 20TH MARCH 1981

AUTHOR: K.J.A. WILLS

COPIES TO: SOUTH AUSTRALIA DEPARTMENT OF MINES AND ENERGY

DATE: 2ND APRIL, 1981

SUBMITTED BY: KJA Wills per [signature]

ACCEPTED BY: [signature]

CONTENTS

1. INTRODUCTION

The Bull Creek E.L. 612 was granted to C.R.A. Exploration Pty. Limited on the 21st March, 1980. Previous exploration has been described in three quarterly reports submitted to the South Australia Department of Mines and Energy.

2. SUMMARY OF WORK DURING THE FOURTH QUARTER

No fieldwork has been carried out during this quarter. A title search was carried out over the Strathalbyn, Wheal Ellen and Aclare Mines stratigraphic zone which revealed that there are no mining tenements which will hinder our proposed work programme.

Data from our 1979 Kanmantoo Trough airborne geophysical survey are currently being interpreted by a senior consultant geophysicist. It is hoped that at least a summary of the results of this work will be available for the next quarterly report.

3. FUTURE WORK

Our proposed 1981 field programme consists of the following three activities:

1. Following up outstanding drainage anomalies from the 1980 Bull Creek drainage survey.

2. Drill testing of any magnetic anomalies recommended by the consultant's geophysical interpretation.

3. Carrying out ground electrical geophysics and preferably lines of coincident auger geochemistry over the Strathalbyn to Aclare Mines stratigraphic zone.

K.J.A. WILLS

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CRA EXPLORATION PTY. LIMITED

FIFTH QUARTERLY REPORT FOR BULL CREEK E.L. 612

SOUTH AUSTRALIA

FOR THE PERIOD ENDING 20TH JUNE, 1981

AUTHORS: A.J. VENABLES
G.J. BUBNER

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S.A.D.M.E.

DATE: 14th JULY, 1981

SUBMITTED BY: AJVenables

ACCEPTED BY: RKennedy

10149

CONTENTS

1. SUMMARY AND CONCLUSIONS

Initial follow-up on eleven second order drainage anomalies led to four being immediately downgraded. Results for the remaining seven are awaited.

Aeromagnetic data in the Strathalbyn-Wheal Ellen Mine area has indicated the presence of approximately five magnetic units. An electromagnetic survey has been planned for the next quarter.

A reassessment of gold potential at the Mt. Monster Mine is currently underway.

2. INTRODUCTION

Bull Creek E.L. 612, covering 469 square kilometres, was granted to CRAE for a period of one year on the 20th March, 1980. It was later renewed for a further twelve months. This report describes work carried out between 21st March, 1981 and 21st June, 1981.

3. RECOMMENDATIONS

a. Any second-order drainage anomalies not downgraded by the initial follow-up should be subjected to further investigation.

b. The results of the pending electromagnetic survey, should be used as a guide in the positioning of soil sampling traverses and drillholes.

c. The recent sampling and reassessment of the Mt. Monster gold mine should determine whether CRAE grants prospectors mining rights in the area.

4. GEOCHEMISTRY

Eleven second order drainage anomalies with elevated copper, lead and zinc values, were originally selected for follow-up appraisal. After initial investigation four were discarded on the basis of being the result of contamination from old mines and diggings. The remaining seven anomalies were resampled at the original sites and 50-100 metres upstream.

The samples were divided into three fractions; (-10+20) mesh (-80) mesh and a panned concentrate. It is intended that this will serve as an orientation survey as well as a check for contamination in the original sample.

Results are awaited at present and will be reported at the end of the next quarter.

5. GEOPHYSICS

Aeromagnetic data in the Wheal Ellen - Strathalbyn area has been reviewed in detail to provide information on local magnetic trends. The results are summarized on Plan SAa 766, which shows the location and characteristics of every aeromagnetic anomaly down to two gammas amplitude that appears on the Bull Creek survey analogue records.

Some comments can be made on this data:

1) There are approximately five sub-parallel magnetic units within the area, trending north to north - north - east.

2) There are no magnetic anomalies associated with either the Wheal Ellen or the Strathalbyn Mine.

3) Assuming the magnetic trends do not represent lithologically cross-cutting metamorphic trends (and this is a reasonably safe assumption in this area), the Wheal Ellen and Strathalbyn Mines can be seen to occur in the same stratigraphic position.

4) A significant number of anomalies are ascribed to cultural sources, in particular the railway line.

5) The abrupt termination and/or change in direction of anomalies in the vicinity of line 300W suggests a local geological structure (fault?).

6) The southern portion of the magnetic trend extending from line 190W to 243W may be due to magnetic debris associated with the mines shown, and the northern portion is almost certainly due to the railway line. The genuiness of this anomaly can only be resolved by ground-checking.

6. MOUNT MONSTER

The Mount Monster gold mine is situated within Adelaidean sediments in the south-western corner of the Bull Creek E.L.

Following recent interest in the mine by prospectors, CRAE has engaged upon a reassessment of the mine's potential. Thus far, this has consisted of a programme of sampling across possible gold bearing horizons. The assay results, which are awaited at present, will determine whether a full scale mapping programme should be instituted.

A.J. Venables

A.J. VENABLES

AJV/km

REFERENCES

Bull Creek E.L. 612 CRAE Reports 10149

Author	Date	Title
Wills, K.J.A.	18/7/80	First Quarterly Report for the period ending 20th June, 1980.
Wills, K.J.A.	3/11/80	Second Quarterly Report for the period ending 20th September, 1980.
Wills, K.J.A. and Cook, I.A.	11/2/81	Third Quarterly Report for the period ending 20th December, 1980.
Wills, K.J.A.	2/4/81	Fourth Quarterly Report for the period ending 20th March, 1981.

LOCATION

Barker SI54-13 1:250 000 Map Sheet

KEYWORDS

Copper, lead, zinc, gold, geochem.-drainage, geophys.-aeromag., geophys.-E.M., Kanmantoo Trough.

LIST OF ATTACHMENTS

Plan No.	Title	Scale
SAa 303	Bull Creek E.L. Location Map	1:250 000
SAa 766	Location of Aeromagnetic Anomalies	1:25 000

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CRA EXPLORATION PTY. LIMITED

SIXTH QUARTERLY REPORT FOR BULL CREEK

E.L. 612, SOUTH AUSTRALIA

FOR THE PERIOD ENDING 20TH SEPTEMBER, 1981

AUTHORS: A.J. VENABLES
G.J. BUBNER

COPIES TO: CRAE LIBRARY
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DATE: 21ST OCTOBER, 1981

SUBMITTED BY: AJVenables

ACCEPTED BY: [signature]

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CONTENTS

1. SUMMARY AND CONCLUSIONS

Pulse E.M. and ground magnetics have been completed over the Strathalbyn and Woodchester grids. Geological mapping of these prospects has been completed.

At Strathalbyn, no drilling targets were defined by the E.M. programme, although it is planned to drill one hole at the Reservoir Prospect, to intersect the down dip extension of a copper-rich outcrop with a moderate magnetic signature. Follow up of the minor E.M. anomalies will be carried out by geochemical techniques.

At the Woodchester Prospect, a strong E.M. anomaly was obtained. The conductive horizon which appears to be a discordant feature, will be tested by two percussion drill holes.

Results of the resampling of seven second-order drainage anomalies were received. Four were immediately downgraded whereas three warrant further follow up.

Interpretation of the 1980 airborne magnetic survey is continuing.

2. INTRODUCTION

Bull Creek E.L. 612, covering 469 square kilometres, was granted to CRA Exploration for a period of one year on the 20th March, 1980. It was later renewed for a further twelve months. This report describes work carried out between 21st June, 1981 and 20th September, 1981.

3. RECOMMENDATIONS

3.1 No E.M. anomalies on the Strathalbyn grid warrant drilling at this stage. It is recommended that the most cost-effective follow up technique would be acquisition of geochemical data, particularly in view of the shallow depth of most of the interpreted sources.

3.2 It is recommended that the conductive body at Woodchester be tested by two drill holes. The first hole should be sited at 840 metres East on line 4, on an azimuth of 112° and declination -60°. The second hole should be sited at 785 metres East on line 6, azimuth 112° and declination -60°. (Refer Plan No.'s SAa 1039 and SAa 1041).

3.3 The copper mineralisation near line 6101300 metres North should be tested at depth by drilling a percussion hole to intersect the horizon at 60-70 metres. (Refer Plan No. SAa 1044).

3.4 The three second-order drainage anomalies which were not downgraded during resampling should be followed up by soil sampling and ground magnetic techniques.

3.5 Interpretation of the airborne magnetics, with a view to delineating anomalies of short strike length should continue.

4. GEOPHYSICS

Acquisition and interpretation of E.M. and ground magnetics data was completed on two prospects in Bull Creek E.L. 612. On the Strathalbyn prospect (refer Plan No.'s SAa 979 and SAa 1073), 28.2 line kilometres of Pulse E.M. and 29.8 line kilometres of ground magnetics were read. On the Woodchester prospect (refer Plan No.'s SAa 979 and SAa 1074), 4.95 line kilometres of Pulse E.M., 5.75 line kilometres of ground magnetics, and 0.7 line kilometres of Sirotem were surveyed. In addition one Pulse E.M. and one Sirotem traverse was surveyed over known mineralisation at the Mt. Torrens prospect in Kanmantoo E.L.A. 266/81.

4.1 RATIONALE

4.1.1 Strathalbyn

Plan No. SAa 766 shows aeromagnetic anomalies selected from analogue charts of the 1979 Kanmantoo airborne survey. Analysis of the interpreted magnetic trends indicates the Wheal Ellen and Strathalbyn mines lie on approximately the same stratigraphic horizon, although this horizon and the mineralisation have no apparent magnetic expression. The Strathalbyn grid was pegged out to investigate by E.M. techniques:

- the non-magnetic horizon between the Wheal Ellen and Strathalbyn mines
- the magnetic horizon to the west of this and
- the area in the immediate vicinity of the Wheal Ellen mine.

The grid as pegged is shown in Plan No. SAa 1073. Difficulties in obtaining access to certain properties prevented acquisition of meaningful data south of 6100150 metres North.

4.1.2 Woodchester

Two aeromagnetic anomalies 2.5 kilometres east of the Wheal Ellen mine were selected for investigation as an adjunct to the Strathalbyn prospect programme. The essential selection criteria were as follows:
- the anomalies are apparently of reverse polarity. Based on previous work in the Kanmantoo Trough, the source of the anomaly is inferred to have a significant pyrrhotite content.
- airborne anomalies in the immediate vicinity of the Kanmantoo mine are observed to be both positive and negative. (The magnetic pattern of the positives and negatives are not consistent with the 'high-low' components expected over a single dipole source. The effects of the open-cut and mine infrastructure are unknowns).
- on a regional scale, those anomalies are in an equivalent stratigraphic position to the Kanmantoo mine.

The aeromagnetic anomalies and original traverses are shown in Plan No. SAa 1107. More detailed work was subsequently carried out in the vicinity of line 4. (Plan No. SAa 1074).

4.2 DATA ACQUISITION AND REDUCTION

4.2.1 Pulse E.M.

CroneGeophysics (Australia) Pty. Limited were contracted to carry out the Pulse E.M. surveys. Readings of the integrated vertical magnetic field using an in-loop receiver and a hundred metre square transmitter loop were taken at 50 metre intervals. The surveys commenced on 15th August, 1981 and finished on 4th September, 1981.

The data has been plotted as profiles on a log scale, with negative values (-x) plotted as -log (+x), and zero values set to 0.015. Although the sample times are known, time of commencement of the voltage shut-off ramp (t=o) was not held constant during the survey. Also, the gain was held constant (800), but the transmitted amperage, approximated by average battery drain was not monitored.

Consequently, it is not possible to convert the observed data values to micro-volts/amp, nor is it possible to compare decay curves, as plotted on an arbitrary vertical scale, from different line.

In general the data is 'clean' i.e. the geological environment is relatively reasonably resistive, with no appreciable development of a conductive overburden. There is, however, obvious interference from a large number of cultural sources - fences, railway lines, power lines, buried cables, sheds, etc.

4.2.2 Sirotem

To obtain data from which more information could be extracted, and to confirm the best Pulse E.M. anomalies, Geoex Pty. Limited were contracted to survey two traverses with the Sirotem system. These traverses were coincident with the Pulse E.M. line over known mineralisation at the Mt. Torrens prospect, and line 3 of the Woodchester prospect. Using a Mk. II unit, readings were taken at 50 metre intervals with a 100 metres square single loop. The survey was conducted on 28th September, 1981; the Mt. Torrens line was repeated on 30th September due to software-induced noise in the original data.

The data has been plotted as profiles and apparent resistivity pseudo-sections. From the apparent resistivities there is some suggestion of anomalously elevated voltages in the later channels i.e. the 'Siro-trial'. This is discussed further in the section on interpretation.

4.2.3 Ground Magnetics

Ground magnetics data was acquired at ten metre intervals using a Scintrex MP-2 proton magnetometer. Two or more readings were taken at each station; analysis of repeatability reveals an average noise envelope of +/- two nT, although in some areas a noise envelope of +/- five nT was common. The diurnal field was monitored using a Scintrex MBS-2 base station magnetometer; and the records used to correct for drift and reduce the data to an arbitrary datum for each of the two grids.

4.3 INTERPRETATION

4.3.1 Strathalbyn

Stacked profiles of ground magnetics are plotted at scales of 1:10 000 (Plan No. SAa 1026) and 1:25 000 (Plan No. SAa 1033). Direct comparison of the latter with the anomalies selected from the airborne survey analogues (Plan No. SAa 766) and confirms that most of the "possible cultural" anomalies are as such, plus the occasional aeromagnetic anomaly originally interpreted as real. The most important factor to emerge from the ground magnetics is confirmation of the magnetic trend suggesting equivalent stratigraphic positions of the Wheal Ellen and Strathalbyn Mines. Other notable features are:

i. along-strike variability of the main magnetic anomaly

ii. weak but real anomalies coincident with copper-carbonate mineralisation at the western end of lines 6101300 metres North and 6101600 metres North.

iii. the complete absence of a magnetic expression over the Wheal Ellen mine (line 6103950 metres North).

The Pulse E.M. data and corresponding ground magnetic profiles are plotted for each line on Plan No.'s SAa 987, SAa 1001, and SAa 1016. Results are discussed hereunder.

Line 6100150 metres North (Plan No. SAa 1016) - erratic, virtually featureless ground magnetics. Numerous E.M. noise spikes due to cultural features. No real anomalies apparent.

Line 6100400 metres North (Plan No. SAa 987) - 500 nT magnetic anomaly representing southern edge of main anomaly. Numerous E.M. noise spikes due to cultural features; elsewhere the response is typical of a relatively resistive, uniform half-space.

Line 6100700 metres North (Plan No. SAa 988) - 350 nT magnetic anomaly. E.M. response as per line 6100400 metres North.

Line 6101050 metres North (Plan No. SAa 989) - 700 nT magnetic anomaly. E.M. response as per line 6100400 metres North, with the exception of station 311400 metres East, where a single large amplitude negative anomaly occurs in an area of no apparent or suspected cultural features. Readings at 311350 metres East are essentially background, although the early channels at 311450 metres East are elevated. On the assumption of a geological source this represents a body dipping to the east, consistent with the dip observed elsewhere on the grid. This anomaly is rated as poor to moderate.

Line 6101300 metres North (Plan No. SAa 990) - 650 nT and 300 nT magnetic anomalies, plus 100 nT anomaly at 309725 metres East, coincident with surface showings of copper-carbonate mineralisation. E.M. response as per line 6100400 metres North.

Line 6101600 metres North (Plan No. SAa 991) - 1150 nT magnetic anomaly, plus 100 nT anomaly at 309825 metres East representing continuation of horizon at 309725 metres East on line to south. E.M. response as per line 6100400 metres North.

Line 6101850 metres North (Plan No. SAa 992) - 250 nT magnetic anomaly; anomalous amplitude and shape due to effects of railway line. E.M. response as per line 6100400 metres North, with a weak anomaly in the early channels at 311000 metres East. This is interpreted to represent a shallow, slightly conductive body dipping east, and is rated as poor to moderate.

Line 610220 metres North (Plan No. SAa 993) - 200 nT magnetic anomaly. E.M. response as per line 6100400 metres North.

Line 6102500 metres North (Plan No. SAa 994) - 400 nT magnetic anomaly. E.M. response as per line 6100400mN, although the assumed cultural anomaly at 310650mE is questioned. At this station the channel one response is background, whereas the late channels are depressed, a reversal of a typical cultural effect. (A similar unusual cultural anomaly is observed at 309850mE, but is not considered to be real due to the erratic behavious of channels three and four). In favour of a geological source is a coincident 50 nT magnetic anomaly, but the body would have a steep-west to vertical dip. This anomaly is rated as poor.

Line 6102750mN (Plan No. SAa 995) - essentially featureless magnetic response. E.M. response as per line 6100400mN.

Line 6103350mN (Plan No. SAa 996) - erratic 100 nT magnetic anomalies. Response as per line 6100400mN, but the influence of the creek at 311000mE is doubtful. Coincident with a 100 nT magnetic anomaly, a shallow, slightly conductive geological source is a possible cause. Rating: poor.

Line 6103550mN (Plan No. SAa 997) - generally featureless magnetic profile with two erratic 100 nT anomalies. E.M. response as per line 6100400mN; the eight channel response at 310850mE is interpreted as being caused by the effects of numerous fences, some enclosing only small areas intersecting near that station.

Line 6103950mN (Plan No. SAa 998) - featureless magnetic profile. A substantial E.M. anomaly occurs adjacent to the workings of the Wheal Ellen mine. The centre of the anomaly is 30 metres west of the actual mine, although this may be a function of the station spacing. The shape of the anomaly is consistent with the observed 70° dip, and from comparison with profiles calculated from model studies a depth to top of the conductive body is interpreted to be of the order of 100 metres. This anomaly is rated as moderate to good. A weaker five channel anomaly occurs at 310550mE. Qualitative interpretation suggests a body dipping west at a depth of 60-80 metres. The dip is not consistent with the observed stratigraphy, but a possible explanation is mineralisation within a shear zone. This anomaly is rated as moderate.

Line 6104250mN (Plan No. SAa 999) - featureless magnetic profile. E.M. response as per line 6100400mN.

Line 6104600mN (Plan No. SAa 1000) - erratic 100 nT magnetic anomalies. E.M. response as per line 6100400mN; the anomaly at 310250mE is believed to be caused by buried cables.

Line 6104950mN (Plan No. SAa 1001) - erratic 100 nT magnetic anomalies. E.M. response as per line 6100400mN.

4.3.2 Woodchester

Pulse E.M. and ground magnetics data acquired on the original two traverses (lines 1 and 4) are shown in Plan No.'s SAa 1002 and SAa 1010.

From the ground magnetics it is apparent that the assumed reverse polarity anomaly is in fact two separate anomalies 600 metres apart. On line 1 there are no obvious E.M. anomalies except for those attributed to fences. Permission to enter the property on which the magnetic high is located was refused. On line 4, apart from anomalies ascribed to fences, a seven channel anomaly is observed at 900mE, coincident with the magnetic high. A further six lines were surveyed to define this anomaly, and the Pulse E.M. data and corresponding magnetic profiles are shown in Plan. No.'s SAa 1003 to SAa 1009. Stacked profiles of the ground magnetics are plotted in Plan No. SAa 1032. Results are discussed hereunder.

Line 1A (Plan No. SAa 1003) - irregular magnetics profile with 100+ nT, lows centred about 910mE. Away from cultural effects a moderate amplitude eight channel low occurs at 1050mE.

Line 2 (Plan No. SAa 1004) - irregular magnetic profile with 100 nT anomaly at 960mE. A six channel E.M. anomaly is roughly coincident with the magnetic anomaly, and suggests a body at a depth of about 60 metres dipping to the west.

Line 3 (Plan No. SAa 1005) - a 200 nT magnetic anomaly is centred at 930mE, and assuming a 2D thin dyke source, forward modelling indicates a source at a depth of 45 metres dipping 60 degrees west. (Plan No. SAa 1064). A broad, high amplitude eight channel E.M. anomaly is coincident with the magnetic anomaly. Assuming a single source, the E.M. is interpreted to represent a conductive body at a depth of 80-100 metres dipping to the west.

Line 4 (Plan No. SAa 1006) - a 200 nT magnetic anomaly centred at 900mE is interpreted to be caused by a body 45 metres deep dipping 55 degrees west. (Plan No. SAa 1065). The calculated profile compares well with the aeromagnetic anomaly on flight line 150E, with a minor variation in width to produce a similar amplitude. (Plan No. SAa 1070). The coincident eight channel E.M. anomaly is interpreted to represent a conductive body, dipping west, at a depth of 40-80 metres.

Line 5 (Plan No. SAa 1007) - a 250 nT magnetic anomaly centred at 875mE is modelled as a body dipping 60 degrees west at a depth of 50 metres. (Plan No. SAa 1066). The coincident eight channel E.M. anomaly is interpreted to be caused by a conductive body dipping steeply west at a depth of 70-100 metres.

Line 6 (Plan No. SAa 1008) - a 300 nT magnetic anomaly centred at 850mE is modelled as a body dipping 60 degrees west at a depth of 45 metres (Plan No. SAa 1067). The coincident eight channel E.M. anomaly is interpreted to represent a west-dipping body at a depth of 0-100 metres.

Line 7 (Plan No. SAa 1009) - a 350 nT magnetic anomaly centred at 830mE is interpreted as a body dipping 65 degrees west at a depth of 40 metres. (Plan No. SAa 1068). Comparison of the calculated profile with the aeromagnetic anomaly on flight line 140W reveals a reasonable fit, although the width has been decreased significantly to obtain a similar amplitude (Plan No. SAa 1069). The coincident seven channel E.M. anomaly is interpreted to represent a conductive body at a depth of 60-100 metres, dipping west.

In general, the results of the magnetics modelling suggests a magnetic source at a depth of 40-50 metres, dipping 55-65 degrees west. The fit of the calculated to the observed profiles varied from good to excellent, after removal of a -25 nT/km regional from the data as calculated using the end points of the traverse on line 4. The E.M. data indicates a conductive body of more variable westerly dip at depths from 40 to 100 metres. The decrease in late channel amplitudes from line 3 to line 7 may reflect a decreasing conductivity-thickness, although assuming a constant susceptibility of 0.1 SI the magnetics modelling suggests increasing thickness to the north. It is also possible that this variation in E.M. amplitude is a function of the t=o setting, or of conductor geometry. In brief, however, there is good spatial correlation of the magnetic and conductive bodies, and a single source of variable mineral content is invoked to explain both the magnetic and E.M. responses. Sirotem data acquired on line 3 is plotted as profiles in Plan No. SAa 1061, and as an apparent resistivity pseudo-section in Plan SAa 1062. Data collected on the Mt. Torrens prospect will be reported on in the next quarterly report on Kanmantoo E.L.A. 266/81.

The Sirotem profiles display a moderate amplitude anomaly indicative of a relatively deep body dipping west. Analysis of the resistivities indicates decreasing resistivity with depth, symptomatic of a 'Siro-tail', and the scope of the decay curve plotted for station 650mE approximated a decay of ρ-1/t for times beyond channel 16. Quantitative interpretation should be possible on channels 1-15; and this will be carried out in the following quarter.

5. GEOLOGICAL MAPPING

5.1 Woodchester

Accurate mapping over the Woodchester grid proved difficult because of the paucity of outcrop. With the exception of a few small outcrops near line 6 and in the creek between line 2 and 3, fragments of float offered the only means of identification. (See Plan No. SAa 1039).

The horizon responsible for the E.M. anomaly appears to be a dark grey, medium grained, highly contorted and brecciated quartzite. Two rock chip samples returned values of 14, 80, 115 p.p.m. and 65, 70, 105 p.p.m. for lead, zinc and copper respectively. Geophysical modelling has indicated depths to the top of the anomaly of about 50 metres, therefore the low values at surface may not be a true reflection. The modelling also shows the conductive horizon to be grossly discordant and dipping in the opposite direction (i.e. west) to bedding. It was not possible to measure the dip and strike of the brecciated quartzite nor were the contacts with the surrounding quartz-biotite schist seen.

To test the anomaly it is proposed to drill two percussion holes as per the directions in the geophysical section of this report. (See Plan No. SAa 1041).

5.2 Strathalbyn

The geology comprises a monotonous sequence of steeply east-dipping dark grey quartz-biotite schists with local horizons carrying various amounts of garnet, andalusite and sillimanite. Mineralisation appears to be confined to three small copper shows and the Wheal Ellen lead-zinc-silver mine. (See Plan No. 1073).

It is proposed to drill one percussion hole to test possible down-dip extensions of the copper mineralisation at one of the small diggings. (See Plan No. 1044).

6. DRAINAGE SURVEYS

Assay results for seven second-order drainage anomalies were received. (See sampling ledgers in Appendix I).

For four of the anomalies, original high values were not duplicated and they were downgraded. The three other anomalous values deserve further attention. They are:

6.1 PINE FOREST ANOMALY

The original sample assayed 290 p.p.m. lead and 350 p.p.m. zinc for the (-10+20) mesh fraction. The two follow up samples assayed 210 and 420 p.p.m. for lead and 180 and 170 p.p.m. for zinc respectively for the same size fraction.

Values for the (-80) mesh fraction and the pan concentrate, although not as high, were elevated. The geology in this area ia rather complex as the anomaly is found close to the Proterozoic - Cambrian boundary. Positive features are formed by quartzite horizons with a moderate felspathic content. More detailed mapping will be done during follow up, which will comprise a soil sampling and ground magnetometer traverse.

6.2 WIRIBANTA ANOMALY

The original sample returned values of 165 p.p.m. lead and 38 p.p.m. zinc for the (-10+20) mesh fraction. Lead and zinc values for the two follow up samples were 100 and 22, and 140 and 55 p.p.m. respectively for the same fraction. These values were not reflected in the (-80) mesh sample and were substatially depressed in the pan concentrate. The local geology comprises a steeply east-dipping succession of metagreywackees and schists with no visible mineralisation. It is felt that this anomaly has a lesser priority than that at Pine Forest for two reasons.

a. The values are substantially lower.

b. It appears to be stratigraphically closely related to the Nairne Pyrite Member although the relationship is not yet clearly understood.

6.3 GOULD CREEK ANOMALY

The original sample assayed 175 p.p.m. copper. This value was not repeated for either of the resamples in the (-10+20) and (-80) mesh fractions. One of the pan concentrates, however, gave a value of 790 p.p.m. lead. This anomaly is regarded as very low priority as contamination is almost certainly responsible for the elevated values. Rocks in the area appear to be almost entirely quartz-biotite schists with interbedded horizons of meta sandstone and greywackee.

7. GEOLOGICAL CONSULTANT

Mr. D.M. Ransom has been engaged to undertake a general review of the potential of the Kanmantoo Trough which includes the Bull Creek E.L. Visits were made to a number of workings including the Strathalbyn, Wheal Ellen, Glenalbyn and Breadalbyn Mines. Borehole core from Wheal Ellen and the Strathalbyn Mine has been examined at the S.A.D.M.E. Core Library. A study of the structure, metamorphic petrology and mineralisation has been made in an attempt to classify the various deposits. A large number of samples have been taken for chemical analysis and thin sections have been made for petrological examination.

It is anticipated that this review will result in a number of suggestions and recommendations for continued work in this area. The final report is due to be completed shortly and will be discussed in detail in the next quarterly report.

8. AIRBORNE MAGNETIC SURVEY

Interpretation of the 1980 airborne magnetic survey is continuing although emphasis has now switched to those anomalies with a restricted linear extent. It is hoped that this will help to delineate target areas of the Kanmantoo Mine type in preference to those of the Nairne Pyrite type with a long strike length.

A.J. VENABLES

AJV/km

REFERENCES

Bull Creek E.L. 612 CRAE Reports 10149.

Author	Date	Title
Wills, K.J.A.	18/7/80	First Quarterly Report for the period ending 20th June, 1980.
Wills, K.J.A.	3/11/80	Second Quarterly Report for the period ending 20th September, 1980.
Wills, K.J.A. and Cook, I.A.	11/2/81	Third Quarterly Report for the period ending 20th December, 1980.
Wills, K.J.A.	2/4/81	Fourth Quarterly Report for the period ending 20th March, 1981.
Venables, A.J. and Bubner, G.J.	14/7/81	Fifth Quarterly Report for the period ending 20th June, 1981.

LOCATION

Barker SI54-13 1:250 000 Map Sheet

KEYWORDS

copper, lead, zinc, gold, geochem.-drainage, geophys.-aeromag., geophys.-E.M., Kanmantoo Trough, schist, discordant, drill-percuss.

LIST OF ATTACHMENTS

Plan No.	Title	Scale
SAa 303	Bull Creek E.L. Location Map	1:250 000
SAa 1039	Woodchester - Geological Plan	1:5 000
SAa 1041	Woodchester - Borehole Sections	1:2 500
SAa 1044	Reservoir Anomaly - Geology Magnetic - Proposed Borehole	1:2 000
SAa 979	Bull Creek - Planned Percussion Drill Holes	1:25 000
SAa 1073	Strathalbyn Grid - Geology	1:5 000
SAa 1074	Woodchester Grid	1:5 000
SAa 766	Aeromagnetic Anomalies - Strathalbyn area	1:50 000
SAa 1110	Woodchester - T.M.I. contours and original traverse lines	1:25 000
SAa 1026	Ground Magnetics - Stacked Profiles - Strathalbyn Grid	1:10 000
SAa 1033	Ground Magnetics - Stacked Profiles - Strathalbyn Grid	1:25 000
SAa 987	Crone Pulse E.M. and Ground Magnetic Profiles - Line 02 - Strathalbyn	1:5 000
SAa 988	Crone Pulse E.M. and Ground Magnetic Profiles - Line 03 - Strathalbyn	1:5 000
SAa 989	Crone Pulse E.M. and Ground Magnetic Profiles - Line 04 - Strathalbyn	1:5 000
SAa 990	Crone Pulse E.M. and Ground Magnetic Profiles - Line 05 - Strathalbyn	1:5 000
SAa 991	Crone Pulse E.M. and Ground Magnetic Profiles - Line 06 - Strathalbyn	1:5 000
SAa 992	Crone Pulse E.M. and Ground Magnetic Profiles - Line 07 - Strathalbyn	1:5 000
SAa 993	Crone Pulse E.M. and Ground Magnetic Profiles - Line 08 - Strathalbyn	1:5 000

LIST OF ATTACHMENTS CONTINUED

Plan No.	Title	Scale
SAa 994	Crone Pulse E.M. and Ground Magnetic Profiles - Line 09 - Strathalbyn	1:5 000
SAa 995	Crone Pulse E.M. and Ground Magnetic Profiles - Line 10 - Strathalbyn	1:5 000
SAa 996	Crone Pulse E.M. and Ground Magnetic Profiles - Line 11 - Strathalbyn	1:5 000
SAa 997	Crone Pulse E.M. and Ground Magnetic Profiles - Line 12 - Strathalbyn	1:5 000
SAa 998	Crone Pulse E.M. and Ground Magnetic Profiles - Line 13 - Strathalbyn	1:5 000
SAa 999	Crone Pulse E.M. and Ground Magnetic Profiles - Line 14 - Strathalbyn	1:5 000
SAa 1000	Crone Pulse E.M. and Ground Magnetic Profiles - Line 15 - Strathalbyn	1:5 000
SAa 1001	Crone Pulse E.M. and Ground Magnetic Profiles - Line 16 - Strathalbyn	1:5 000
SAa 1016	Crone Pulse E.M. and Ground Magnetic Profiles - Line 01 - Strathalbyn	1:5 000
SAa 1002	Crone Pulse E.M. and Ground Magnetic Profiles - Line 1 - Woodchester	1:5 000
SAa 1010	Crone Pulse E.M. and Ground Magnetic Profiles - Line 4 - Woodchester	1:5 000
SAa 1003	Crone Pulse E.M. and Ground Magnetic Profiles - Line 1A - Woodchester	1:5 000
SAa 1004	Crone Pulse E.M. and Ground Magnetic Profiles - Line 02 - Woodchester	1:5 000

LIST OF ATTACHMENTS CONTINUED

Plan No.	Title	Scale
SAa 1005	Crone Pulse E.M. and Ground Magnetic Profiles - Line 03 - Woodchester	1:5 000
SAa 1006	Crone Pulse E.M. and Ground Magnetic Profiles - Line 04 - Woodchester	1:5 000
SAa 1007	Crone Pulse E.M. and Ground Magnetic Profiles - Line 05 - Woodchester	1:5 000
SAa 1008	Crone Pulse E.M. and Ground Magnetic Profiles - Line 06 - Woodchester	1:5 000
SAa 1009	Crone Pulse E.M. and Ground Magnetic Profiles - Line 07 - Woodchester	1:5 000
SAa 1032	Ground Magnetics - Stacked Profiles - Woodchester Grid	1:5 000
SAa 1064	Interpretation of Ground Magnetics - Woodchester - Line 03	1:5 000
SAa 1065	Interpretation of Ground Magnetics - Woodchester - Line 04	1:5 000
SAa 1066	Interpretation of Ground Magnetics - Woodchester - Line 05	1:5 000
SAa 1067	Interpretation of Ground Magnetics - Woodchester - Line 06	1:5 000
SAa 1068	Interpretation of Ground Magnetics - Woodchester - Line 07	1:5 000
SAa 1069	Interpretation of Airborne Magnetics - Woodchester - Line 140	1:10 000
SAa 1061	Sirotem Profiles - Woodchester Grid - Line 03	1:5 000
SAa 1062	Apparent Resistivity Pseudo-section - Woodchester Grid - Line 03	1:5 000

APPENDIX I

Drainage Sampling Ledgers.

APPENDIX I

DRAINAGE SAMPLING LEDGERS

C.R.A. EXPLORATION PTY. LIMITED

GEOCHEMICAL DRAINAGE SAMPLING LEDGER

Page: 1 of 3

Tenement: Bull Creek

Area / Prospect: 2nd Order Anomalies

Plan / Photo Ref.:

Sample Nos.: 835801 – 835815

Mesh Size: −10 +20 #

D.P.O. No: B0428

Geologist: A.J.V. Date: 9/6/1981

Analysed by: COMLABS

Sample Number	H.M. Trap/ Random	Channel: Wet/Dry	Channel: Width	Channel: Banks	Channel: Grad.	Channel: Alluv.	Channel: Colluv.	Sediment: Grav %	Sediment: Sand %	Sediment: Silt %	Sediment: Mud %	Sediment: Org %	pH	Metal Content in p.p.m.: Pb	Zn	Cu							Geological Observations
835801	R	W	5	2	0			20	40	20	10	10		8	12	2							Resample of 833526
02	R	W	1	.5	5			20	30	20	20	10		6	8	10							Upstream of 833526
03	R	W	5	2	0			30	40	10	10	10		6	12	4							Upstream of 833526
04	R	W	2	2	5			30	40	15	10	5		210	180	36							Resample of 833262 (Pins Point)
05	R	W	1	2	10			30	40	15	10	5		420	170	38							Upstream of 833262
06	HMT	W	2	.5	0			10	30	30	25	5		80	28	12							Resample of 833379
07	HMT	W	1	.5	15			10	30	30	20	10		44	28	10							Upstream of 833379
08	R	W	.5	.5	5			40	30	20	10	0		100	22	26							Upstream of 833378
09	R	W	1	.3	0			40	30	20	10	0		140	55	20							Resample of 833378
10	HMT	D	3	1	0			20	30	20	20	10		36	42	22							Resample of 833356
11	HMT	D	3	1	0			20	30	20	20	10		55	38	16							Upstream of 833356
12	R	W	4	1.3	2			15	50	15	15	5		85	70	24							Resample of 833362
13	R	D	4	1.3	2			20	50	15	10	5		24	24	22							Upstream of 833362
14	R	W	2	1	0			5	15	25	25	30		12	30	8							Resample of 833406
15	R	W	2	2	0			30	40	15	15	0		14	16	8							Upstream of 833406

C.R.A. EXPLORATION PTY. LIMITED

GEOCHEMICAL DRAINAGE SAMPLING LEDGER

Tenement: Bull Creek
Area / Prospect: 2nd Order Anomalies
Plan / Photo Ref:
Sample Nos.: 835301 – 835315
Mesh Size: – 80 #
D.P.O. Nº: B0425
Geologist: A.J.V.
Date: 9/6/1981
Analysed by: COMLABS

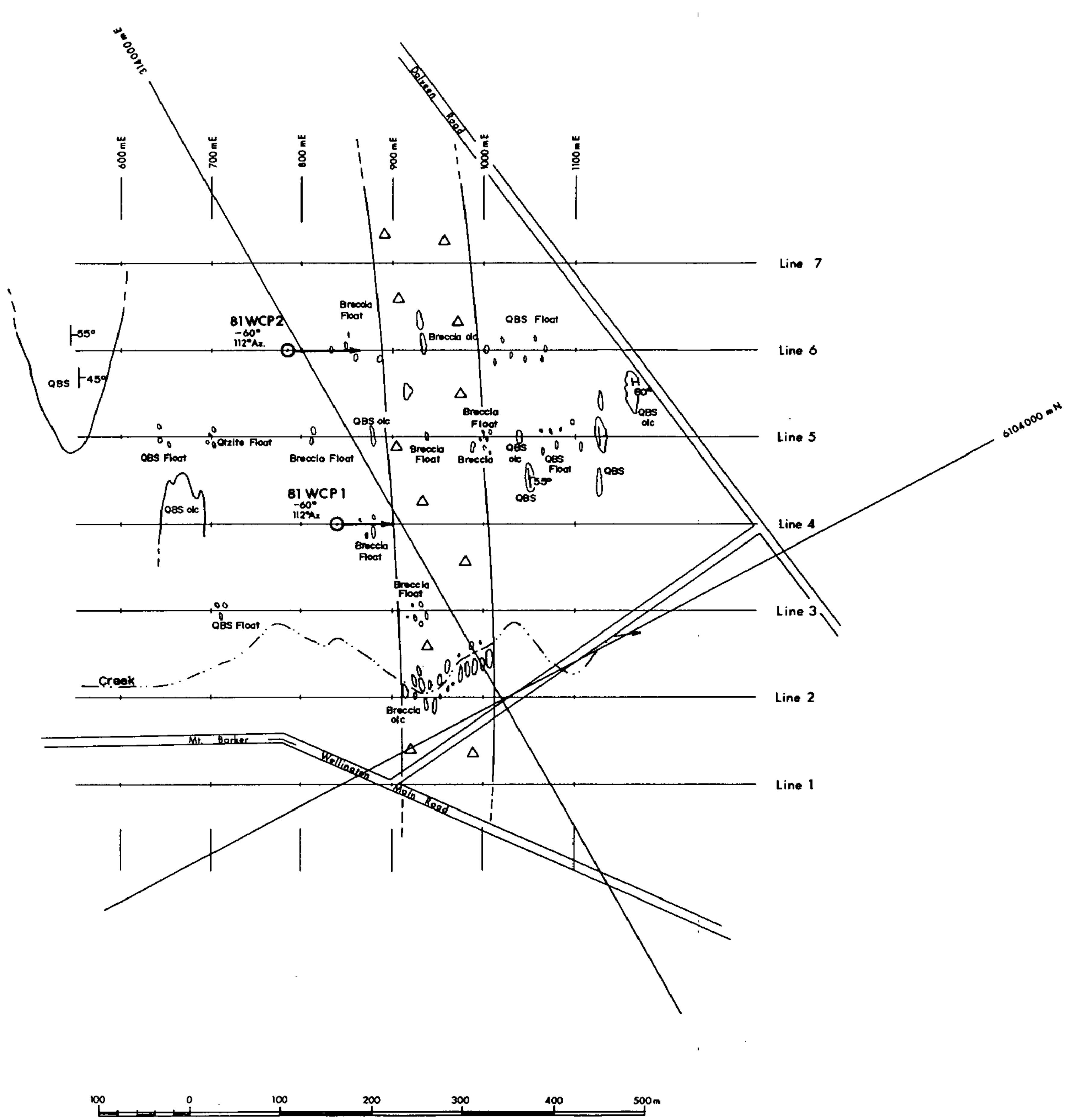
Sample Number	H.M. Trap/ Random	Channel						Sediment					pH	Metal Content in p.p.m.									Geological Observations
		Wet/Dry	Width	Banks	Grad.	Alluv.	Colluv.	Grav %	Sand %	Silt %	Mud %	Org %		Pb	Zn	Cu							
835301	R	W	5	2	0			20	40	20	10	10		6	12	6							
02	R	W	1	.5	5			20	30	20	20	10		6	10	6							
03	R	W	5	2	0			30	40	10	10	10		4	10	4							
04	R	W	2	2	5			30	40	15	10	5		105	100	18							
05	R	W	1	2	10			30	40	15	10	5		130	90	14							
06	HMT	W	2	.5	0			10	30	30	25	5		6	10	2							
07	HMT	W	1	.5	15			10	30	30	20	10		<4	6	2							
08	R	W	.5	.5	5			40	30	20	10	0		18	16	10							
09	R	W	1	.3	0			40	30	20	10	0		10	12	4							
10	HMT	D	3	1	0			20	30	20	20	10		6	14	4							
11	HMT	D	3	1	0			20	30	20	20	10		14	12	6							
12	R	W	4	1.3	2			15	50	15	15	5		12	115	6							
13	R	D	4	1.3	2			20	50	15	10	5		6	26	4							
14	R	W	2	1	0			5	15	25	25	30		4	10	2							
15	R	W	2	2	0			30	40	15	15	0		4	12	2							

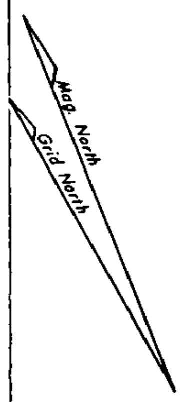
C.R.A. EXPLORATION PTY. LIMITED

GEOCHEMICAL DRAINAGE SAMPLING LEDGER

Tenement: Bull Creek
Area / Prospect: 2nd Order Anomalies
Plan / Photo Ref.:
Sample Nos.: 833301 – 833315
Mesh Size: Pan Concentrate
D.P.O. Nº: B0428
Geologist: AJV Date: 9/6/1981
Analysed by: COMLABS

Sample Number	H.M. Trap/ Random	Channel: Wet/Dry	Width	Banks	Grad.	Alluv.	Colluv.	Sediment: Grav %	Sand %	Silt %	Mud %	Org %	pH	Metal Content in p.p.m.: Pb	Zn	Cu	Geological Observations
833301	R	W	5	2	0			20	40	20	10	10		10	12	4	
02	R	W	1	.5	5			20	30	20	20	10		6	24	6	
03	R	W	5	2	0			30	40	10	10	10		44	8	2	
04	R	W	2	2	5			30	40	15	10	5		200	175	30	
05	R	W	1	2	10			30	40	15	10	5		280	145	28	
06	HMT	W	2	.5	0			10	30	30	25	5		10	10	2	
07	HMT	W	1	.5	15			10	30	30	20	10		4	8	2	
08	R	W	.5	.5	5			40	30	20	10	0		65	18	16	
09	R	W	1	.3	0			40	30	20	10	0		65	24	8	
10	HMT	D	3	1	0			20	30	20	20	10		14	30	46	
11	HMT	D	3	1	0			20	30	20	20	10		790	30	40	
12	R	W	4	1.3	2			15	50	15	15	5		65	60	12	
13	R	D	4	1.3	2			20	50	15	10	5		10	38	12	
14	R	W	2	1	0			5	15	25	25	30		44	10	2	
15	R	W	2	2	0			30	40	15	15	0		4	10	6	





LEGEND

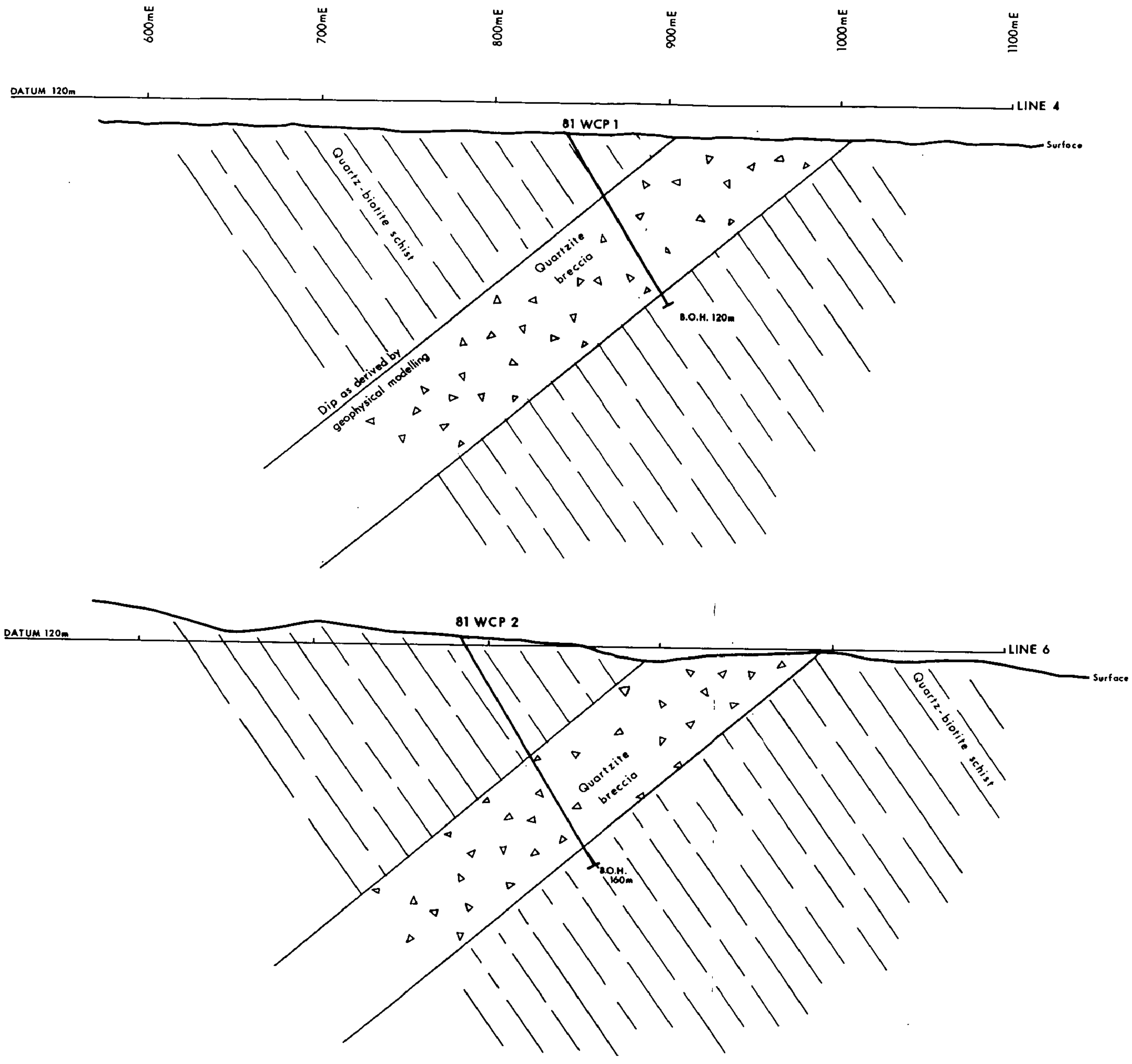
- △ △ Estimated trend of brecciated quartzite
- ⬭ QBS Quartz-biotite schist (outcrop or float)
- 55° Strike direction with dip in degrees

C R A EXPLORATION PTY LIMITED

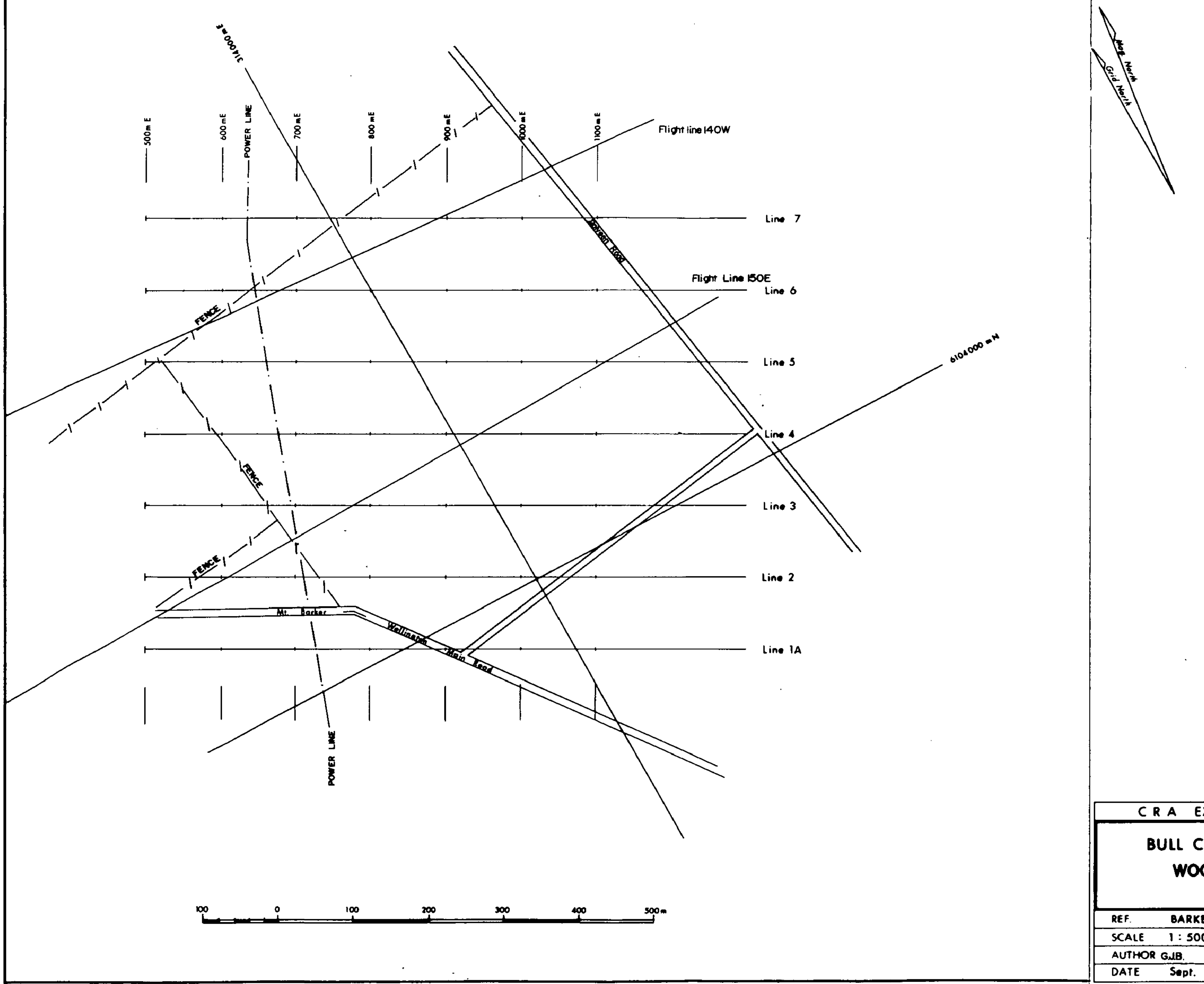
BULL CREEK EL 612 — S.A.
GEOLOGICAL PLAN OF WOODCHESTER SHOWING TREND OF BRECCIATED QUARTZITE ZONE AND PROPOSED BOREHOLE SITES

REF.	BARKER SI 54-13	
SCALE	1 : 5000	
AUTHOR	A.J.V.	REPORT 10149
DATE	Sept. 1981	PLAN No SAa 1039

000067



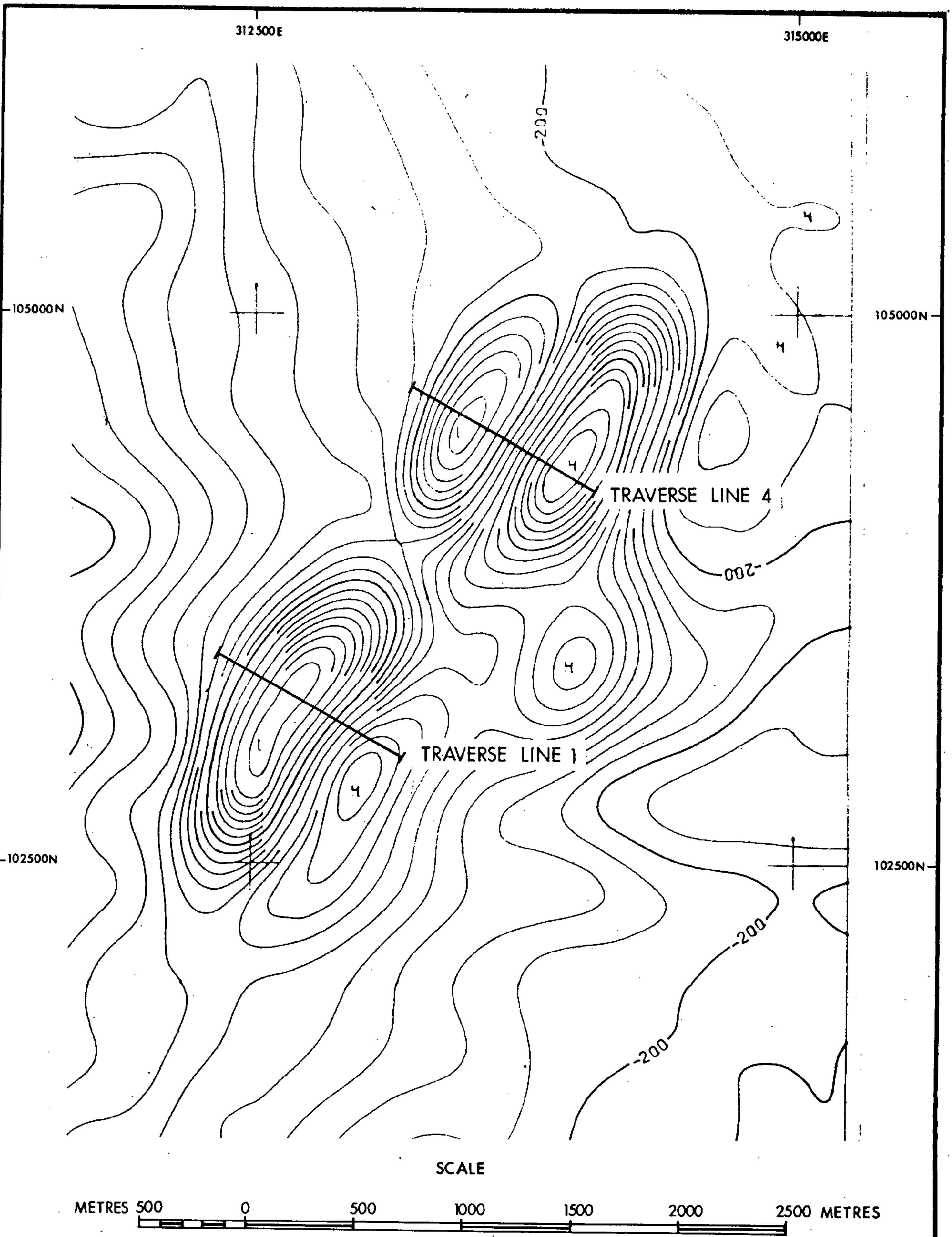
CRA EXPLORATION PTY. LIMITED	
BULL CREEK E.L.612 WOODCHESTER PROSPECT PROPOSED BOREHOLE SECTIONS	
Ref: BARKER SI54-13	
Scale: 1:2,500	**Drawn:** S.J.B.
Author: A.J.V.	**Report No:** 10149
Date: SEPTEMBER 1981	**Plan No:** SAa 1041



C R A EXPLORATION PTY LIMITED	
BULL CREEK EL 612 — S. A. WOODCHESTER GRID	
REF. BARKER SI 54-13	
SCALE 1 : 5000	
AUTHOR G.J.B.	REPORT 10149
DATE Sept. 1981	PLAN No SAa 1074

000069

000070



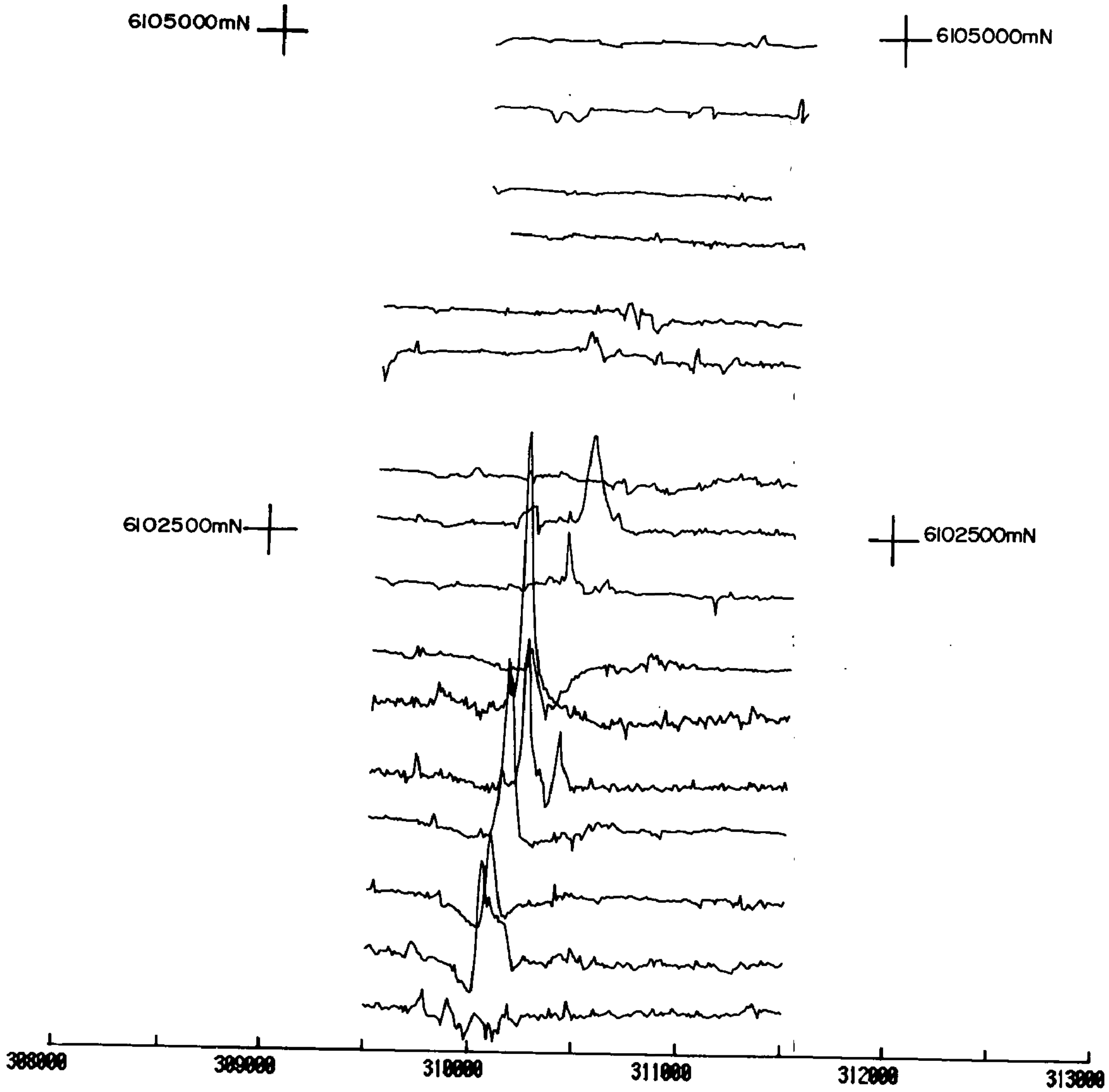
CRA EXPLORATION PTY LIMITED

BULL CREEK E.L. 612

WOODCHESTER ANOMALY

T.M.I. CONTOURS
WITH SUPERIMPOSED TRAVERSE LINES
NOS. 1 & 4

REF.: ADELAIDE S154-9, BARKER S154-13	
SCALE: 1:25,000	
AUTHOR: G.J.B., A.J.V.	**REPORT**: 10149
DATE: OCTOBER 1981	**PLAN No**: SAa 1110



Magnetometer	:	Scintrex MP-2
Quoted sensitivity	:	+/- 1 nT
Noise envelope	:	+/- 5 nT
Station spacing	:	10 metres
Line orientation	:	90 deg AMG
Survey date	:	Aug-Sep 1981
Vertical scale	:	200 nT/cm

Horizontal scale : AMG metres east

C R A EXPLORATION PTY LIMITED

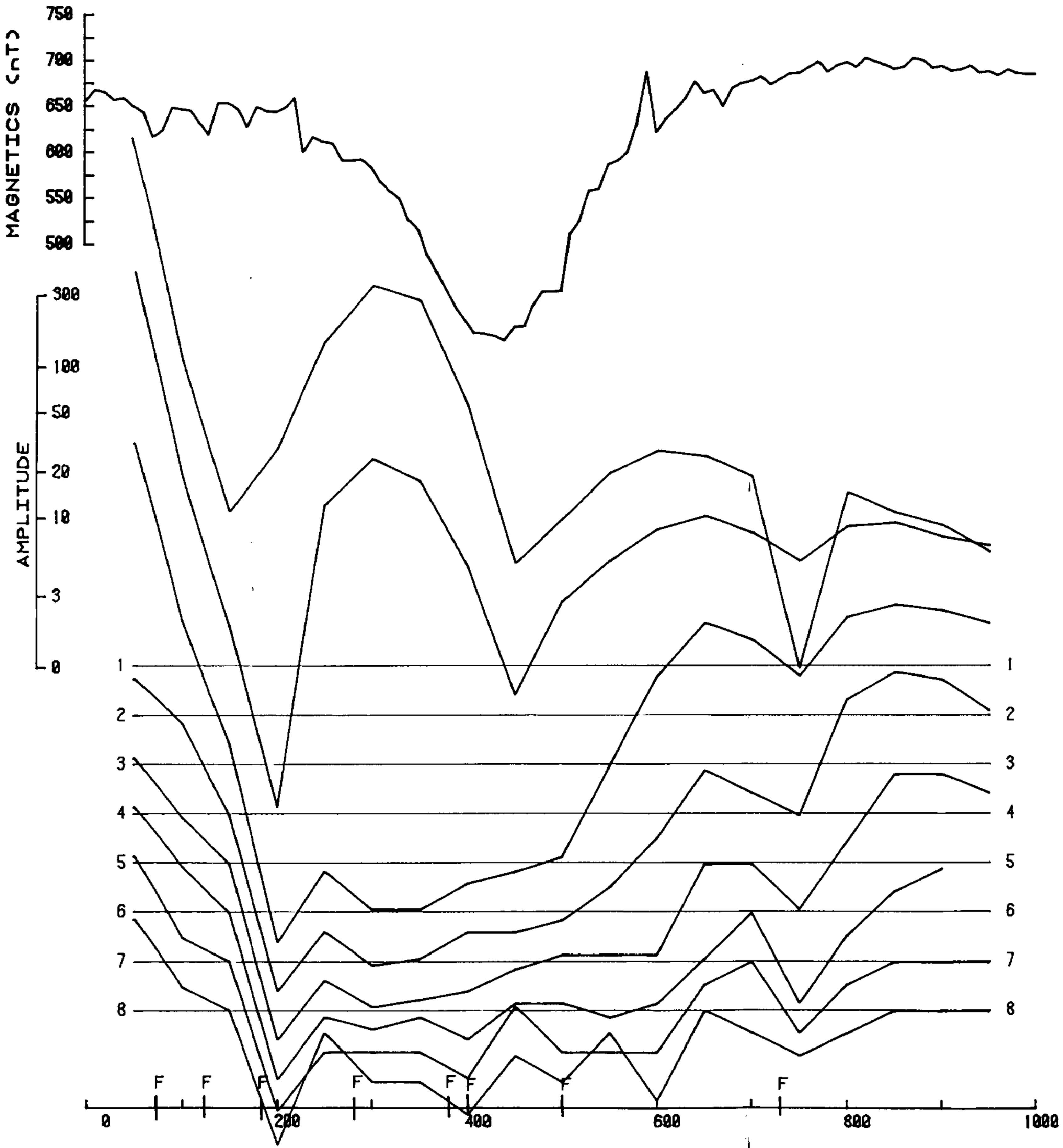
BULL CREEK E.L. 812

GROUND MAGNETICS STACKED PROFILES

STRATHALBYN GRID

REF. BARKER SI 54-13	
SCALE 1:25000	
AUTHOR G.J.B.	REPORT 10149
DATE SEP. 1981	PLAN No SAg 1033

000071



Magnetometer	:	Scintrex MP-2
Quoted sensitivity	:	+/- 1 nT
Noise envelope	:	+/- 5 nT
Station spacing	:	10 metres
Line orientation	:	119 deg AMG
Survey date	:	16/09/81
Vertical scale	:	200 nT/cm

Transmitter loop	:	100 x 100 metres
Receiver	:	In-loop
Field component	:	Vertical
Time base	:	20 ms
Gain	:	800
Survey date	:	Aug 1981
Receiver offset	:	50 metres north

Horizontal scale : metres East

F : Fence

C. R. A. EXPLORATION PTY. LIMITED

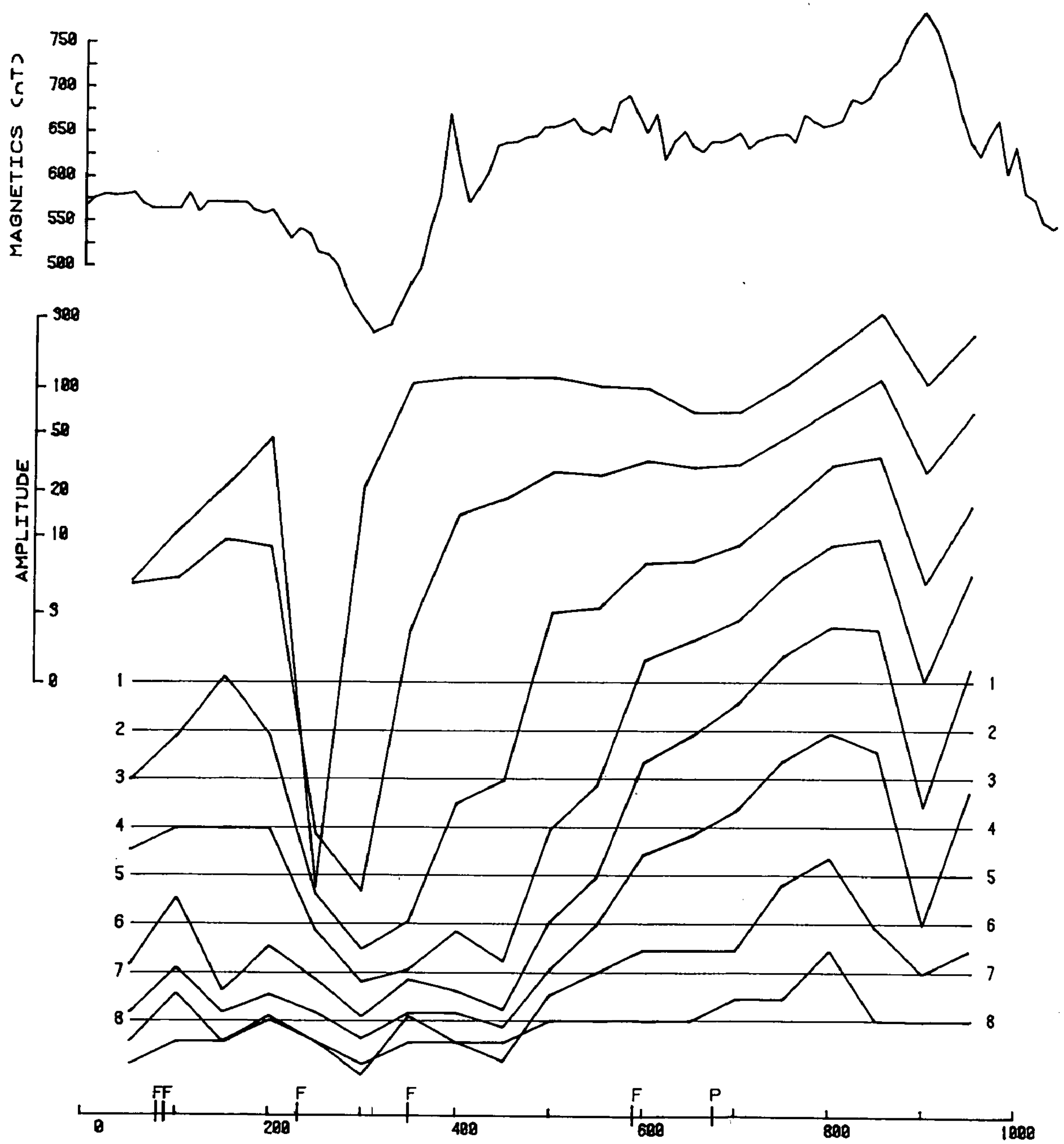
BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

WOODCHESTER GRID : LINE 01

Ref.	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 1002

000072



Magnetometer	:	Scintrex MP-2
Quoted sensitivity	:	+/- 1 nT
Noise envelope	:	+/- 5 nT
Station spacing	:	10 metres
Line orientation	:	119 deg AMG
Survey date	:	02/09/81
Vertical scale	:	50 nT/cm

Transmitter loop	:	100 x 100 metres
Receiver	:	In-loop
Field component	:	Vertical
Time base	:	20 ms
Gain	:	800
Survey date	:	Aug 1981
Receiver offset	:	50 metres north

Horizontal scale : metres East

F : Fence

P : Power line

C. R. A. EXPLORATION PTY. LIMITED

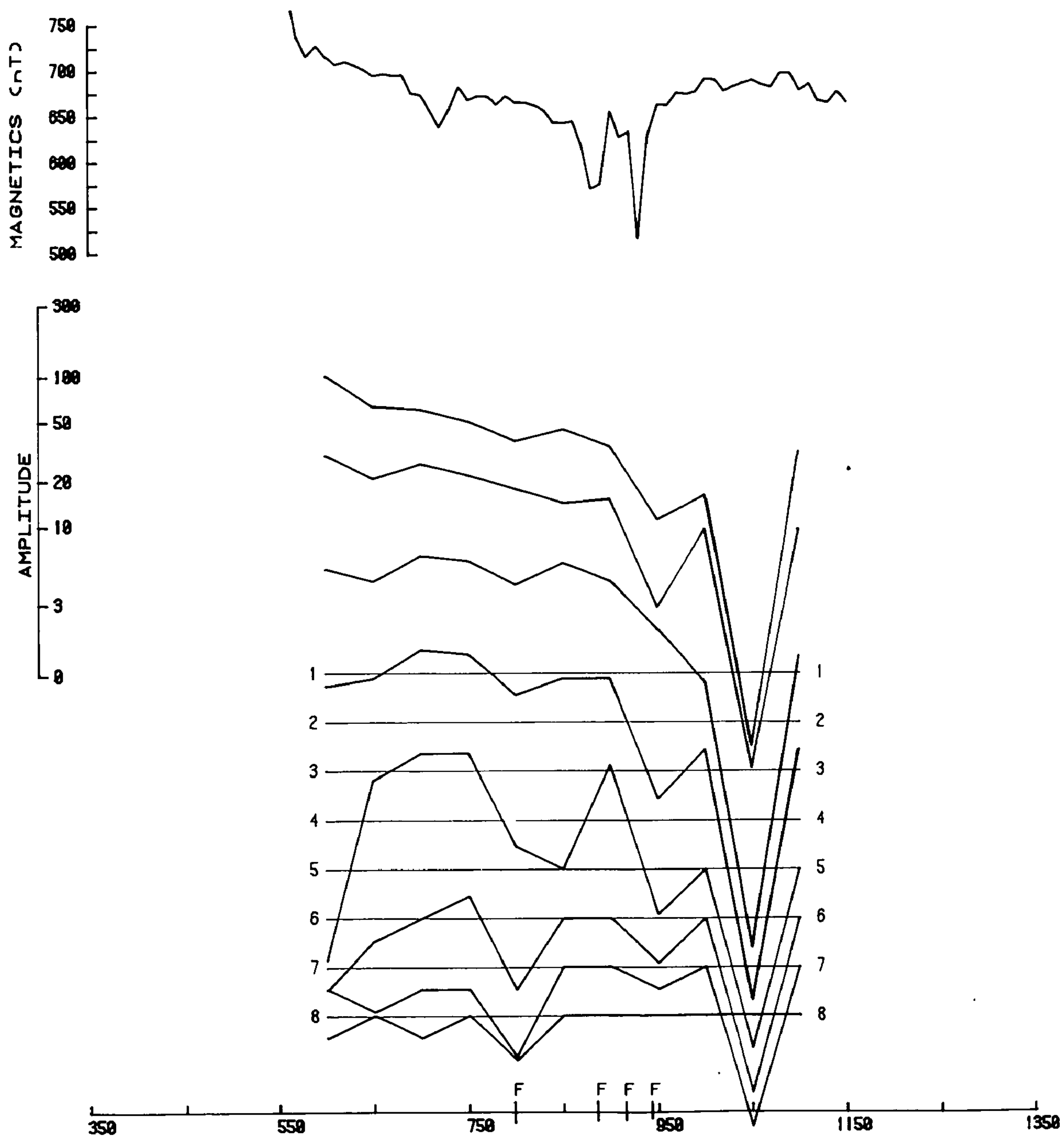
BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

WOODCHESTER GRID : LINE 04

Ref.	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 1010

000073



Magnetometer : Scintrex MP-2
Quoted sensitivity : +/- 1 nT
Noise envelope : +/- 5 nT
Station spacing : 10 metres
Line orientation : 119 deg AMG
Survey date : 16/09/81
Vertical scale : 200 nT/cm

Transmitter loop : 100 x 100 metres
Receiver : In-loop
Field component : Vertical
Time base : 20 ms
Gain : 800
Survey date : Sep 1981
Receiver offset : 50 metres north

Horizontal scale : metres East

F | : Fence

C. R. A. EXPLORATION PTY. LIMITED

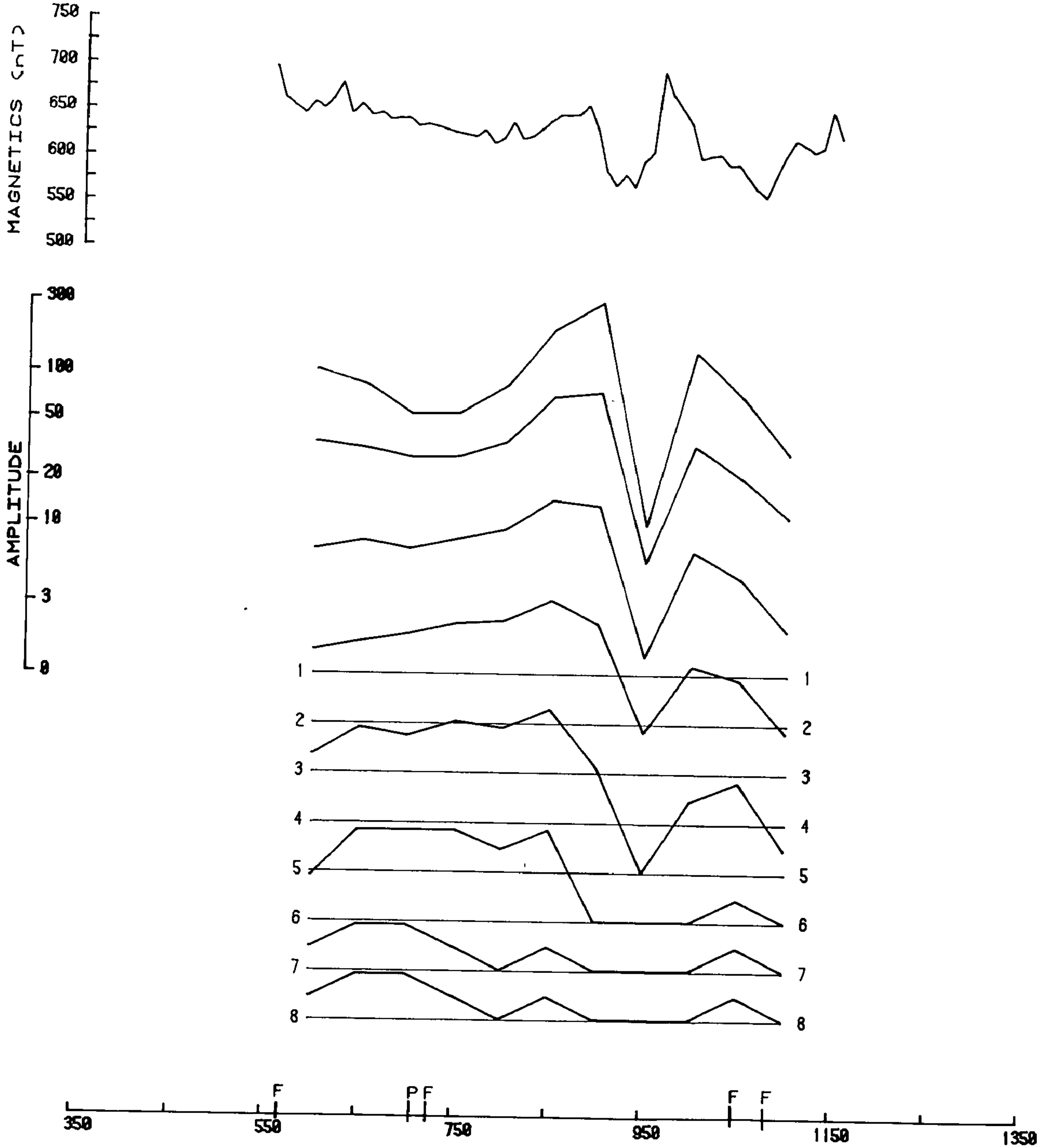
BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

WOODCHESTER GRID : LINE 1A

Ref.	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 1003

000074



Magnetometer : Scintrex MP-2
Quoted sensitivity : +/- 1 nT
Noise envelope : +/- 5 nT
Station spacing : 10 metres
Line orientation : 119 deg AMG
Survey date : 02/09/81
Vertical scale : 50 nT/cm

Transmitter loop : 100 x 100 metres
Receiver : In-loop
Field component : Vertical
Time base : 20 ms
Gain : 800
Survey date : Sep 1981
Receiver offset : 50 metres north

Horizontal scale : metres East

F : Fence

P : Power line

C. R. A. EXPLORATION PTY. LIMITED

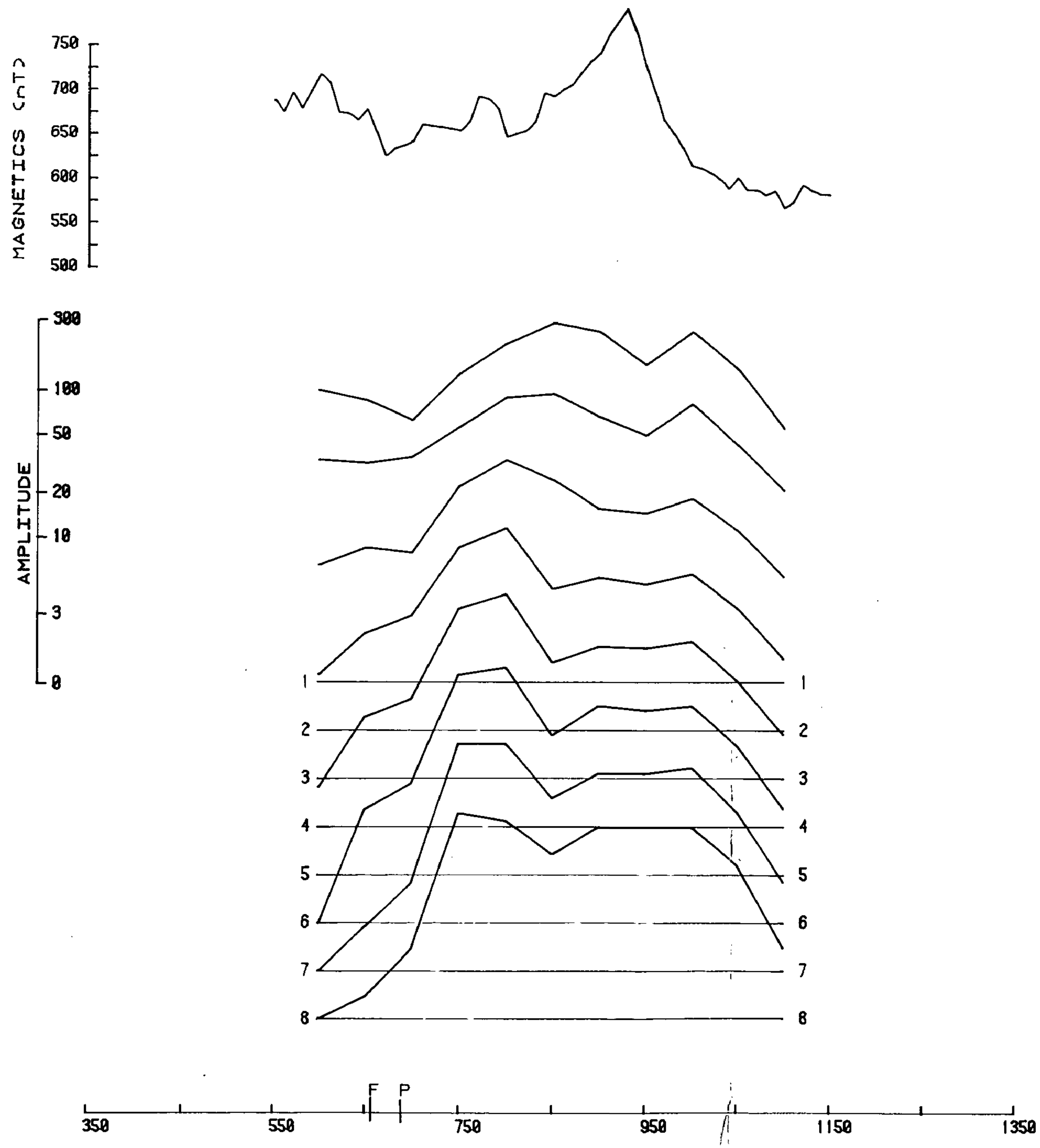
BULL CREEK E.L. 612

CRONE PULSE EM AND
GROUND MAGNETIC PROFILES

WOODCHESTER GRID : LINE 02

Ref.	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 1004

000075



Magnetometer : Scintrex MP-2
Quoted sensitivity : +/- 1 nT
Noise envelope : +/- 5 nT
Station spacing : 10 metres
Line orientation : 119 deg AMG
Survey date : 03/09/81
Vertical scale : 50 nT/cm

Transmitter loop : 100 x 100 metres
Receiver : In-loop
Field component : Vertical
Time base : 20 ms
Gain : 800
Survey date : Sep 1981
Receiver offset : 50 metres north

Horizontal scale : metres East

F : Fence

P : Power line

C. R. A. EXPLORATION PTY. LIMITED

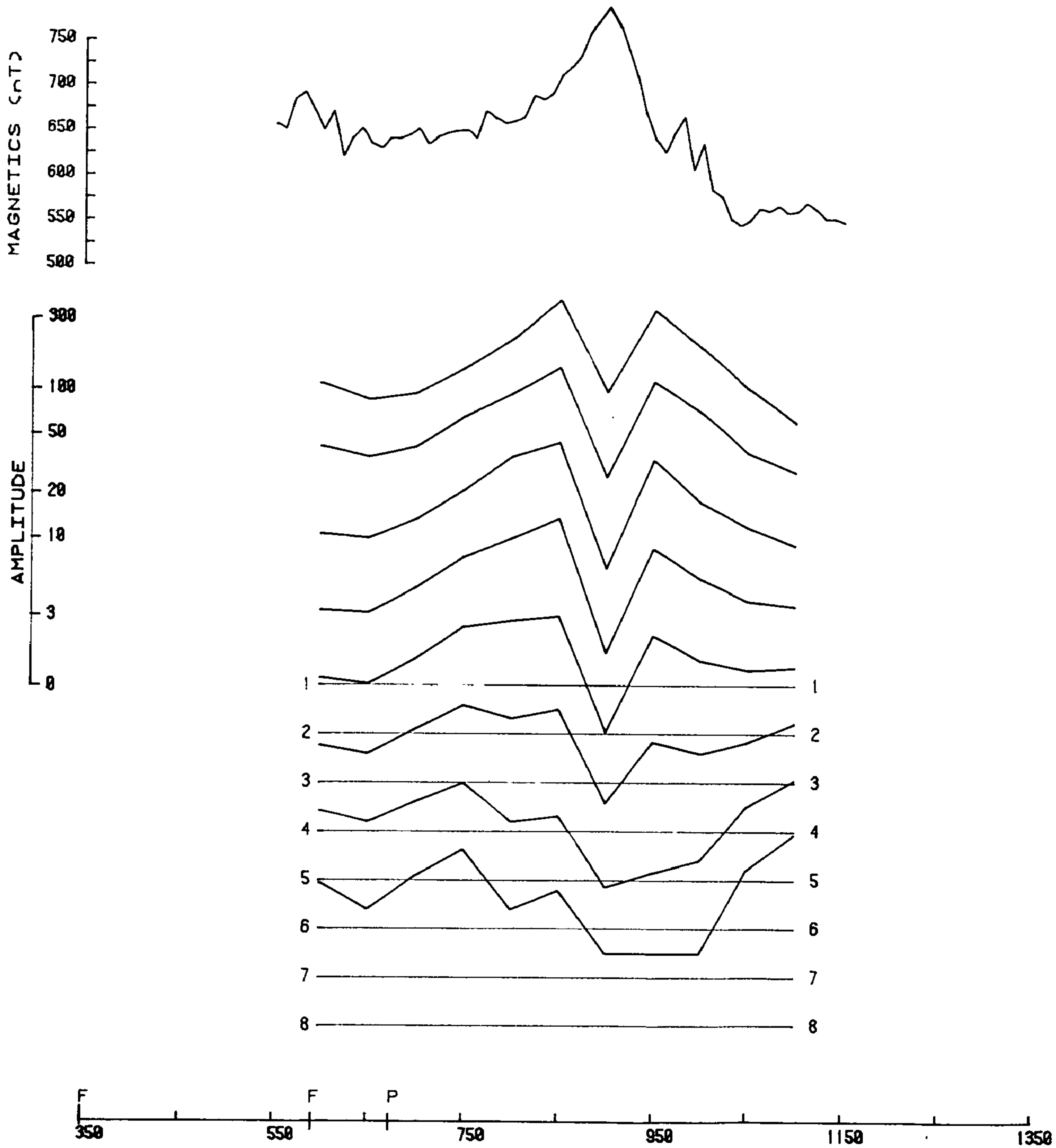
BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

WOODCHESTER GRID : LINE 03

Ref.	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 1005

000076



Magnetometer	:	Scintrex MP-2
Quoted sensitivity	:	+/- 1 nT
Noise envelope	:	+/- 5 nT
Station spacing	:	10 metres
Line orientation	:	119 deg AMG
Survey date	:	02/09/81
Vertical scale	:	50 nT/cm

Transmitter loop	:	100 x 100 metres
Receiver	:	In-loop
Field component	:	Vertical
Time base	:	20 ms
Gain	:	800
Survey date	:	Sep 1981
Receiver offset	:	50 metres north

Horizontal scale : metres East

F : Fence

P : Power line

C. R. A. EXPLORATION PTY. LIMITED

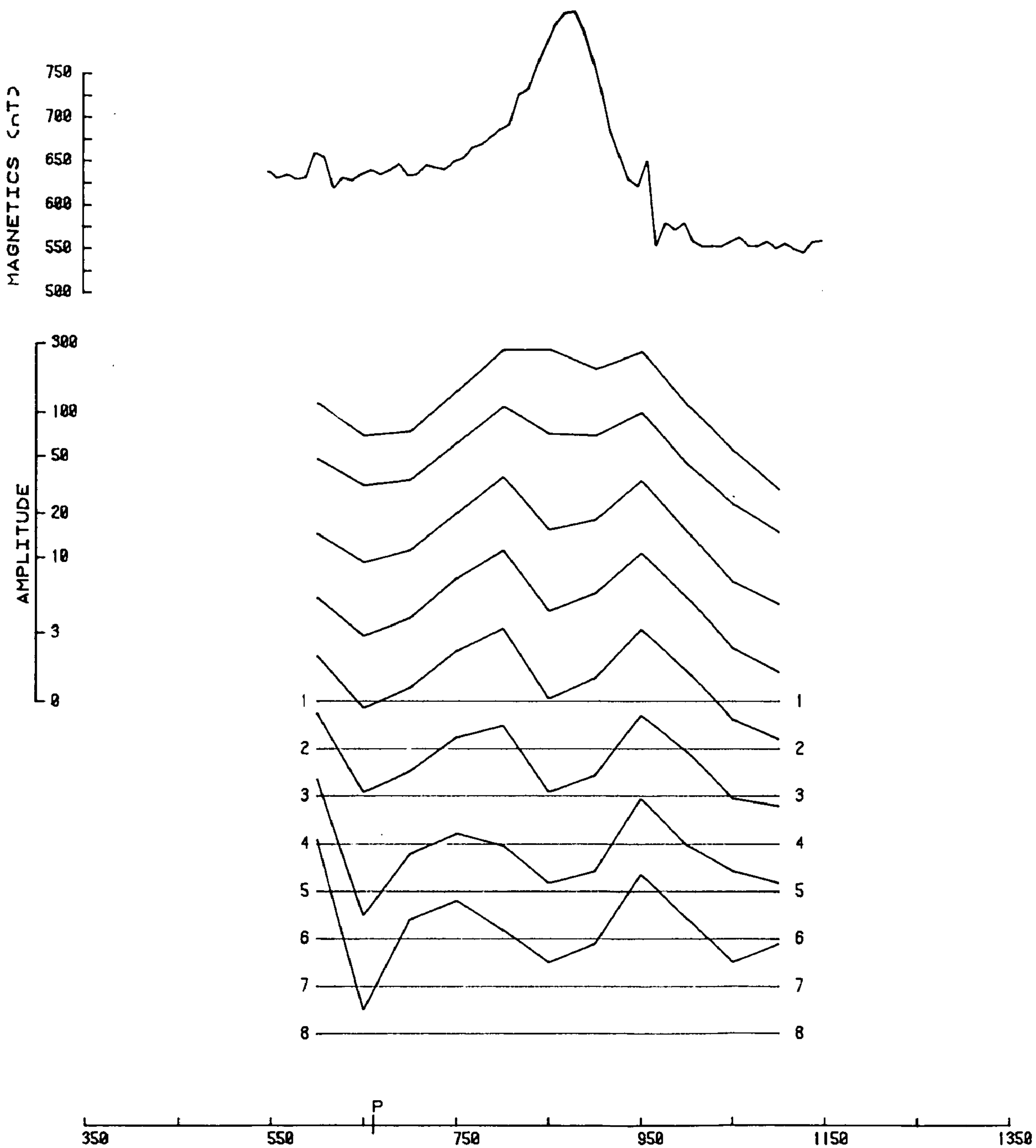
BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

WOODCHESTER GRID : LINE 04

Ref.	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 1006

000077



Magnetometer	:	Scintrex MP-2
Quoted sensitivity	:	+/- 1 nT
Noise envelope	:	+/- 5 nT
Station spacing	:	10 metres
Line orientation	:	119 deg AMG
Survey date	:	02/09/81
Vertical scale	:	50 nT/cm

Transmitter loop	:	100 x 100 metres
Receiver	:	In-loop
Field component	:	Vertical
Time base	:	20 ms
Gain	:	800
Survey date	:	Sep 1981
Receiver offset	:	50 metres north

Horizontal scale : metres East

P : Power line

C. R. A. EXPLORATION PTY. LIMITED

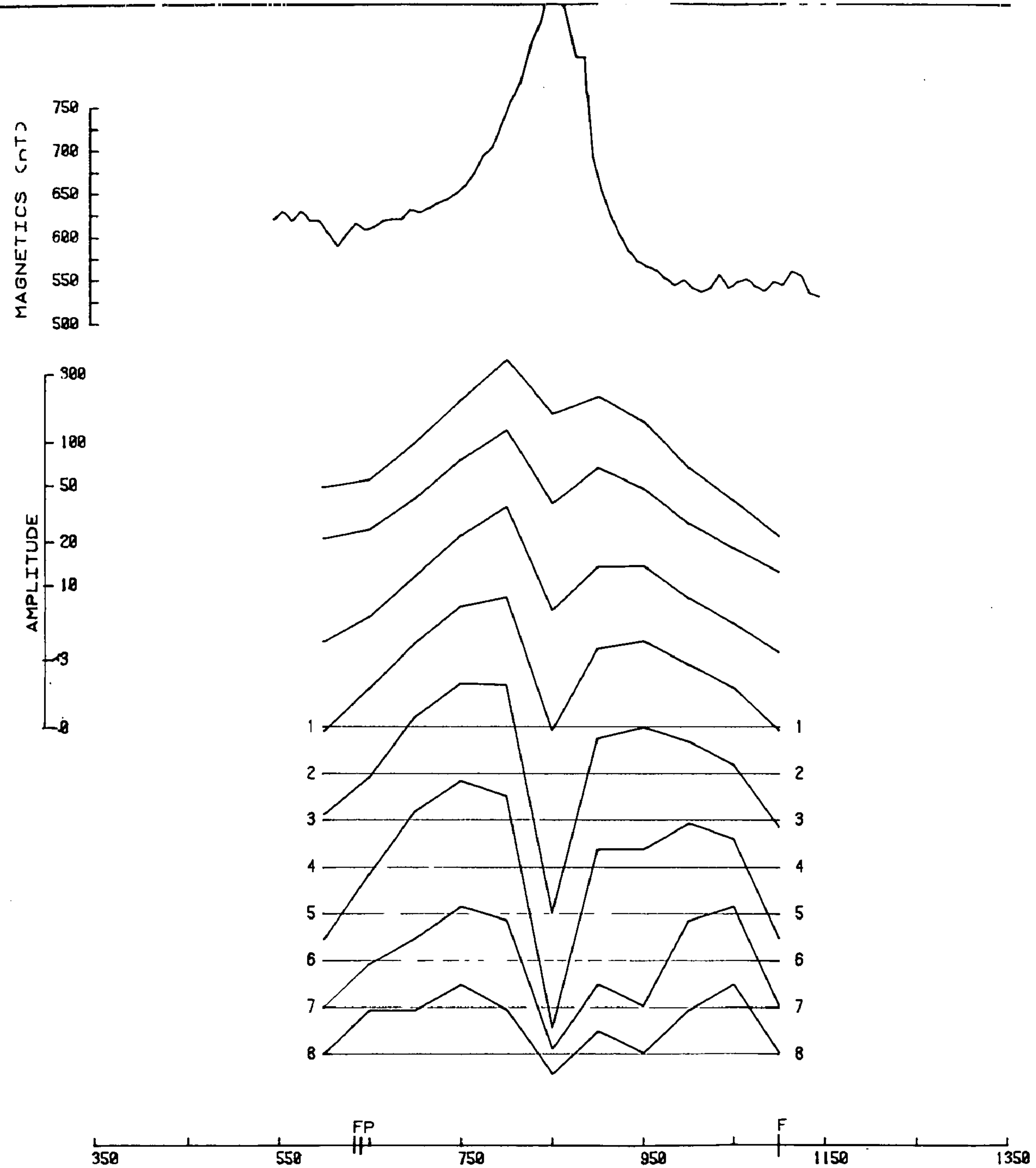
BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

WOODCHESTER GRID : LINE 05

Ref.	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 1007

000078



Magnetometer : Scintrex MP-2
Quoted sensitivity : +/- 1 nT
Noise envelope : +/- 5 nT
Station spacing : 10 metres
Line orientation : 119 deg AMG
Survey date : 02/09/81
Vertical scale : 50 nT/cm

Transmitter loop : 100 x 100 metres
Receiver : In-loop
Field component : Vertical
Time base : 20 ms
Gain : 800
Survey date : Sep 1981
Receiver offset : 50 metres north

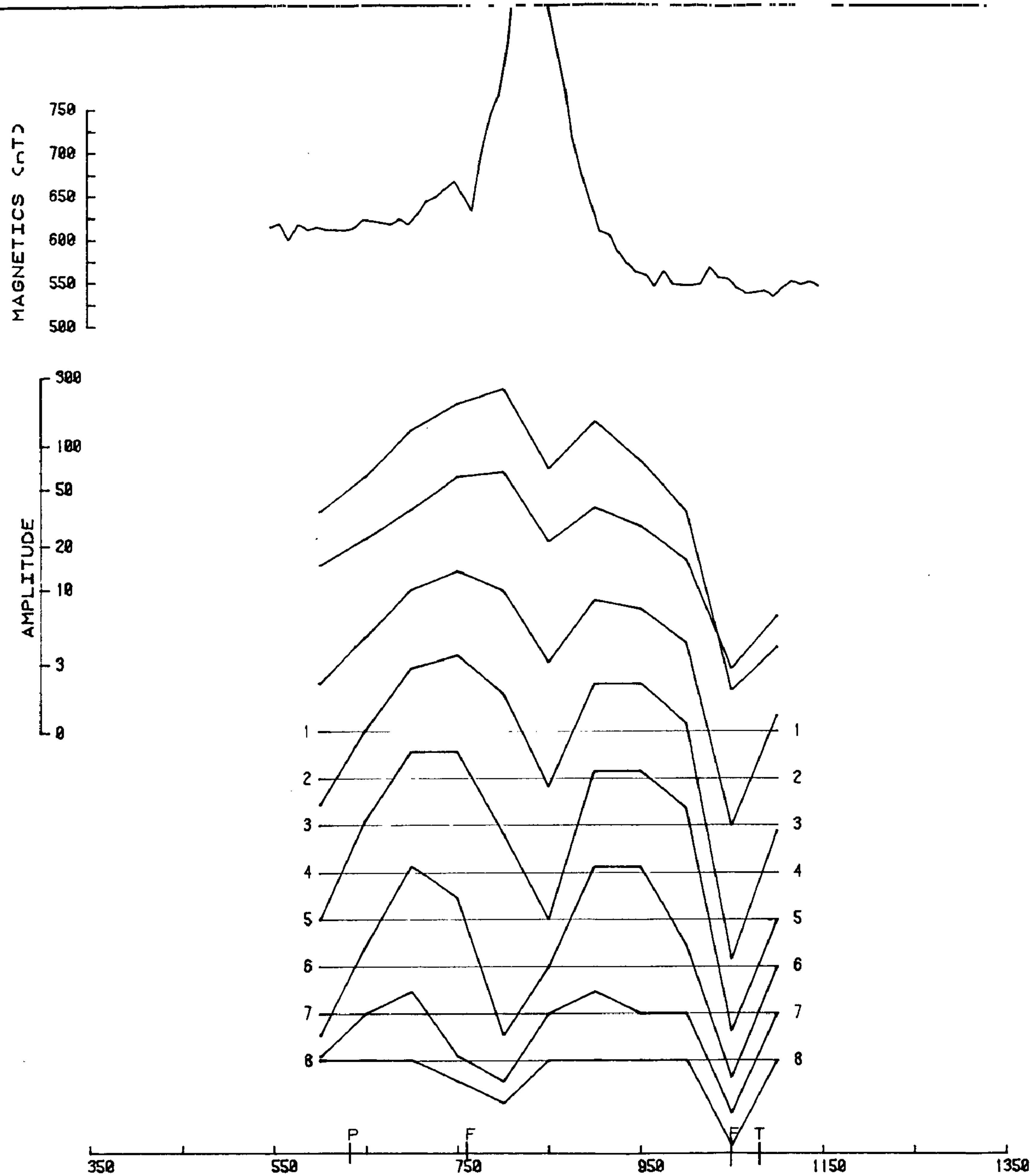
Horizontal scale : metres East

F : Fence

P : Power line

C. R. A. EXPLORATION PTY. LIMITED			
BULL CREEK E.L. 812			
CRONE PULSE EM AND GROUND MAGNETIC PROFILES			
WOODCHESTER GRID : LINE 06			
Ref.	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 1008

000079



Magnetometer	:	Scintrex MP-2
Quoted sensitivity	:	+/- 1 nT
Noise envelope	:	+/- 5 nT
Station spacing	:	10 metres
Line orientation	:	119 deg AMG
Survey date	:	02/09/81
Vertical scale	:	50 nT/cm

Transmitter loop	:	100 x 100 metres
Receiver	:	In-loop
Field component	:	Vertical
Time base	:	20 ms
Gain	:	800
Survey date	:	Sep 1981
Receiver offset	:	50 metres north

Horizontal scale : metres East

F | : Fence

T | : Telephone line

P | : Power line

C. R. A. EXPLORATION PTY. LIMITED

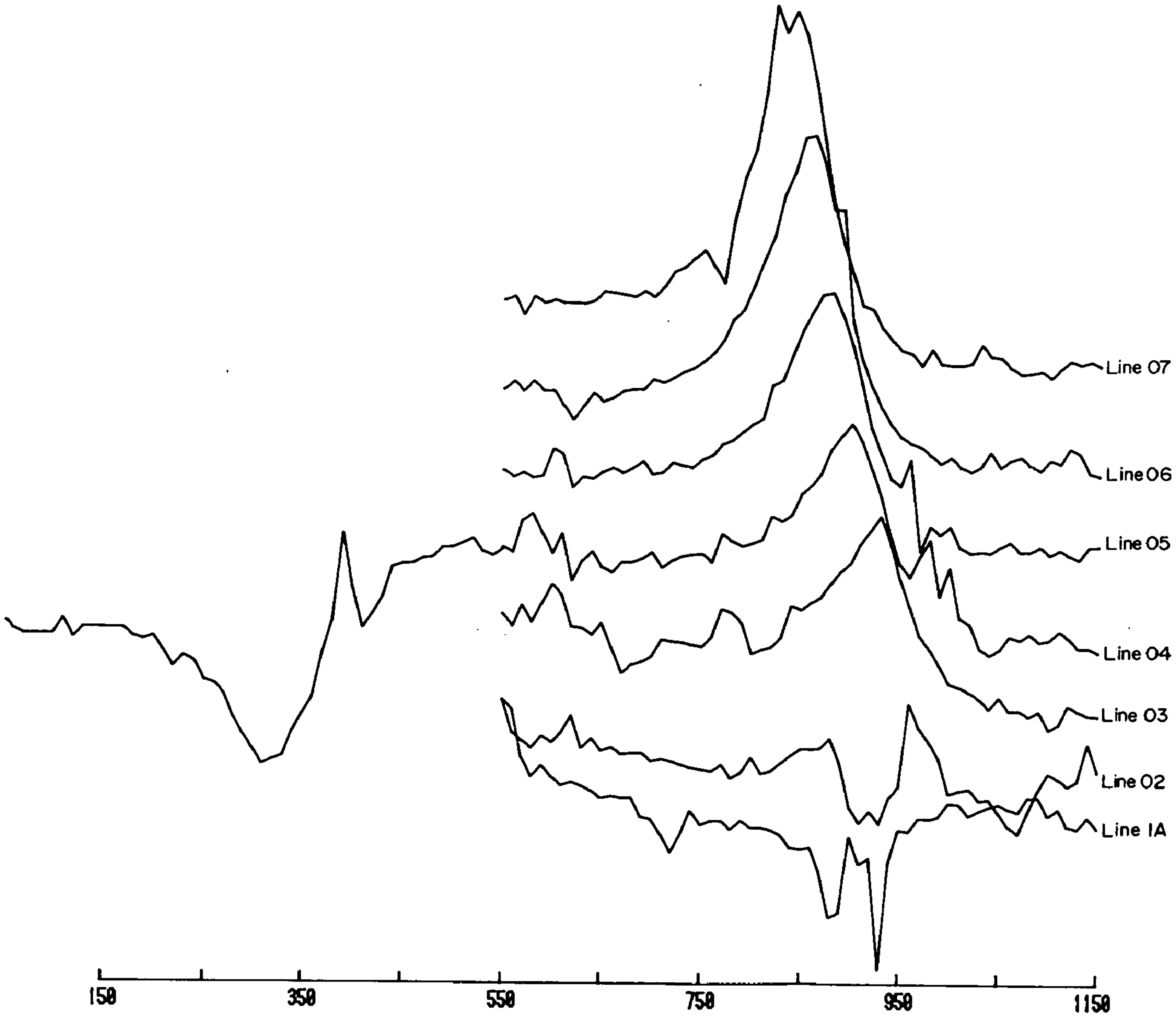
BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

WOODCHESTER GRID : LINE 07

Ref.	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 1009

080000

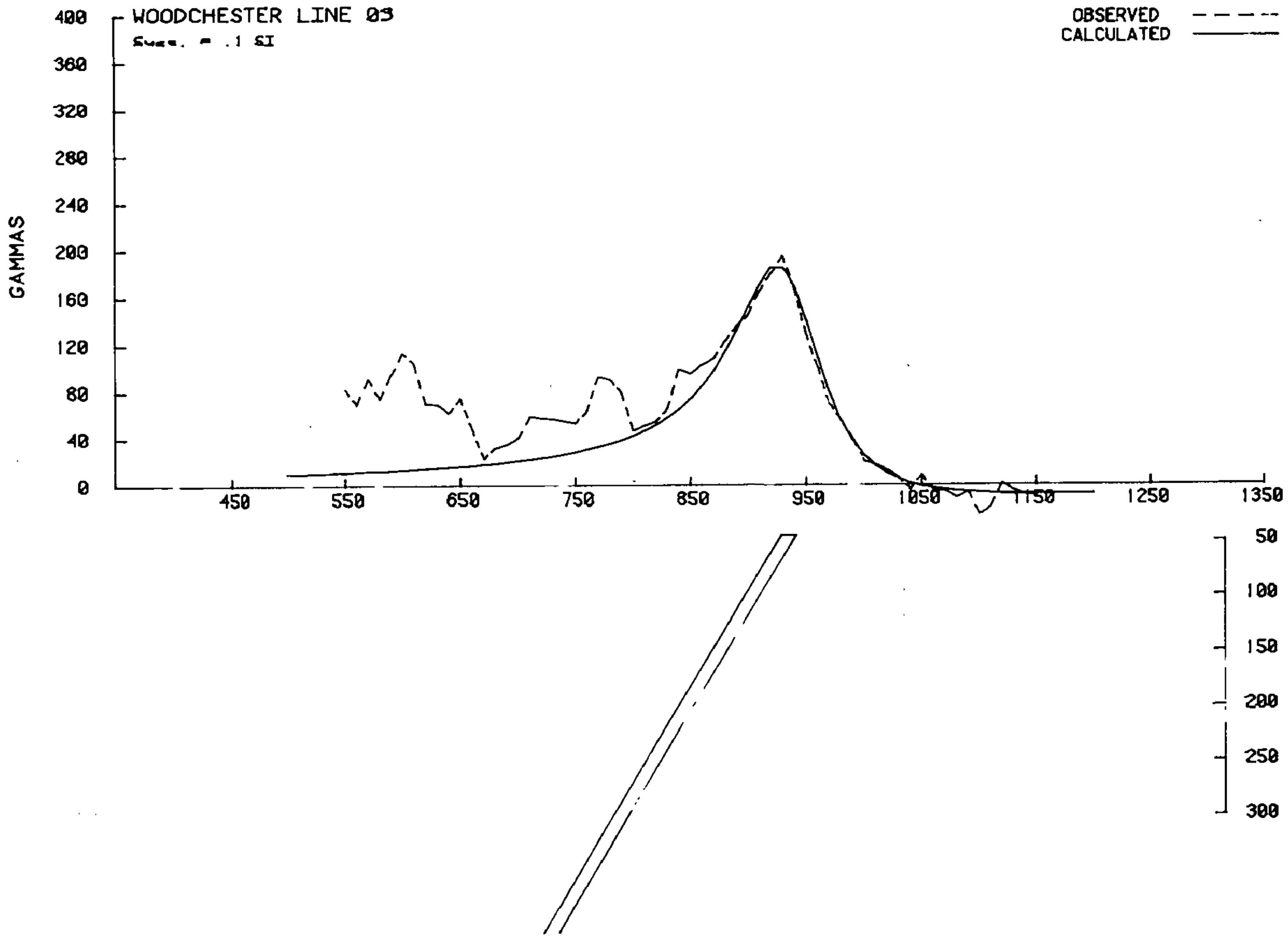


Magnetometer : Scintrex MP-2
Quoted sensitivity : +/- 1 nT
Noise envelope : +/- 5 nT
Station spacing : 10 metres
Line orientation : 119 deg AMG
Survey date : Sep 1981
Vertical scale : 50 nT/cm

Horizontal scale : metres east

C. R. A. EXPLORATION PTY. LIMITED	
BULL CREEK E.L. 612	
GROUND MAGNETICS STACKED PROFILES	
WOODCHESTER GRID	
Ref. BARKER SI 54-13	
Scale 1:5000	Drawn
Author G.J.B.	Report No. 10149
Date SEP. 1981	Plan No. SAa 1032

000081



Line orientation	:	120 deg True
Survey date	:	02/09/81
Vertical scale	:	47 nT/cm
Horizontal scale	:	metres

Model	:	Thin dyke
Strike	:	15 deg True
Depth to top	:	45 metres
Depth to bottom	:	Infinite
Dip	:	60 deg west
Width	:	11 metres

C R A EXPLORATION PTY LIMITED

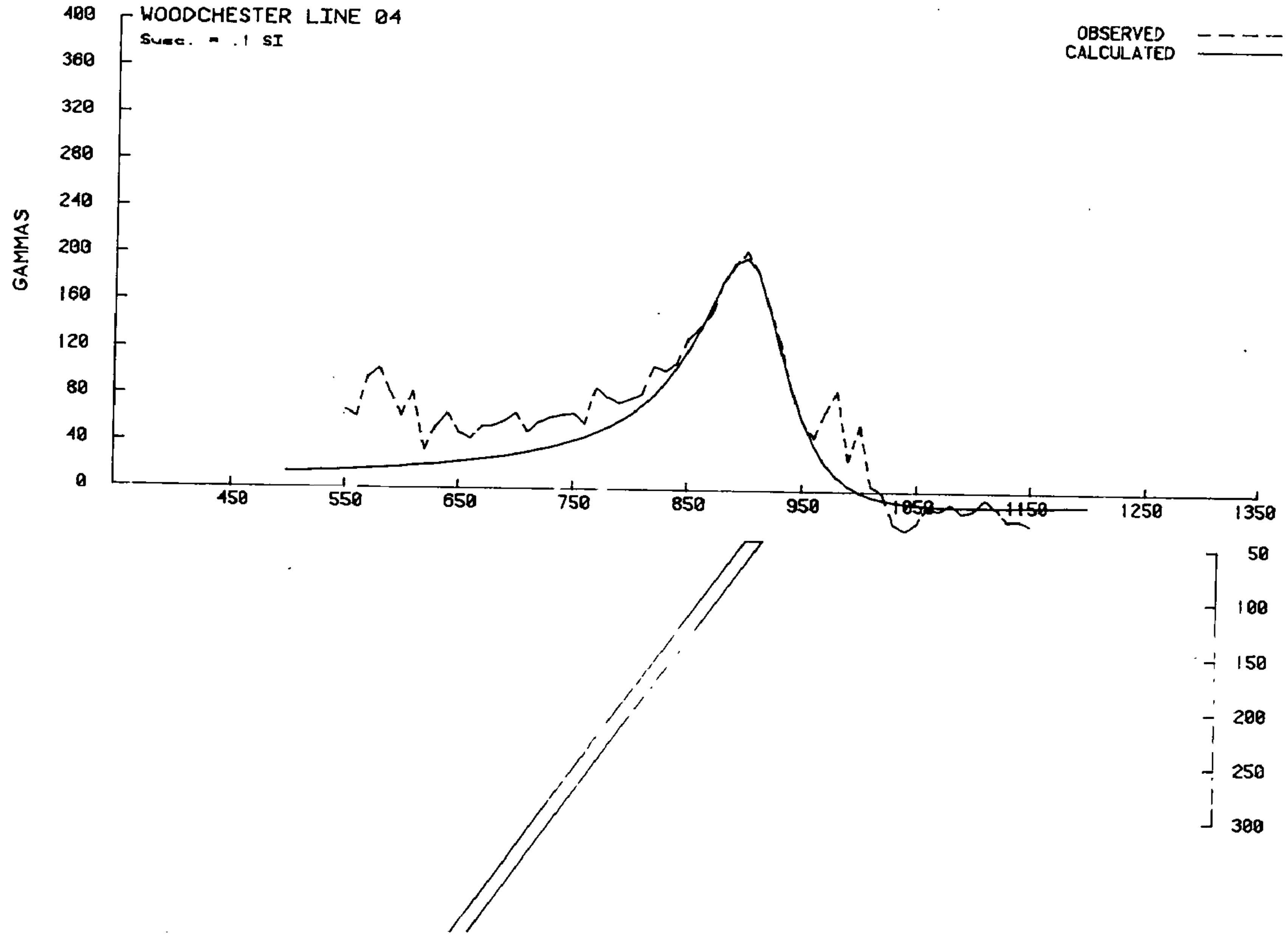
BULL CREEK E.L. 612

INTERPRETATION OF GROUND MAGNETICS

WOODCHESTER GRID : LINE 3

REF. BARKER SI 54-13	
SCALE 1 : 5000	
AUTHOR G.J.B.	REPORT 10149
DATE OCT. 1981	PLAN No SAa 1064

000082



Line orientation : 120 deg True
Survey date : 02/09/81
Vertical scale : 47 nT/cm

Horizontal scale : metres

Model : Thin dyke
Strike : 15 deg True
Depth to top : 45 metres
Depth to bottom : Infinite
Dip : 55 deg west
Width : 12 metres

C R A EXPLORATION PTY LIMITED

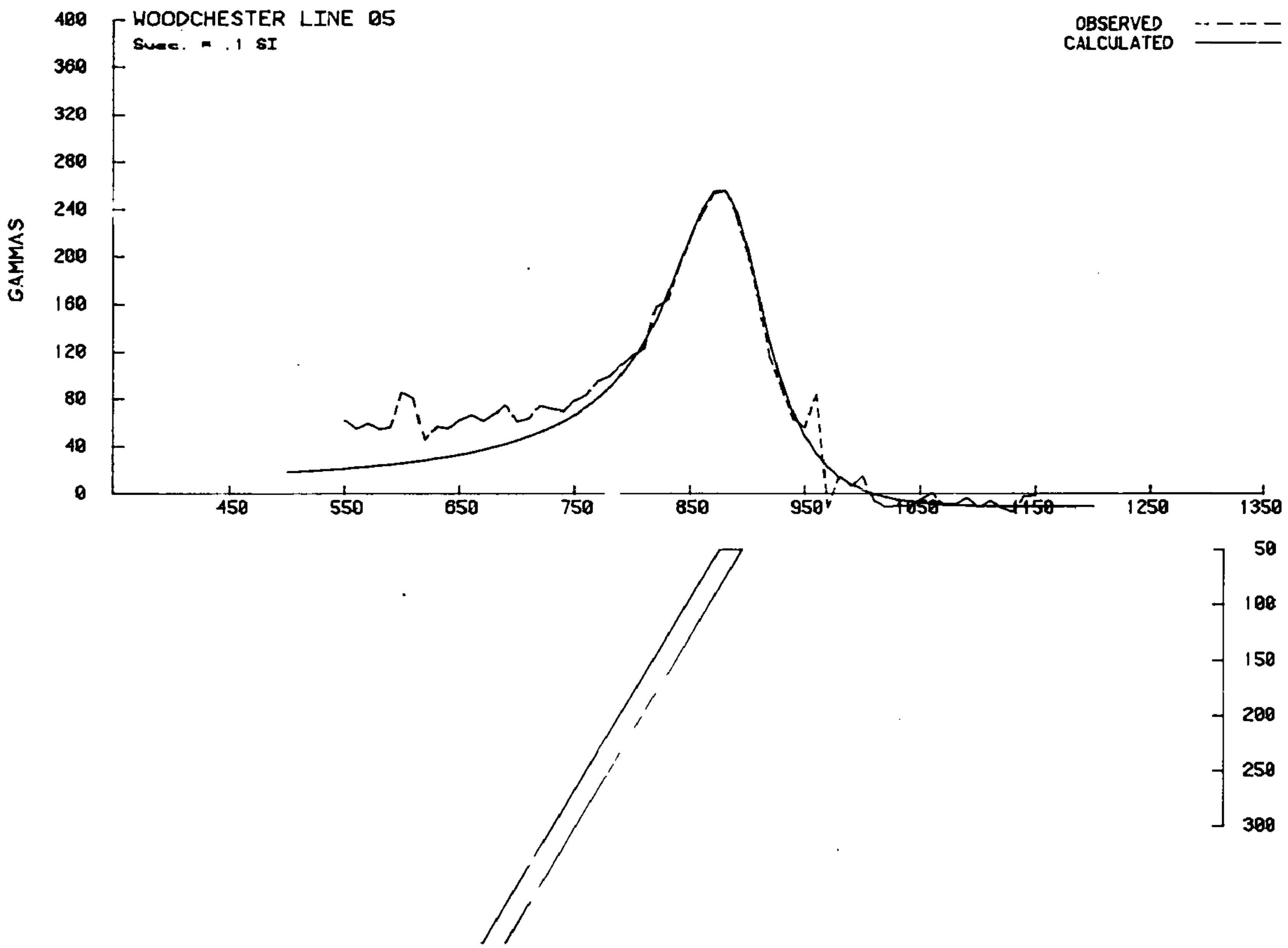
BULL CREEK E.L. 612

INTERPRETATION OF GROUND MAGNETICS

WOODCHESTER GRID : LINE 4

REF. BARKER SI 54-13	
SCALE 1 : 5000	
AUTHOR R. J. B.	REPORT 10149
DATE OCT. 1981	PLAN No SAa 1065

000083



Line orientation	:	120 deg True
Survey date	:	02/09/81
Vertical scale	:	47 nT/cm
Horizontal scale	:	metres

Model	:	Thin dyke
Strike	:	15 deg True
Depth to top	:	50 metres
Depth to bottom	:	Infinite
Dip	:	60 deg west
Width	:	17 metres

C R A EXPLORATION PTY LIMITED

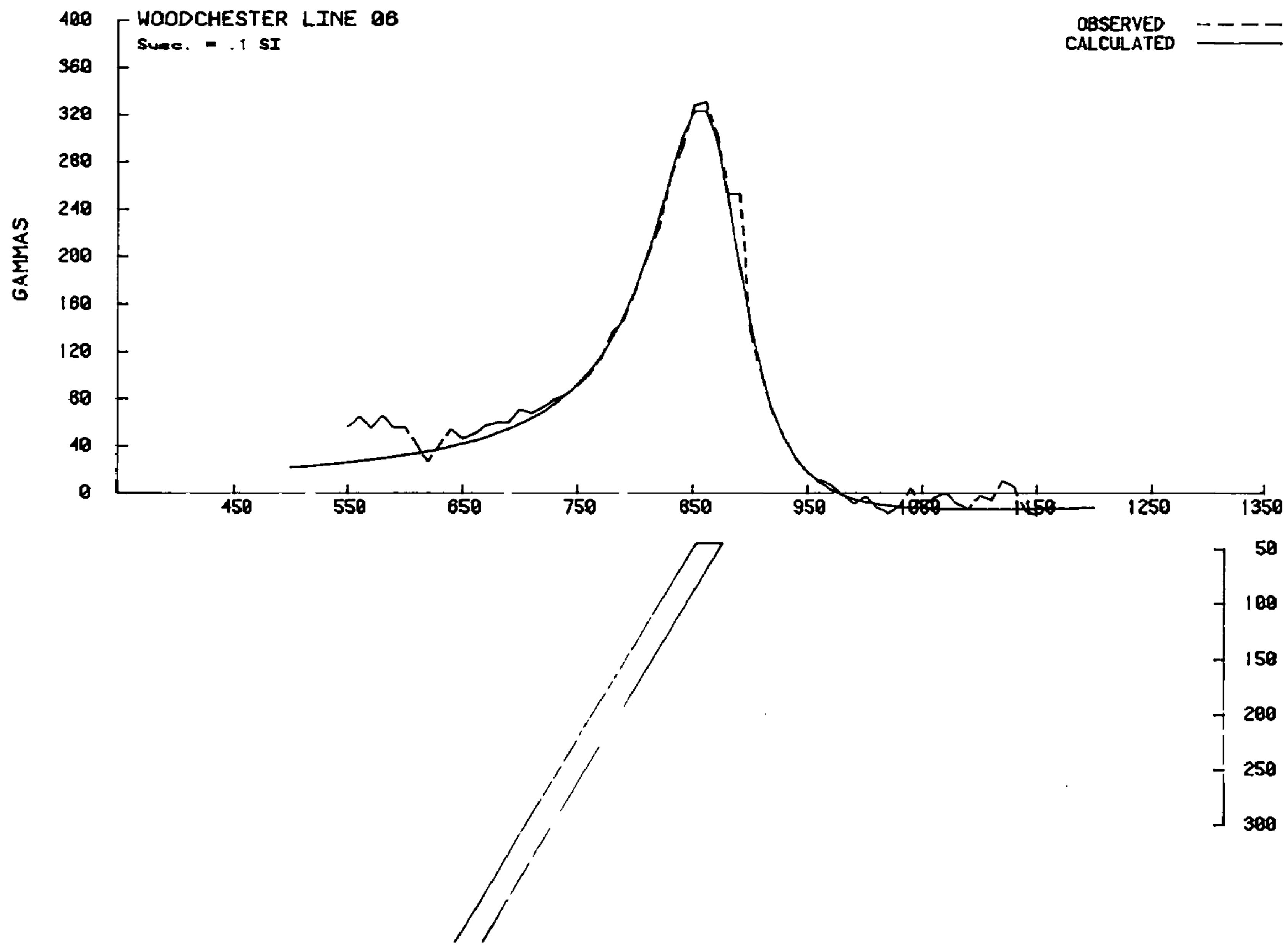
BULL CREEK E.L. 612

INTERPRETATION OF GROUND MAGNETICS

WOODCHESTER GRID : LINE 5

REF. BARKER SI 54-13	
SCALE 1 : 5000	
AUTHOR G.J.B.	REPORT 10149
DATE OCT. 1981	PLAN No SAa 1066

U00084



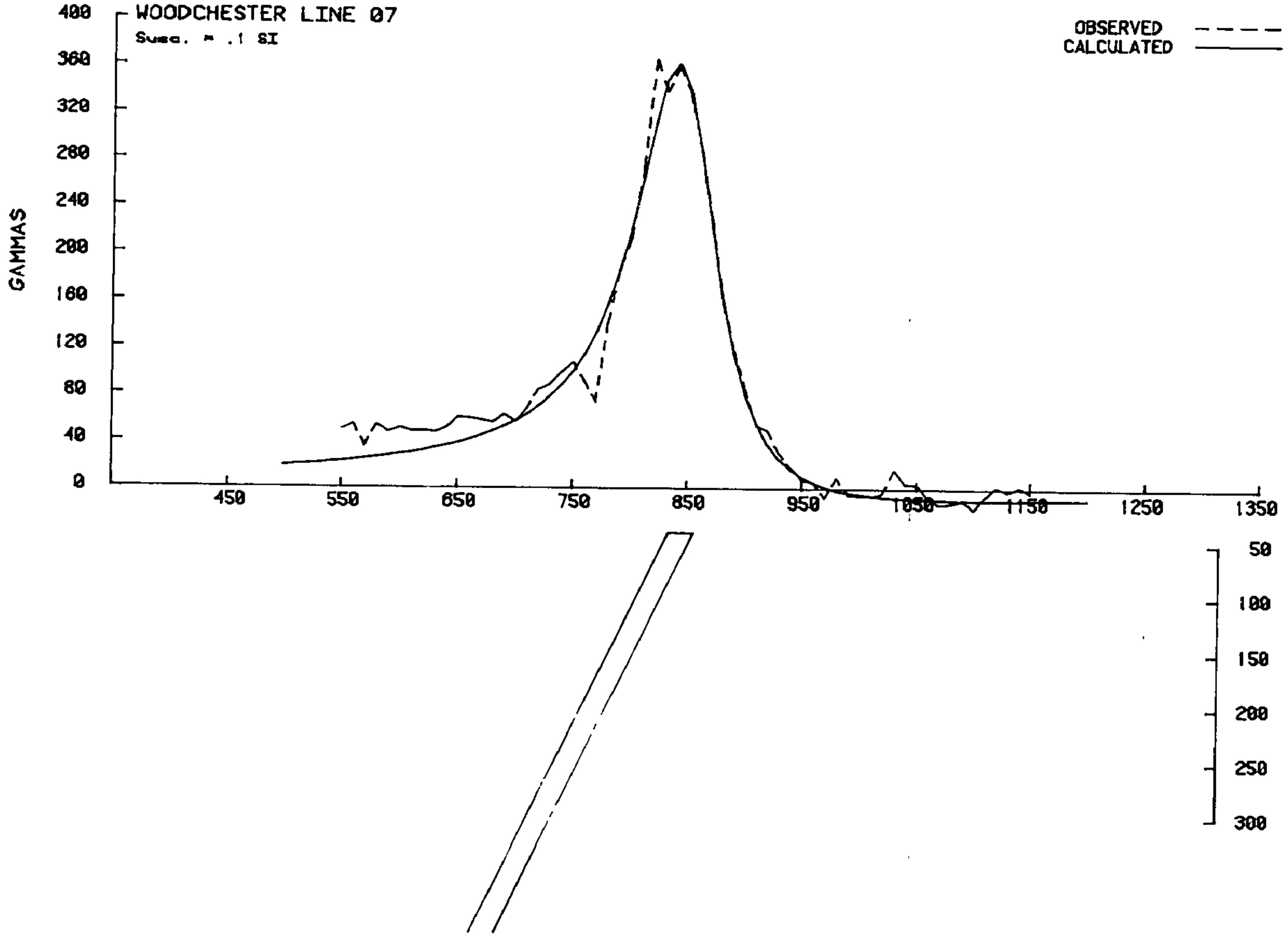
Line orientation : 120 deg True
Survey date : 02/09/81
Vertical scale : 47 nT/cm

Horizontal scale : metres

Model : Thin dyke
Strike : 15 deg True
Depth to top : 45 metres
Depth to bottom : Infinite
Dip : 60 deg west
Width : 19.5 metres

C R A EXPLORATION PTY LIMITED	
BULL CREEK E.L. 612 INTERPRETATION OF GROUND MAGNETICS WOODCHESTER GRID : LINE 6	
REF. BARKER SI 54-13	
SCALE 1 : 5000	
AUTHOR G.J.B.	REPORT 10149
DATE OCT. 1981	PLAN No SAa 1067

000085



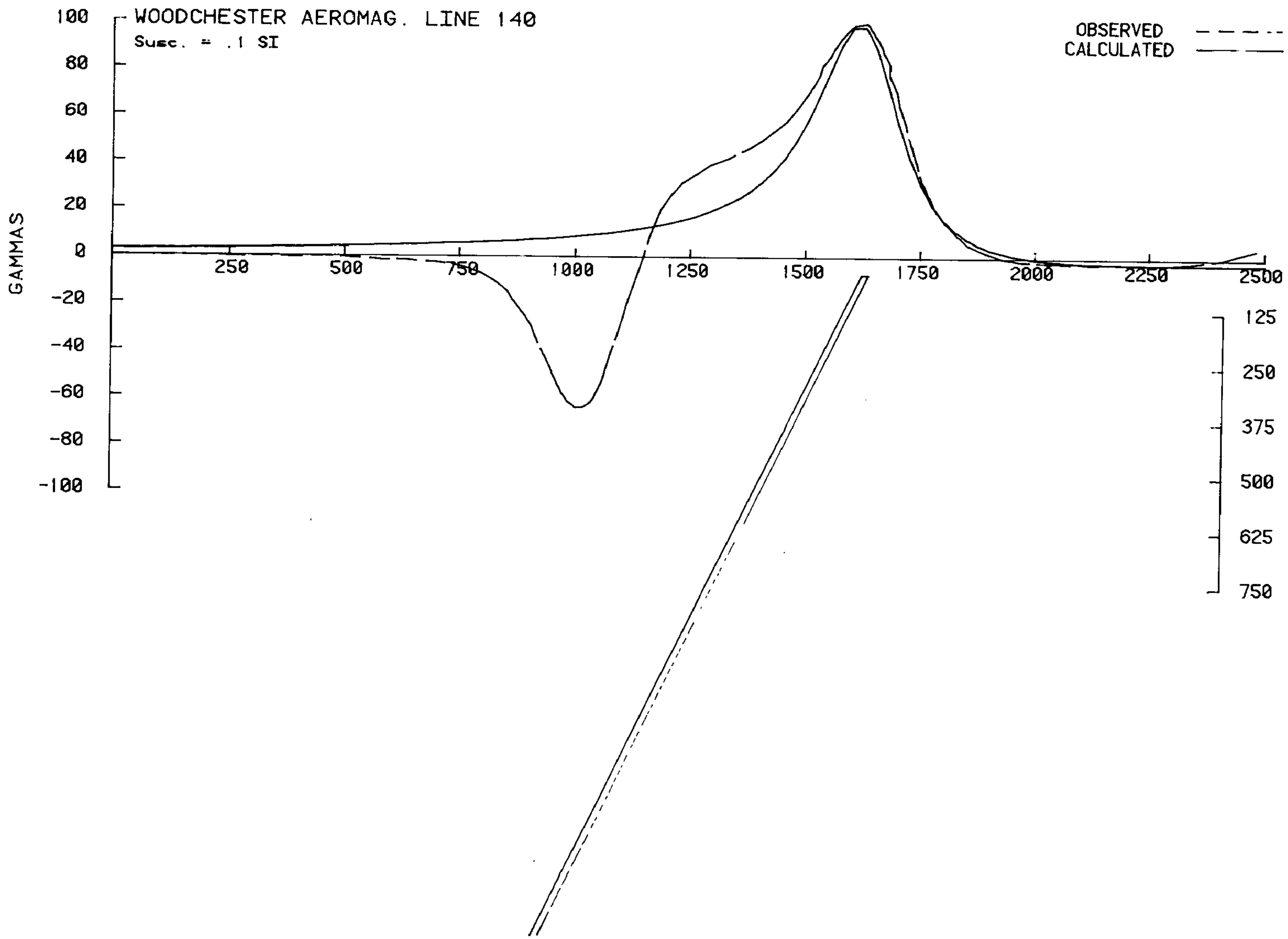
Line orientation : 120 deg True
Survey date : 02/09/81
Vertical scale : 47 nT/cm

Horizontal scale : metres

Model : Thin dyke
Strike : 15 deg True
Depth to top : 40 metres
Depth to bottom : Infinite
Dip : 65 deg west
Width : 19 metres

C R A EXPLORATION PTY LIMITED	
BULL CREEK E.L. 612 INTERPRETATION OF GROUND MAGNETICS WOODCHESTER GRID : LINE 7	
REF. BARKER SI 54-13	
SCALE 1 : 5000	
AUTHOR G.J.B.	REPORT 10149
DATE OCT. 1981	PLAN No SAa 1068

980000



Line orientation : 90 deg True
Survey date : Sept. 1979
Vertical scale : 19 nT/cm

Horizontal scale : metres

Model : Thin dyke
Strike : 15 deg True
Depth to top : 40 metres
Depth to bottom : Infinite
Dip : 65 deg west
Width : 14 metres

C R A EXPLORATION PTY LIMITED

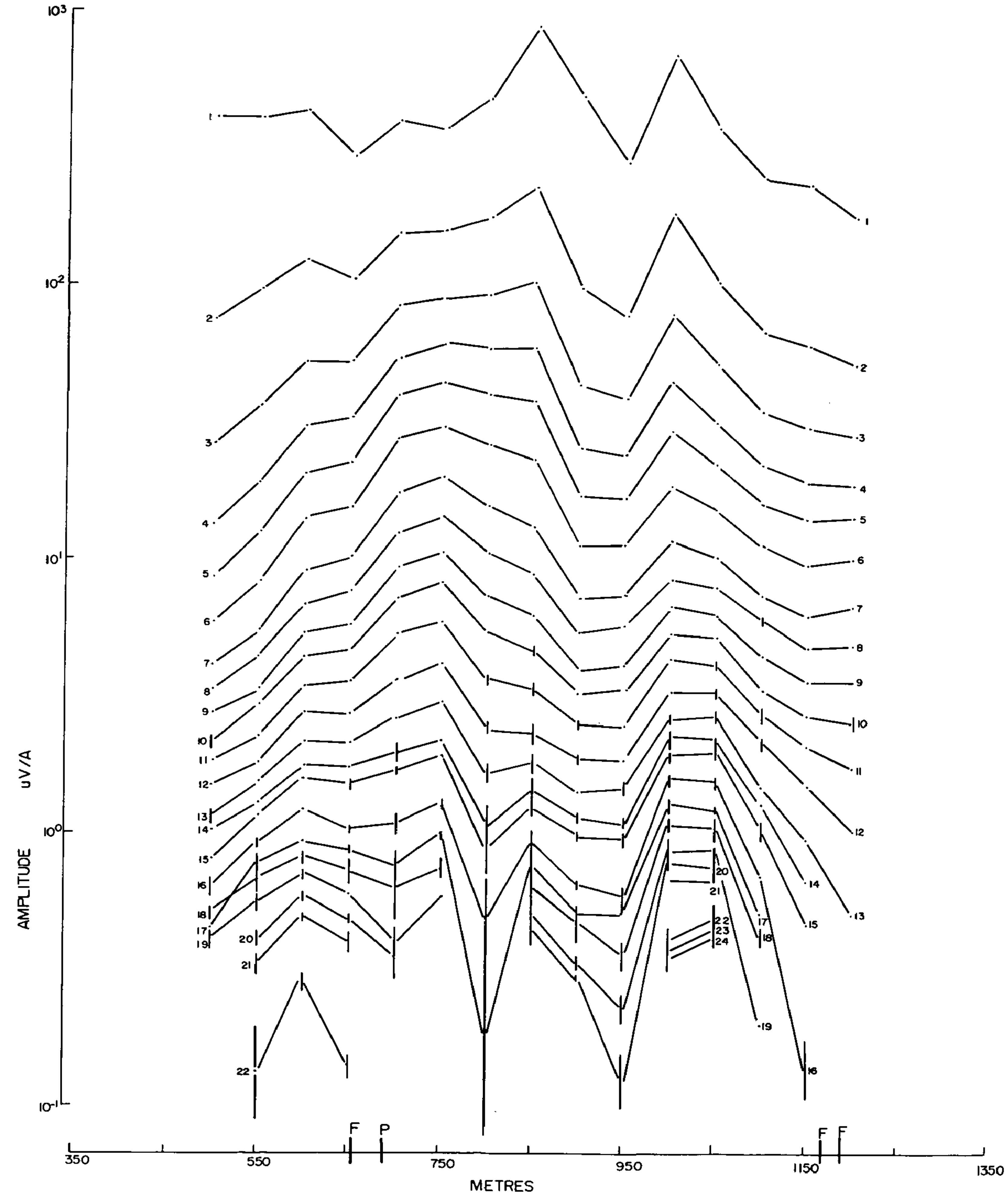
BULL CREEK E.L. 612

INTERPRETATION OF AIRBORNE MAGNETICS

WOODCHESTER LINE 140W

REF. BARKER SI 54-13	
SCALE 1 : 10000	
AUTHOR G.J.B.	REPORT 10149
DATE OCT. 1981	PLAN No SAg 1069

000087



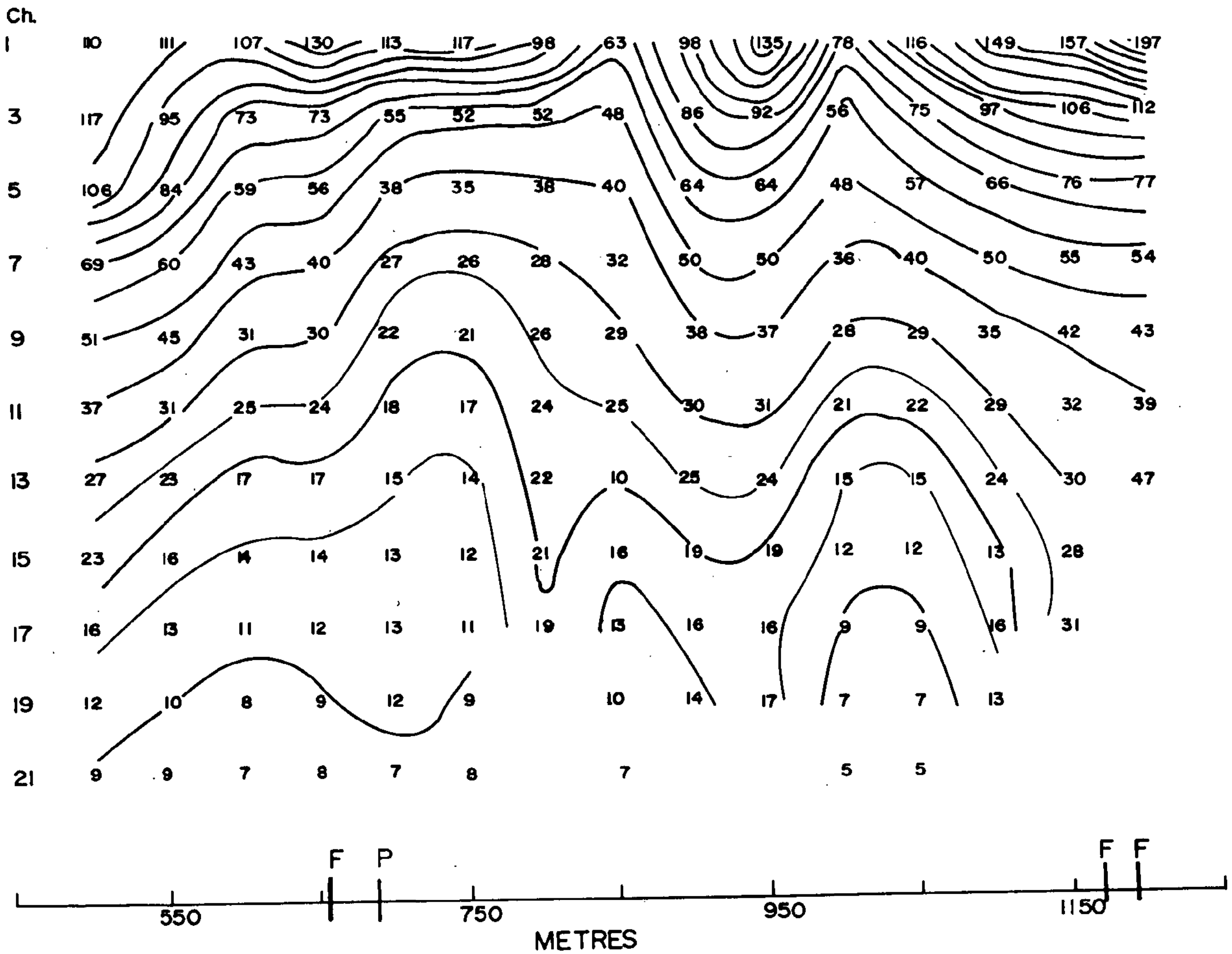
SIROTEM Mk. II
SINGLE LOOP MODE 100m x 100m
28th September 1981
LOOP CENTRE OFFSET 50m north

F : Fence

P : Power line

CRA EXPLORATION PTY. LIMITED	
BULL CREEK E.L.612 **SIROTEM PROFILES** WOODCHESTER GRID: LINE 03	
Ref. BARKER S154-13	
Scale 1:5000	Drawn D.D.
Author G.J.B.	Report No. 10149
Date SEPTEMBER 1981	Plan No. SAa 1061

880000



SIROTEM Mk II
SINGLE LOOP MODE 100m x 100m
28th September 1981
LOOP CENTRE OFFSET 50m north

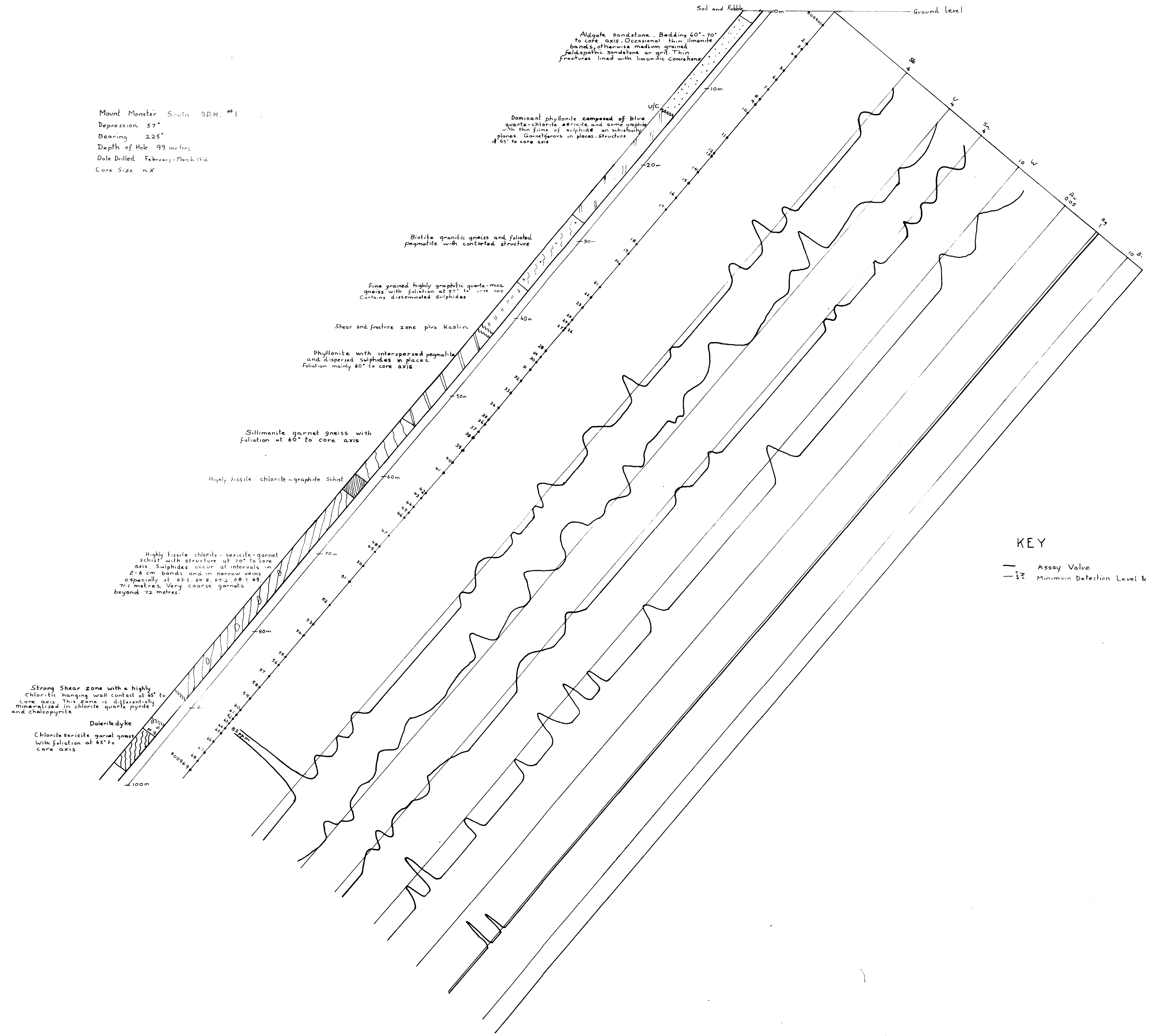
F : Fence — 10 Ω m contour
P : Power line — 5 Ω m contour

CRA EXPLORATION PTY LIMITED

BULL CREEK E.L. 612
APPARENT RESISTIVITY
PSEUDO SECTION
WOODCHESTER GRID: LINE 03

REF. BARKER SI 54-13	
SCALE 1:5000	
AUTHOR G.J.B.	REPORT 10149
DATE SEPTEMBER 1981	PLAN No SAa1062

Mount Monster South DDH #1
Depression 57°
Bearing 225°
Depth of Hole 99 metres
Date Drilled February - March 19[illegible]
Core Size NX



KEY

Assay Value
Minimum Detection Level & Element

3832 (1) — 1

C.R.A. EXPLORATION PTY. LIMITED

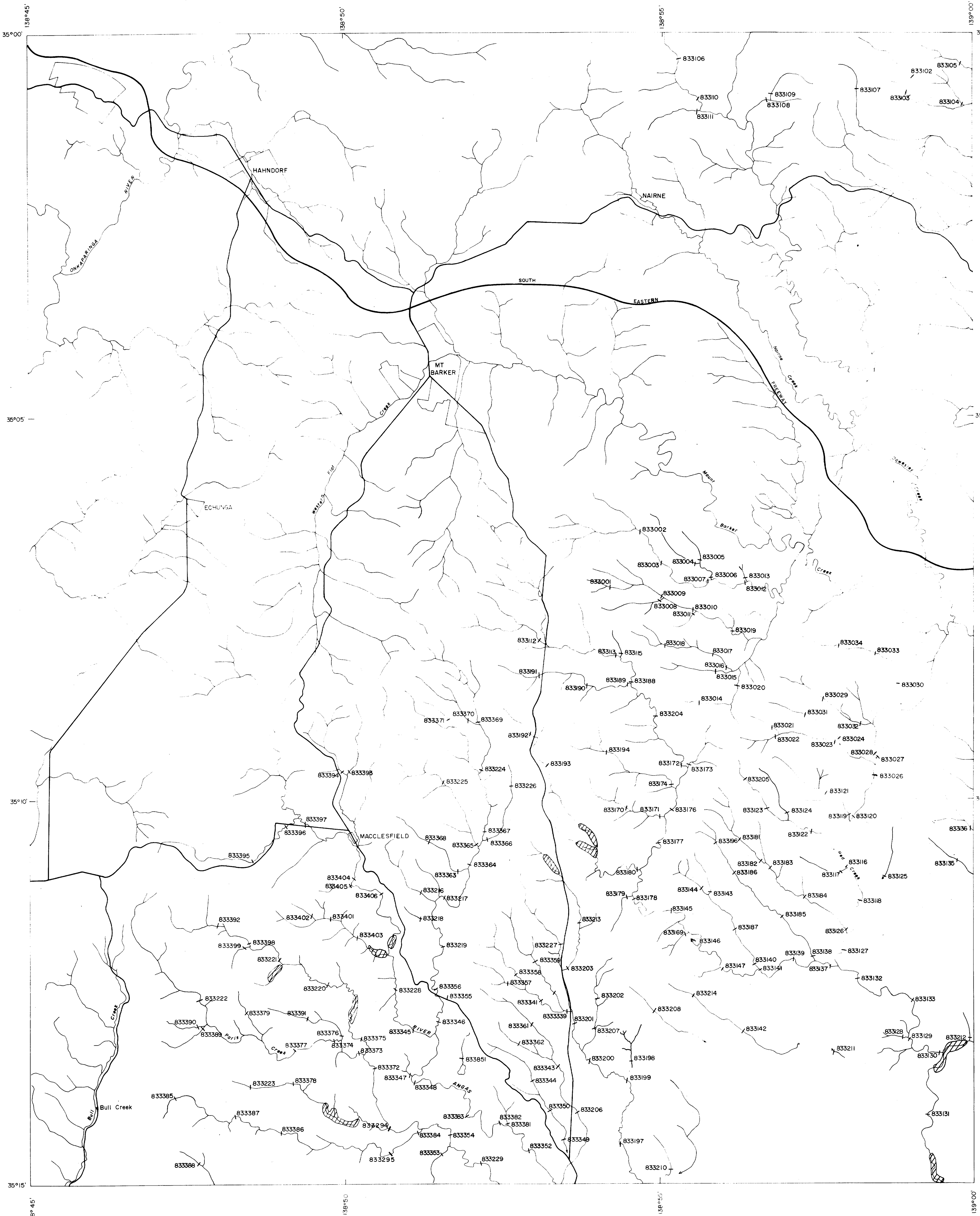
BULL CREEK EL. 612

MOUNT MONSTER CORE LOG

Drilled by Australian Development N.L.

Assayed by C.R.A.E.

Geol I.A.C.	Scale 1:200	Date 8-5-80
Drawn I.A.C.	Report No. 10149	Plan No. SAa 465



Sites unsuitable for sampling

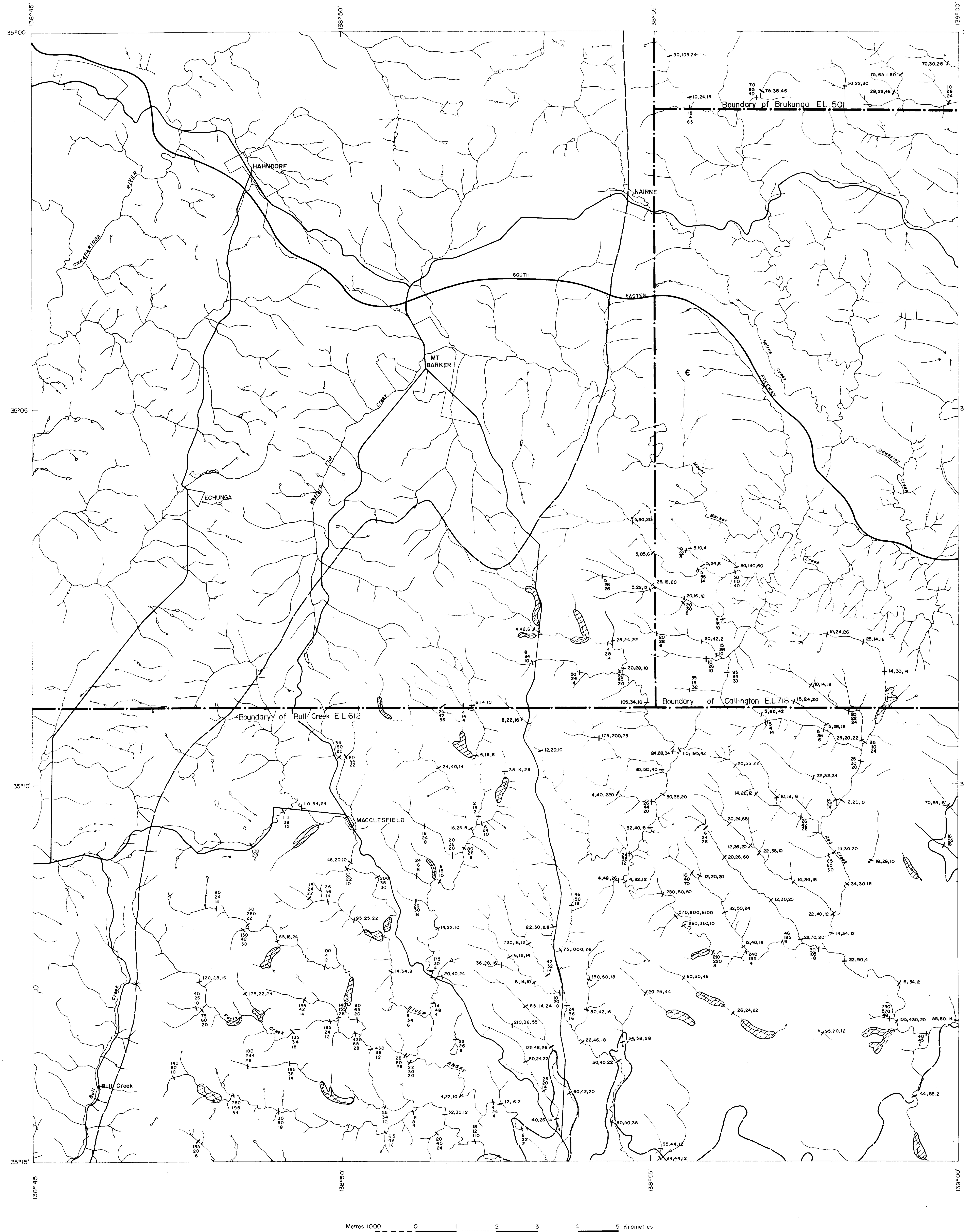
C.R.A. Kanmantoo E.L. Boundaries

Cambrian Outcrop Boundaries

833080 STREAM SEDIMENT SAMPLE SITE

3832 (1) - 2

C.R.A. EXPLORATION PTY. LTD.		
ECHUNGA SHEET 6627-1 STREAM SEDIMENT SAMPLE SITES PARTS OF BULL CREEK E.L. 612, CALLINGTON E.L. 718 AND BRUKUNGA E.L. 501 SHEET REFERENCE BARKER SI54-13		
GEOL : I.A.C.	SCALE : 1:50 000	REPORT Nº 10149
DRAWN : J.C.R.	DATE : SEPT 1980	PLAN Nº SAd 575



Sites unsuitable for sampling

C.R.A. Kanmantoo E.L. Boundaries

Cambrian Outcrop Boundaries

28,10,8 Pb Zn Cu (PPM)

3832(1)-3

C.R.A. EXPLORATION PTY. LTD.

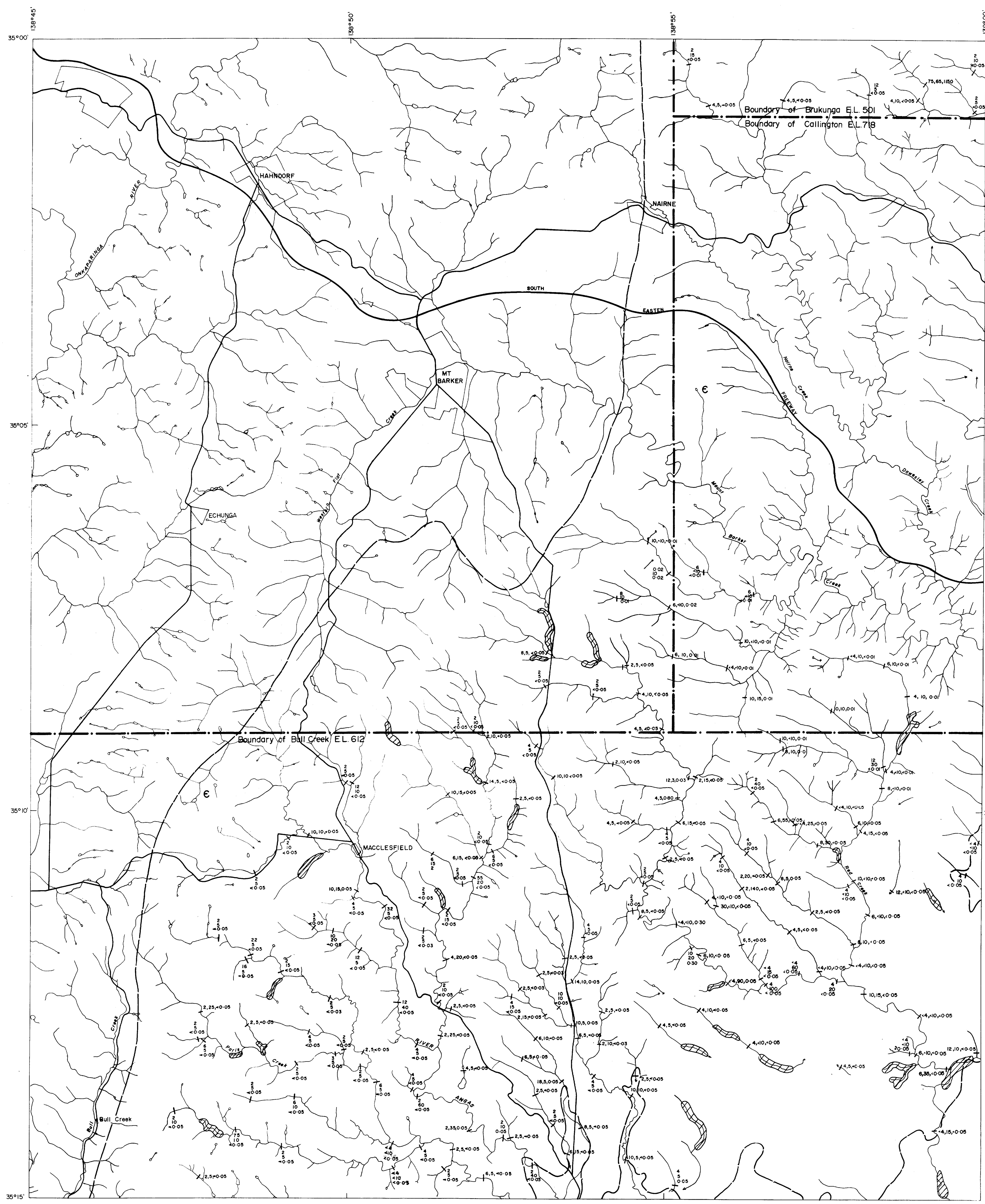
ECHUNGA SHEET 6627-1

LEAD, ZINC, COPPER (P.P.M.) ASSAY RESULTS

PARTS OF BULL CREEK E.L. 612, CALLINGTON E.L. 718 AND BRUKUNGA E.L. 501

SHEET REFERENCE BARKER SI54-13

GEOL. I.A.C.	SCALE 1:50 000	REPORT Nº 10149
DRAWN J.C.R.	DATE SEPT 1980	PLAN Nº SAa 596



Sites unsuitable for sampling

C.R.A. Kanmantoo E.L. Boundaries

Cambrian Outcrop Boundaries

28,10,8 Sn (PPM) W Au

3832 (1) -4

C.R.A. EXPLORATION PTY. LTD.

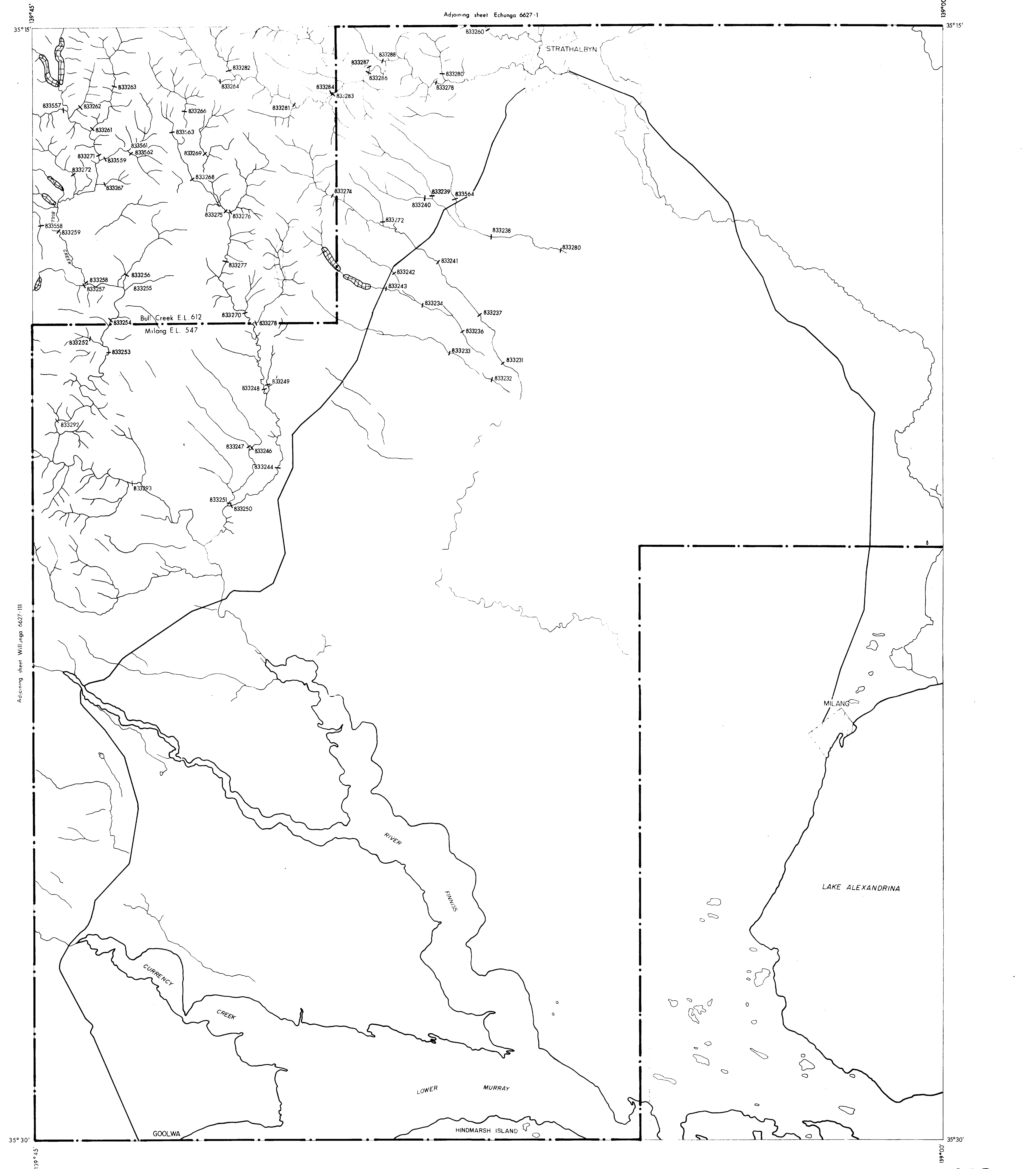
ECHUNGA SHEET 6627-1

TIN, TUNGSTEN, GOLD (P.P.M.) ASSAY RESULTS

PARTS OF BULL CREEK E.L.612, CALLINGTON E.L.718 AND BRUKUNGA E.L.501

SHEET REFERENCE BARKER SI54-13

GEOL I.A.C.	SCALE 1:50 000	REPORT Nº 10149
DRAWN J.C.R.	DATE SEPT 1980	PLAN Nº SAa 597



Metres 1000 0 1 2 3 4 5 Kilometres

833252 STREAM SEDIMENT SAMPLE SITE.

3832(1)-5

C.R.A. EXPLORATION PTY. LTD.

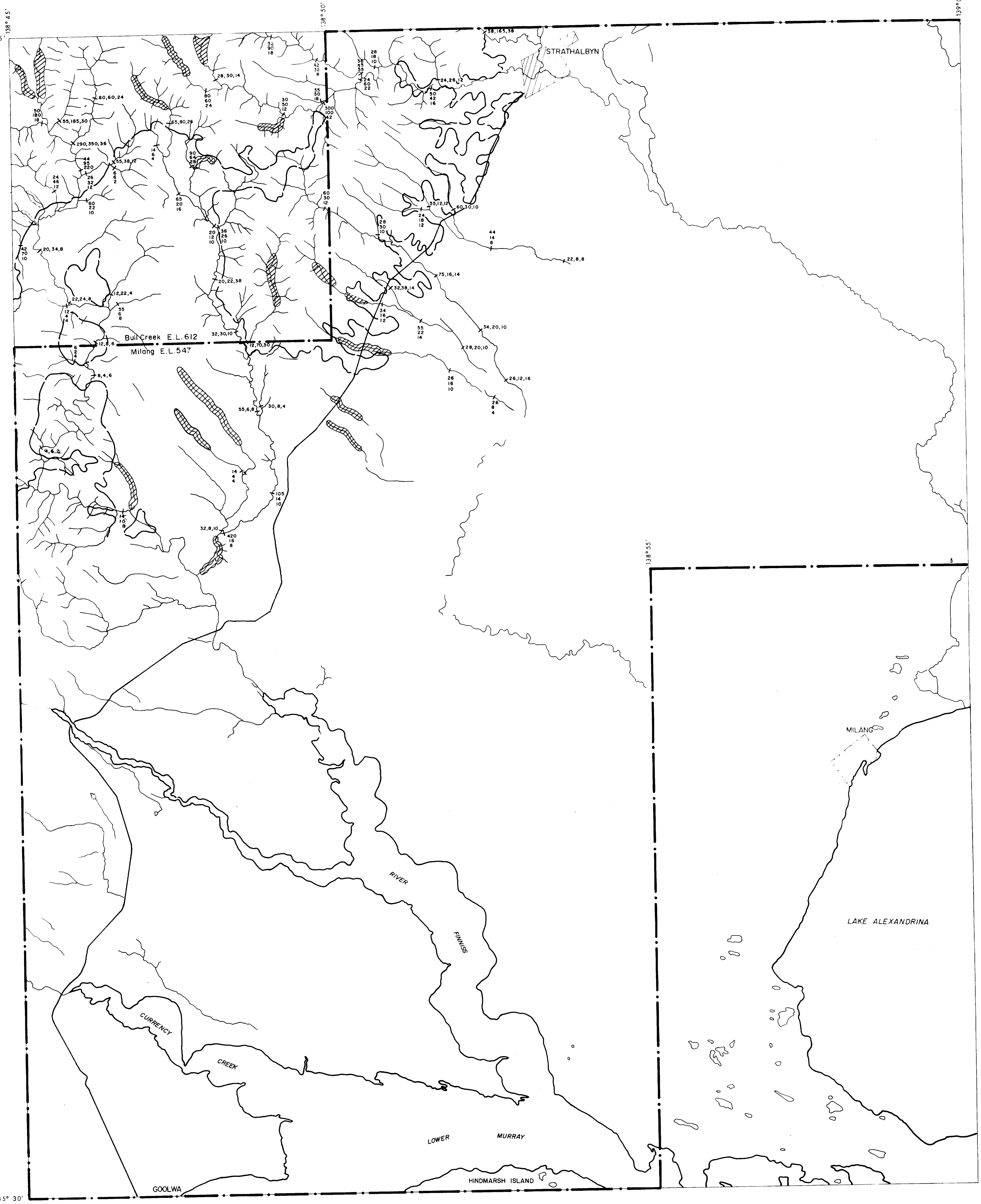
MILANG SHEET 6627-II

STREAM SEDIMENT SAMPLE SITES

PARTS OF BULL CREEK E.L.612 AND MILANG E.L.547

SHEET REFERENCE BARKER SI54-13

GEOL: I.A.C.	SCALE: 1:50 000	REPORT Nº 10149
DRAWN: J.C.R.	DATE: OCT 1980	PLAN Nº SAa 595



3832 (1)-6

Sites unsuitable for sampling

C.R.A. Kanmantoo E.L. Boundaries

Cambrian Outcrop Boundaries

Metres 1000 0 1 2 3 4 5 Kilometres

28,10,8 Pb (PPM) Zn Cu

C.R.A. EXPLORATION PTY. LTD.

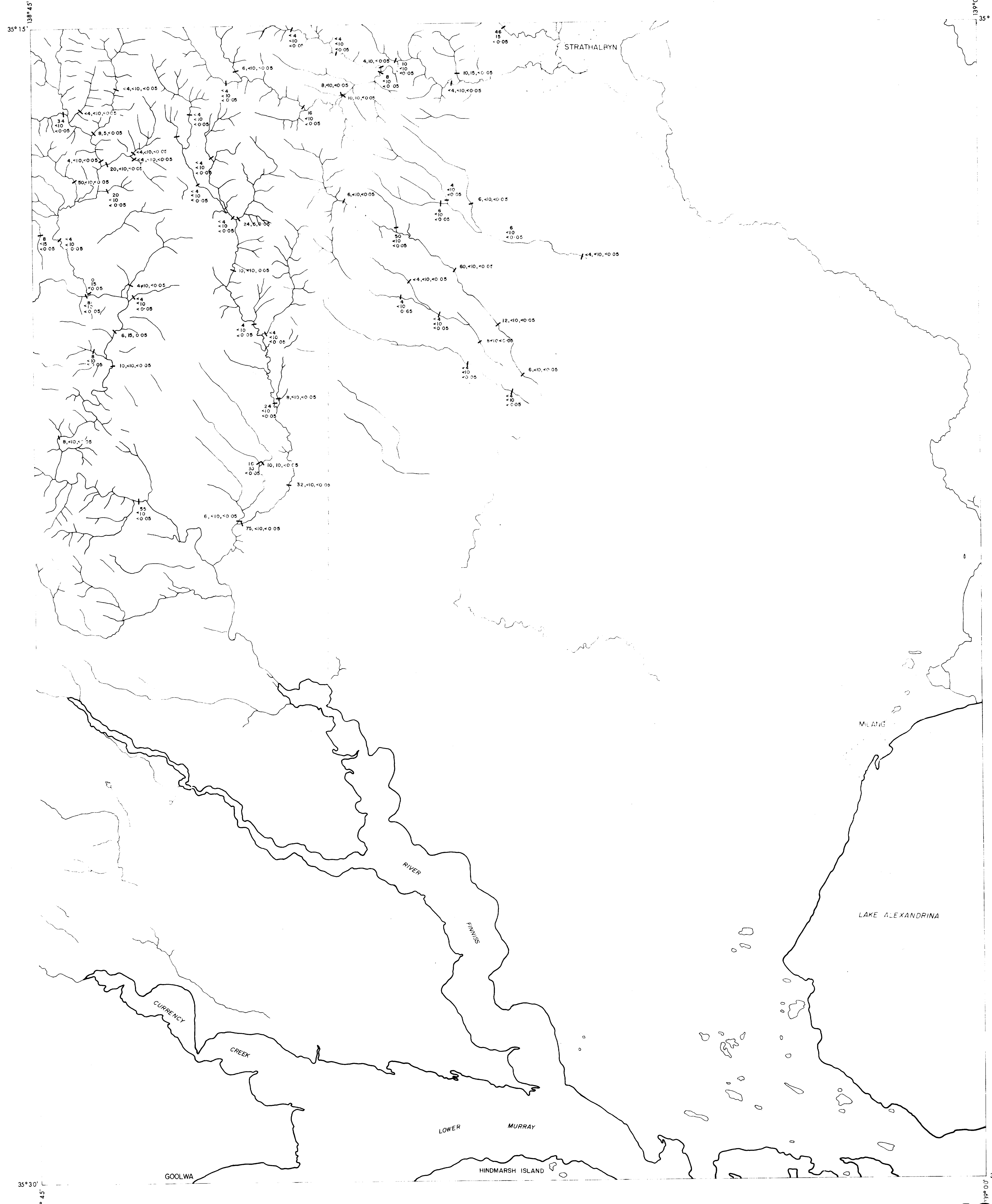
MILANG SHEET 6627-11

LEAD, ZINC, COPPER (P.P.M.) ASSAY RESULTS

PARTS OF BULL CREEK E.L.612 AND MILANG E.L.547

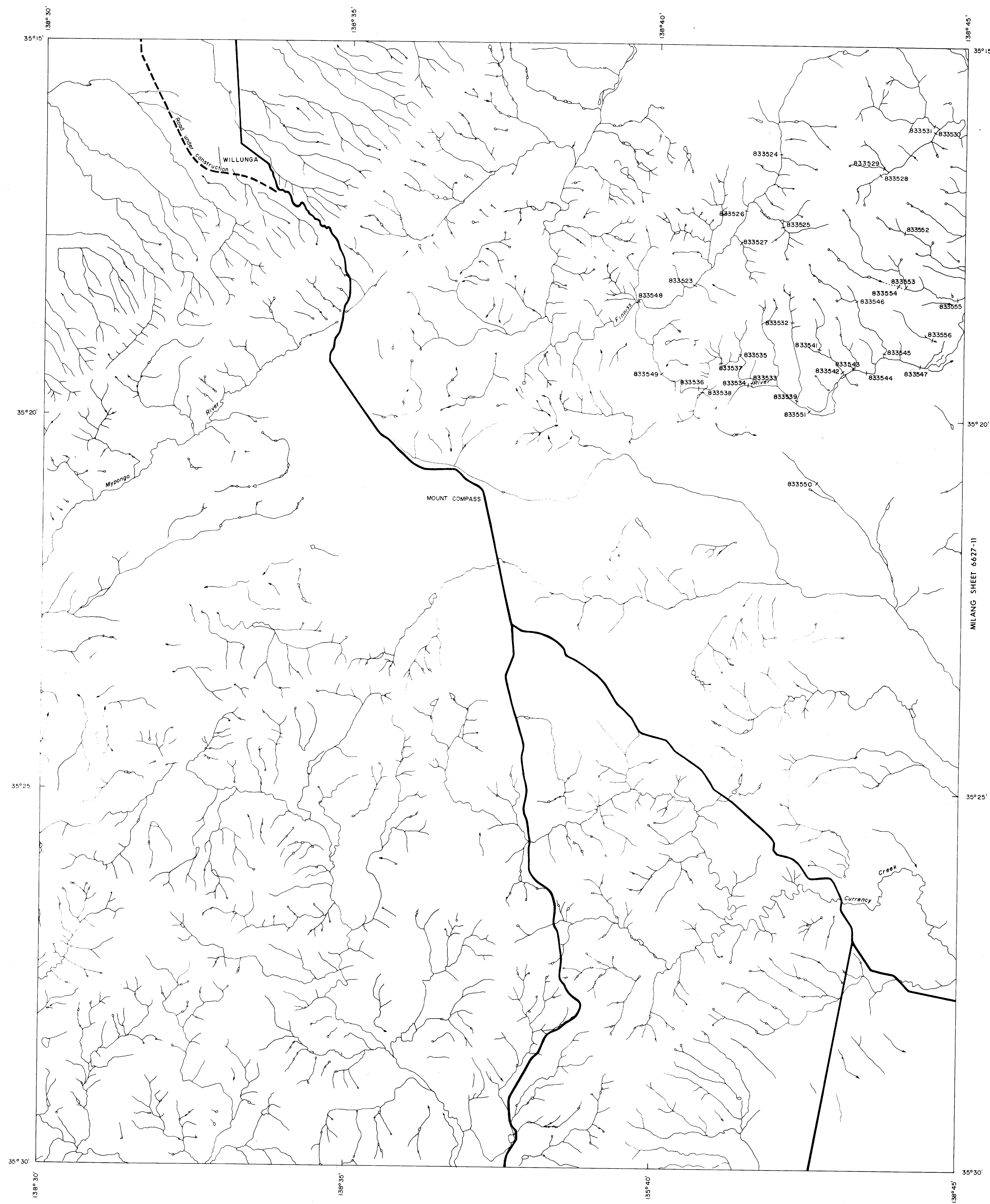
SHEET REFERENCE BARKER SI54-13

GEOL : I.A.C.	SCALE : 1:50 000	REPORT Nº 10149
DRAWN : J.C.R.	DATE : OCT 1980	PLAN Nº SAa 679



3832 (1) - 7

C.R.A. EXPLORATION PTY. LTD.		
MILANG SHEET 6627-11 TIN, TUNGSTEN, GOLD (P.P.M.) ASSAY RESULTS PARTS OF BULL CREEK E.L.612 AND MILANG E.L.547 SHEET REFERENCE BARKER SI54-13		
GEOL : I.A.C.	SCALE : 1:50 000	REPORT Nº 10149
DRAWN : L.P.R.	DATE : Feb. 1981	PLAN Nº SAa 677



SCALE 1:50000

Metres 1000 0 1 2 3 4 5 Kilometres

833550 STREAM SEDIMENT SAMPLE SITE

3832(1)-8

C.R.A. EXPLORATION PTY. LTD.

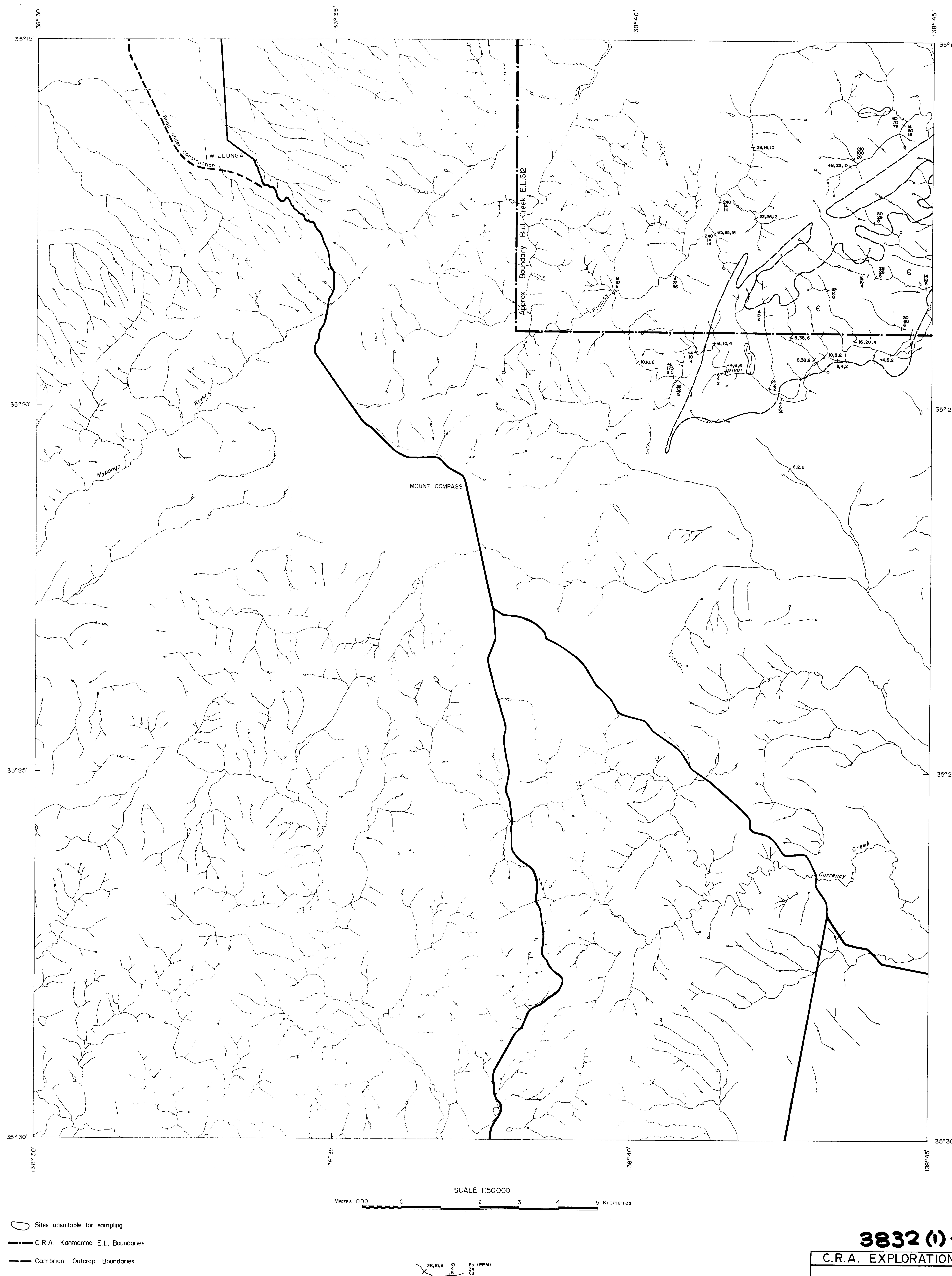
WILLUNGA SHEET 6627-111

STREAM SEDIMENT SAMPLE SITES

BULL CREEK E.L. 612

SHEET REFERENCE : BARKER S154-13

GEOL: I.A.C.	SCALE: 1:50000	REPORT Nº 10149
DRAWN:	DATE: AUG. 1980	PLAN Nº SAa 570



3832 (1) – 9

C.R.A. EXPLORATION PTY. LTD.

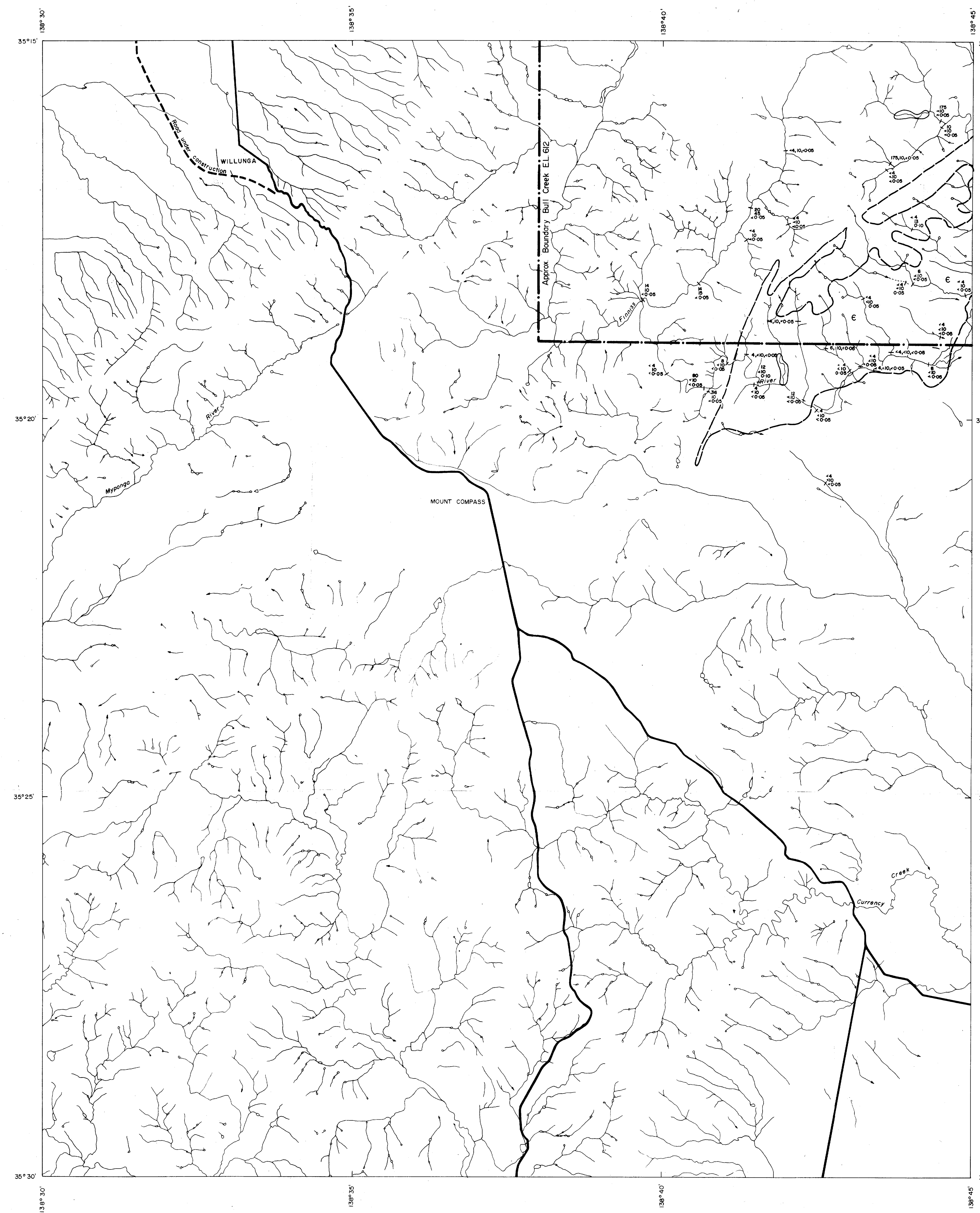
WILLUNGA SHEET 6627-111

LEAD, ZINC, COPPER (P.P.M.) ASSAY RESULTS

BULL CREEK E.L. 612

SHEET REFERENCE : BARKER S154-13

GEOL : I.A.C.	SCALE 1 50000	REPORT Nº 10149
DRAWN : J C R	DATE AUG. 1980	PLAN Nº SAa 592



SCALE 1:50000

Metres 1000 0 1 2 3 4 5 Kilometres

Sites unsuitable for sampling

C.R.A. Kanmantoo E.L. Boundaries

Cambrian Outcrop Boundaries

28,10,8 Sn (PPM) W Au

3832 (1)—10

C.R.A. EXPLORATION PTY. LTD.

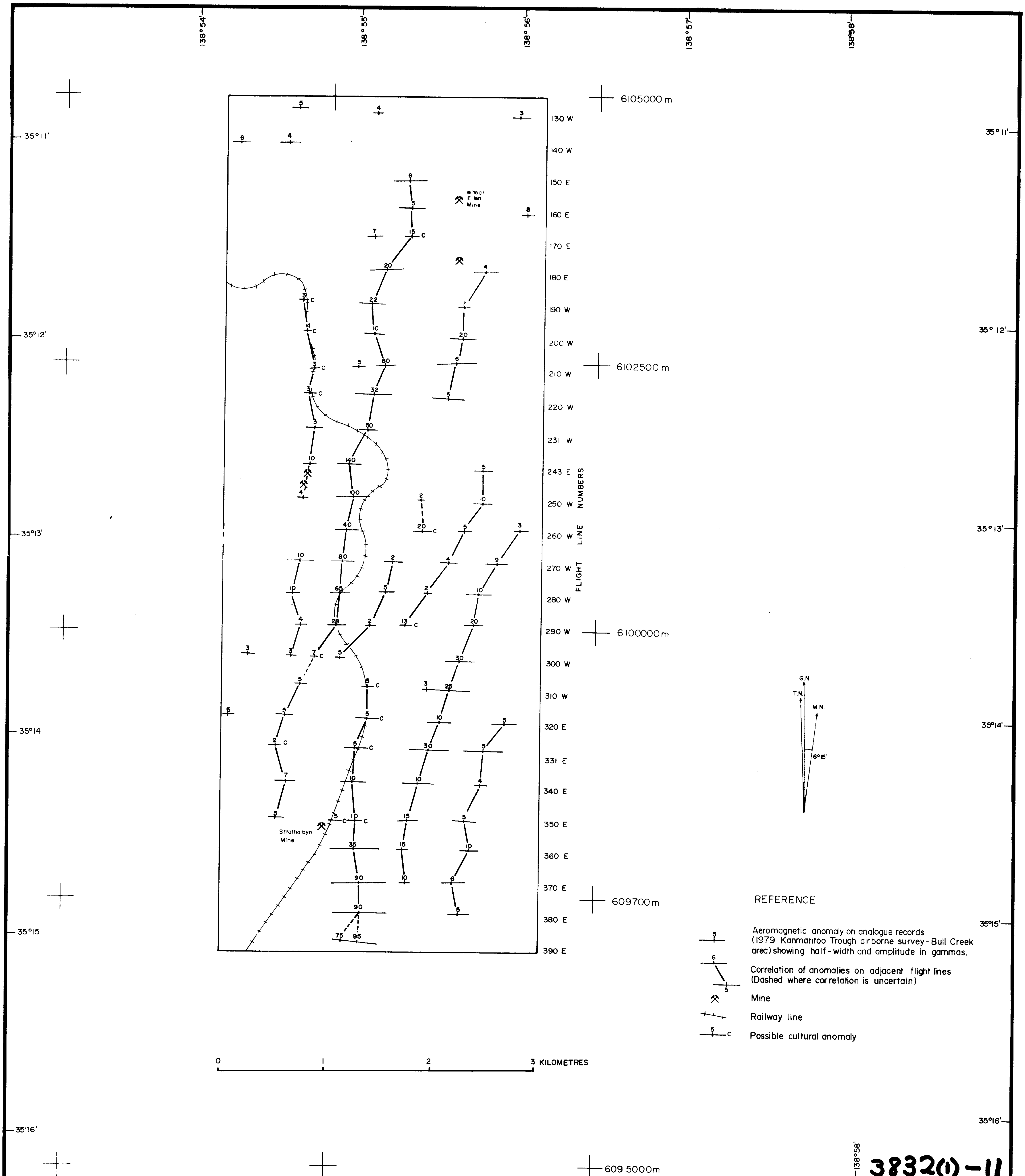
WILLUNGA SHEET 6627-111

TIN, TUNGSTEN, GOLD (P.P.M.) ASSAY RESULTS

BULL CREEK E.L. 612

SHEET REFERENCE: BARKER S154-13

GEOL: I.A.C.	SCALE: 1:50000	REPORT Nº 10149
DRAWN: J.C.R.	DATE: OCT. 1980	PLAN Nº SAa 593



3832(1)-11

CRA EXPLORATION PTY. LIMITED

BULL CREEK E.L. 612

LOCATION OF
AEROMAGNETIC ANOMALIES

STRATHALBYN AREA

Geophys: G.J.B.	Scale: 1:25000	Report no. 10149
Date: June 1981	Drawn: J.C.R. & D.D.	Plan no: SAa 766

II

000090

CRA EXPLORATION PTY. LIMITED
(INC. IN N.S.W.)

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

G.P.O. BOX 384D
MELBOURNE, AUSTRALIA 3001
TELEGRAMS: "CONRIO"
TELEX: AA30108
TELEPHONE: (AREA CODE 03)
SWITCHBOARD: 658 3333
DIRECT LINE: 658
IN REPLY PLEASE QUOTE

4th February, 1982.

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

Dear Sir,

E.L. 612 - Bull Creek, S.A.

Report for the Quarter Ended 20th December, 1981

Please find enclosed report 10149 by A.J. Venables entitled, "Seventh Quarterly Report for Bull Creek E.L. 612, South Australia, for the Period Ending 20th December, 1981", dated 13th January, 1982.

Expenditure for the period ended 31st December, 1981, the nearest accounting period, amounted to $41,290, comprising:

Drilling	$19,388
Salaries and Wages	8,718
General Supplies	262
Vehicles	1,352
Travel and Accommodation	494
Tenement Payments	550
Contractors	2,921
Assaying	836
General Overheads	6,769
	$41,290

Yours faithfully,

SAF:dr

for: J. Collier
General Manager

000091

CRA EXPLORATION PTY. LIMITED

SEVENTH QUARTERLY REPORT FOR BULL CREEK

E.L. 612, SOUTH AUSTRALIA,

FOR THE PERIOD ENDING 20TH DECEMBER, 1981.

AUTHOR: A.J. VENABLES

COPIES TO: CRAE LIBRARY
S.A.D.M.E.

DATE: 13TH JANUARY, 1982.

SUBMITTED BY: A.J. Venables

ACCEPTED BY:

10149

CONTENTS

1. SUMMARY

Three percussion drill holes were completed during the quarter.

The E.M. and magnetic anomalies at the Woodchester Prospect were explained by the intersection of substantial thicknesses of pyritic and pyrrhotitic units.

With the exception of zinc which attained a maximum value of 2300ppm over 2 metres, base metal values from the two Woodchester holes were very low.

A maximum copper value of 8500ppm was returned from a two metre interval from the hole at the Reservoir prospect.

Downhole geophysical logging of the holes is currently in progress and will be reported in the next quarterly report.

Geophysical contractor K. Jones has selected three aeromagnetic targets in the Bull Creek E.L. as being worthy of follow-up work.

A report on base metal mineralisation potential in the Kanmantoo Trough has been prepared by consultant D. Ransom.

2. INTRODUCTION

Bull Creek E.L. 612, covering 469 square kilometres, was granted to CRA Exploration for a period of one year on the 20th March, 1980. It was later renewed for a further twelve months. This report describes work carried out between 21st September, 1981 and 20th December, 1981.

3. RECOMMENDATIONS

- In view of the poor assay results no further drilling at Woodchester is warranted.

- A deep hole, aimed at an intersection below the level of oxidation should be considered at the Reservoir Prospect.

- Follow up work, involving mainly ground geophysics, should commence on the aeromagnetic targets outlined by the contractor.

4. DRILLING

During the quarter, 3 percussion drill holes were drilled at the Woodchester and Reservoir Prospects.

The contract was awarded to J. Nitschke Drilling Pty. Ltd. of Hahndorf. Drilling took place from the 28th to the 30th November, 1981.

4.1 Woodchester Prospect

Holes 81WCP1 and 81WCP2 were sited at 840 metres East and 785 metres East on lines 4 and 6 respectively of the Woodchester grid. Both were drilled on an azimuth of 112° with a declination of -60°. See Plan no. SAa 1039.

4.1.1 81WCP1

See borehole log in Appendix I. The borehole was drilled to a final depth of 142 metres and cased with PVC tubing to facilitate geophysical logging. See Plan no. SAa 1249.

Summary Log

0-6 metres Soil and Subsoil.

6-92 metres Light grey, fine to medium grained quartzite with narrow interbedded lenses of dark grey to black quartz- biotite schist. Sulphide content, (pyrite and pyrrhotite) ranges from trace to about 2%. Base metal values are low.

	Mean (ppm)	Maximum (ppm)
Lead	25	72 (10 metres)
Zinc	75	220 (2 metres)
Copper	24	70 (2 metres)

92-130 metres Light geenish-grey micaceous quartzite. The zone is well mineralised with up to 10% combined pyrite and pyrrhotite. Although zinc values are significantly elevated, lead and copper are very poor.

	Mean (ppm)	Maximum (ppm)
Lead	37	65 (2 metres)
Zinc	520	2300 (2 metres)
Copper	63	110 (2 metres)

130-142 metres Interbedded quartz - biotite schist and quartzite. Very poorly mineralised with negligible lead zinc and copper values.

4.1.2 81WCP2

See borehole log in Appendix I. This hole reached a final depth of 182 metres. Due to caving problems it was only possible to case the hole to 30 metres. See Plan no. SAa 1250.

Summary Log

0-2 metres Soil and Subsoil.

2-114 metres Light-grey, fine to medium grained quartzite with interbedded lenses of dark grey quartz-biotite schist. Combined pyrite and pyrrhotite contents range from trace to 2%. Base metal values are low.

	Mean (ppm)	Maximum (ppm)
Lead	18	80 (2 metres)
Zinc	72	180 (4 metres)
Copper	26	75 (2 metres)

114-152 metres Light, greenish - grey micaceous quartzite. Quartz veins are fairly common. Mineralisation is moderate with up to 3% combined pyrite and pyrrhotite. Pyrrhotite is the major component in an approximately 70:30 ratio. As in 81WCP1 lead and copper values are poor whereas zinc is elevated.

	Mean (ppm)	Maximum (ppm)
Lead	42	320 (2 metres)
Zinc	340	1620 (4 metres)
Copper	43	65 (2 metres)

152-166 metres Dark grey to black, well-mineralised biotite-quartz schist with a combined sulphide content of 6-8%. Pyrite and pyrrhotite occur in similar proportions.

	Mean (ppm)	Maximum (ppm)
Lead	114	195 (4 metres)
Zinc	1500	1775 (4 metres)
Copper	58	64 (8 metres)

166-182 metres Light-grey, fine-grained very poorly mineralised quartzite.

Both 81WCP1 and 81WCP2 intersected 38 metres of well mineralised quartzite. In 81WCP2, however an additional 14 metres of well mineralised schist occurs below the quartzite.

The geometry of the mineralised horizons is not yet fully understood. Geophysical modelling based on pulse E.M., ground and airborne magnetics, and Sirotem, has indicated that the magnetic conductor is grossly discordant and dipping to the west. The conductor is modelled as being ± 15 metres thick. The boreholes were designed to drill down the strata dip, (i.e. in an easterly direction) to intersect the conductor as close as possible to the normal. As the holes were not cored, it is impossible to relate core bedding dips to the core axis and to detect changes in the attitude of the strata. The thicknesses of conductive material intersected (38 metres in 81WCP1 and 52 metres in 81WCP2) may be deceptive, as it is possible that the holes were drilled at a very low angle to the dip of the mineralised horizons which may be conformable to the rest of the strata.

4.2 Reservoir Prospect

Hole 81RVP1 was sited midway between lines 6101300 and 6101600m north on the Strathalbyn grid. See Plan no. SAa 1044. It was drilled on an azimuth of 290° at a declination of -60° to intersect the inferred source of a copper bearing gossan at depth. (Plan no. SAa 1251).

Summary Log

0-4 metres	Soil and Subsoil.
4-42 metres	Dark grey metagreywacke with narrow interbeds of quartz-muscovite schist. Mineralisation is very poor with only traces of pyrite observed.
42-66 metres	Quartz - biotite - garnet - sillimanite schist with malachite and azurite mineralisation.

	Mean (ppm)	Maximum (ppm)
Lead	32	65 (8 metres)
Zinc	460	950 (8 metres)
Copper	1800	8500 (2 metres)

66-70 metres	Quartz - biotite schist. No mineralisation observed.

The mineralisation appears to be closely related to the high grade metamorphic horizon. No copper sulphides were detected and it appears that the level of oxidation is fairly deep. There may be justification in drilling another hole at this prospect to intersect the unit at 150-200 metres.

Downhole geophysical logging of all these boreholes is currently in progress. Detailed logs will be submitted with the next quarterly report.

5. GEOLOGICAL CONSULTANT

A review of base metal mineralisation and exploration in the Kanmantoo Trough, part of which is encompassed by the Bull Creek E.L. was completed by consultant D.M. Ransom.

Conclusions and recommendations which are relevant to the Bull Creek E.L. are:-

1. The present programme in the current CRA Exploration E.L.'s in the Kanmantoo Trough, of follow up of the stream sediment anomalies with soil sampling and geophysics should continue and be brought to a logical conclusion with an emphasis on final testing by percussion drilling;

2. A programme of selection and follow up of limited strike length magnetic anomalies in the Kanmantoo - Callington - Monarto - Strathalbyn area similar to that associated with the Kanmantoo copper deposit should be initiated. A review of all available airborne and magnetic data from the Kanmantoo deposit should be undertaken prior to anomaly selection;

6. GEOPHYSICAL CONSULTANT

Contractor K. Jones has been engaged to interpret the results of the 1980 Kanmantoo airborne magnetic survey. This far, seventeen target areas, three of which fall within the boundaries of the Bull Creek E.L. have been delineated. Follow-up, in the form of ground inspection and geophysics will shortly commence.

A.J. Venables

A.J. VENABLES

AJV/lmc

REFERENCES

Bull Creek E.L. 612 CRAE Reports 10149.

Author	Date	Title
Wills, K.J.A.	18/7/80	First Quarterly Report for the period ending 20th June, 1980.
Wills, K.J.A.	3/11/80	Second Quarterly Report for the period ending 20th September, 1980.
Wills, K.J.A. and Cook, I.A.	11/2/81	Third Quarterly Report for the period ending 20th December, 1980.
Wills, K.J.A.	2/4/81	Fourth Quarterly Report for the period ending 20th March, 1981.
Venables, A.J. and Bubner, G.J.	14/7/81	Fifth Quarterly Report for the period ending 20th June, 1981.
Venables, A.J.	21/10/81	Sixth Quarterly Report for the period ending 20th September, 1981.
Ransom, D.M.	Sept. 1981.	A review of base metal mineralisation and exploration in the Kanmantoo Trough, S.A. (unpub. CRAE Report no. 10815).

LOCATION

Barker SI54-13 1:250 000 Map Sheet

KEYWORDS

copper, lead, zinc, gold, geochem. - drainage, geophys. - aeromag., geophys. - E.M., Kanmantoo Trough, schist, quartzite, discordant, drill percuss.

LIST OF ATTACHMENTS

Plan No.	Title	Scale
SAa 303	Bull Creek E.L. location map.	1:250 000
SAa 1039	Geological Plan of Woodchester showing trend of brecciated quartzite and proposed borehole sites.	1:5000
SAa 1044	Reservoir anomaly, Geological Plan with superimposed magnetic profiles and borehole collar position.	1:2000
SAa 1249	Woodchester Prospect. Borehole Section 81WCP1	1:1000
SAa 1250	Woodchester Prospect. Borehole Section 81WCP2	1:1000
SAa 1251	Reservoir Prospect. Borehole Section 81RVP1	1:1000

LIST OF APPENDICES

Appendix I

Percussion Borehole logs.

APPENDIX I

PERCUSSION BOREHOLE LOGS.

C R A EXPLORATION PTY LIMITED

PERCUSSION DRILL CORE LOG

PROJECT: Bull Creek E.L. 612 Woodchester Prospect

CO-ORDINATES: 35°11'13" S, 138°57'29" E — AZIMUTH: 112° — DRILLERS: J. Nitschke — COMMENCED: 27/11/81 — DEPTH: 182 m — HOLE No. 81 WCP2

RL COLLAR: 112 m (AHD) — INCLINATION: -60° — DRILL TYPE: Ingersol Rand T4 — COMPLETED: 30/11/81 — CASING LEFT: 30 m — DPO No(s): Box 38/9

DEPTH FROM (M)	DEPTH TO (M)	CORE REC (M)	MAG SUSC.	GRAPHIC LOG	CORE DESCRIPTION	SPECIAL FEATURES (WEATH., ALTERATION, FRACTURING, VEINING, MINERALIZATION)	SAMPLE No.	FROM (M)	TO (M)	REC (M)	Pb	Zn	Cu	Ag
0	2				Soil and Subsoil									
2	4													
4	6				Weathered iron-stained schist	Minor pyrite (≈ 0.1%)								
6	8					..								
8	10				Interbedded dark-grey biotite-sericite schist and lighter	Trace py + po								
10	12				coloured fine-grained quartzite									
12	14					No visible mineralization								
14	16				Light to dark-grey "dirty" sugary quartzite with a	Trace py + po								
16	18				high proportion of biotite and sericite. In places the	.. .. ..								
18	20				quartzite is iron-stained. A few fragments of dark-	.. .. ..								
20	22				grey biotite-schist are present	.. .. ..								
22	24					No visible mineralisation.								
24	26													
26	28				"Dirty", greenish-grey, micaceous (biotite) quartzite	Trace po.								
28	30													
30	32													
32	34				Dark-grey to black, biotite-sericite schist.	Minor py. ≈ 0.2%								
34	36					Trace py								
36	38				Light greenish-grey micaceous (biotite) quartzite	No visible mineralisation								
38	40					.. .. ..								
40	42					.. .. ..								
42	44				Black, very fissile, biotite schist	Trace pyrite (< 0.1%)								
44	46					.. .. ..								
46	48					Minor pyrite (≈ 0.5%) Tr. po.								
48	50					.. ..								
50	52				Light-grey, fine-grained quartzite with rare dark	.. ..								
52	54				bands. Mineralisation is predominantly pyrite and	.. ..								
54	56				varies from trace to ≈ 2%	Py with quartz vein (≈ 1%)	945793	54	56		4	30	8	<1
56	58					.. ..	794	56	58		6	26	10	<1
58	60					Good py. (≈ 2%) Tr. po.	795	58	60		6	42	28	<1
60	62					Moderate pyrite (≈ 0.5%)	796	60	62		42	140	42	<1
62	64					Quartz vein with py.	797	62	64		80	220	22	<1
64	66					No visible mineralisation								
66	68					Minor py mineralisation (≈ 0.2%)								
68	70				Light-grey, fine-grained quartzite with rare	.. ..								
70	72				dark bands associated with increased biotite and	.. ..								
72	74				sericite contents. Mineralisation is generally poor.	Trace py and po.								
74	76					No visible mineralisation.								
76	78					.. .. ..								
78	80					.. .. ..								
80	82				Well laminated biotite schist.	Minor py (≈ 0.2%)								
82	84					Mineralisation very poor								
84	86				Light and dark grey quartzite with black schist fragments.	.. .. ..								
86	88					Good py mineralisation (≥ 1%)	945798	86	88		20	110	42	
88	90				Black biotite schist	.. ..	799	88	90		26	140	42	
90	92					.. ..	800	90	92		38	135	32	

SUMMARY AND SPECIAL COMMENTS: Interbedded quartzites and schists with pyrite mineralisation ranging from trace to 2%. Pyrrhotite content generally poor.

LOGGED BY: A.J. Weale (signature) — DATE: 7/12/1981

SHEET 1 OF 2

CRA EXPLORATION PTY. LIMITED

PERCUSSION DRILL CORE LOG

PROJECT Bull Creek E.L. 612 Woodchester Prospect

CO-ORDINATES 35°11'12"S, 138°57'29"E AZIMUTH 112° DRILLERS J. Nitschke COMMENCED 27/11/81 DEPTH 182 m HOLE No. 81 WCP 2

RL COLLAR 112 m (AHD) INCLINATION -60° DRILL TYPE Ingersoll Rand T4 COMPLETED 30/11/81 CASING LEFT 30 m DPO No(s) B04381/9

DEPTH FROM (M)	DEPTH TO (M)	CORE REC (M)	MAG SUSC.	GRAPHIC LOG	CORE DESCRIPTION	SPECIAL FEATURES (WEATH., ALTERATION, FRACTURING, VEINING, MINERALIZATION)	SAMPLE No	FROM (M)	TO (M)	REC (M)	Pb	Zn	Cu	Ag
92	94					Well mineralised with py (2%)	965801	92	94		40	120	44	<1
94	96					Moderate mineralisation (py = 0.5%)	802	94	96		6	44	20	<1
96	98					" " "	803	96	98		6	34	14	<1
98	100				Interbedded light to dark grey quartzites and	" " "	804	98	100		8	30	10	<1
100	102				subordinate black biotite schists. The colour of	" " "	805	100	102		14	50	18	<1
102	104				the quartzite is a function of the percentage of	Qtz. veins with ass. py. min.	806	102	104		10	44	20	<1
104	106				contained biotite. Mineralisation is essentially	Poorly mineralised.	807	104	106		10	30	14	<1
106	108				pyrite and varies from trace to 2%.	" "	808	106	108		4	28	12	<1
108	110					Trace py.	809	108	110		10	36	16	<1
110	112		260			" "	810	110	112		6	32	18	<1
112	114		200			" "	811	112	114		18	85	75	<1
114	116		300			Moderate py. (0.5 - 1%)	812	114	116		20	95	65	<1
116	118		400			" " "	813	116	118		26	270	44	1
118	120		700			Po + Py ≈ 1%. (70% po.)	814	118	120		24	170	18	1
120	122		800			Po + Py ≈ 3% "	815	120	122		34	250	28	1
122	124		400			as above	816	122	124	I	320	1610	88	2
124	126		420		Light, greenish-grey, micaceous quartzite with	as above	817	124	126		115	1630	60	1
126	128		900		darker biotite fragments. Quartz veining	as above	818	126	128		32	400	48	1
128	130		1500		is fairly common throughout this zone	as above	819	128	130		10	60	34	1
130	132		600		and may or may not be associated with the	as above	820	130	132		18	60	30	1
132	134		300		amount of mineralisation. The only sulphides	as above	821	132	134		16	90	44	<1
134	136		1300		detected visually were pyrite and pyrrhotite	as above	822	134	136		6	70	36	1
136	138		1500		with pyrrhotite the major component.	as above	823	136	138		24	860	60	1
138	140		940			as above	824	138	140		10	110	28	1
140	142		350			Mineralisation 90% po. 10% py.	825	140	142		26	65	42	<1
142	144		300			Qtz. vein with py + po.	826	142	144		18	55	44	<1
144	146		320			Py + Po ≈ 1%	827	144	146		24	105	55	1
146	148		320			" " "	828	146	148		18	48	48	1
148	150		260			" " "	829	148	150		24	115	36	1
150	152		240			" " "	830	150	152		26	330	48	1
152	154		610			Py + Po ≈ 5-6%	831	152	154		44	1360	70	1
154	156		1200		Dark grey to black well mineralised schist.	" " "	832	154	156		70	1640	60	1
156	158		1100		Mineralisation appears to be concentrated	" " "	833	156	158		125	1680	65	2
158	160		800		along schistosity and cleavage planes. Pyrite and	" " "	834	158	160	I	210	1860	60	2
160	162		900		pyrrhotite occur in roughly equal proportions	" " "	835	160	162		180	1730	65	1
162	164		900			± 8% py + po associated with qtz vein.	836	162	164		105	1610	55	2
164	166		800			" " " " " "	837	164	166		70	740	44	1
166	168		600			Py + po ≈ 1%	838	166	168		36	200	26	1
168	170		380			" " "	839	168	170		30	120	32	1
170	172		130		Light grey, fine-grained quartzite with	" " "	840	170	172		26	85	20	1
172	174		15		sulphide content decreasing with depth.	Py + po ≈ 0.5%. Qtz vein.	841	172	174		34	140	18	<1
174	176		0		Mainly pyrite (≈95%)	V. poorly mineralised. No po.	842	174	176		38	145	12	<1
176	178		0			No visible mineralisation	843	176	178		20	95	14	1
178	180		0			" " "	844	178	180		18	110	10	<1
180	182		0		E.O.H.	" " "	845	180	182		6	110	16	<1
					Hole cased to 30m with P.V.C. 4" casing.									

SUMMARY AND SPECIAL COMMENTS: Roughly 50 m of mineralisation ranging from 1% - 8% total sulphides in mixed quartzite and schist lithologies.

LOGGED BY A.J. Vevalder DATE 7/12/1981

SHEET 2 OF 2

CRAE 117
PLAN No M414

CRA EXPLORATION PTY LIMITED

PERCUSSION DRILL CORE LOG

PROJECT: Bull Creek E.L. 612 Woodchester Prospect

CO-ORDINATES: 35°11'17"S 138°57'29"E   AZIMUTH: 112°   DRILLERS: J. Nitschke   COMMENCED: 26/11/1981   DEPTH: 142 m   HOLE No. 81 WCP 1

RL COLLAR: 110 m (AHD)   INCLINATION: -60°   DRILL TYPE: Ingersoll Rand T4   COMPLETED: 27/11/1981   CASING LEFT: 142 m   DPO No(s): B 0428

DEPTH FROM (M)	DEPTH TO (M)	CORE REC (M)	MAG SUSC.	GRAPHIC LOG	CORE DESCRIPTION	SPECIAL FEATURES (WEATH, ALTERATION, FRACTURING, VEINING, MINERALIZATION)	SAMPLE No.	FROM (M)	TO (M)	REC (M)	Pb	Zn	Cu	Ag
0	2		490		Soil and subsoil. Weathered mica schist. Trace		945722	0	2		26	85	20	<1
2	4		430		pyrite and pyrrhotite.	Trace py + po ≈ 0.1%	723	2	4		20	80	24	<1
4	6		440				724	4	6		14	60	20	<1
6	8		440		Interbedded dark-grey schist and light-grey	Trace py + po ≈ 0.1%	725	6	8		10	50	22	<1
8	10		340		quartzite. Trace pyrite and pyrrhotite.		726	8	10		14	80	18	<1
10	12		450				727	10	12		18	85	34	<1
12	14		450				728	12	14		24	95	36	<1
14	16		450		Interbedded black, biotite-sericite schist and fine-		729	14	16		12	70	20	<1
16	18		440		grained light-grey quartzite. Fragments of vein quartz	Py + po ≈ 0.5%	730	16	18		6	26	10	<1
18	20		440		are fairly common.	Mainly py.	731	18	20		8	30	20	<1
20	22		450				732	20	22		4	30	16	<1
22	24		440				733	22	24		6	48	18	<1
24	26		450				734	24	26		8	38	12	<1
26	28		440		Biotite-sericite-quartz schist	Py ≈ 0.5%. No po	735	26	28		16	50	42	<1
28	30		440				736	28	30		12	55	34	<1
30	32		420		Light-grey quartzite with dark layers arising from	No visible mineralisation	737	30	32		8	55	20	<1
32	34		440		accumulations of biotite and heavy minerals		738	32	34		28	90	24	<1
34	36		440				739	34	36		22	110	32	<1
36	38		430		Dark-grey to black, biotite-sericite schist. Layered pyrite occurs	Py ≈ 1-2%. No po observed.	740	36	38		40	125	48	<1
38	40		430		at a high angle to schistosity. (Parallel to bedding?)		741	38	40		10	105	55	<1
40	42		440				742	40	42		10	34	12	<1
42	44		450		Light-grey quartzite	Trace py + po ≈ 0.1%	743	42	44		8	36	12	<1
44	46		430		Dark grey to black, biotite schist		744	44	46		20	90	46	<1
46	48		430				745	46	48		4	40	16	<1
48	50		440		Light-grey quartzite with darker layers arising from		746	48	50		6	26	10	<1
50	52		450		accumulations of biotite and heavy minerals. Narrow	Moderate py mineralisation ≈ 1-2%	747	50	52		12	44	16	<1
52	54		450		interbeds of biotite schist also occur	Po very rare ≈ 0.1%	748	52	54		12	38	18	<1
54	56		450				749	54	56		70	125	28	<1
56	58		450				750	56	58		12	34	12	<1
58	60		450		Biotite-sericite schist	Py ≈ 0.6%	751	58	60		50	220	20	<1
60	62		450		Light-grey quartzite with darker banding	No visible mineralisation	752	60	62		6	30	8	<1
62	64		450				753	62	64		28	145	46	<1
64	66		430		Dark-grey to black biotite-sericite schist	Tr py and po on schistosity planes	754	64	66		24	120	48	<1
66	68		440				755	66	68		110	80	12	<1
68	70		430		Light-grey quartzite with darker banding	Py + Po ≈ 1%	756	68	70		60	110	18	<1
70	72		440				757	70	72		26	120	70	<1
72	74		440		Biotite schist. Minor sericite and quartz	Py + po ≈ 2%	758	72	74		75	180	28	<1
74	76		430				759	74	76		90	105	28	<1
76	78		430		Light-grey quartzite with darker banding	Py + po ≈ 1% (90% Py)	760	76	78		20	38	24	<1
78	80		410				761	78	80		22	38	10	<1
80	82		430				762	80	82		30	70	14	<1
82	84		430		Light-grey quartzite with occasional bands of	Very poorly mineralised.	763	82	84		40	155	30	<1
84	86		410		very fissile quartz-biotite schist.	Trace py. No visible po	764	84	86		10	48	18	<1
86	88		410				765	86	88		8	46	14	<1
88	90		410				766	88	90		22	65	22	<1
90	92		450				767	90	92		34	65	12	<1

SUMMARY AND SPECIAL COMMENTS: Interbedded succession of schists and quartzites with variable mineralisation ranging from trace to 2% pyrite and very minor pyrrhotite.

LOGGED BY: A.J. Veale   DATE: 3/12/1981

SHEET 1 OF 2

CRAE 117
PLAN No M414

C R A EXPLORATION PTY LIMITED

PROJECT Bull Creek E.L. 612 Woodcheste Project

Percussion DRILL CORE LOG

CO-ORDINATES 35°11'17"S, 138°58'29" E AZIMUTH 112° DRILLERS J. Nitschke COMMENCED 26/11/1981 DEPTH 142m HOLE No. 81WCP 1

RL COLLAR 110m (AHD) INCLINATION -60° DRILL TYPE Ingersol Rand T4 COMPLETED 27/11/1981 CASING LEFT 142m DPO No(s) B0438

DEPTH FROM (M)	DEPTH TO (M)	CORE REC (M)	MAG SUSC.	GRAPHIC LOG	CORE DESCRIPTION	SPECIAL FEATURES WEATH, ALTERATION, FRACTURING VEINING, MINERALIZATION	SAMPLE No.	FROM (M)	TO (M)	REC (M)	ASSAY VALUES Pb	Zn	Cu	Ag
92	94		660				965768	92	94		65	220	55	<1
94	96		700				769	94	96		34	115	65	<1
96	98		1500				770	96	98		20	165	55	<1
98	100		540				771	98	100		24	620	55	<1
100	102		1200				772	100	102		36	260	110	<1
102	104		350		Light greenish-grey micaceous quartzite		773	102	104		46	75	44	<1
104	106		1000		showing moderate schistosity in places.		774	104	106	—	22	2300	90	<1
106	108		400		The zone is well mineralised with up to	Well mineralised. Pyrite	775	106	108		34	330	80	<1
108	110		200		10% combined pyrite and pyrrhotite	and pyrrhotite occur in	776	108	110		60	165	65	<1
110	112		240		occurring in places. Fragments of vein quartz	± 60:40 ratio. Total	777	110	112		26	110	60	<1
112	114		200		are common. The sulphides tend to occur along	sulphide content ranges	778	112	114		60	155	50	<1
114	116		1500		planes of cleavage and schistosity and also	from 5-10%	779	114	116		48	1250	75	<1
116	118		600		as fine disseminations within the quartzite		780	116	118		36	170	38	<1
118	120		230				781	118	120		28	240	50	<1
120	122		750				782	120	122		34	1100	70	<1
122	124		780				783	122	124		26	200	65	<1
124	126		700				784	124	126		40	1400	60	<1
126	128		420				785	126	128		32	730	65	<1
128	130		230				786	128	130		40	200	55	<1
130	132		90				787	130	132		16	65	36	<1
132	134		80		Interbedded schist and quartzite. Mineralisation	V. poorly mineralised.	788	132	134		20	70	28	<1
134	136		50		is poor to non-existent.		789	134	136		10	30	22	<1
136	138		50				790	136	138		16	48	34	<1
138	140		40				791	138	140		10	32	20	<1
140	142		40		E.O.H.		792	140	142		6	36	22	<1
					Hole cased to 142m with 4" P.V.C. casing.									

CRAE 117
PLAN No. M414

SUMMARY AND SPECIAL COMMENTS Well mineralised schistose quartzite. Combined pyrite and pyrrhotite content reaches 10%.

LOGGED BY A.J. Veabler DATE 4/12/1981

SHEET 2 OF 2

CRA EXPLORATION PTY LIMITED

PERCUSSION DRILL CORE LOG

PROJECT: Bull Creek E.L. 612 Reservoir Prospect

CO-ORDINATES: 35°12'43"S, 138°56'37"E AZIMUTH: 290° DRILLERS: J. Nitschke COMMENCED: 30/11/1981 DEPTH: 70 m HOLE No. 81 RVP 1

RL COLLAR: 180 m (AHD) INCLINATION: -60° DRILL TYPE: Ingersol Rand T4 COMPLETED: 30/11/1981 CASING LEFT: 70 m DPO No(s): B6439

DEPTH FROM (M)	DEPTH TO (M)	CORE REC (M)	MAG SUSC.	GRAPHIC LOG	CORE DESCRIPTION	SPECIAL FEATURES (WEATH., ALTERATION, FRACTURING, VEINING, MINERALIZATION)	SAMPLE No.	FROM (M)	TO (M)	REC (M)	Pb	Zn	Cu	Ag
0	2				Soil + subsoil.									
2	4				Weathered quartz-biotite-sericite schist. Large mica flakes.									
4	6				Dark grey, quartz-biotite metagreywacke. Slight schistosity.	Quartz vein.								
6	8				Interbedded metagreywacke and very fissile quartz-	Qtz vein.								
8	10				muscovite schist. Large mica flakes.									
10	12													
12	14													
14	16					Vein quartz ≃ 10% of cuttings								
16	18					" " ≃ 5% " "								
18	20													
20	22				Dark grey to black metagreywacke comprising at	Trace pyrite								
22	24				least 90% quartz and biotite. Lesser feldspar and		945846	22	24		10	130	20	<1
24	26				clay minerals. In cases narrow interbeds of quartz-	Vein quartz ≃ 5%	847	24	26		16	115	30	1
26	28				muscovite schist occur. Mineralisation is very poor.		848	26	28		16	115	85	1
28	30						849	28	30		30	90	46	<1
30	32						850	30	32		14	85	38	<1
32	34						851	32	34		12	80	60	1
34	36						852	34	36		14	85	55	1
36	38						853	36	38		6	90	32	<1
38	40						854	38	40		6	95	12	<1
40	42				Dark grey metagreywacke becoming schistose in places		855	40	42		10	115	55	1
42	44				(higher biotite content?)		856	42	44		16	110	500	1
44	46					Malachite + azurite ≃ 0.5%	857	44	46	—	18	250	8500	2
46	48						858	46	48		12	850	1890	2
48	50				High-grade metamorphic horizon. Predominantly	Malachite + pyrite ≃ trace	859	48	50		12	140	1510	2
50	52				quartz-biotite schist with lesser pink garnet		860	50	52	—	12	185	3000	3
52	54				and fibrous sillimanite. Increase in sulphide	Trace pyrite.	861	52	54		14	380	950	1
54	56				content	Moderate pyrite with qtz vein ≃ 2%	862	54	56	—	28	135	3100	2
56	58					Trace py and po	863	56	58		14	260	1420	1
58	60					" " " "	864	58	60		48	520	280	<1
60	62						865	60	62		55	730	320	1
62	64				Quartz-biotite schist. Very little evidence	Vein quartz + minor py + po.	866	62	64		70	1530	240	1
64	66				for high-grade metamorphism or mineralisation.	" " " " "	867	64	66		90	1020	185	<1
66	68					1 grain malachite (contam?)	868	66	68		50	330	95	1
68	70				E.O.H.	No mineralisation	869	68	70		32	250	55	<1
					Hole cased to 70 m with P.V.C. 4" casing									

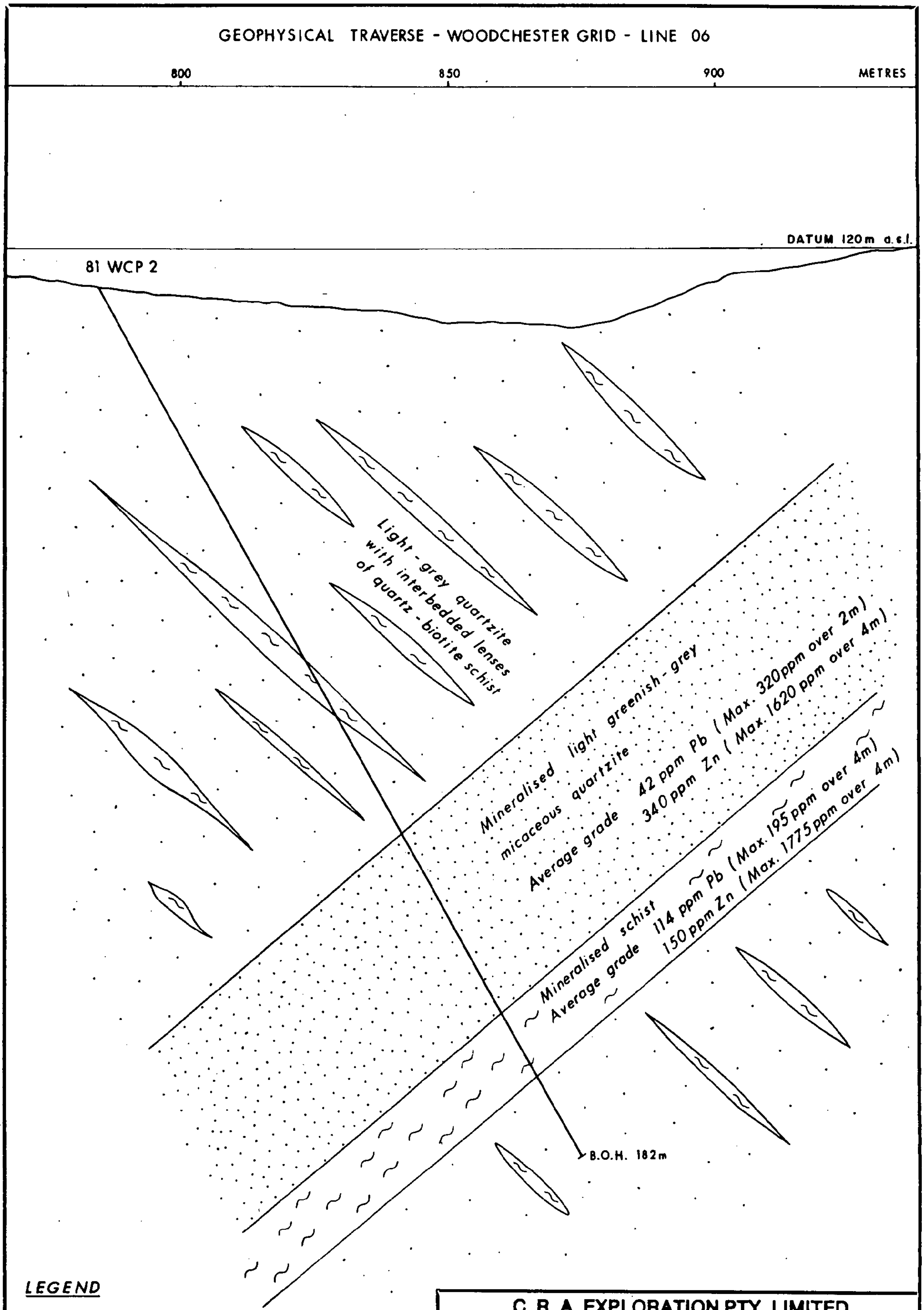
SUMMARY AND SPECIAL COMMENTS: High grade, moderately mineralised horizon (qtz-bt-gt-sill schist) in poorly mineralised succession of metagreywackes and schists.

LOGGED BY: A.J. Veale DATE: 7/12/1981

SHEET 1 OF 1

CRAE 117 PLAN No M 418

PIPOV 15658



LEGEND

Schist

Quartzite and metagreywacke

Dips of lithological units derived by geophysical modelling and from local observations.

C. R. A. EXPLORATION PTY. LIMITED

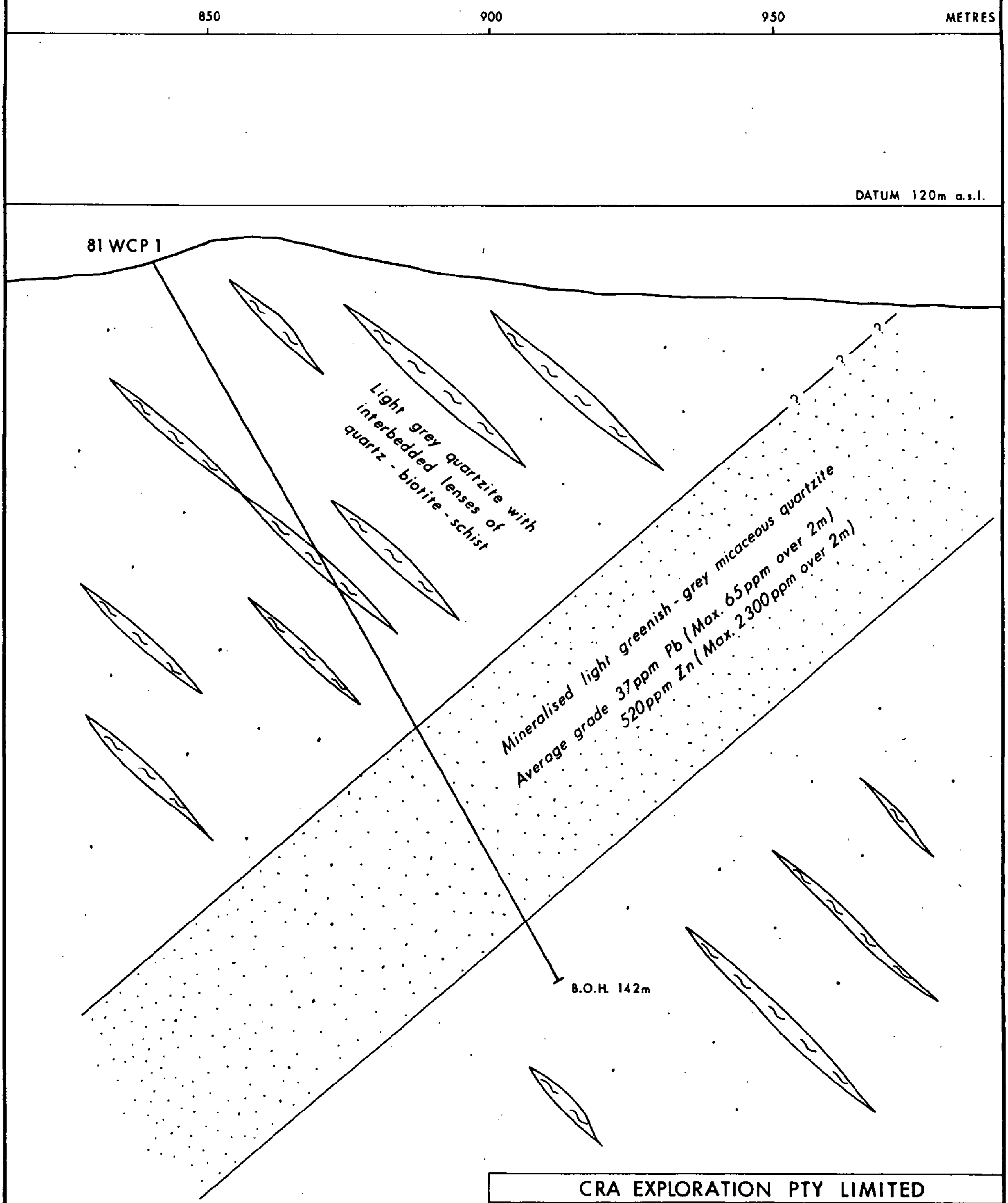
BULL CREEK E.L. 612

WOODCHESTER PROSPECT

BOREHOLE SECTION 81 WCP 2

Ref. BARKER SI 54 - 13	
Scale 1:1,000	**Drawn** S.J.B.
Author A.J.V.	**Report No.** 10149
Date JANUARY 1982	**Plan No.** SAa 1250

GEOPHYSICAL TRAVERSE - WOODCHESTER GRID - LINE 04

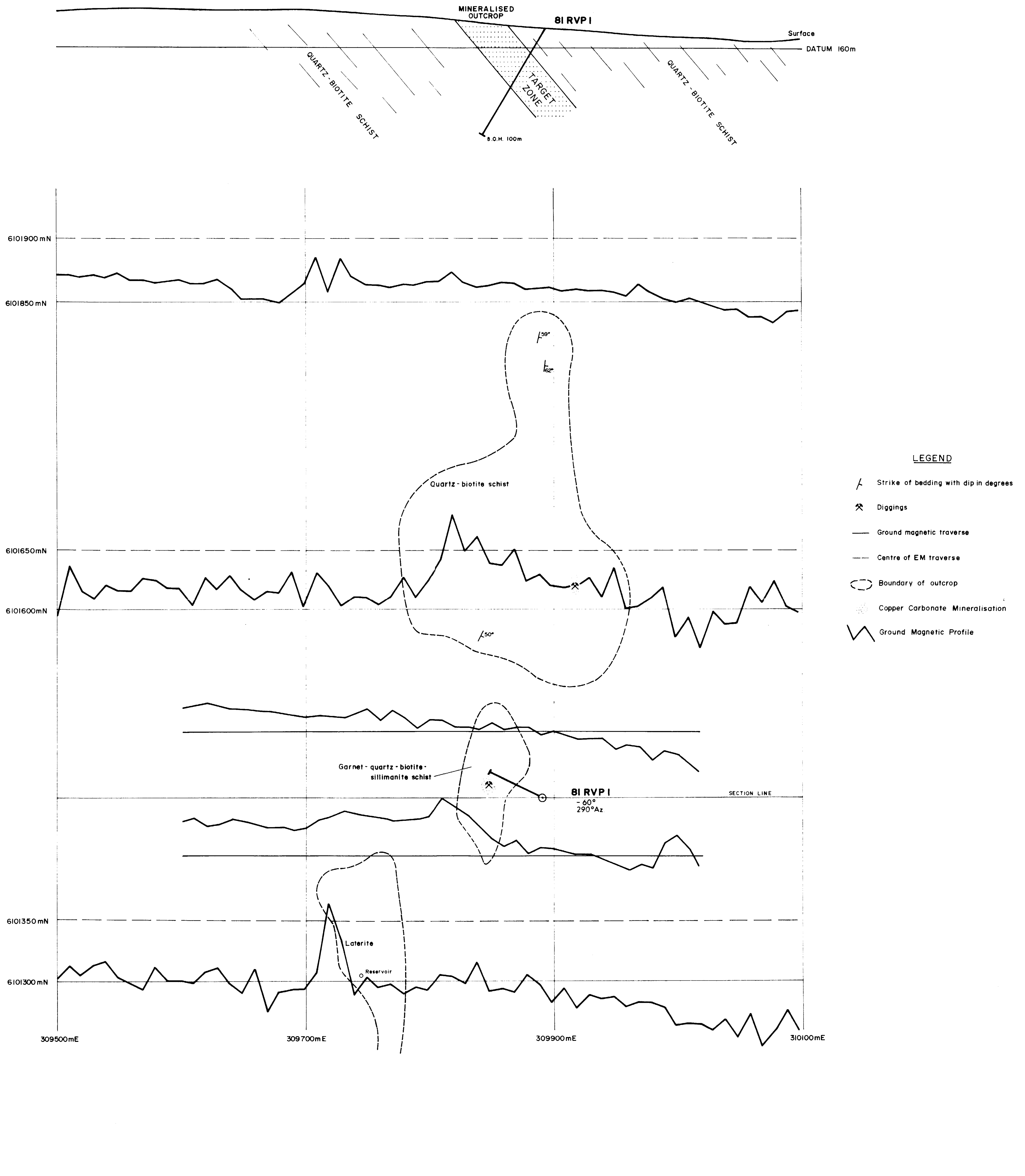


LEGEND

- Schist
- Quartzite & Metagreywacke

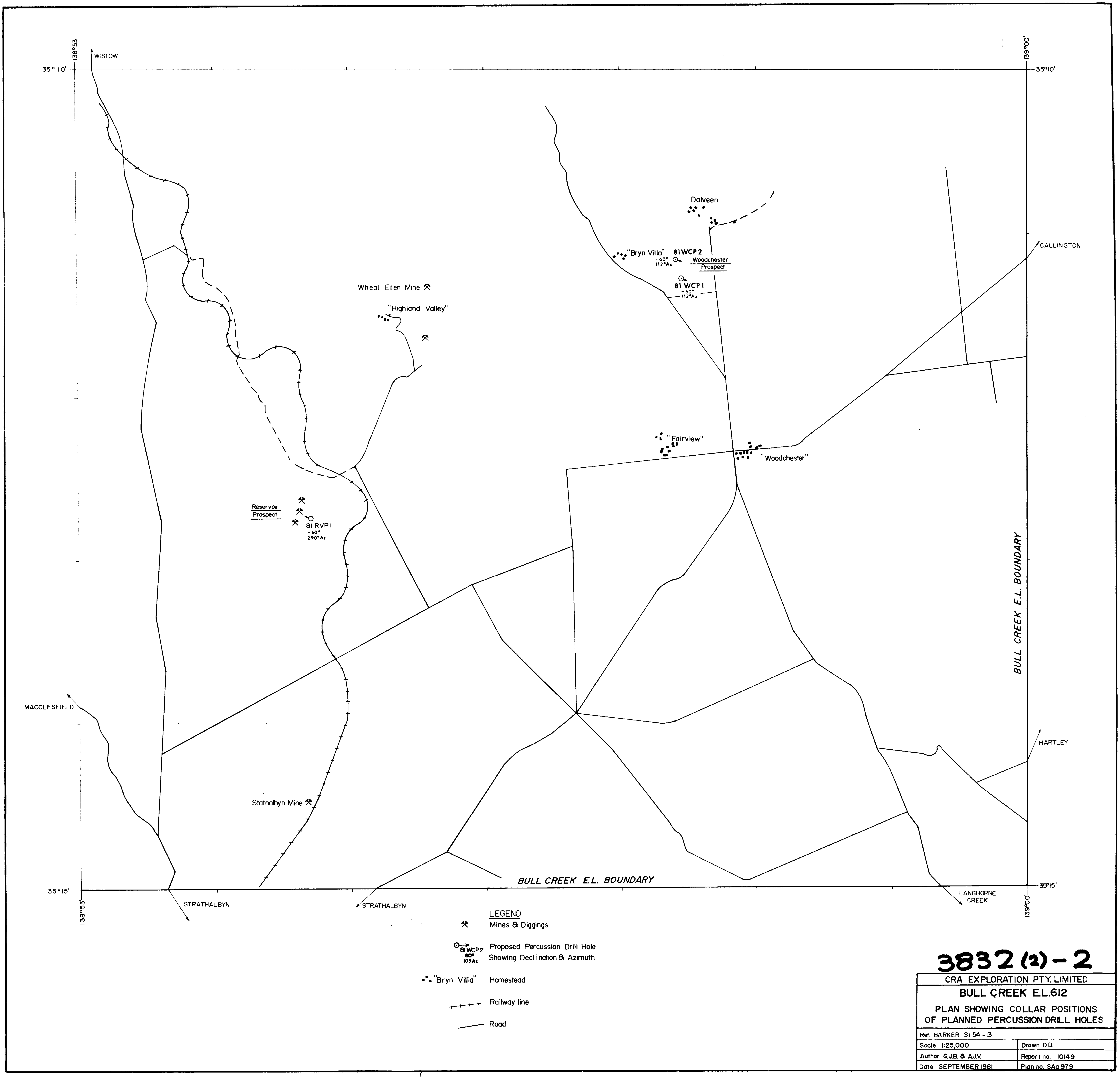
Dips of lithological units derived by geophysical modelling and from local observations.

CRA EXPLORATION PTY LIMITED	
BULL CREEK E.L. 612 WOODCHESTER PROSPECT BOREHOLE SECTION 81 WCP 1	
REF. BARKER SI 54-13	
SCALE 1:1000	DRAWN S.J.B.
AUTHOR A.J.V.	REPORT 10149
DATE JANUARY 1981	PLAN No SAa 1249

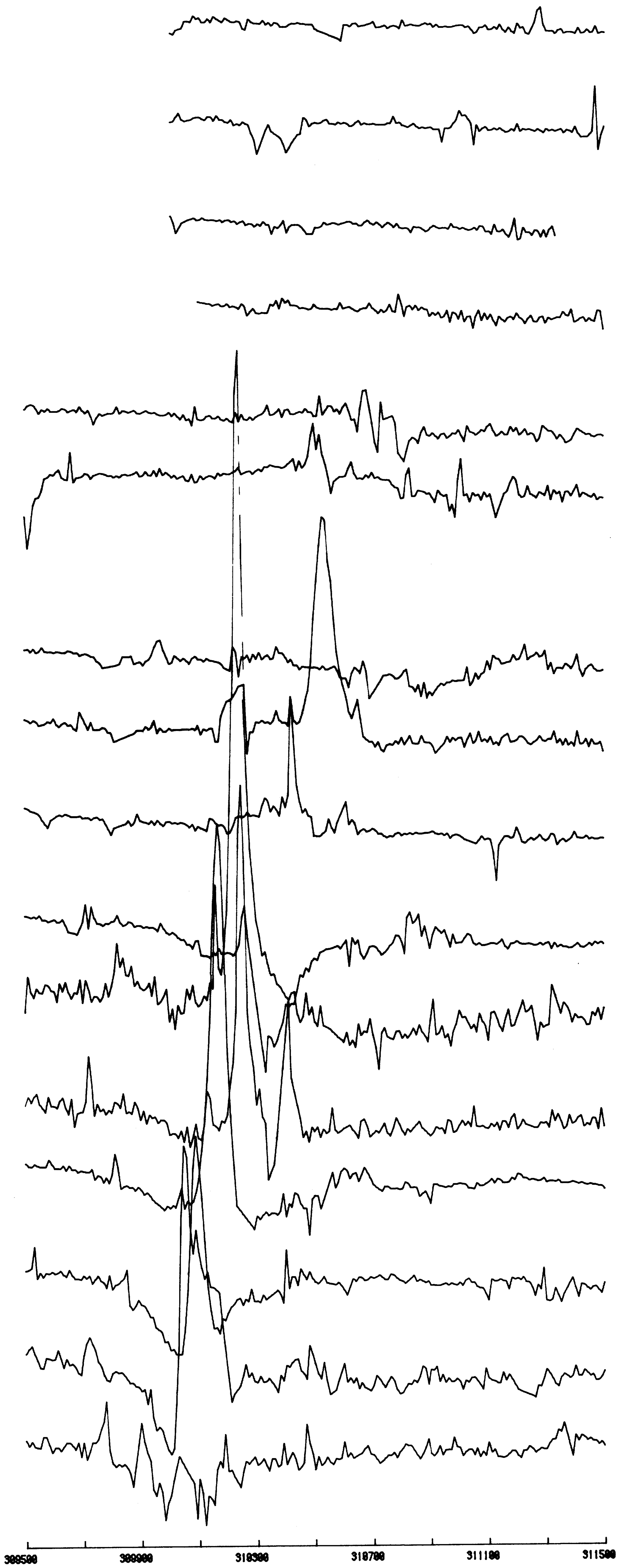


3832 (2) - 1

CRA EXPLORATION PTY. LIMITED	
BULL CREEK E.L. 612 RESERVOIR ANOMALY GEOLOGICAL PLAN WITH SUPERIMPOSED MAGNETIC PROFILES AND BOREHOLE COLLAR POSITION	
REF.: BARKER SI 54-13	
Geol.: A.J.V.	Scale : 1:2000
Drawn : J.C.R.	Report Nº 10149
Date : Sept. 1981	Plan Nº: SAa 1044


WISTOW
35° 10'
138°53
139°00'
35°10'
Dalveen
"Bryn Villa"
81WCP2
-60°
112°Az
Woodchester
Prospect
81 WCP1
-60°
112°Az
CALLINGTON
Wheal Ellen Mine
"Highland Valley"
"Fairview"
"Woodchester"
Reservoir
Prospect
81 RVP1
-60°
290°Az
BULL CREEK E.L. BOUNDARY
MACCLESFIELD
HARTLEY
Stathalbyn Mine
BULL CREEK E.L. BOUNDARY
35°15'
STRATHALBYN
STRATHALBYN
LANGHORNE
CREEK
LEGEND
Mines & Diggings
81WCP2
-60°
105Az
Proposed Percussion Drill Hole
Showing Declination & Azimuth
"Bryn Villa" Homestead
Railway line
Road
3832 (2) - 2
CRA EXPLORATION PTY. LIMITED
BULL CREEK E.L.612
PLAN SHOWING COLLAR POSITIONS
OF PLANNED PERCUSSION DRILL HOLES
Ref. BARKER SI 54-13
Scale 1:25,000
Drawn D.D.
Author G.J.B. & A.J.V.
Report no. 10149
Date SEPTEMBER 1981
Plan no. SAg 979


Quartz biotite schist
Becomes coarser grained and less schistose westwards
Quartz biotite schist with local horizons of metagreywacke and sandstone
Quartz veins and well developed gossan in mica schist
Wheal Ellen Pb-Zn-Ag Mine
North Air Shaft
Spencer Shaft
Middle Air Shaft
Main Engine Shaft
Scott Shaft
Basset Shaft (collapsed)
Biotite schist
No o/c
MN
Lateritised schist
Poorly schistose
mod well laminated
Poorly laminated
Quartz-biotite Metagreywacke
Laterite
Mainly Q
Decreasing biotite content
Biotite schist minor quartz
Biotite schist very little quartz
Well laminated Biotite Quartz Schist
Narrow interbeds of course grained Biotite-andalusite "Knotty" schist
Quartz-biotite metagreywacke very poor schistosity
35° 12' 00"
QBS + minor garnet
QBS + retrograded andalusite
QB Metasediments Poor schistosity in places
Minor garnet
Poor schistocity
Copper Carbonate mineralization
Copper carbonate mineralization with garnet sillimanite quartz biotite schist and quartz veins
Calcrete
Coarse grained Muscovite schist
Decreasing schistosity
QBS + rare garnet
LEGEND
Boundary of outcrop
Strike and dip of Strata in degrees
Northern Mining Borehole Collar Position
Mine Shaft
Diggings
Mineral and Rock Abbreviations
Q Quartz
B Biotite
G Garnet
A Andalusite
M Muscovite
S Schist
No o/c No outcrop
1 Calcrete
2 Laterite
3 Quartz Biotite schist and metagreywacke
Quartz biotite schist with garnets or andalusite
Biotite schist
Muscovite schist
3832 (2) - 3
CRA EXPLORATION PTY LIMITED
STRATHALBYN GRID
GEOLOGY
REF
SCALE 1:5000
AUTHOR AJV
DATE October 1981
REPORT No. 10149
PLAN No. SAa 1073



Magnetometer	:	Scintrex MP-2
Quoted sensitivity	:	+/- 1 nT
Noise envelope	:	+/- 5 nT
Station spacing	:	10 metres
Line orientation	:	90 deg AMG
Survey date	:	Aug-Sep 1981
Vertical scale	:	50 nT/cm

Horizontal scale : AMG metres east

3832(2)-4

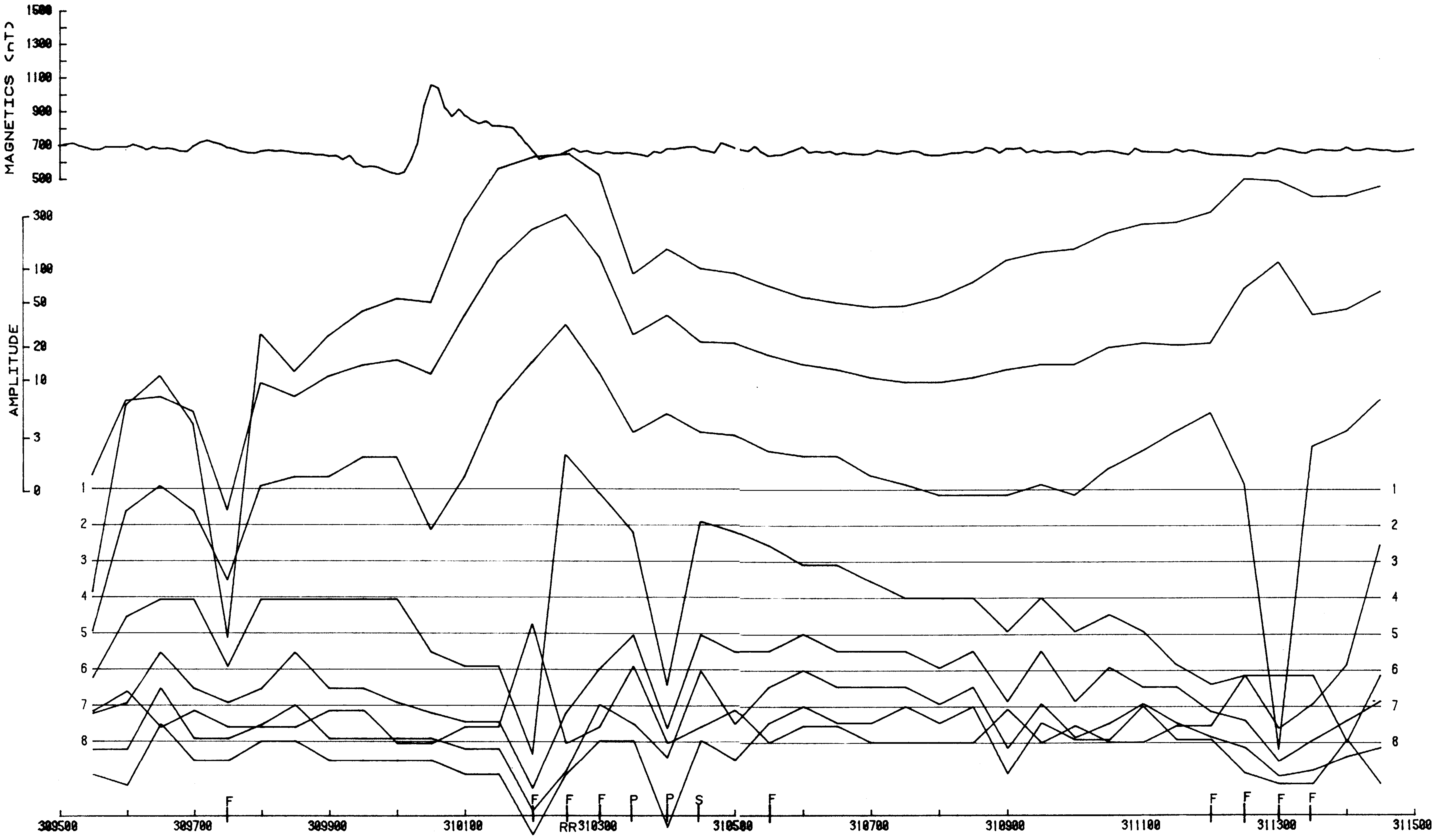
C. R. A. EXPLORATION PTY. LIMITED

BULL CREEK E.L. 612

GROUND MAGNETICS STACKED PROFILES

STRATHALBYN GRID

Ref.	BARKER SI 54-13		
Scale	1:10000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 1026



Magnetometer : Scintrex MP-2
Quoted sensitivity : +/- 1 nT
Noise envelope : +/- 5 nT
Station spacing : 10 metres
Line orientation : 90 deg AMG
Survey date : 27/08;16/09/81
Vertical scale : 200 nT/cm

Transmitter loop : 100 x 100 metres
Receiver : In-loop
Field component : Vertical
Time base : 20 ms
Gain : 800
Survey date : Aug 1981
Receiver offset : 50 metres north

Horizontal scale : AMG metres East

F : Fence
RR : Railway line
P : Power line
S : Shed

3832 (2)-5

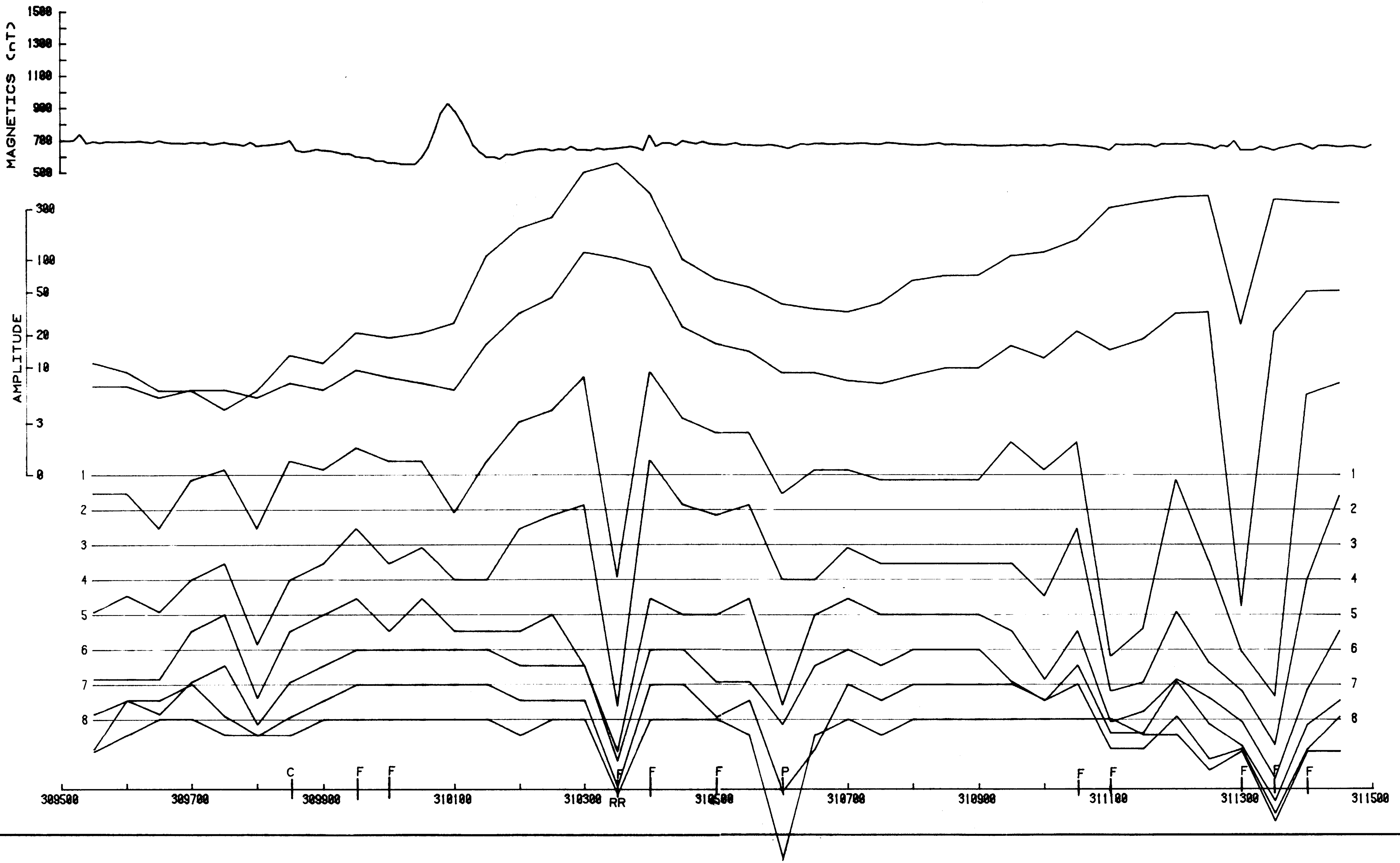
C. R. A. EXPLORATION PTY. LIMITED

BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

STRATHALBYN GRID : LINE 02 (6100400mN)

Ref.	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 987



Magnetometer	:	Scintrex MP-2
Quoted sensitivity	:	+/- 1 nT
Noise envelope	:	+/- 5 nT
Station spacing	:	10 metres
Line orientation	:	90 deg AMG
Survey date	:	08/09/81
Vertical scale	:	200 nT/cm

Transmitter loop	:	100 x 100 metres
Receiver	:	In-loop
Field component	:	Vertical
Time base	:	20 ms
Gain	:	800
Survey date	:	Aug 1981
Receiver offset	:	50 metres north

Horizontal scale : AMG metres East

F | : Fence

P | : Power line

| RR : Railway line

C | : Creek

3832(2)-6

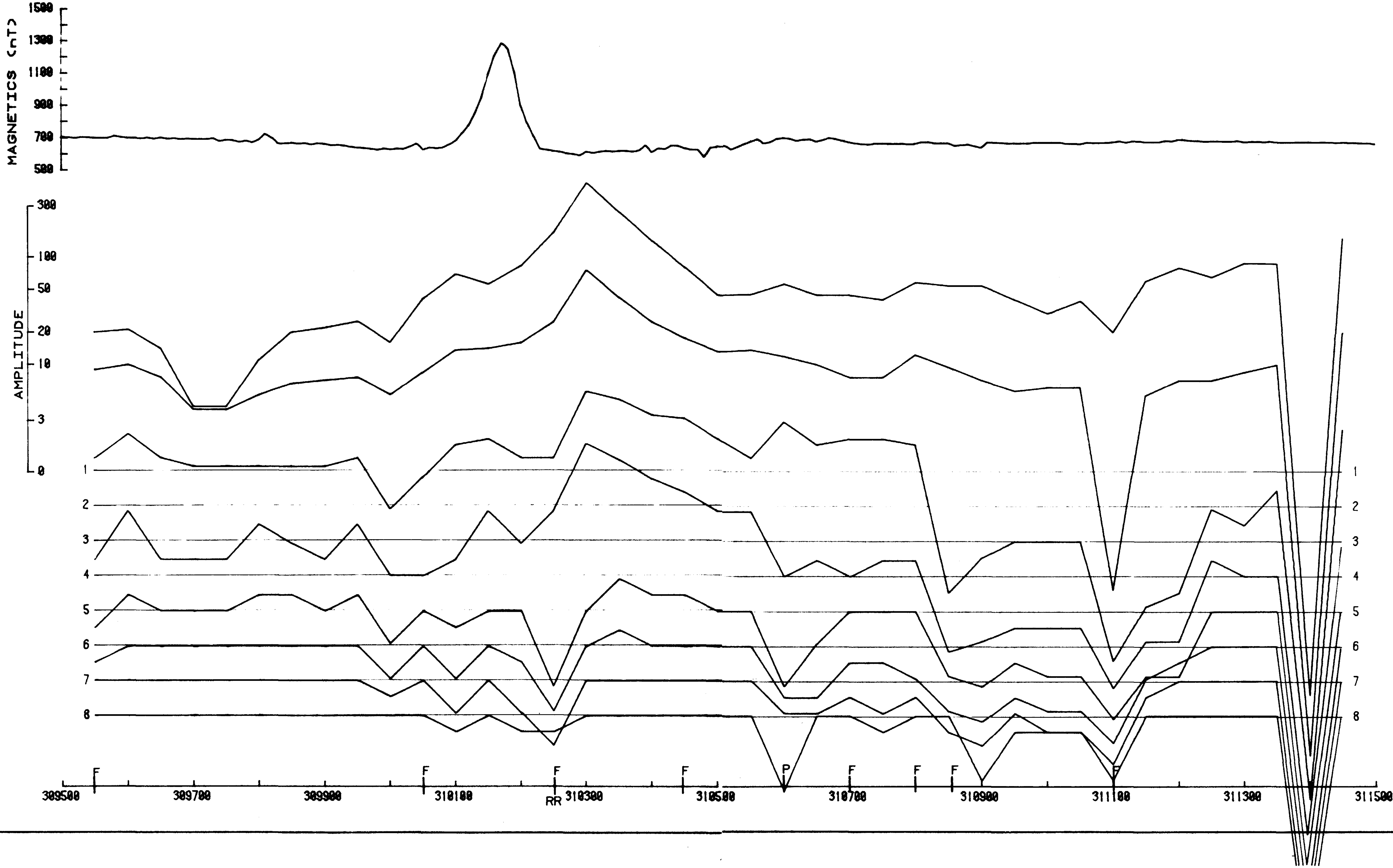
C. R. A. EXPLORATION PTY. LIMITED

BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

STRATHALBYN GRID : LINE 03 (6100700mN)

Ref.	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 988



Magnetometer : Scintrex MP-2
Quoted sensitivity : +/- 1 nT
Noise envelope : +/- 5 nT
Station spacing : 10 metres
Line orientation : 90 deg AMG
Survey date : 08/09/81
Vertical scale : 200 nT/cm

Transmitter loop : 100 x 100 metres
Receiver : In-loop
Field component : Vertical
Time base : 20 ms
Gain : 800
Survey date : Aug 1981
Receiver offset : 50 metres north

Horizontal scale : AMG metres East

F : Fence
RR : Railway line
P : Power line

3832(2)-7

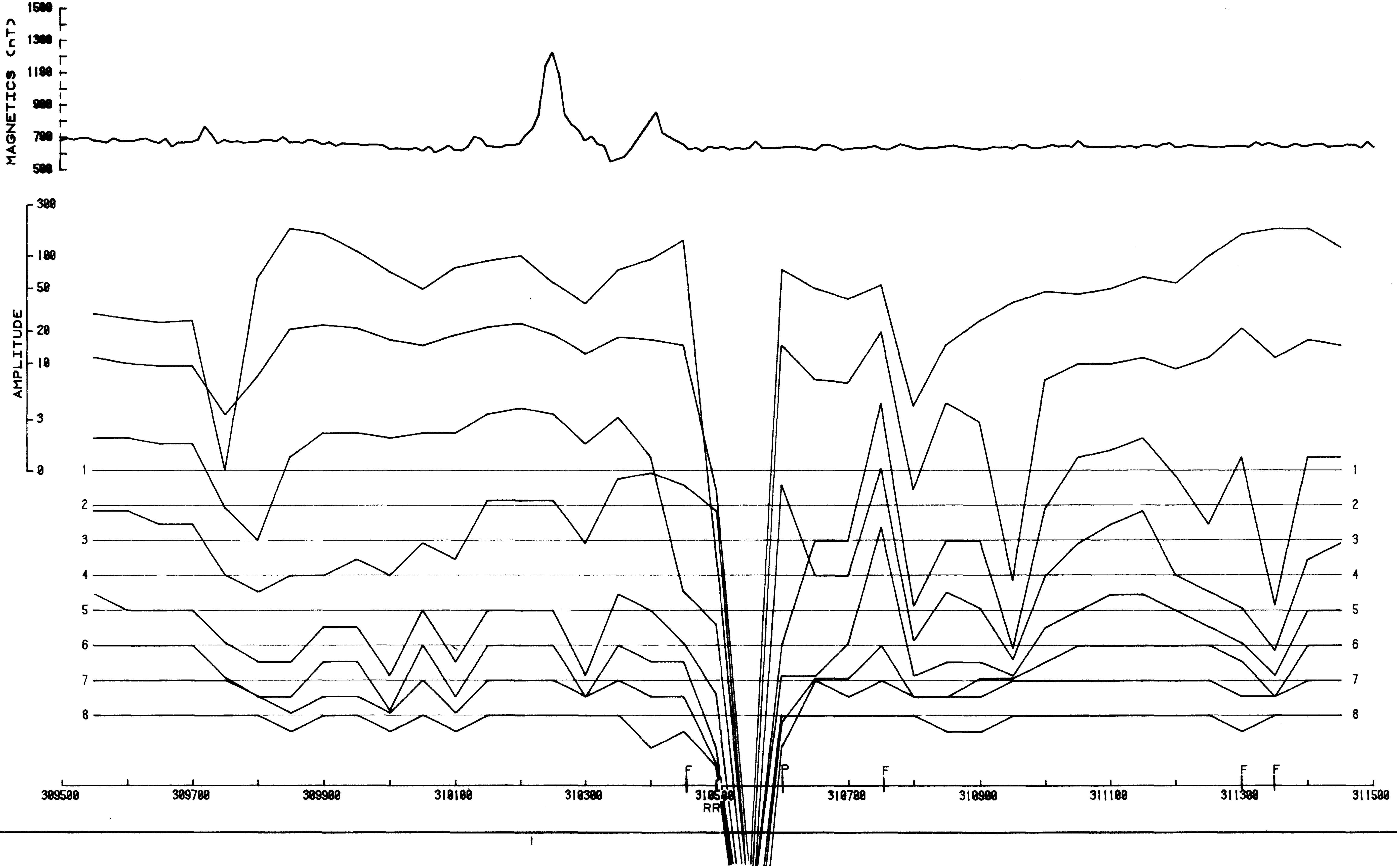
C. R. A. EXPLORATION PTY. LIMITED

BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

STRATHALBYN GRID : LINE 04 (6101050mN)

Ref.	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 989



Magnetometer : Scintrex MP-2
Quoted sensitivity : +/- 1 nT
Noise envelope : +/- 5 nT
Station spacing : 10 metres
Line orientation : 90 deg AMG
Survey date : 27/08/81
Vertical scale : 200 nT/cm

Transmitter loop : 100 x 100 metres
Receiver : In-loop
Field component : Vertical
Time base : 20 ms
Gain : 800
Survey date : Aug 1981
Receiver offset : 50 metres north

Horizontal scale : AMG metres East

F : Fence
RR : Railway line
P : Power line

3832(2)-8

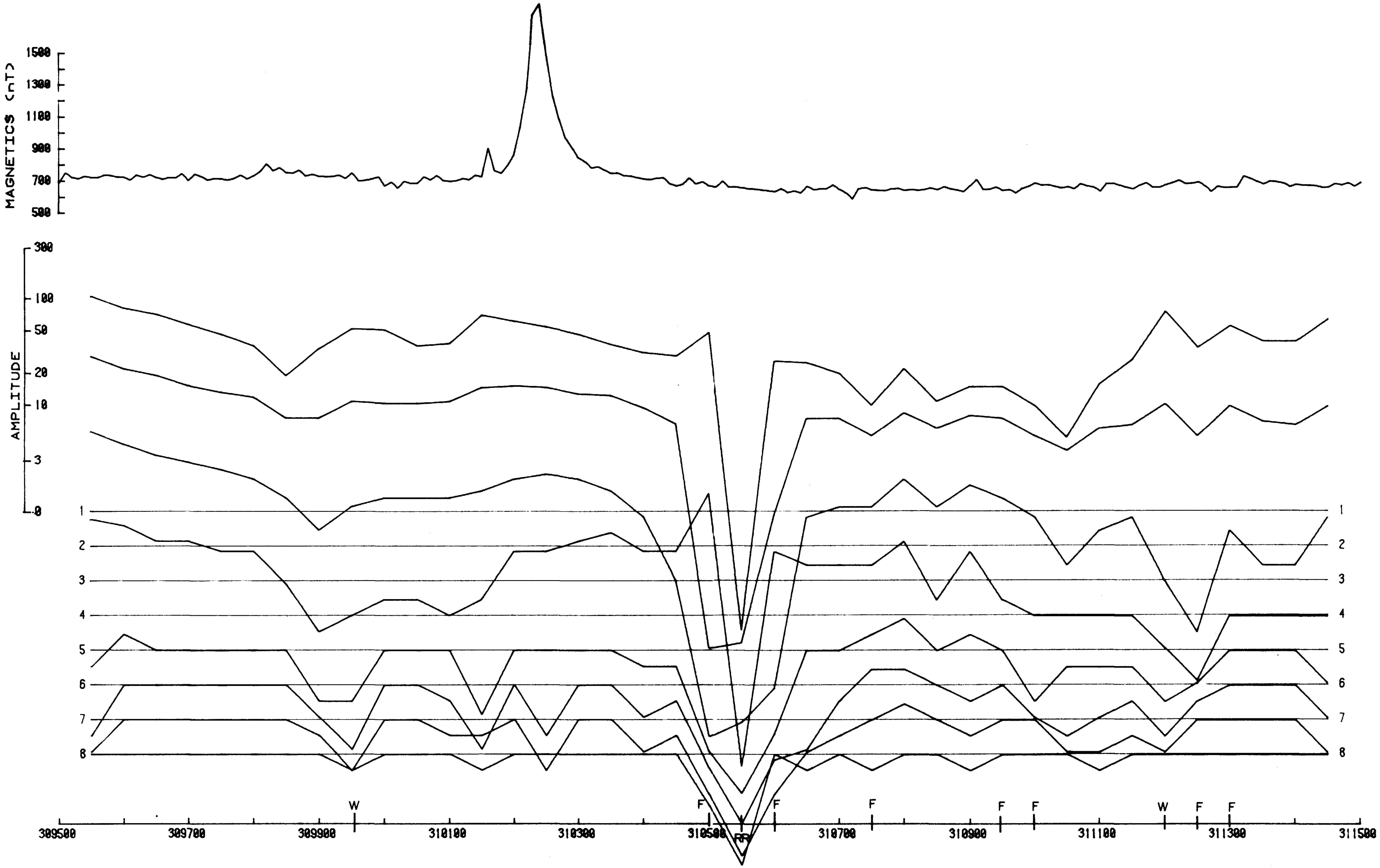
C. R. A. EXPLORATION PTY. LIMITED

BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

STRATHALBYN GRID : LINE 05 (6101300mN)

Ref.	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 990



Magnetometer : Scintrex MP-2
Quoted sensitivity : +/- 1 nT
Noise envelope : +/- 5 nT
Station spacing : 10 metres
Line orientation : 90 deg AMG
Survey date : 27/08/81
Vertical scale : 200 nT/cm

Transmitter loop : 100 x 100 metres
Receiver : In-loop
Field component : Vertical
Time base : 20 ms
Gain : 800
Survey date : Aug 1981
Receiver offset : 50 metres north

Horizontal scale : AMG metres East

F : Fence
RR : Railway line
W : Water bore

3832(2)-9

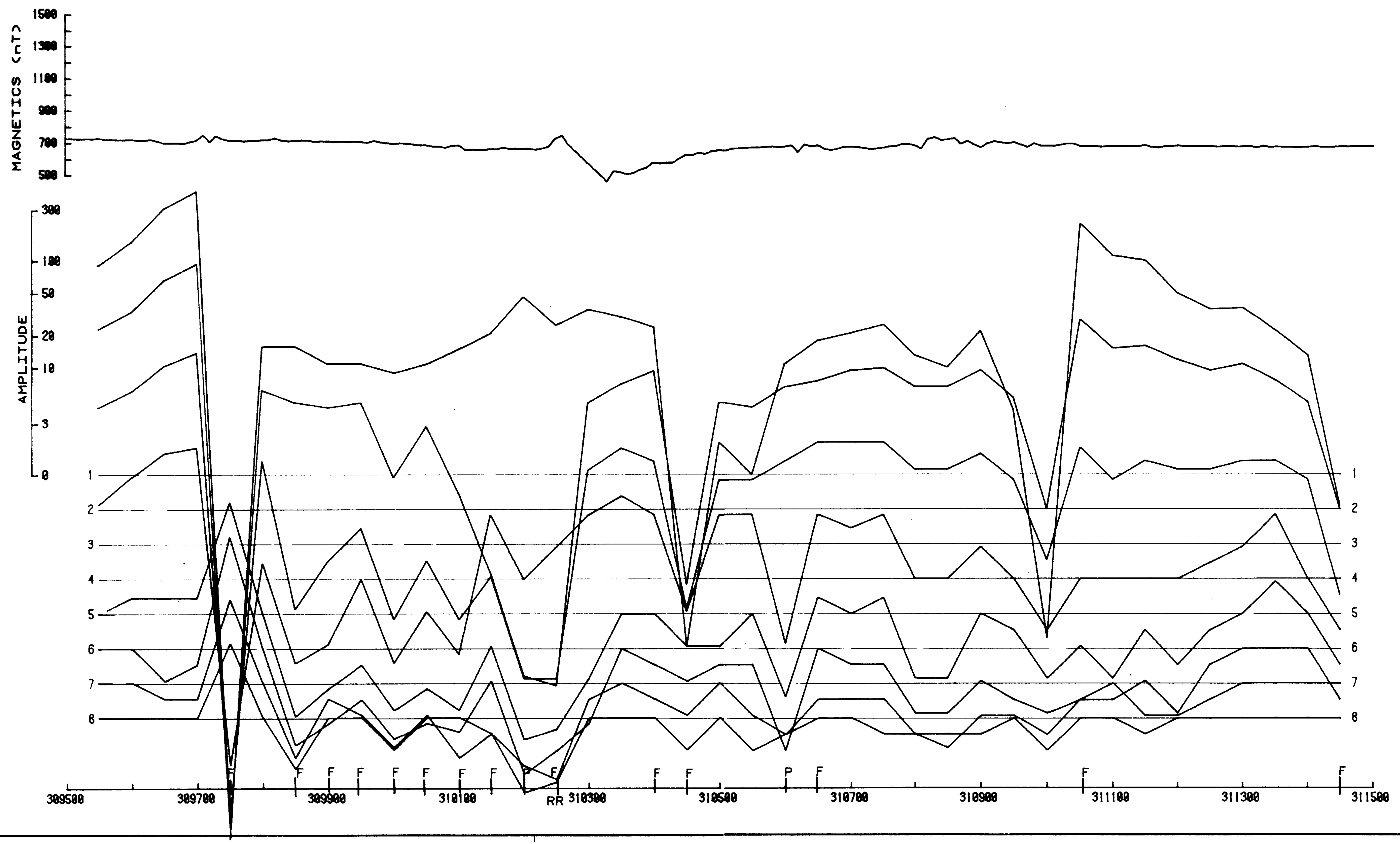
C. R. A. EXPLORATION PTY. LIMITED

BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

STRATHALBYN GRID : LINE 06 (6101600mN)

Ref.	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 991



Magnetometer	:	Scintrex MP-2
Quoted sensitivity	:	+/- 1 nT
Noise envelope	:	+/- 5 nT
Station spacing	:	10 metres
Line orientation	:	90 deg AMG
Survey date	:	08/09/81
Vertical scale	:	200 nT/cm

Transmitter loop	:	100 x 100 metres
Receiver	:	In-loop
Field component	:	Vertical
Time base	:	20 ms
Gain	:	800
Survey date	:	Aug 1981
Receiver offset	:	50 metres north

Horizontal scale : AMG metres East

F : Fence
RR : Railway line
P : Power line

3832(2)-10

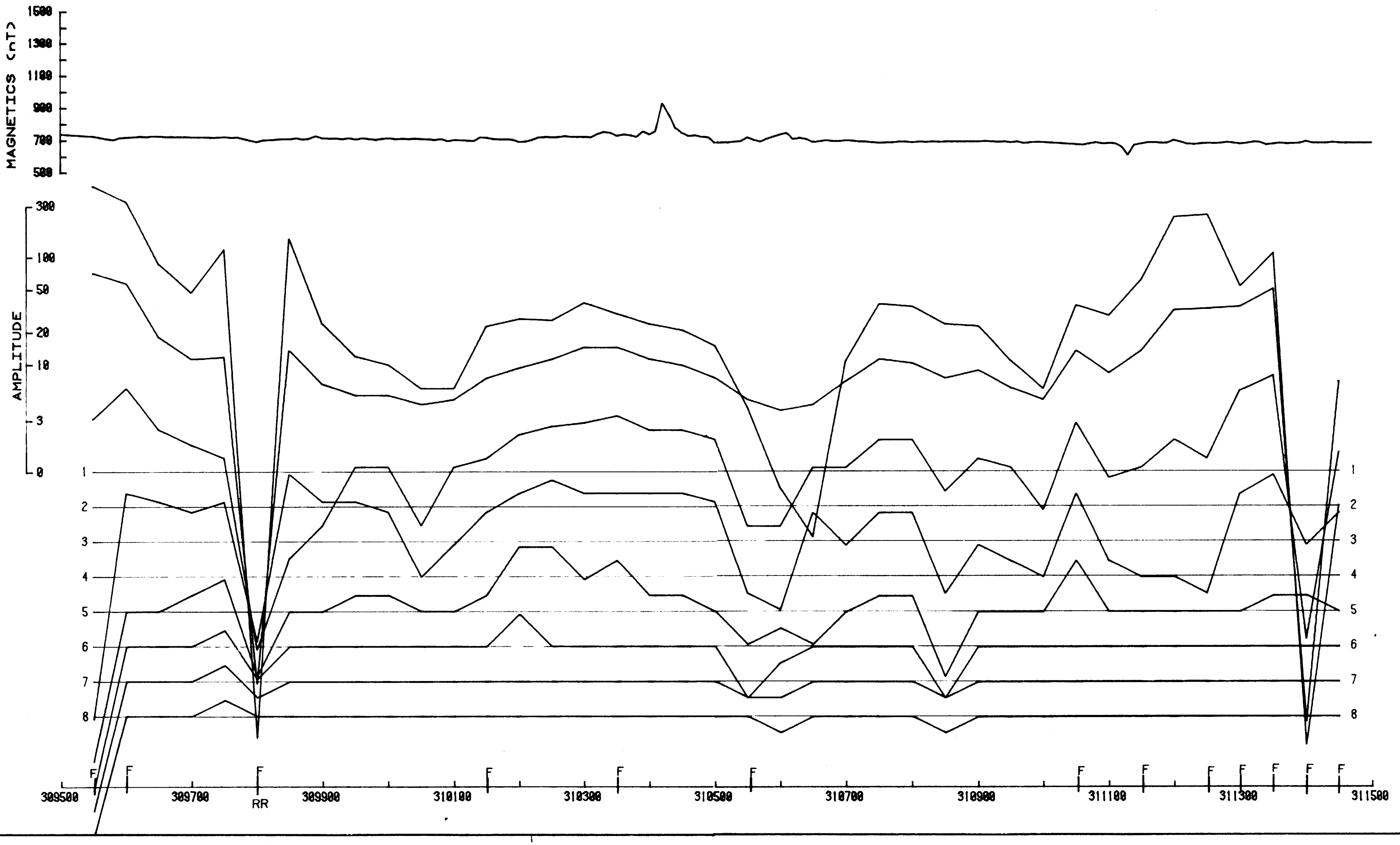
C. R. A. EXPLORATION PTY. LIMITED

BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

STRATHALBYN GRID : LINE 07 (6101850mN)

Ref.	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 992



Magnetometer	:	Scintrex MP-2
Quoted sensitivity	:	+/- 1 nT
Noise envelope	:	+/- 5 nT
Station spacing	:	10 metres
Line orientation	:	90 deg AMG
Survey date	:	09/09/81
Vertical scale	:	200 nT/cm

Transmitter loop	:	100 x 100 metres
Receiver	:	In-loop
Field component	:	Vertical
Time base	:	20 ms
Gain	:	800
Survey date	:	Aug 1981
Receiver offset	:	50 metres north

Horizontal scale : AMG metres East

F : Fence

RR : Railway line

3832(2)-11

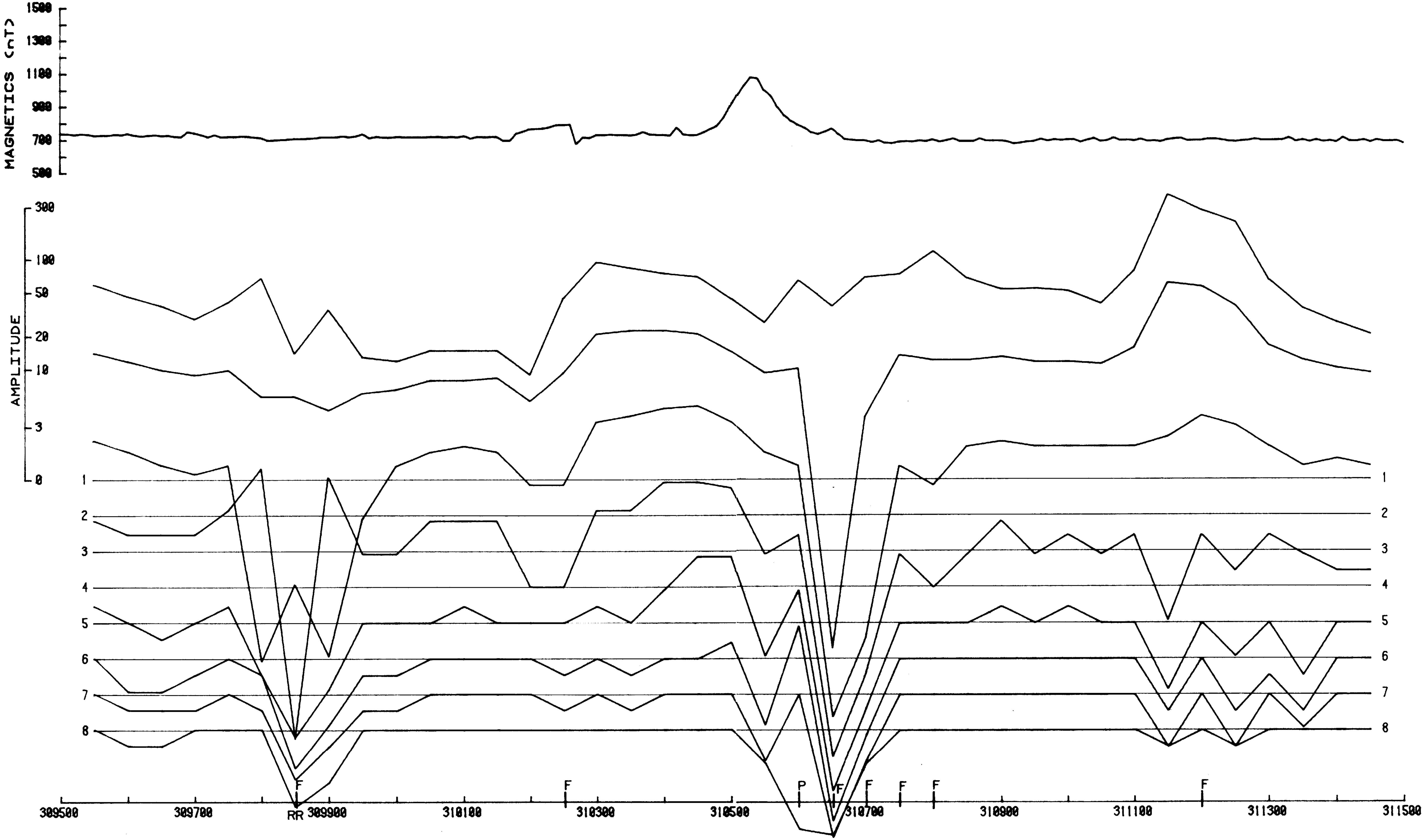
C. R. A. EXPLORATION PTY. LIMITED

BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

STRATHALBYN GRID : LINE 08 (6102200mN)

Ref.	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 993



Magnetometer : Scintrex MP-2
Quoted sensitivity : +/- 1 nT
Noise envelope : +/- 5 nT
Station spacing : 10 metres
Line orientation : 90 deg AMG
Survey date : 09/09/81
Vertical scale : 200 nT/cm

Transmitter loop : 100 x 100 metres
Receiver : In-loop
Field component : Vertical
Time base : 20 ms
Gain : 800
Survey date : Aug 1981
Receiver offset : 50 metres north

Horizontal scale : AMG metres East

F : Fence
RR : Railway line
P : Power line

3832(2)-12

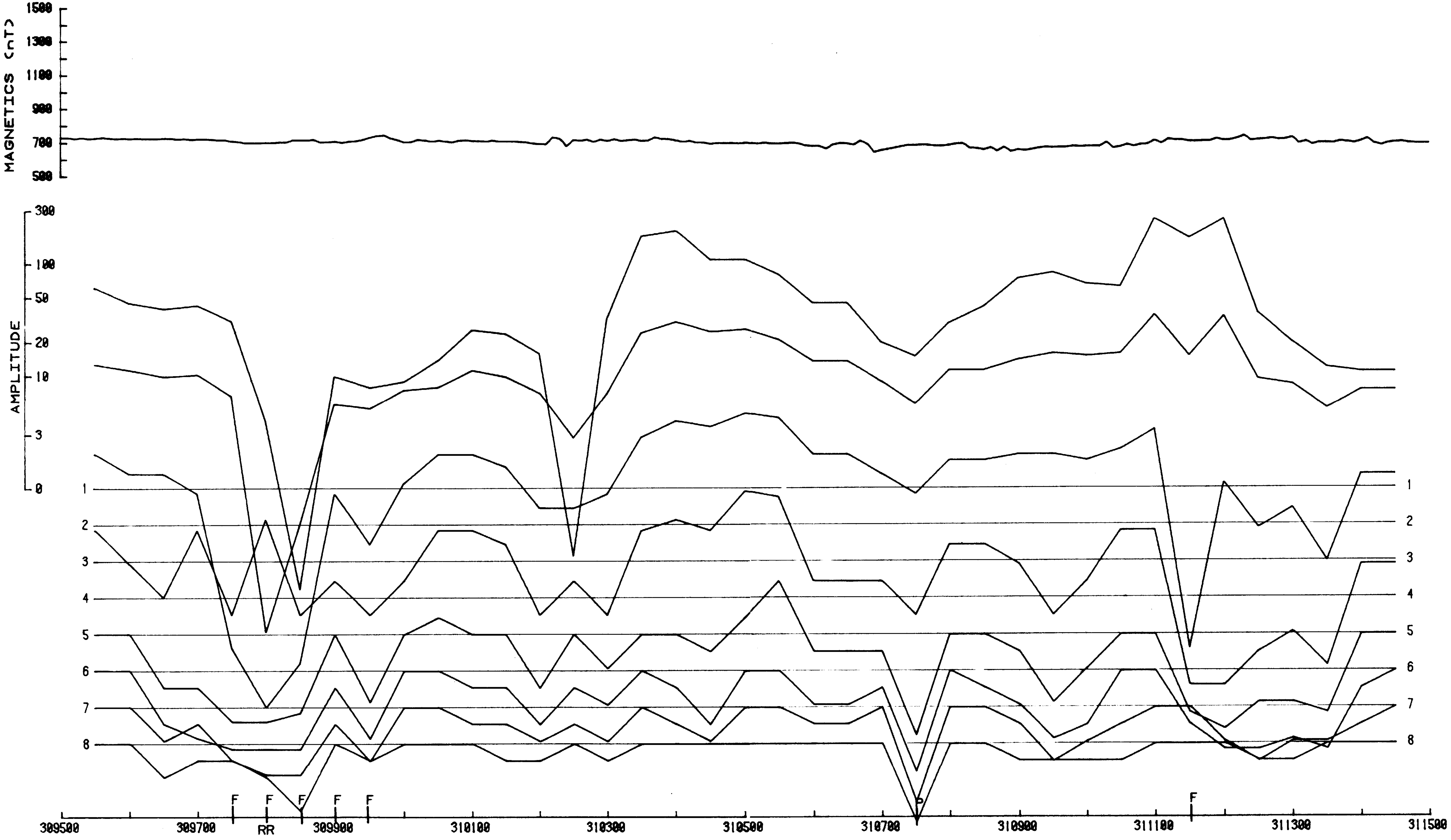
C. R. A. EXPLORATION PTY. LIMITED

BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

STRATHALBYN GRID : LINE 09 (6102500mN)

Ref.	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 994



Magnetometer	:	Scintrex MP-2
Quoted sensitivity	:	+/- 1 nT
Noise envelope	:	+/- 5 nT
Station spacing	:	10 metres
Line orientation	:	90 deg AMG
Survey date	:	09/09/81
Vertical scale	:	200 nT/cm

Transmitter loop	:	100 x 100 metres
Receiver	:	In-loop
Field component	:	Vertical
Time base	:	20 ms
Gain	:	800
Survey date	:	Aug 1981
Receiver offset	:	50 metres north

Horizontal scale : AMG metres East

F : Fence
RR : Railway line
P : Power line

3832 (2) - 13

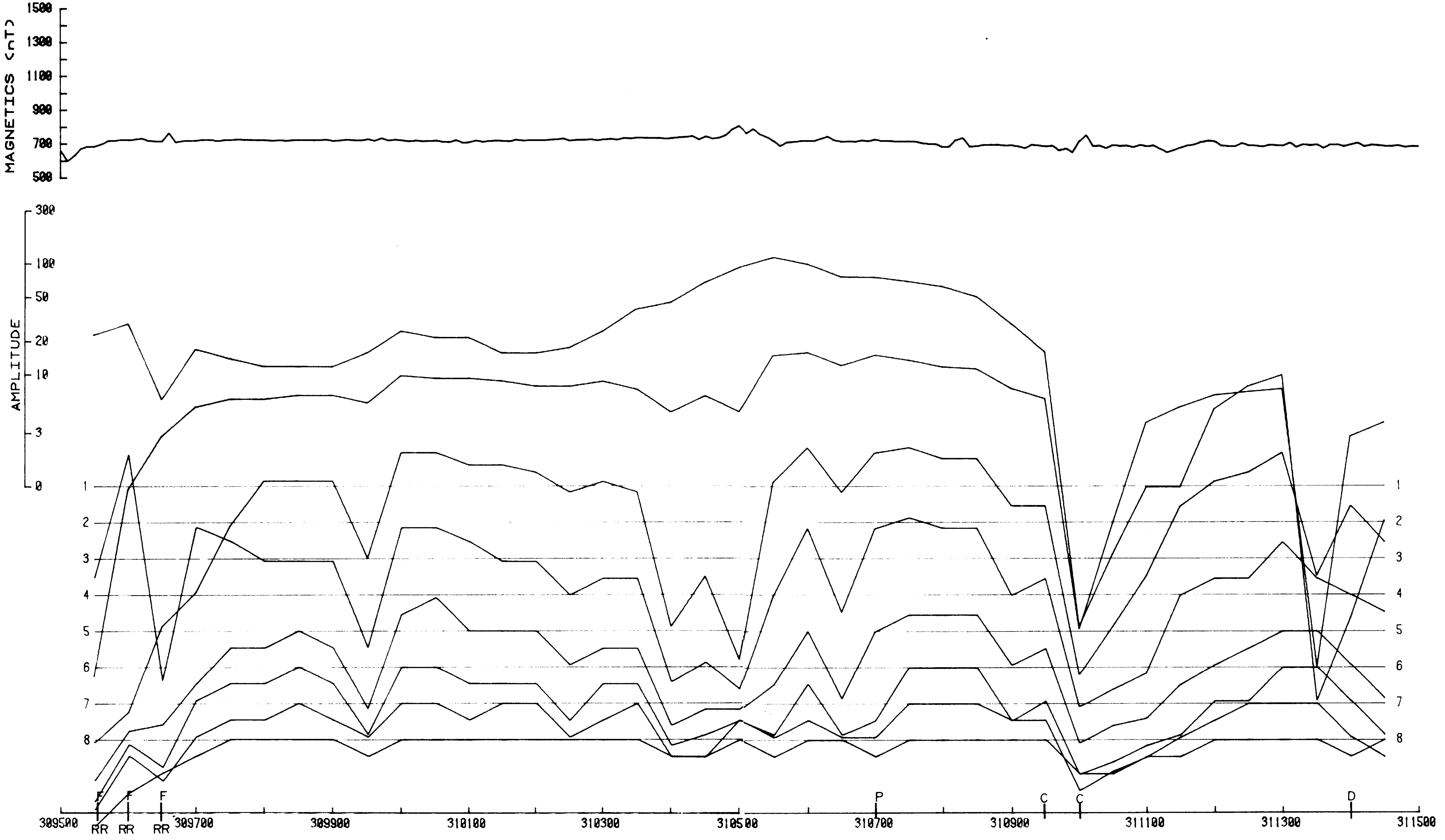
C. R. A. EXPLORATION PTY. LIMITED

BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

STRATHALBYN GRID : LINE 10 (6102750mN)

Ref.	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 995



Magnetometer	:	Scintrex MP-2
Quoted sensitivity	:	+/- 1 nT
Noise envelope	:	+/- 5 nT
Station spacing	:	10 metres
Line orientation	:	90 deg AMG
Survey date	:	15/09/81
Vertical scale	:	200 nT/cm

Transmitter loop	:	100 x 100 metres
Receiver	:	In-loop
Field component	:	Vertical
Time base	:	20 ms
Gain	:	800
Survey date	:	Aug 1981
Receiver offset	:	50 metres south

Horizontal scale : AMG metres East

F : Fence
RR : Railway line
P : Power line
C : Creek
D : Dam

3832(2)-14

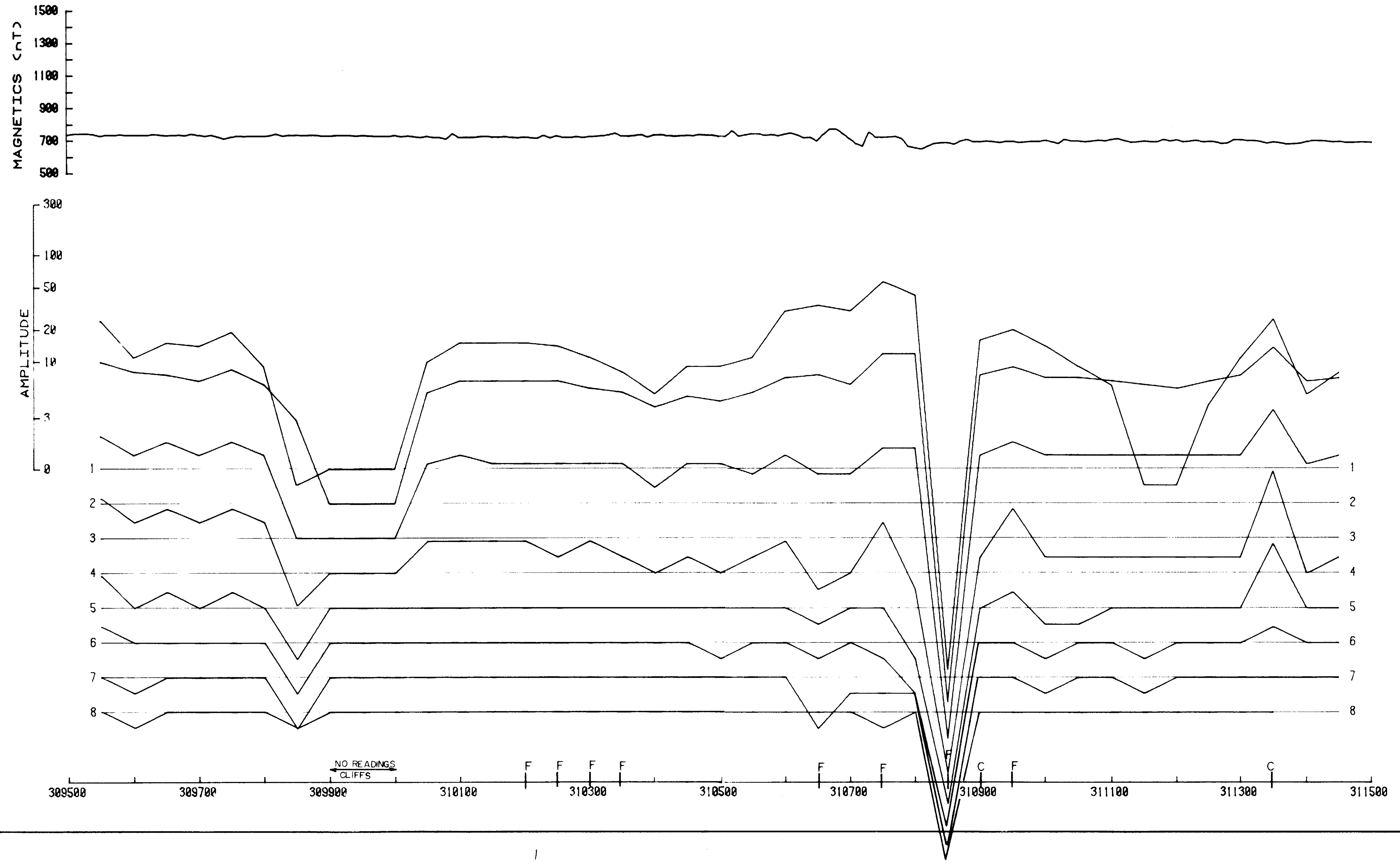
C. R. A. EXPLORATION PTY. LIMITED

BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

STRATHALBYN GRID : LINE 11 (6103350mN)

Ref. BARKER SI 54-13	
Scale 1:5000	Drawn
Author G.J.B.	Report No. 10149
Date SEP. 1981	Plan No. SAg 996



Magnetometer	:	Scintrex MP-2
Quoted sensitivity	:	+/- 1 nT
Noise envelope	:	+/- 5 nT
Station spacing	:	10 metres
Line orientation	:	90 deg AMG
Survey date	:	15/09/81
Vertical scale	:	200 nT/cm

Transmitter loop	:	100 x 100 metres
Receiver	:	In-loop
Field component	:	Vertical
Time base	:	20 ms
Gain	:	800
Survey date	:	Aug 1981
Receiver offset	:	50 metres north

Horizontal scale : AMG metres East

F : Fence

C : Creek

3832 (2) - 15

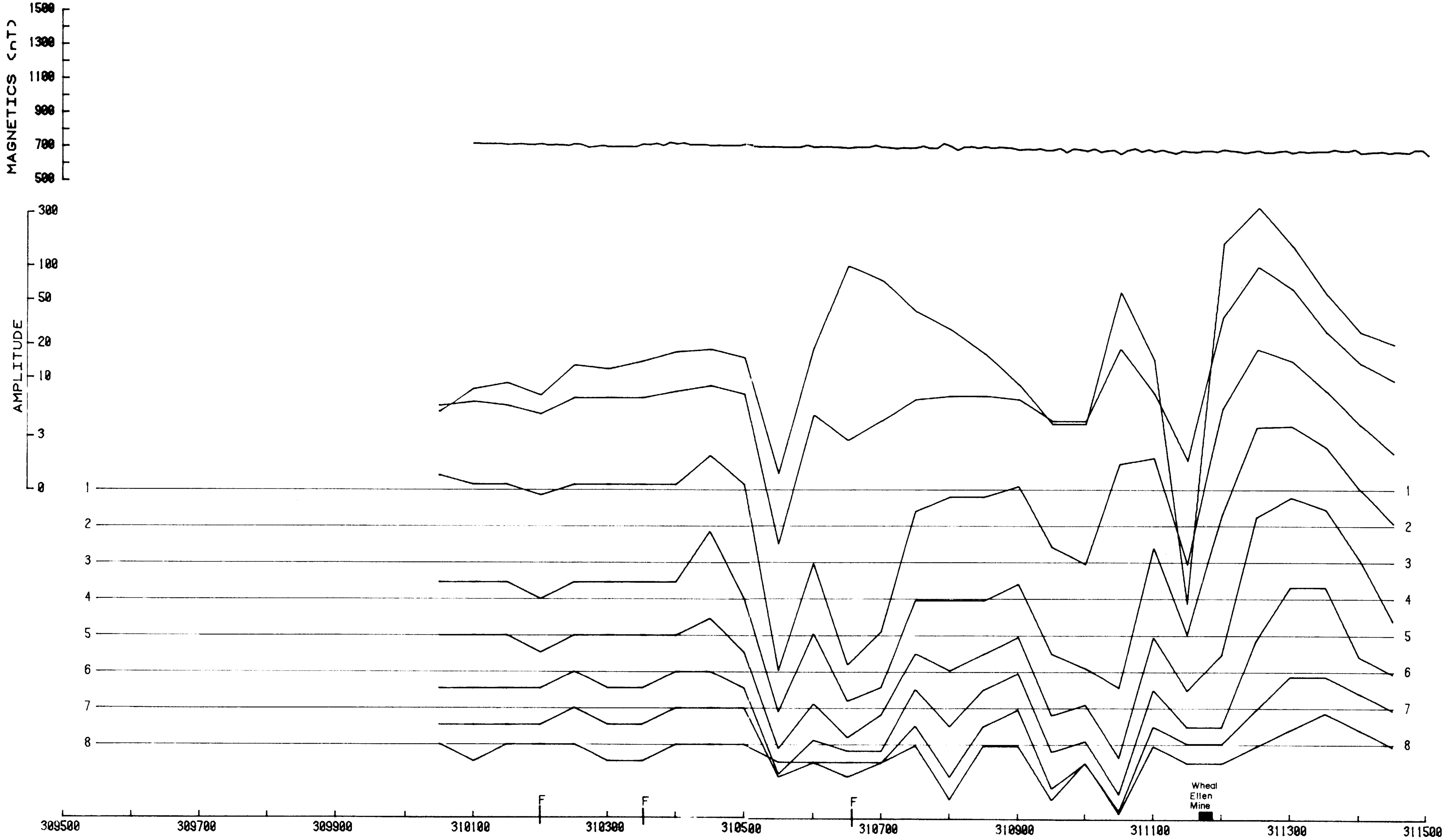
C. R. A. EXPLORATION PTY. LIMITED

BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

STRATHALBYN GRID : LINE 12 (6103550mN)

Ref	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No	SAa 997



Magnetometer : Scintrex MP-2
Quoted sensitivity : +/- 1 nT
Noise envelope : +/- 5 nT
Station spacing : 10 metres
Line orientation : 90 deg AMG
Survey date : 15/09/81
Vertical scale : 200 nT/cm

Transmitter loop : 100 x 100 metres
Receiver : In-loop
Field component : Vertical
Time base : 20 ms
Gain : 800
Survey date : Aug 1981
Receiver offset : 50 metres north

Horizontal scale : AMG metres East

F : Fence

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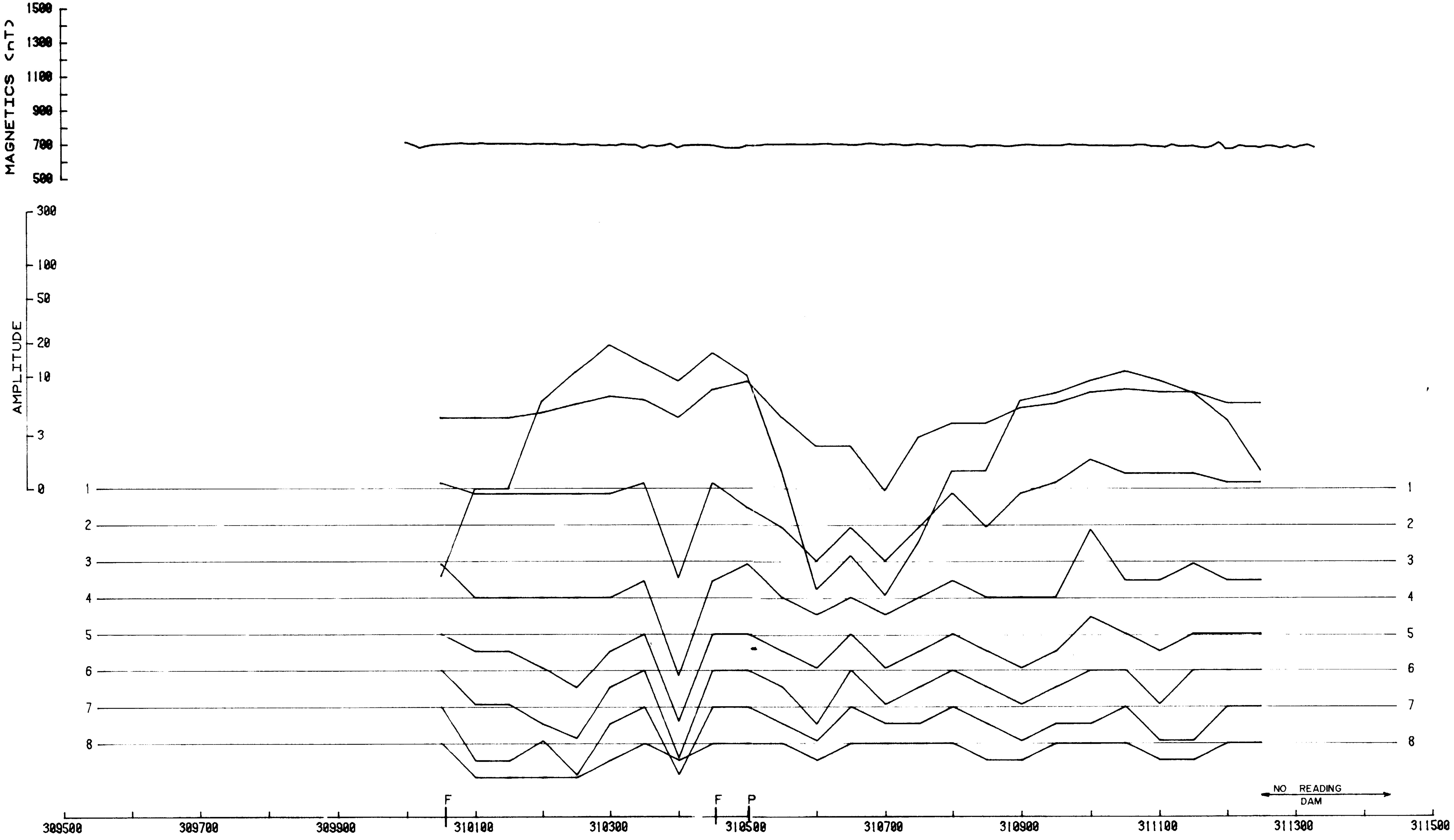
C. R. A. EXPLORATION PTY. LIMITED

BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

STRATHALBYN GRID : LINE 13 (6103950mN)

Ref. BARKER SI 54-13	
Scale 1:5000	Drawn
Author G.J.B.	Report No. 10149
Date SEP. 1981	Plan No. SAa 998



Magnetometer : Scintrex MP-2
Quoted sensitivity : +/- 1 nT
Noise envelope : +/- 5 nT
Station spacing : 10 metres
Line orientation : 90 deg AMG
Survey date : 15/09/81
Vertical scale : 200 nT/cm

Transmitter loop : 100 x 100 metres
Receiver : In-loop
Field component : Vertical
Time base : 20 ms
Gain : 800
Survey date : Aug 1981
Receiver offset : 50 metres north

Horizontal scale : AMG metres East

F : Fence

P : Power line

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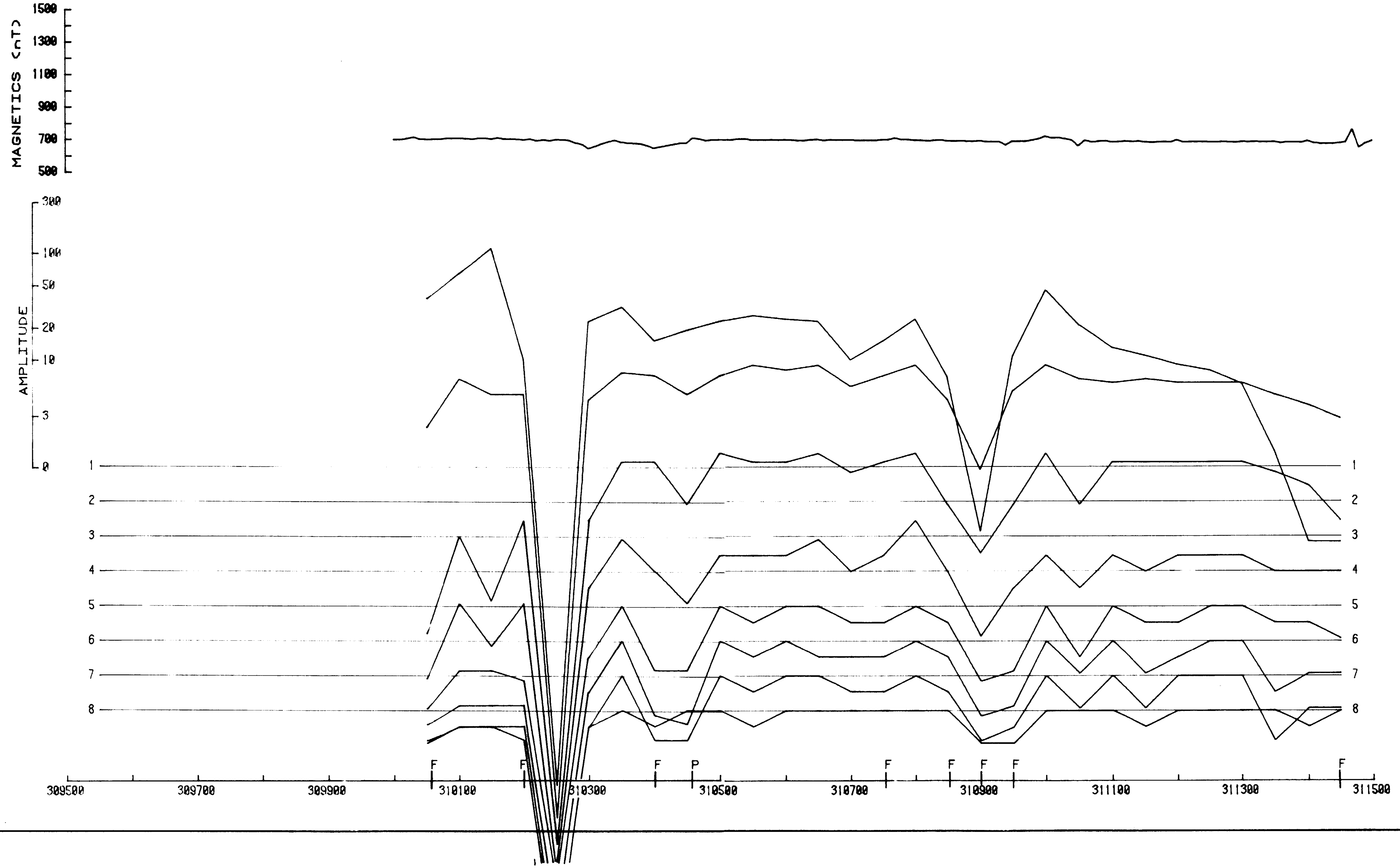
C. R. A. EXPLORATION PTY. LIMITED

BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

STRATHALBYN GRID : LINE 14 (6104250mN)

Ref	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 999



Magnetometer : Scintrex MP-2
Quoted sensitivity : +/- 1 nT
Noise envelope : +/- 5 nT
Station spacing : 10 metres
Line orientation : 90 deg AMG
Survey date : 16/09/81
Vertical scale : 200 nT/cm

Transmitter loop : 100 x 100 metres
Receiver : In-loop
Field component : Vertical
Time base : 20 ms
Gain : 800
Survey date : Aug 1981
Receiver offset : 50 metres north

Horizontal scale : AMG metres East

F : Fence
P : Power line

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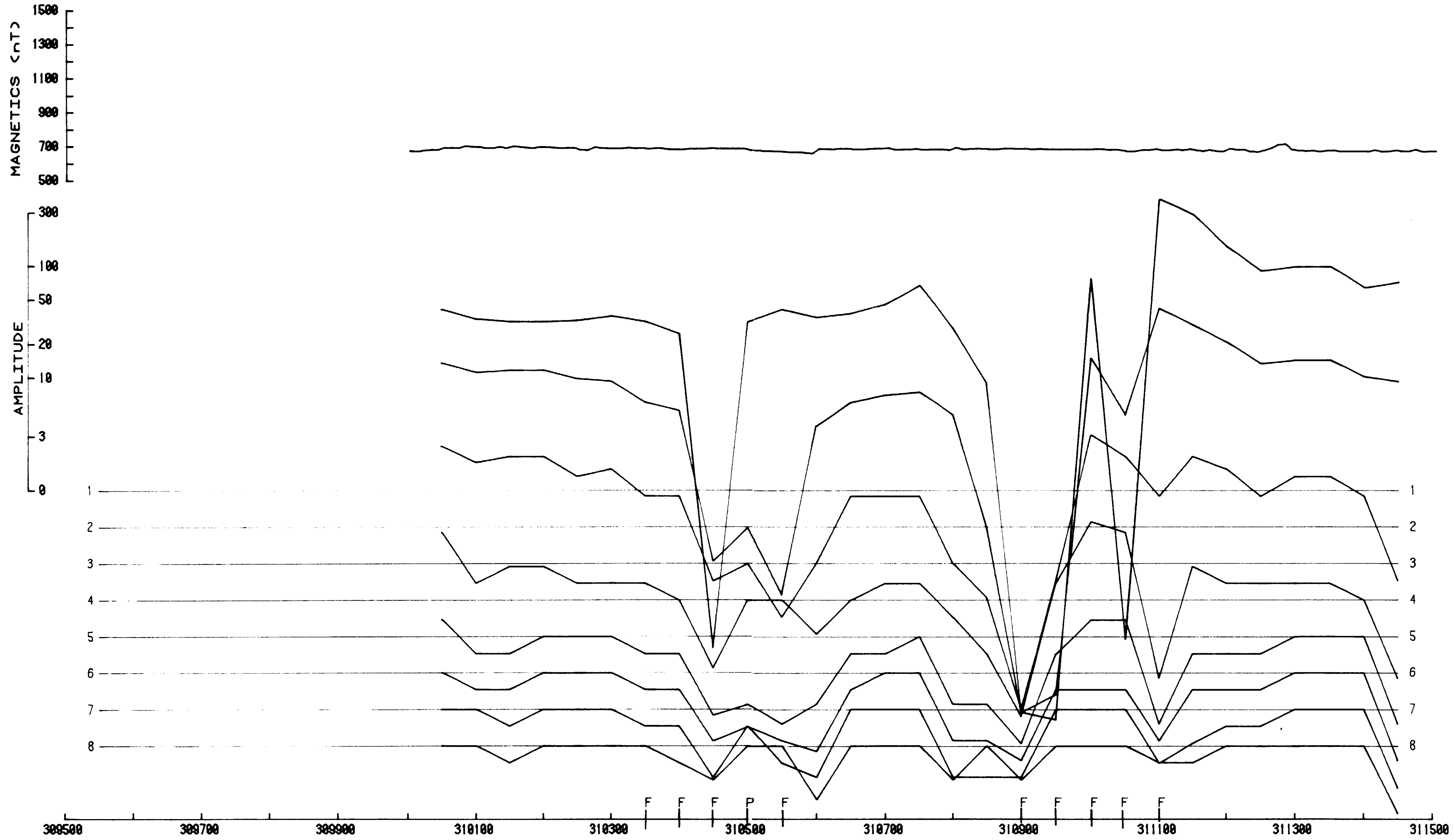
C. R. A. EXPLORATION PTY. LIMITED

BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

STRATHALBYN GRID : LINE 15 (6104600mN)

Ref.	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 1000



Magnetometer : Scintrex MP-2
Quoted sensitivity : +/- 1 nT
Noise envelope : +/- 5 nT
Station spacing : 10 metres
Line orientation : 90 deg AMG
Survey date : 16/09/81
Vertical scale : 200 nT/cm

Transmitter loop : 100 x 100 metres
Receiver : In-loop
Field component : Vertical
Time base : 20 ms
Gain : 800
Survey date : Aug 1981
Receiver offset : 50 metres north

Horizontal scale : AMG metres East

F : Fence
P : Power line

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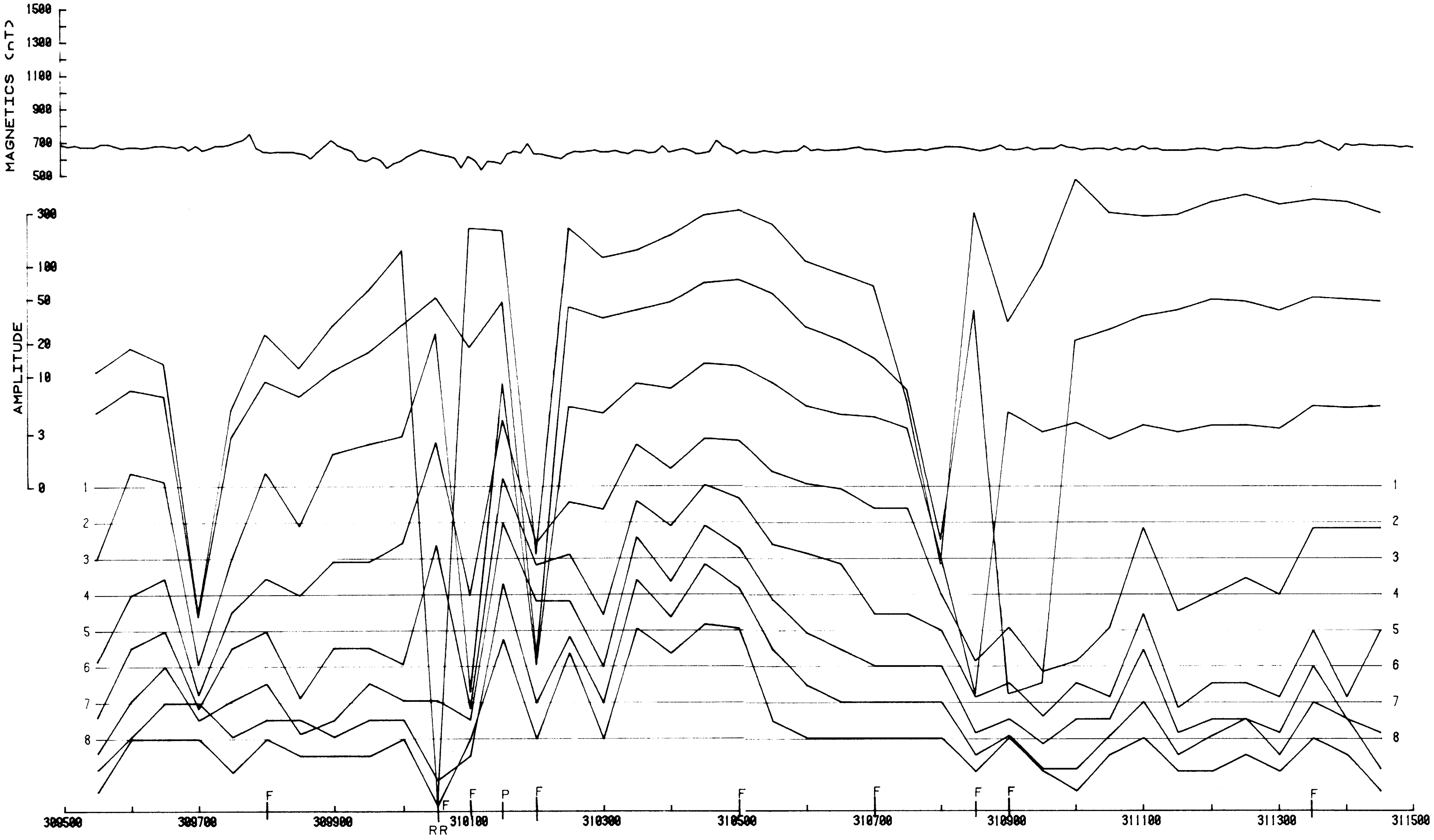
C. R. A. EXPLORATION PTY. LIMITED

BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

STRATHALBYN GRID : LINE 16 (6104950mN)

Ref.	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No.	10149
Date	SEP. 1981	Plan No.	SAa 1001



Magnetometer	:	Scintrex MP-2
Quoted sensitivity	:	+/- 1 nT
Noise envelope	:	+/- 5 nT
Station spacing	:	10 metres
Line orientation	:	90 deg AMG
Survey date	:	12;13/08/81
Vertical scale	:	200 nT/cm

Transmitter loop	:	100 x 100 metres
Receiver	:	In-loop
Field component	:	Vertical
Time base	:	20 ms
Gain	:	800
Survey date	:	Aug 1981
Receiver offset	:	50 metres north

Horizontal scale : AMG metres East

F : Fence
RR : Railway line
P : Power line

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C. R. A. EXPLORATION PTY. LIMITED

BULL CREEK E.L. 612

CRONE PULSE EM AND GROUND MAGNETIC PROFILES

STRATHALBYN GRID : LINE 01 (6100150mN)

Ref	BARKER SI 54-13		
Scale	1:5000	Drawn	
Author	G.J.B.	Report No	10149
Date	SEP. 1981	Plan No.	SAa 1016

000109

CRA EXPLORATION PTY. LIMITED

EIGHTH QUARTERLY REPORT FOR

BULL CREEK E.L. 612, SOUTH AUSTRALIA

FOR THE PERIOD ENDING 20TH MARCH, 1982.

AUTHOR: G.J. BUBNER

COPIES TO: CRAE LIBRARY
S.A.D.M.E.

DATE: 16TH APRIL, 1982

SUBMITTED BY:

ACCEPTED BY:

CONTENTS

1. SUMMARY AND CONCLUSIONS

Further geophysical surveys comprising UTEM, Mise-a-la-masse and self-potential at the Woodchester Prospect indicate the target conductive body has been adequately tested by drilling, and no further drilling is warranted.

Logging of the three percussion holes drilled in November, 1981 was completed using a hard-rock suite of probes.

Follow up of three anomalies selected from the 1979 aeromagnetic survey data by consultant Keith Jones has been deferred pending landowner acquiescence and access considerations.

Three second-order drainage anomalies remain to be followed up.

2. INTRODUCTION

Bull Creek E.L. 612 was granted to CRA Exploration Pty. Limited for one year from 21st March, 1980 with a twelve month renewal to 20th March, 1982. An application for renewal of the E.L., excluding an area surrounding the Mount Monster Mine, has been lodged (Plan No. SAa 1328).

This report describes work carried out in the three months ending 20th March, 1982.

3. RECOMMENDATIONS

- In view of the poor assay results from 81WCP1 and 81WCP2, combined with subsequent geophysical surveys, the Woodchester Prospect has been down-graded and no encouragement exists for further exploration.

- In respect of disappointing results from geophysical surveys carried out in 1981 the Reservoir Prospect drilled in November, 1981 has been down-graded and no further work can be justified.

- The grid at the Woodchester Prospect should be maintained as the geophysical parameters of the mineralisation and ease of access provide an excellent test site for geophysical techniques.

- Possible logistics problems in gaining access to aeromagnetic anomaly "J" selected by consultant Keith Jones be considered before commencing follow up.

- Ground magnetometer traverses be completed over the Woodchester grid to complement the data acquired from the previous exploration and test surveys.

- Soil sampling and ground magnetometer traverses be carried out over three second-order drainage geochemical anomalies outstanding from the 1981 sampling programme.

4. WORK CARRIED OUT

4.1 Woodchester Prospect

4.1.1 UTEM Survey

A test survey employing the UTEM time domain E.M. system was carried out on the Woodchester grid by Lamontague Geophysics over the period 17th - 23rd January, 1982. The transmitter loop configuration and receiver survey lines are plotted on Plan No. SAa 1074. A preliminary interpretation of the data was prepared by G. Staltari of G.E.C. Pty. Limited, followed by a formal interpretation by Yves Lamontague. These two reports and the field data comprise Appendix I.

4.1.2 Mise-A-La-Masse Survey

A Mise-a-la-masse survey was carried out by CRA Exploration Pty. Limited on the Woodchester grid from lines 3 to 9 over the period 24th - 26th February, 1982. The downhole current electrode was implanted in 81WCP2 at a depth of 158 metres in a conductive zone of (apparent) width twelve metres. Remote current and potential electrodes were emplaced as shown in Plan No. SAa 1435. A 2A DC current was transmitted by a McPhar P660 transmitter, and the voltage during transmission of normal and reverse polarity current was observed using a commercial 0-0.5V full-scale multimeter.

The results are plotted as mV/A in Plan No. SAa 1435, and as contours in Plan No. SAa 1436. These results are consistent with information from drillhole data and previous geophysical surveys viz. a conductive horizon striking approximately 10° AMG and dipping steeply west.

The raw field data is included in Appendix II.

4.1.3 Self-Potential Survey

A self-potential survey was conducted by CRA Exploration Pty. Limited concurrent with the mise-a-la-masse survey. Measurements of natural potentials were recorded during transmitter-off periods on a commercial multimeter with a 20K ohm input impedence.

Results are plotted as mV and contours in Plan Nos. SAa 1433 and SAa 1434 respectively. Results are consistent with drillhole information and interpretation of other geophysical surveys in that an elongate anomaly of amplitude up to -70 mV occurs over a strike length of 400 metres. The results of this survey would indicate that the mineralisation producing the anomaly has been adequately tested by drillholes 81WCP1 and 81WCP2.

The raw field data is included in Appendix II.

4.1.4 Mineralogy

Six rock chip samples from 81WCP1 and 81WCP2 were submitted for petrographic and mineragraphic analysis to determine the nature of the magnetic/conductive minerals producing the observed magnetic/electrical/E.M. anomalies. The examinations revealed the dominant sulphide mineral to be pyrrhotite, with lesser amounts of pyrite. Magnetite is absent.

The intervals from which the samples were collected are shown in Table I, and the full service report is included in Appendix III.

4.1.5 Geochemistry

Two rock chip samples were collected from a small pit situated at 800 mE on line 9 of the Woodchester grid, and assayed for copper, lead, zinc and iron. No significant assays resulted, the highest being 280 p.p.m. lead. The analytical report is included in Appendix III.

4.2 Downhole Logging

Geophysical logging of 81WCP1, 81WCP2 and 81RVP1 was carried out by Geoex Pty. Limited during December, 1981. Logs of natural gamma, neutron, long-spaced density, caliper, magnetic susceptibility and E.M. conductivity were obtained in all three holes, and in addition resistance, self-potential and I.P. chargeability and resistivity using a Wenner array were recorded in 81WCP2. The logs, accompanied by plots of lead, zinc and copper assays, are shown in Plan Nos. SAa 1470, SAa 1471 and SAa 1472.

TABLE I Source of Rock Chip Samples Submitted for Petrography and Mineragraphy.

Sample Number	Drillhole	Depth (m)
835833	81WCP1	96
835834	81WCP1	115
835835	81WCP1	135
835836	81WCP2	122
835837	81WCP2	140
835838	81WCP2	158

5. GEOPHYSICAL CONSULTANT

A report entitled "A Review Of Aeromagnetic Data In The Kanmantoo Trough And Along The Western Margins Of The Murray Basin" was completed by consultant K. Jones. In this report a number of aeromagnetic anomalies have been selected for further investigation, of which three, designated "F", "G" and "J", fall within the Bull Creek E.L. (Plan No. SAa 1469). These anomalies are briefly discussed below:-

Anomaly "F": this linear anomaly was investigated in 1981 through detailed geological mapping, ground magnetics and P.E.M. traverses. (Sixth Quarterly Report on Bull Creek E.L. 612). In view of the disappointing results from the geophysical surveys and drillhole 81RVP1 no further work is warranted on this anomaly.

Anomaly "G": the Strathalbyn Mine occurs at the northern extremity of this anomaly. The ground over this anomaly comprises sub-divided lots, built-up areas and a lowlands area known as "The Swamp", the latter currently undergoing major earthworks development. In consequence no effective exploration can be carried out on this anomaly.

Anomaly "J": no work is planned for this anomaly in the immediate future pending landowner acquiescence and results of follow up work on anomalies in adjacent E.L.'s.

G.J. BUBNER

GJB/pw

REFERENCES

Bull Creek E.L. 612 CRAE Reports 10149

Author	Date	Title
Wills, K.J.A.	18.07.80	First Quarterly Report for the Period Ending 20th June, 1980.
Wills, K.J.A.	03.11.80	Second Quarterly Report for the Period Ending 20th September, 1980.
Wills, K.J.A. & Cook, I.A.	11.02.81	Third Quarterly Report for the Period Ending 20th December, 1980.
Wills, K.J.A.	02.04.81	Fourth Quarterly Report for the Period Ending 20th March, 1981.
Venables, A.J. & Bubner, G.J.	14.07.81	Fifth Quarterly Report for the Period Ending 20th June, 1981.
Venables, A.J. & Bubner, G.J.	21.10.81	Sixth Quarterly Report for the Period Ending 20th September, 1981.
Venables, A.J.	13.01.82	Seventh Quarterly Report for the Period Ending 20th December, 1981.
Jones, K.	Jan., 82	A Review Of Aeromagnetic Data In The Kanmantoo Trough And Along The Western Margins Of The Murray Basin. (unpubl. CRAE Report 11368).

LOCATION

Barker SI 54-13 1:250 000 sheet

KEYWORDS

Copper, lead, zinc, mineragraphy, petrography, assays-geochem, Kanmantoo Trough, geophys-borehole, geophys-E.M., geophys-mag., geophys-other.

LIST OF ATTACHMENTS

Plan No.	Title	Scale
SAa 1074	Woodchester Grid - UTEM layout	1: 5 000

Plan No.	Title	Scale
SAa 1328	Bull Creek E.L. 612 - Modified area for re-application.	1:250 000
SAa 1433	Self potential survey - Woodchester grid.	1: 5 000
SAa 1434	Self potential contour - Woodchester grid.	1: 5 000
SAa 1435	Mise-a-la-masse: 81WCP2 Woodchester grid.	1: 5 000
SAa 1436	Mise-a-la-masse: 81WCP2 Woodchester grid.	1: 5 000
SAa 1469	Aeromagnetic contours showing location of anomalies "F", "G" and "J".	1: 50 000
SAa 1470	Geophysical logs and assay results: 81WCP1.	1: 400
SAa 1471	Geophysical logs and assay results: 81WCP2.	1: 400
SAa 1472	Geophysical logs and assay results: 81RVP1.	1: 400

LIST OF APPENDICES

APPENDIX I

PRELIMINARY INTERPRETATION REPORT ON WOODCHESTER UTEM SURVEY

REPORT ON A UTEM SURVEY AT THE WOODCHESTER PROSPECT, SOUTH AUSTRALIA FOR CRA EXPLORATION PTY. LIMITED

BY LAMONTAGUE GEOPHYSICS LIMITED, MARCH, 1982.

GEOPHYSICAL EXPLORATION CONSULTANTS PTY. LTD.
521 Burke Road, Camberwell, Victoria, 3124. Telephone (03) 20 1406

8th February, 1982.

The Chief Geophysicist,
C.R.A. Exploration,
31 Osmond Tce.,
Norwood, South Australia, 5067

Attention: Mr R.J. Smith

Dear Bob,

Woodchester Utem Survey

Please find enclosed extra copies of field profiles for the recent Woodchester survey together with an itemized invoice. The final invoice to which the latter refers will be the charge for Yves Lamontagne's report - about 1 day's interpretation work.

I had hoped to obtain some of Lamontagne's interpretation aids but these have not been forthcoming from Toronto. I will therefore base my comments on a qualitative assessment of the data with some semi-quantitative estimates.

The main conductive unit extends across all the grid lines covered by the survey increasing in conductivity-thickness towards the north. The subdued early-time responses on lines 300N and 400N, appear to be caused by overburden/oxidation-zone blanking; that is, the early time "imaging" of the primary field at the inductive limit. From line 500N northward, the effect of the main conductor is enhanced at early times, reflecting a decrease in conductance of overburden/oxidation. Quantitative estimates of the latter will probably yield estimates up to several mhos - Lamontagne's report should elaborate on this.

In addition to the blanking effect mentioned above, the main conductive unit has a strong current gathering effect as evidenced by the sharp change in general background response across the unit. All lines surveyed show this effect - it can be thought of as the attenuation of half space and oxidation zone currents as they move outwards from the primary source.

.../2

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The important features of the main conductive unit can be seen on profile 600N. Both H_z' and H_x' measurements indicate that it dips in a westerly direction - this is indicated by the migration of the H_z' crossover, with time, towards the west. On this line, the unit occurs around 875E at a depth of less than fifty metres from the surface. The early time anomaly shape suggests that it possibly extends to less than 20 metres from the surface - this is particularly the case on lines 700N, 800N and 900N where the early time response, though subdued by blanking, shows peak-to-trough cross-over distances of 50 metres.

Conductance estimates along the main unit vary from around 15 to 30 mhos. On line 300N, it is estimated at 18 mhos whereas on line 600N, it is estimated at 28 mhos. These estimates are subject to error imposed by the estimate of inductive limit response - they may vary by about ± 30%, being very much dependent on the judgement of the interpreter. Lamontagne is likely to provide more soundly-based estimates.

The second main feature in the data is a weakly conductive unit relatively close to the transmitter loop position. There is evidence in the H_z' and H_x' data on line 600N that this comprises at least two very thin units, at around 1040E and 1090E well within several tens of metres from the surface. The more prominent of the two features is the western one - although the time-constant of the decay is significantly shorter than that of the main unit - and its conductance is estimated to occur within the range 1 to 3 mhos.

A weak conductivity inhomogeneity is apparent on the northern lines around 650E. Its effect on 600N, for example, is seen on the H_x' and H_z' data at around 665E. Given that the response is seen at very early time within the blanking zone, it is possible that the response has a significant component of current gathering.

In summary, several linear conductive zones have been detected - these relate to metasedimentary units trending in a general N-S direction. The main one strengthens from 600N northwards and its effect gives rise to estimates of depth ranging from 20 to 50 metres, a westerly dip estimate, and conductances of between

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15 and 30 mhos. It should be noted that the alternative interpretation to a westerly dip is that of a shallow conductive lens at around 875E neighboured by a deeper unit on its western side, both dipping easterly - the responses on line 600N are also consistent with this picture.

The second conductive zone occurs about 175 metres east of the main one. It is very shallow (less than 25 metres) and probably comprises at least two units. The main unit has an estimated conductance of between 1 and 3 mhos. Dip appears steep but its direction is difficult to assess without more closely spaced data. A weak conductive zone appears to the west of the main unit but this may be enhanced by current gathering.

The above comments should provide some food for thought while you await Lamontagne's report. Also, several decay curve examples are attached for your perusal.

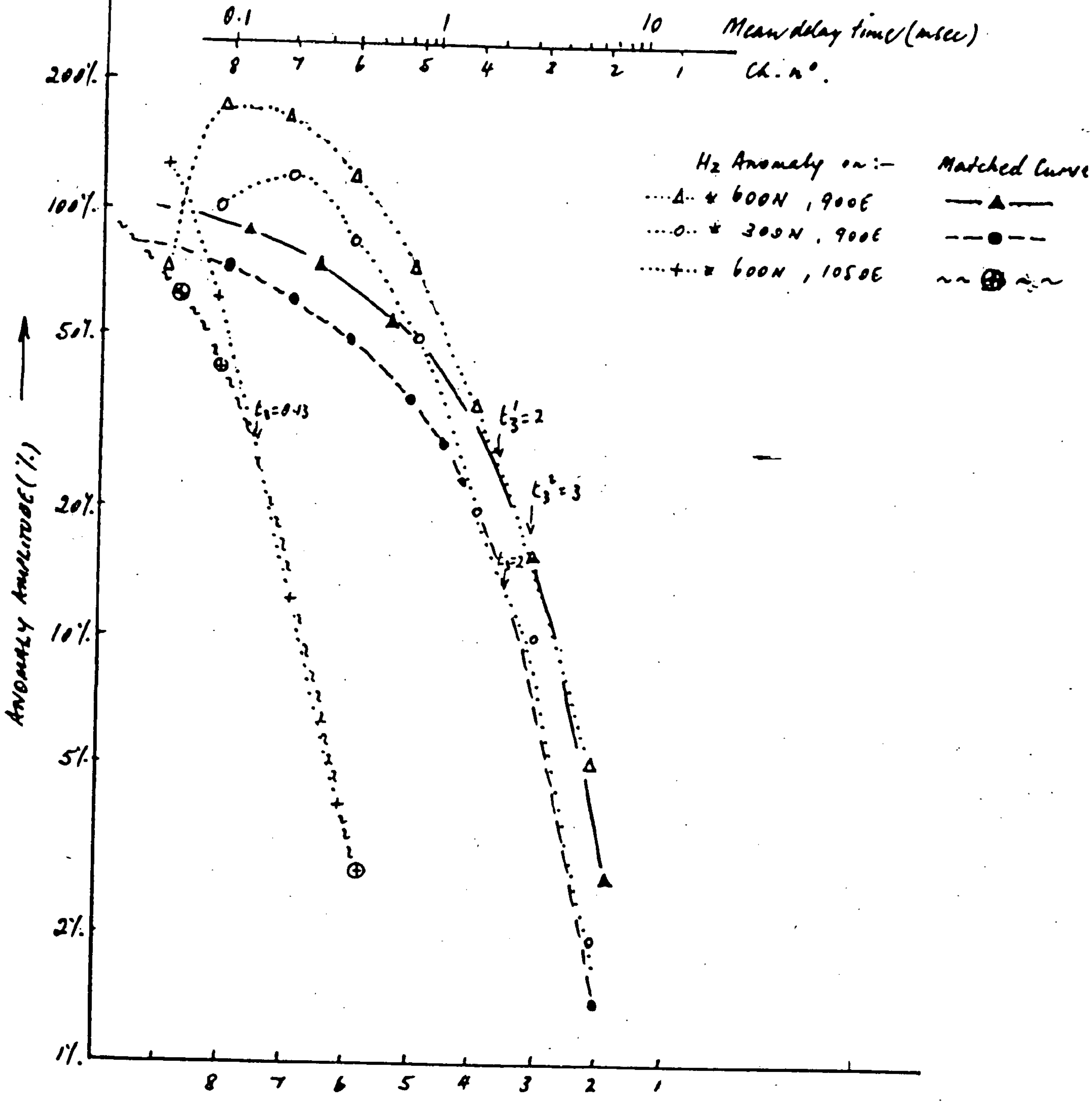
One final point - none of the channel 1 responses show significant I.P. or magnetic effects, suggesting that these are extremely small in comparison to the inductive and gathering effects.

Kind regards,

Guido

Guido Staltari
Consultant Geophysicist

Enclosed: Utem data profiles
Decay curve examples



DELAY CURVES for peak-peak Utem anomalies

WOODCHESTER, S.A.

G. STALTARI ; FEB, 1982

000122

REPORT ON A UTEM SURVEY

AT THE

WOODCHESTER PROSPECT, SOUTH AUSTRALIA

FOR

CRA EXPLORATION (PTY) LTD.

BY

LAMONTAGNE GEOPHYSICS LIMITED

MARCH, 1982

J.C. MACNAE

F. GLASS

TABLE OF CONTENTS

INTRODUCTION

During the later part of January, 1982, a UTEM survey was performed by Lamontagne Geophysics of Toronto, Canada on the Woodchester prospect, held by CRA Exploration Pty. Limited of Adelaide, Australia. The prospect is located about 45 km S.E. of Adelaide and is situated just north of the village of Woodchester, South Australia. An electromagnetic conductor had been previously delineated on this property and two surface drills of the percussion type had proved the presence of the barren sulphides as the cause for the principal conductor.

The purpose of the survey was to present to the CRA staff the field operation of the UTEM system and, secondly, to compare the field data and interpretation capabilities of the system with the known geological and geophysical results so far accumulated from surveys previously completed on the property. G. Bubner, geophysicist for CRA, was in charge of the project.

FIELD SURVEY

The UTEM field surveys on the Woodchester prospect were carried out between January 17th and January 23rd, 1982, by F. Glass of Lamontagne Geophysics and, for the first half of the survey period, G. Staltari of Geophysical Exploration Consultants of Melbourne. The crew was based in Adelaide and drove to the property each day, less than an hour's drive in time each day.

The property straddled several farmer's plots and was traversed by two secondary roads. It was situated within open

open farmlands which permitted excellent access to any part of the survey area. Unfortunately, the open fields provided no protection from the sun or the wind, which was quite gusty at times.

During the particular week that the survey was in progress, the general area around Adelaide experienced unseasonally hot weather during which time a total fire ban was in effect in the Woodchester area. Ambient temperatures in the shade varied between 40°C to 45°C or more. During one of the days, recorded temperatures within the receiver's inner and outer consoles reached at 53°C and 58°C respectively during the hottest time of day. The outer windings of the receiver coil broke at the end of the first day of surveying as a result of overheating. For the remainder of the survey period, a reflective white paper cover was used on both the receiver and the coil in an attempt to reduce the internal heating problems.

The survey loop used on this survey was 0.8km square and traversed open fields in which sheep were present. The wire loop was frequently pulled out of place on the back corners and was broken by the sheep on several occasions. The front edge of the loop was frequently pulled off line but this was repositioned at the beginning of each day.

Although the motor-generator and its fuel line were protected from direct sun-light, more adequate protection should have been used to cover the entire area around the motor-generator in an attempt to keep it cooler.

Because of the open farm fields, there was no protection from the wind which was sometimes very gusty. For all the Hz measurements, the tripod support for the coil was positioned such that the base of the coil rested directly on the ground or on a stable support. This was very important as had the coil not been supported in this manner, the data would most likely have been considerably noisier due to microphonic noise.

A double electric power line traversed the north-west section of the Woodchester property and because of this, longer than normal averaging times of 2K duration were used for all readings.

The receiver was synchronized with the transmitter and calibrated with the received signal ("loop test") at the beginning and end of each survey day. The quartz crystals were virtually drift free and the calibration tests indicated very similar readings on all channels (absolute measurements) except on channels 9 and 10 as expected. The calibration tests completed at the end of the day showed almost identical results to those obtained at the beginning of the day and it sometimes seemed that these calibration tests were redundant. The very high quality of the calibration tests gave tremendous satisfaction that offset the rather hot and monotonous conditions experienced during the survey. The equipment used on the Woodchester survey consisted of the UTEM Mk III model. The Mk III unit employed had been modified in Toronto just prior to shipment to Australia in late 1981. The modifications included improving the signal-to-noise ratios by a factor of 3,5 to 1 in the presence of normal spheric noise and of improving the transmitter characteristics. The transmitter power was increased two-fold and its internal power dissipation had been reduced to cope better with hot conditions.

The UTEM system is a wide band, time domain electromagnetic system having a step-function response. This UTEM method is described in Appendix 2 attached to this report.

LAYOUT AND SURVEY DESIGN

The Co-ordinates of the survey loop and the grid lines surveyed are presented in Table I. The lines were all chained up and well marked with a station interval of 25m. Survey readings were taken every 25m and a base frequency of 26,204 Hz was used throughout. As requested by CRA, all three magnetic components were measured on line 600N.

DATA PRESENTATION

The profiles of the survey field results are presented in Appendix 1. The presentation of these profiles is standard according to UTEM practise which is explained in Appendix 2, section 4.

The standard data plots have three axes, the bottom axis is used for channel 1 only, the centre axis is used for channels 2 to 5 and the top axis for channels 5 to 9. All the channels 2 to 9 are normalized with respect to channel 1 thus correcting the first order for geometric (chaining) errors and static magnetic anomalies. Channel 1 is itself plotted as an absolute secondary field according to the relation (ch 1 - H^P)/H^P

It should be repeated here, as it is in the appendix, that channel 1 is the latest in time and channel 9 is the earliest in time to measure the received waveform after its reversal of polarity. Poor quality conductors having short time decay constants are evident on the early channels (say channels 9 to 7) but good quality conductors of reasonable dimensions relative to the loop size should be evident on the later time channels (channels 5 to 2).

A legend for the data plots as used in this respect is presented in Figure 1 of Appendix 1, and is followed by a legend for the compilation map.

INTERPRETATION

In interpretation of EM survey data, the first step is usually to interpret the regional response due to conductive overburden or weathered layers. The UTEM survey data over the Woodchester prospect show some response that can be attributed to a conductive weathered, near surface material. The effect of the surface conductivity shows up at the earliest delay times (channels 9, 8) in a migrating crossover point and in channel amplitudes close to -200% far from the transmitter loop.

Interpretation of layered earth conductives is a standard procedure when the response is purely due to layering. In this case here, a number of local steeply dipping conductive features makes quantitative interpretation of layer conductivity independent of thickness impossible. However, an estimate of the total layer conductivity thickness product is 0.5 Siemens with an upper limit of 1.0 Siemens. The surface conductance is higher towards the south end of the grid.

Two main steeply dipping conductive zones were detected in the UTEM data. The most conductive zone is called Zone A and its location is plotted on the compilation map. Distinct, large amplitude anomalies occur on all lines surveyed. Interpretation of the geometrical shape of the anomalies indicates that the depth to top of the conductor is in the range of 75m to 100m, with its shallowest part on the central lines of the grid. Depth estimates based on amplitude information are slightly less than geometrically estimated depths and fall in the range of 50 to 60m. This indicates that the body must have a large depth extent, and provides some evidence that current gathering may be taking place. Alternatively, the conductor could be thick and lie at a shallower depth than the geometrical depth estimate.

A scale model study of the case of a vertical dyke under conductive overburden is shown in figure 9.1 of Appendix 2, and figure 9.2 shows the plotted decay of the peak to peak response for the cases of the dyke in contact and not in contact with the overburden. Figure 1 of the data shows the actual decay curve on line 5 of the Woodchester grid, and it can be seen that by fitting an infinite dyke decay to the late time part of the response, that a significant enhancement has occured at intermediate times (channels 8 to 5), which by comparison with figure 9.2 of Appendix 2 confirms the fact that current gathering is indeed forming a large part of the response at intermediate times. At the earliest delay time (channel 9) the field has not had time to penetrate the conductive surface layer, and the "overburden blanking" effect is starting to show. That the extra current above the directly induced response is being collected from the surface layer rather than a poorer conductive "halo" zone surrounding the main Zone A conductor is almost certain, as the enhancement of the peak-to-peak response is largest at those delay times where the maximum current in the overburden "smoke ring" passes the local dyke conductor. Figure A14 of Appendix 1 shows the response of a 2 Siemen overburden. Due to the time scaling properties of the UTEM response, this type curve can also be used to closely predict the response of a 0.5 S surface layer by simply changing the channel numbers on the decay plot as shown on the figure. Maximum local current concentration occurs approximately when the response crosses over - and for a 0.5 Siemen surface layer, this would occur at a time around Channel 8 to Channel 7 for the Woodchester Zone A conductor.

The zone itself is interpreted to have a conductance of 7 to 8 Siemens, and to be in contact with the surface conductivity, indicating a minimum thickness for the conductive surface layer. Assuming that the depth to top is about 75 metres, and that the conductance of the surface layer is 0.5 Siemens, then the resistivity of the surface material must be greater than 75/0.5 = 150 ohm - metres. Of course, this estimate has made the assumptions that the cause of the regional response is a weathered layer which is conductive from the surface down.

A line by line summary of the Zone A conductor is included in Table 2. On line 6N, horizontal components of the magnetic field were also measured. The anomaly in the Hx (along line) component is typical of that over a steeply dipping feature (see Figure 7.2 of Appendix 2). The regional response is again evident far from the loop as a positive anomaly in the Hx component. Using the two horizontal components of the magnetic field, it is possible to estimate the "strike" direction of a conductor under the assumption that the secondary current flow is linear. In this case, the estimated strike direction from the + x direction is given by strike = arctan (Hx/Hy). In this case for Zone A, an estimation at about station 850C would give +74 degrees or a N16°W - S16°E strike direction. This is extremely close agreement with the actual strike as estimated on a line to line basis. In this case, this estimate is of little practical advantage, however when multiple conductors or curving conductors are present it can be of assistance in the interpretation of conductor geometry.

The dip of the zone is best estimated on point normalized data (absolute secondary field rather than continuously normalized to local primary field) and on Figure A6 of Appendix 1, it would seem that the Zone A anomaly has slightly larger positive than negative shoulders, indicating a steep dip towards the east. Due to the enhancement at intermediate times by current gathering, and the presence of the surface layer response, no quantitative estimate can be made with confidence, however the dip is very likely to be steeper than 60°.

The nature of the response indicates that on some lines, notably 700E, 800E and 900E that the inflection points are sharper than expected for a conductor at a depth of 100m. This may indicate that the conductor at depth is not thin, but may have a thickness of as much as 20m to 30m. If this is the case, then its actual depth to top will be somewhat shallower than that shown on the compilation map or in Table 2.

A second zone of much poorer conductivity occurs close to the transmitter loop, and is labelled Zone B on the compilation map. The zone appears to have multiple conductive sources on some lines, and single conductor sources on others as shown. The zone comes close to surface on all lines, and has an interpreted conductance of less than 1 Siemen. Current gathering is quite likely contributing a great deal to the response. Where the zone appears multiple, the easternmost part of the anomaly appears to be smaller in amplitude than the western part, indicating reduced size of conductor or alternatively discontinuous conductivity. In any event, the low conductance of this zone indicates that it is not necessarily of sulphide origin and may instead reflect a geologically interesting feature such as a contact or shear zone.

CONCLUSIONS

The Woodchester prospect UTEM survey was successful in clearly detecting and delineating a moderate conductor at an interpreted depth to top of about 75m. The surface conductivity was interpreted to be low, however, the presence of current gathering effects visible as an enhancement in anomaly amplitude indicates that the surface layer must be at least fairly uniformly conductive to some depth. A second, poorly conductive near-surface zone was detected east of the main conductor.

TABLE 1 Survey Parameters

LOOP CO-ORDINATES	LINES SURVEYED	COMPONENT (26,204 Hz)	PRODUCTION (km)
1) 1200E 200N	L-300N	Hz	0,675
2) 2000E 200N	400N	Hz	0,675
3) 2000E 1000N	500N	Hz	0,675
4) 1200E 1000N	600N	Hz,Hx,Hy	0,675
	700N	Hz	0,675
	800N	Hz	0,675
	900N	Hz	0,675
			4,725

TABLE 2 ZONE A PARAMETERS

LINE 300N

Conductor at 900E. Depth to top less than 100M. Channel 8 shows some screening and Channel 9 is almost totally blanked. Evidence that conductor is thick based on other lines indicate actual depth to top may be only 70M or 80M.

LINE 400N

Conductor at 880E, depth to top less than 100M. Example of good crossover migration on this line. Crossovers on Channels 9, 8, 7, 6, 5 move outwards from loop, and then come back to where Channels 4, 3 and 2 have coincident channels. This behaviour is typical of conductors at some depth below a conductive layer.

LINE 500N

Conductor at 860E, depth to top less than 85M.

LINE 600N

Conductor at 840E, dept to top less than 75M. Overburden conductance about that seen on Line 300N.

LINE 700N

Conductor at 815E, depth to top interpreted to be less than 90M. Conductor steeply dipping

LINE 800N

Conductor at 760E, depth less than 100M. Change is relative amplitude of positive and negative shoulders relative to line 700N indicates shallow dip to E on this line. Zone seems to change direction between lines 700N and 800N, however large amplitudes indicate that zone is continuous and not disconnected.

TABLE 2 (CONTINUED)

LINE 900N

Conductor at 730E, depth to top 100M maximum. Somewhat sharper nature of anomaly may indicate that the zone has actually some width and be at a shallower depth than interpreted.

APPENDIX 1 DATA SECTIONS

LEGEND FOR UTEM PLOTS

Symbol	Channel number	Mean Delay Time (milliseconds) f=30Hz	f=26Hz	f=15Hz	f=13Hz
◇	10	0.025	0.029	0.05	0.058
△	9	0.05	0.058	0.1	0.115
⧗	8	0.1	0.115	0.2	0.231
⌝	7	0.2	0.231	0.4	0.462
∆	6	0.4	0.462	0.8	0.923
Σ	5	0.8	0.923	1.6	1.85
□	4	1.6	1.85	3.2	3.69
\	3	3.2	3.69	6.4	7.38
/	2	6.4	7.38	12.8	14.77
|	1	12.8	14.77	25.6	29.54

All channels are plotted as:

$$\frac{\text{Channel - reference}}{\text{base}} \times 100\%$$

For total field normalization: reference = 0

secondary : reference = primary component or Channel 1.

If Ch 1 symbol appears on plot then:

reference = primary for Chan 1
reference = Chan 1 for all other channels.

If no Ch 1 symbol is present then:

reference = primary component for all channels.

Normally base = primary field (total) at reading station.

If symbol ***> appears then base = primary field at reference station marked with symbol.

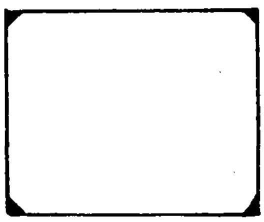
LEGEND FOR UTEM COMPILATION MAPS

Axis of a crossover type anomaly. The number a indicates the estimated geometrical depth to top of the source. Text must always be consulted for discussion of validity of estimate

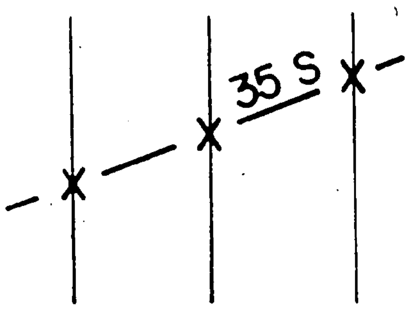
Axis of reversed crossover - can be produced when a small conductor dips towards the transmitter. The number b indicates latest anomalous time channel.

Indicates a negative anomaly of width shown by the dash. Can sometimes be confused with negative lobe of a crossover anomaly.

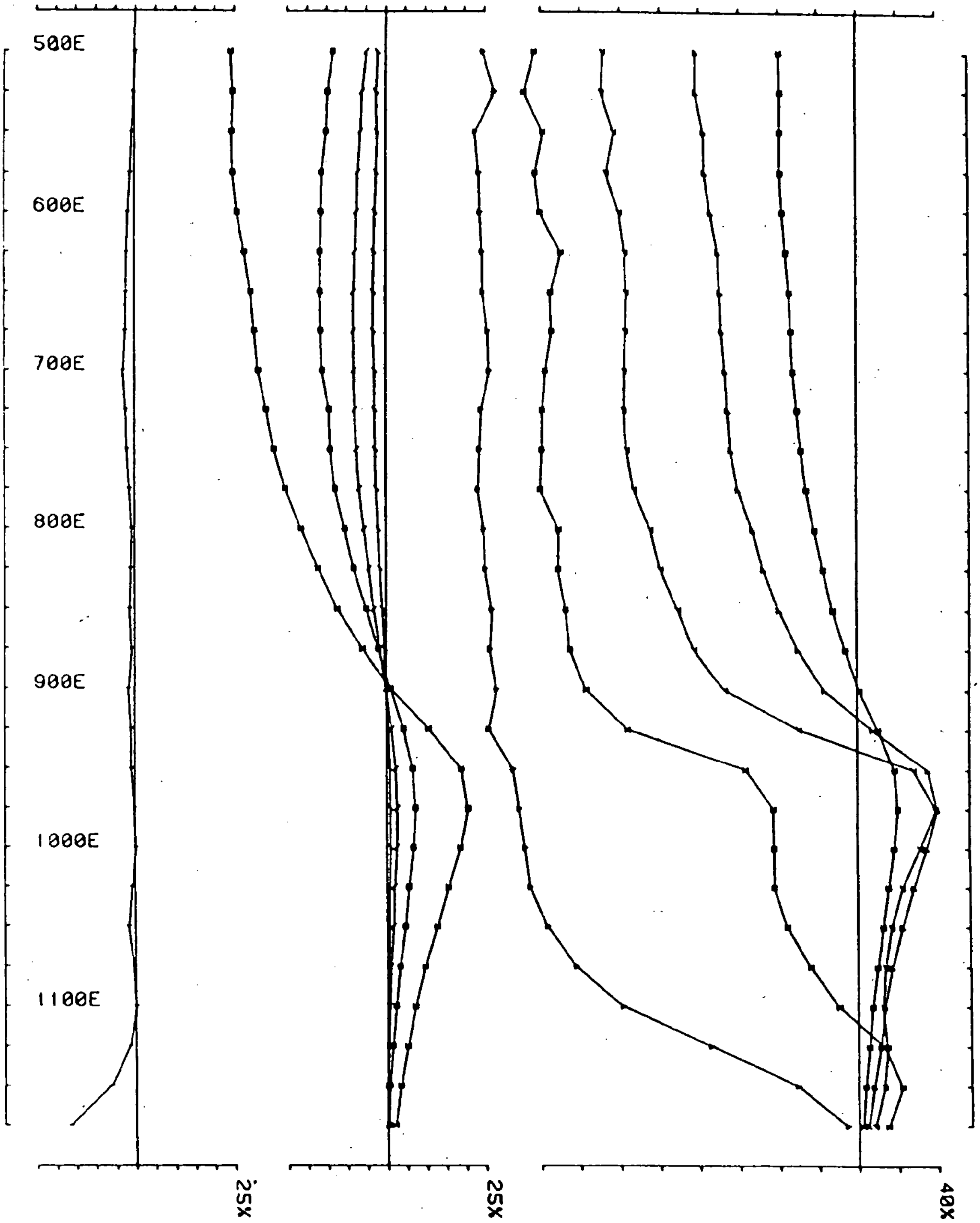
NOTE: SYMBOLS MAY HAVE VARYING SIZE ACCORDING TO IMPORTANCE



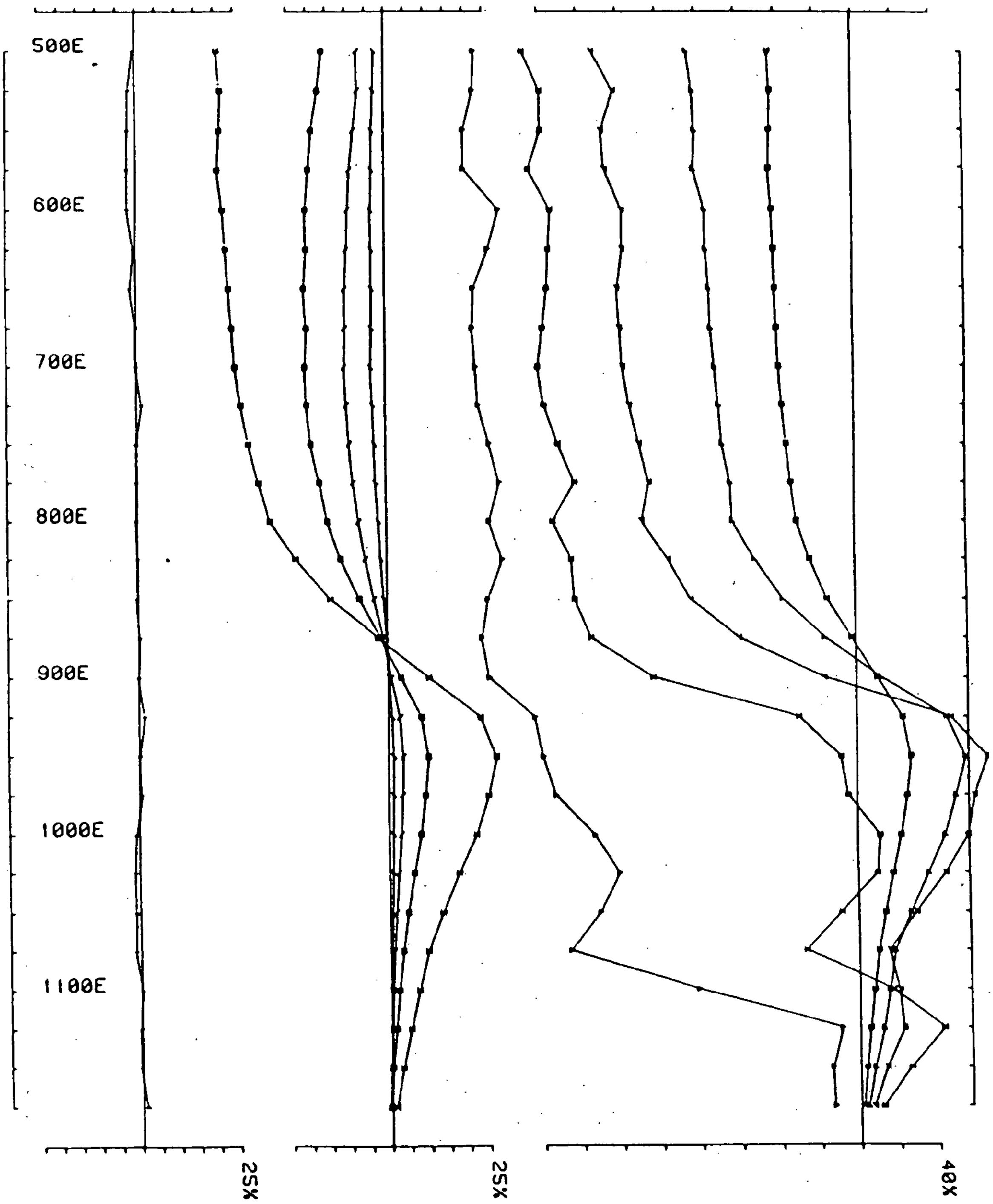
Outline of Transmitter Loop



Conductor axis as shown by crossover anomalies. Conductance in Siemens (mhos) is interpreted value of zone as a whole.



Area WOODCHESTER (ADELAIDE) SOUTH AUSTRALIA CRA Job 007002 freq(hz) 26.204
Loopno 0721 Line 300N component Hz secondary Ch 1



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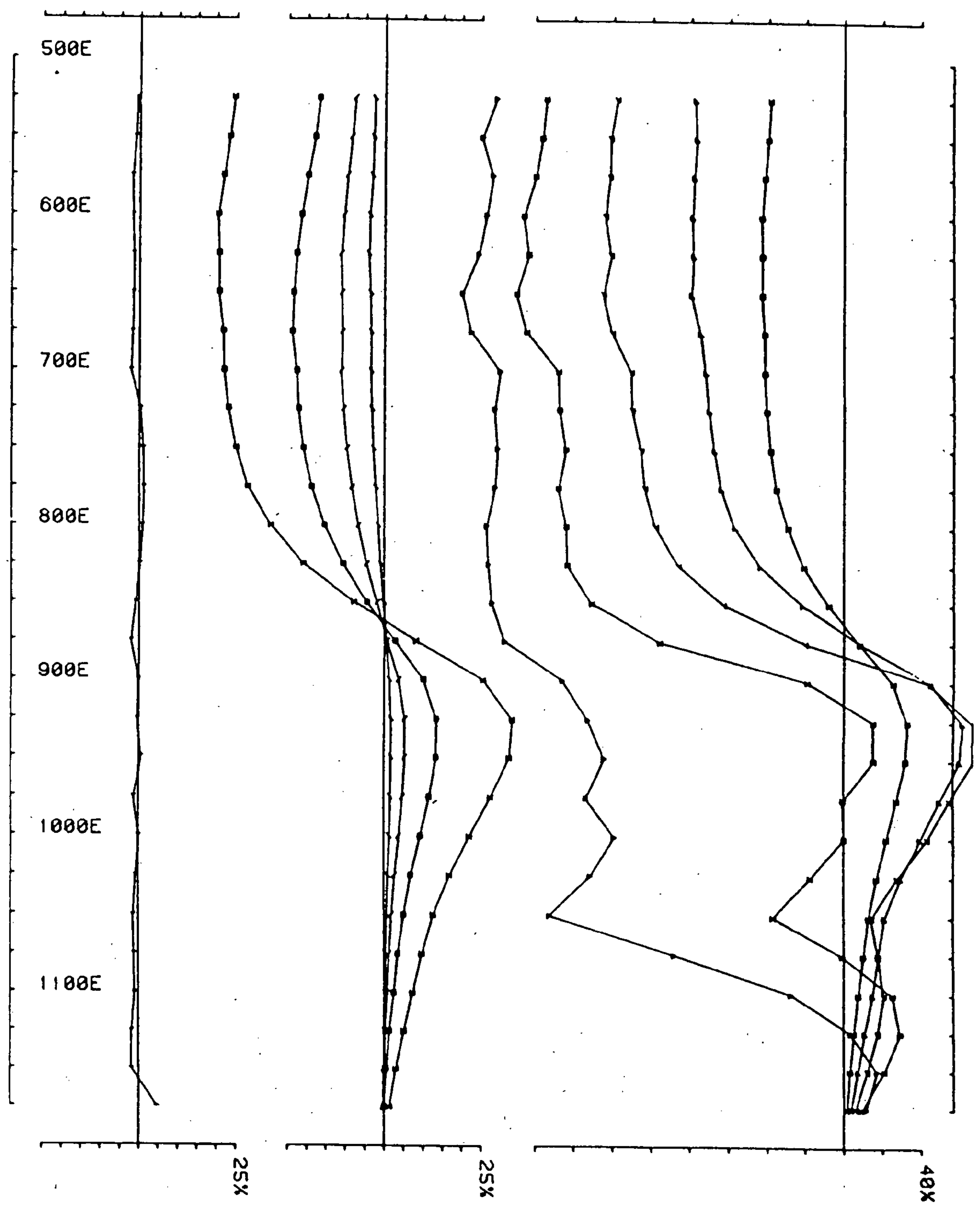
Loop 0721 Line 400N component Hz secondary Ch 1



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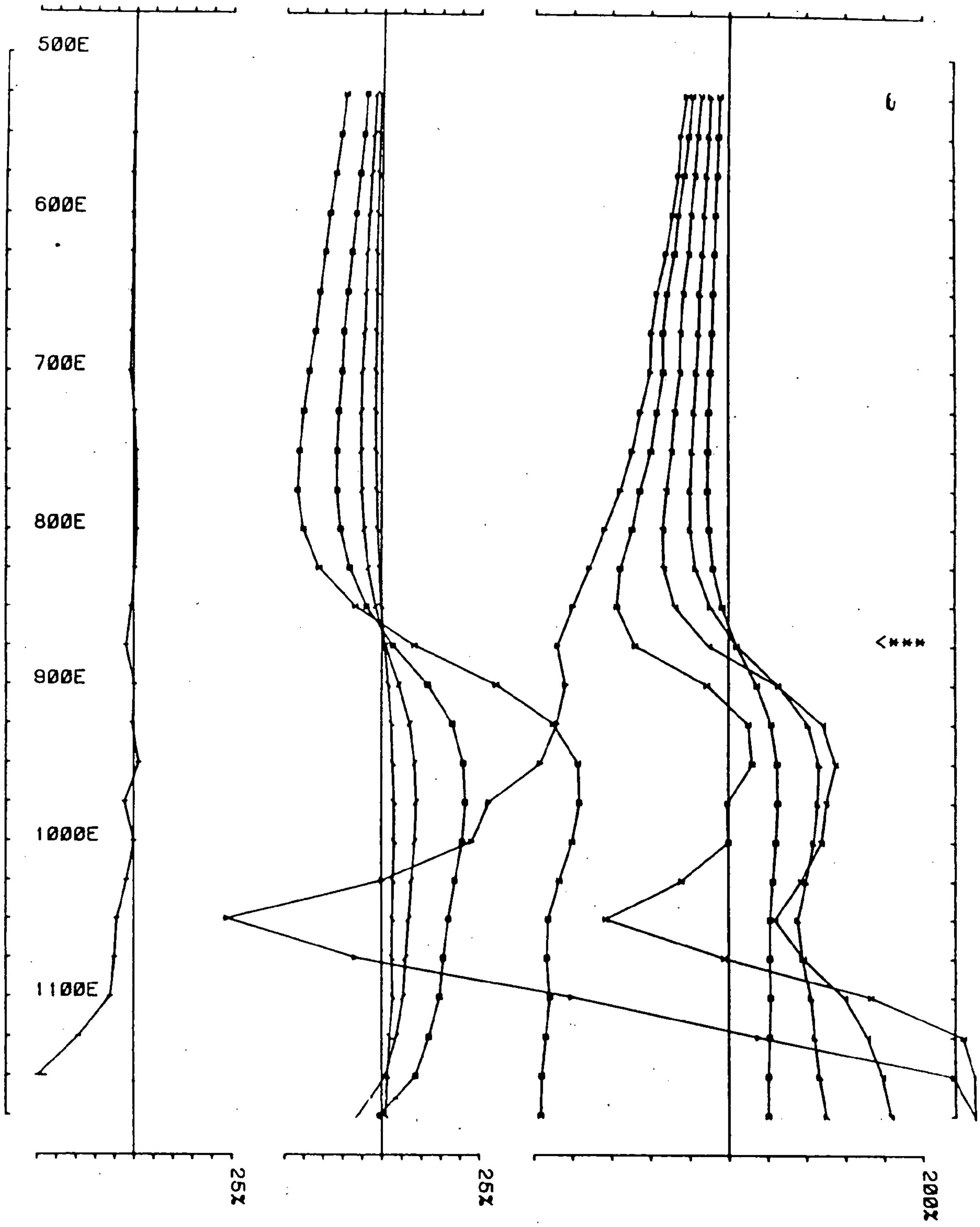
Loopno 0721 Line 500N component Hz secondary Ch 1



Area WOODCHESTER (ADELAIDE) SOUTH AUSTRALIA CRA Job 007002 freq(hz) 26.204
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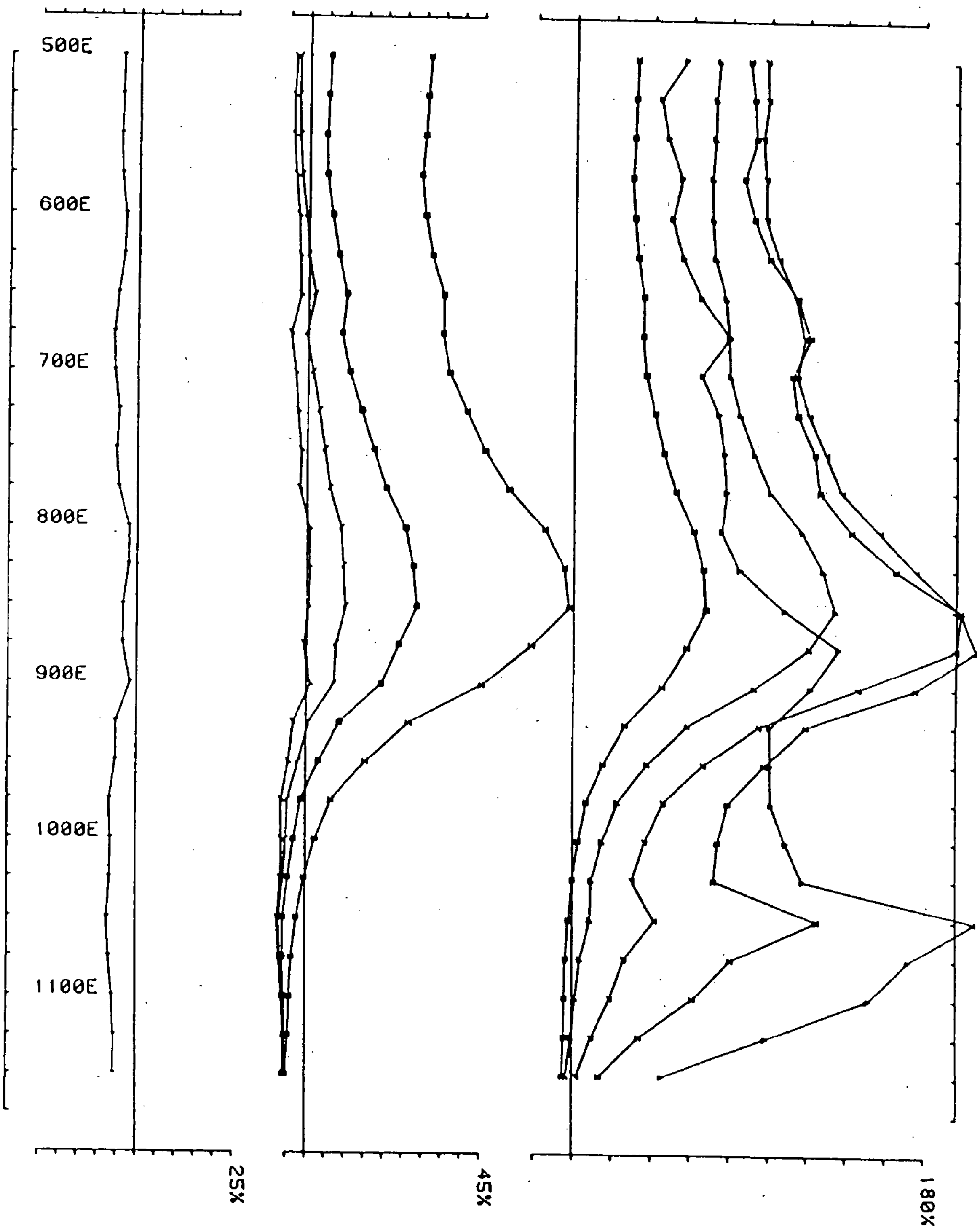
000144

7



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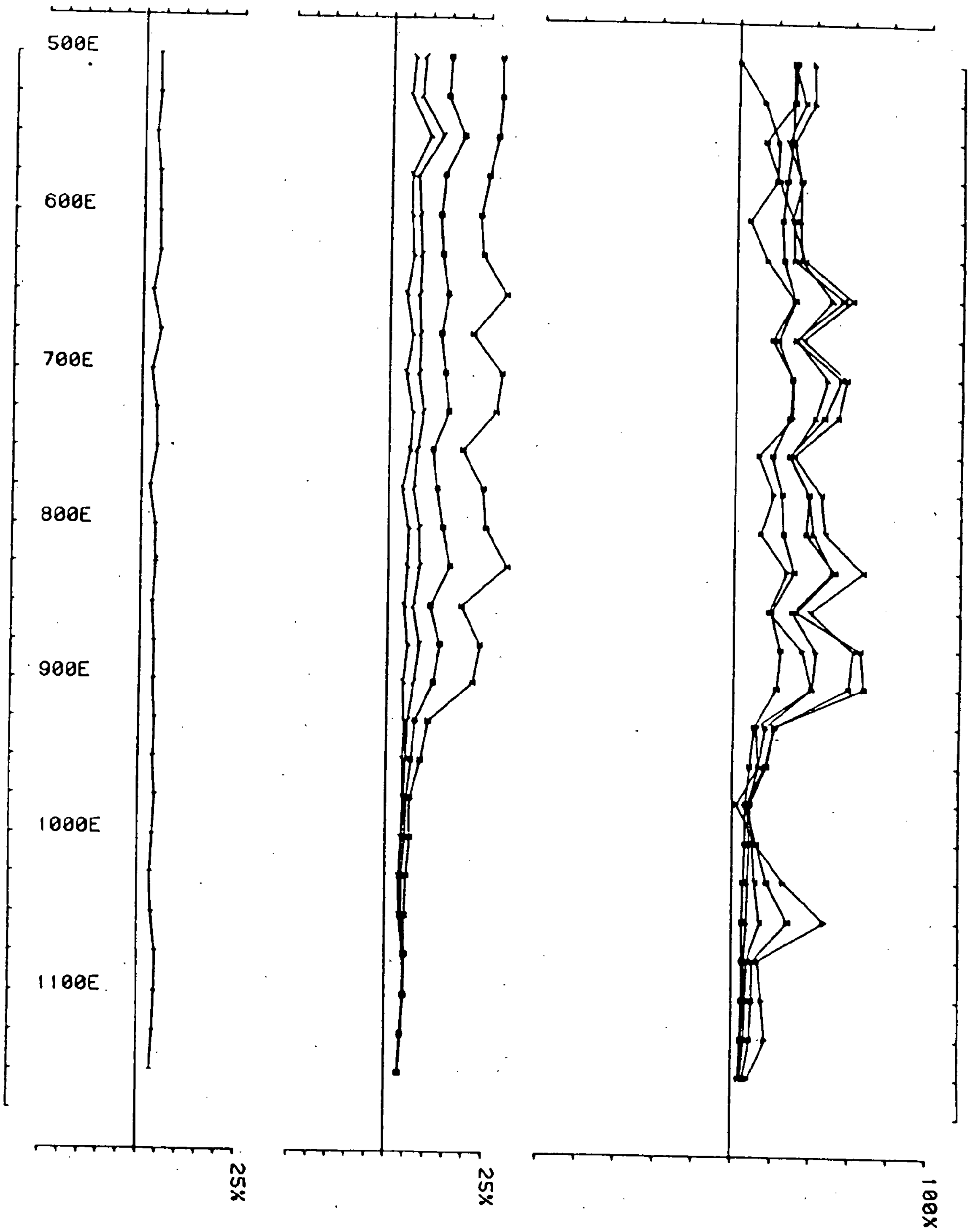
Loopno 0721 Line 600N component Hx secondary



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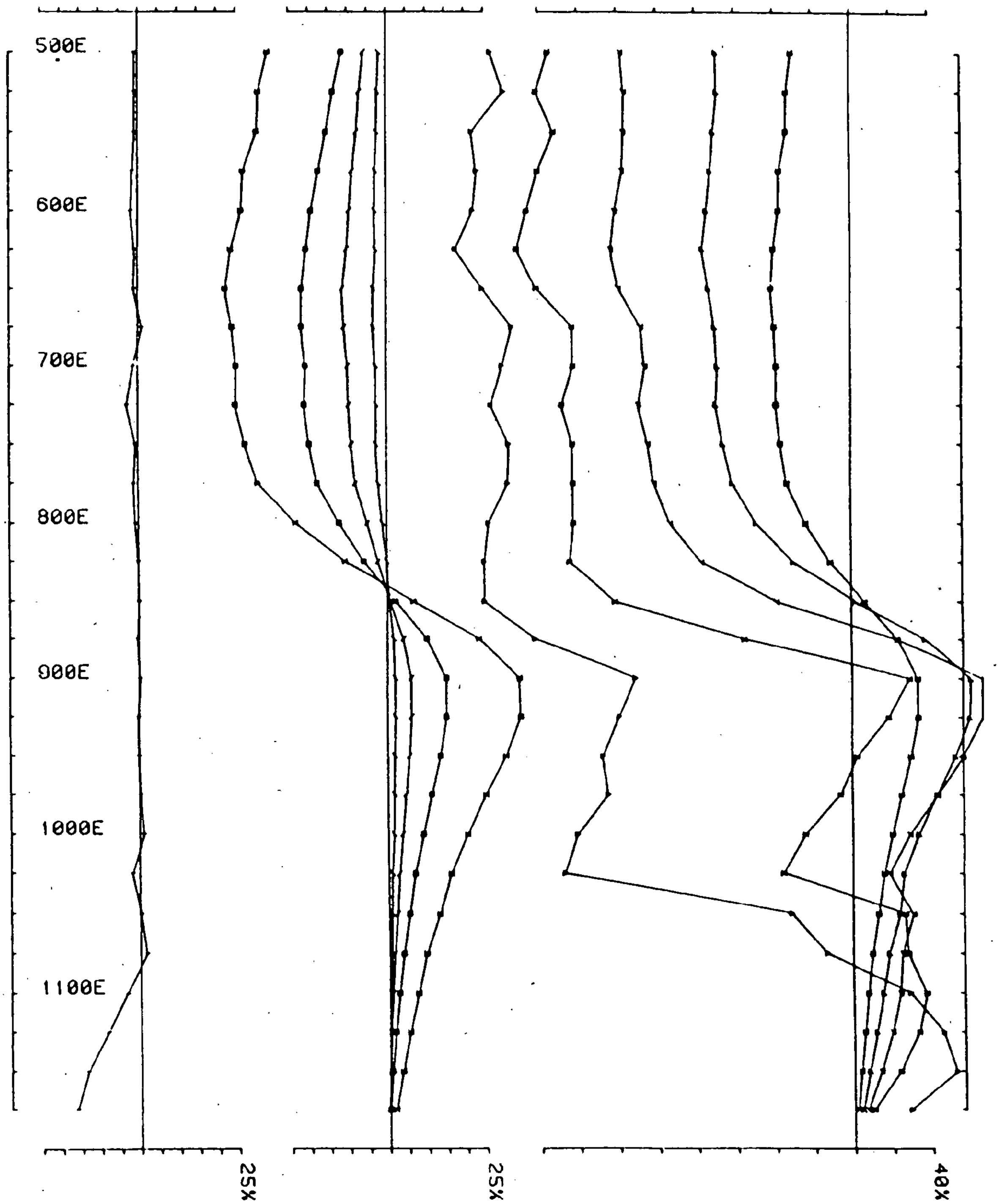
Loopno 0721 Line 600N component Hy secondary

9



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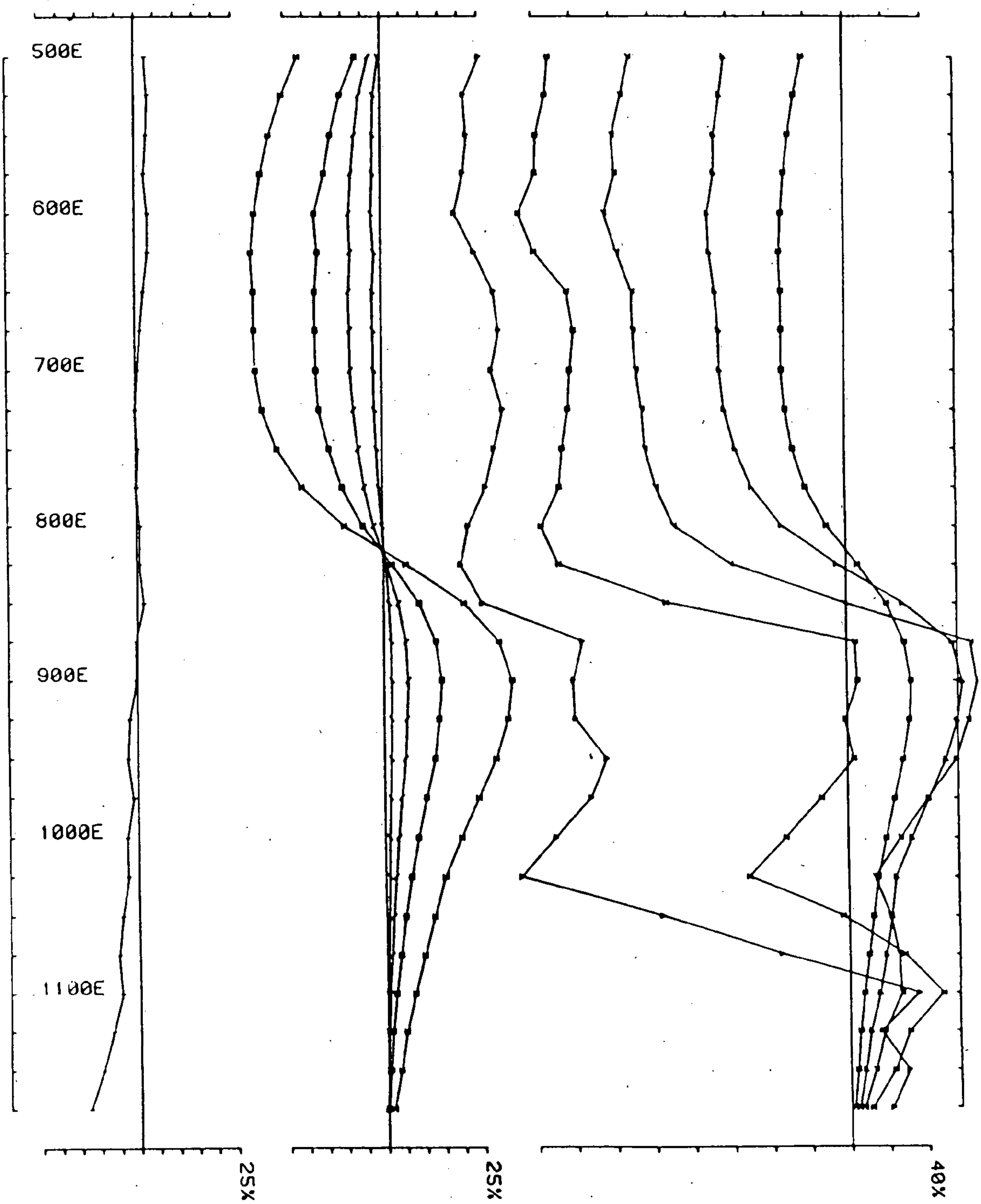
Loop no 0721 Line 600N component Hz secondary Ch 1



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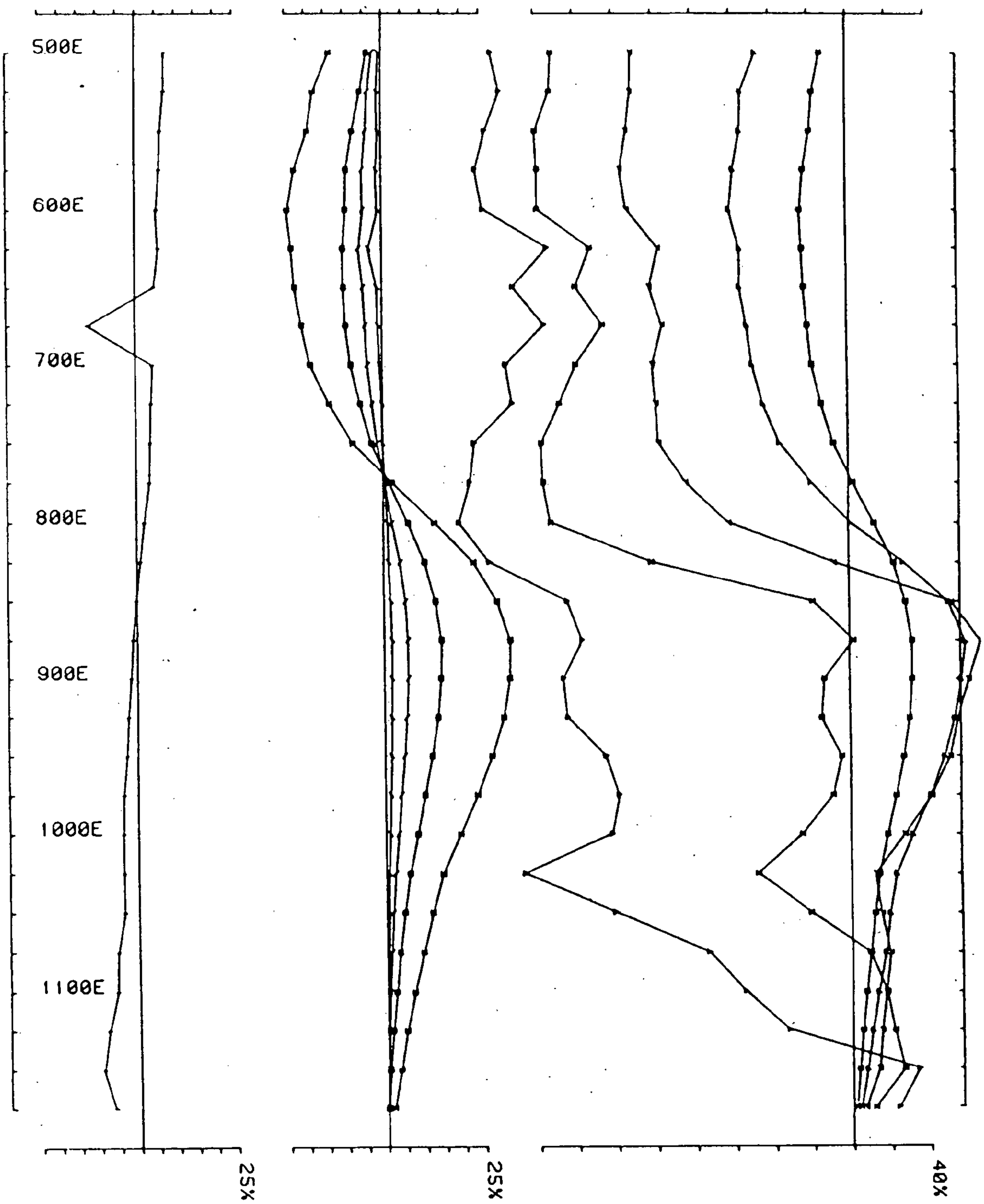
Loopno 0721 Line 700N component Hz secondary Ch 1



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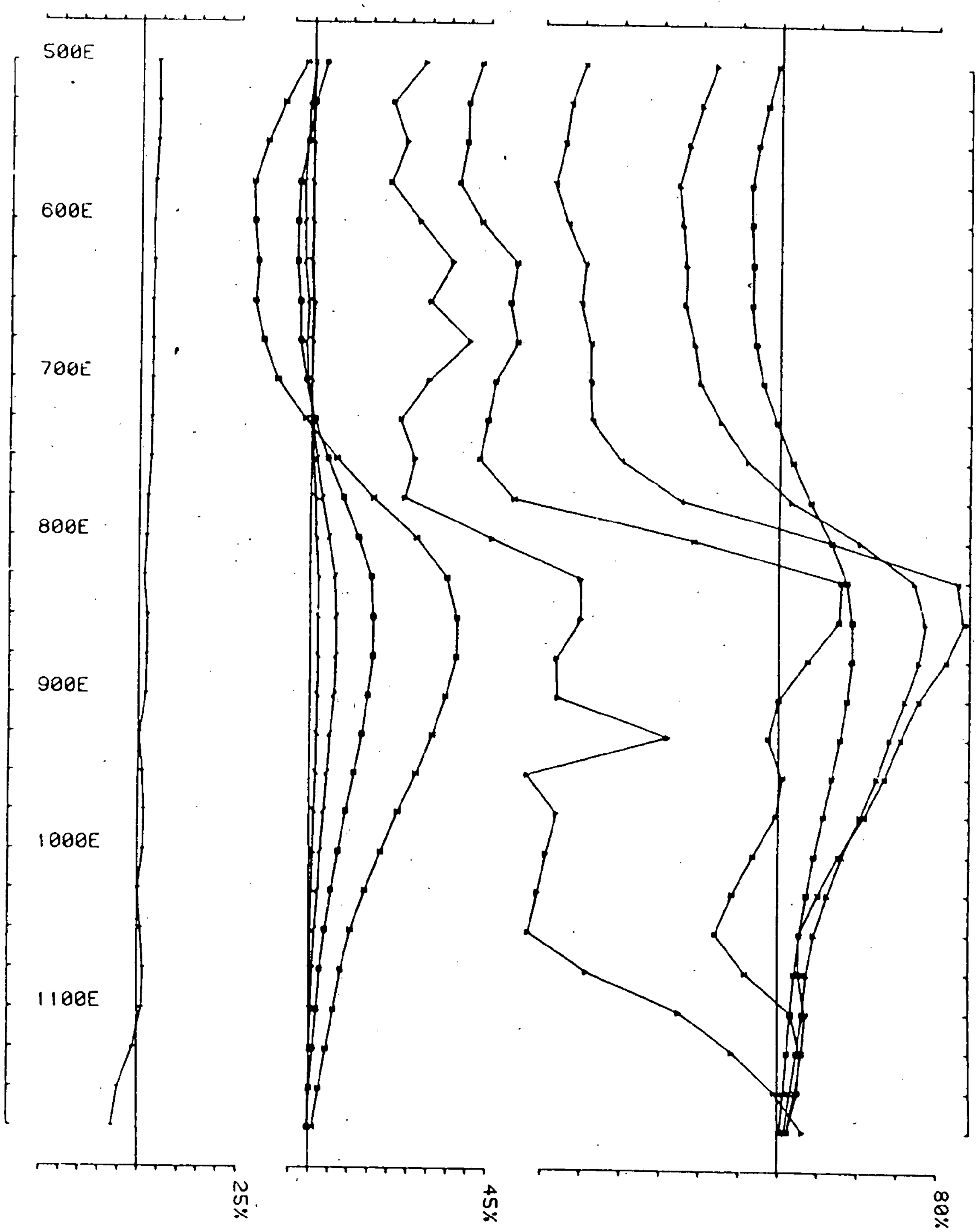
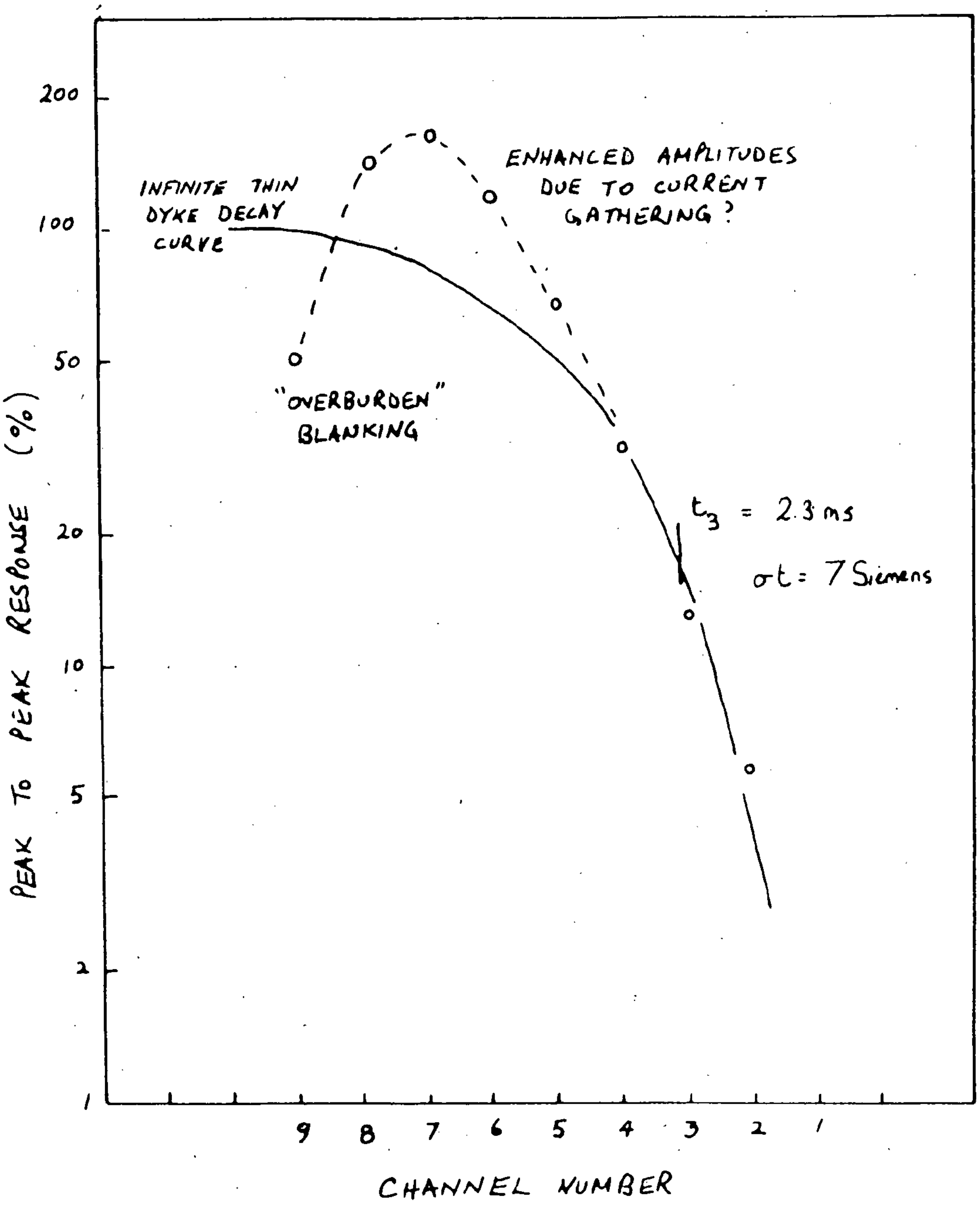
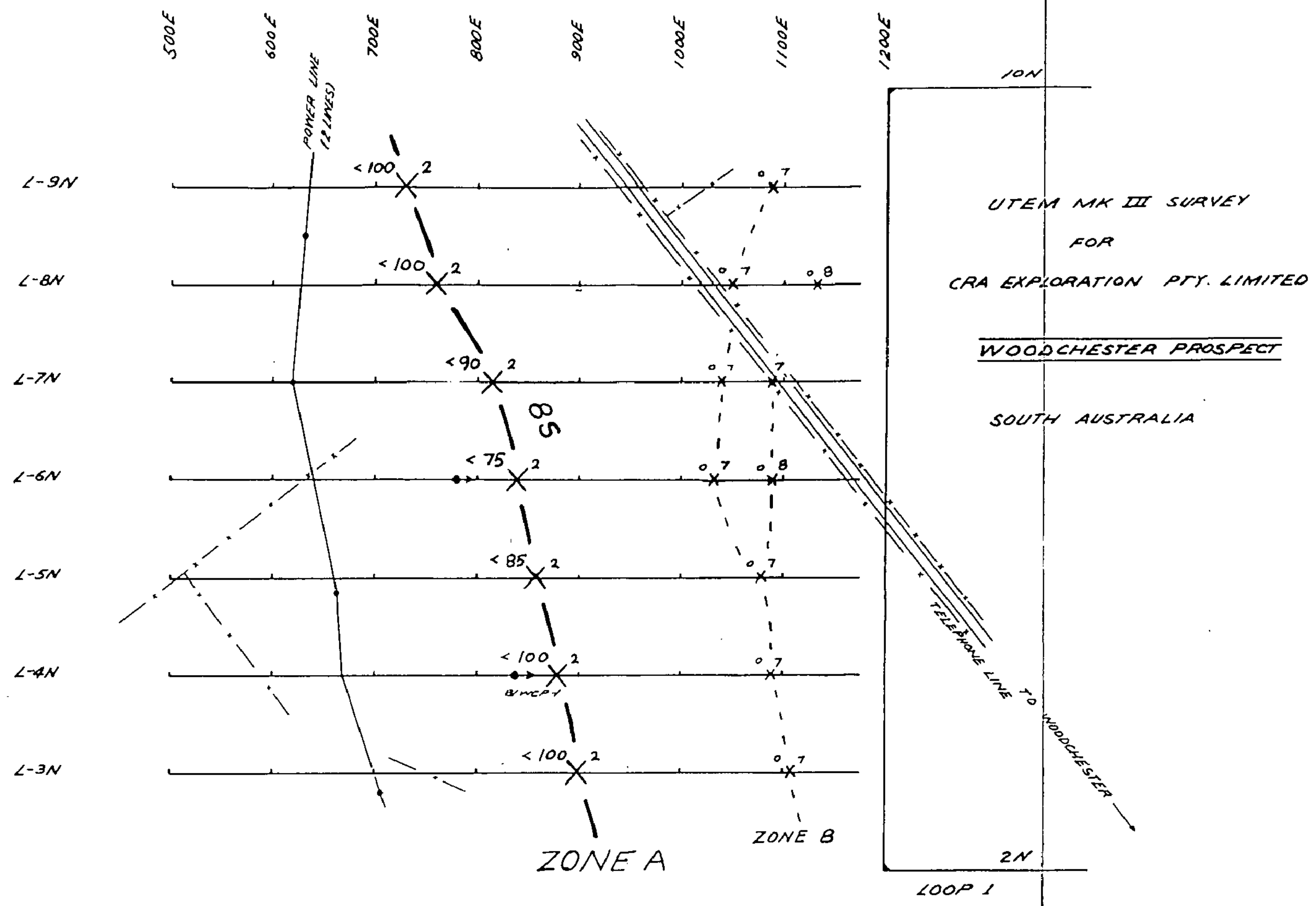
Loopno 0721 Line 800N component Hz secondary Ch 1



Area WOODCHESTER (ADELAIDE) SOUTH AUSTRALIA CRA Job 007002 freq(hz) 26.204
Loopno 0721 Line 900N component Hz secondary Ch 1

LINE 5N ZONE A DECAY PLOT

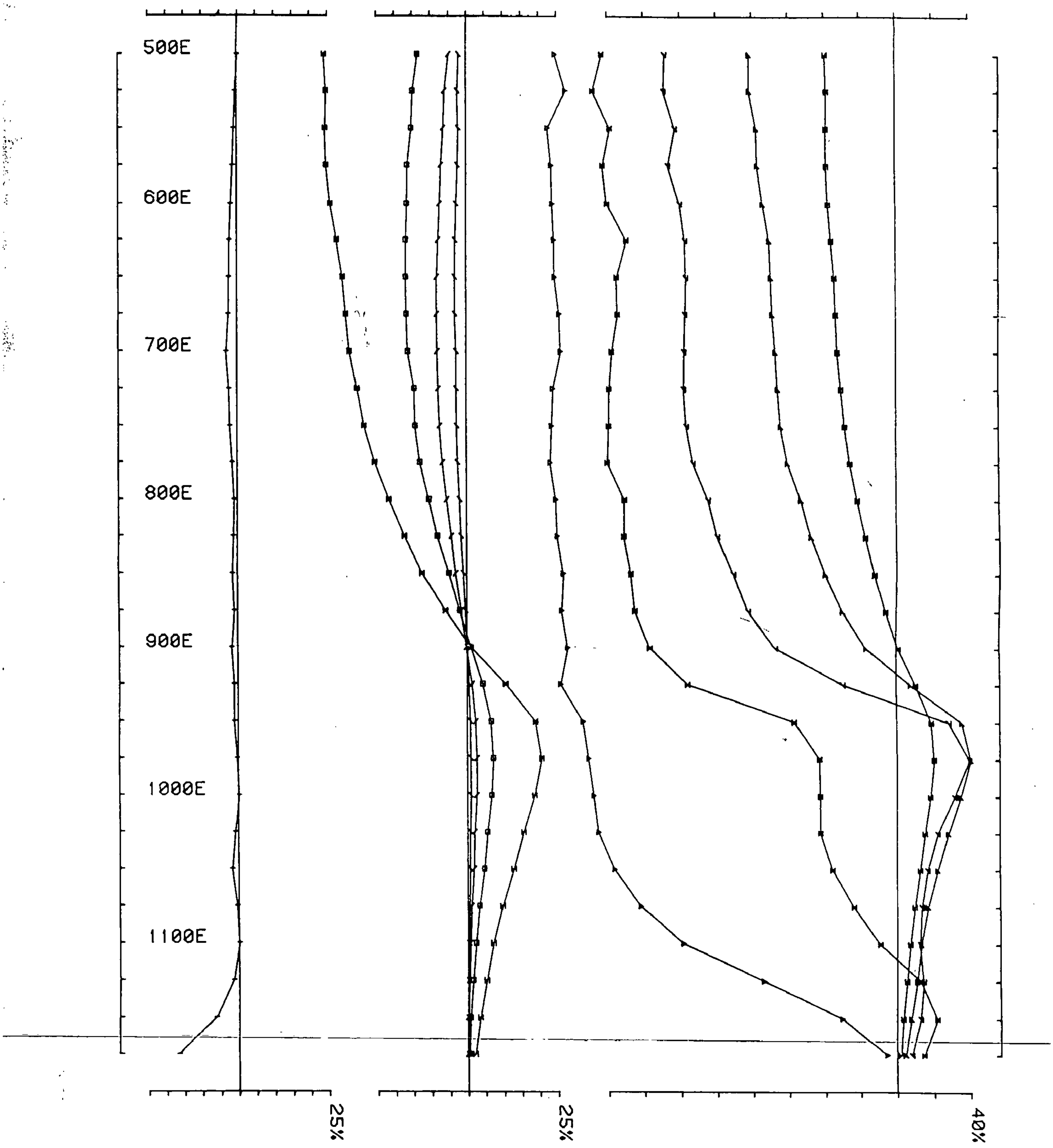




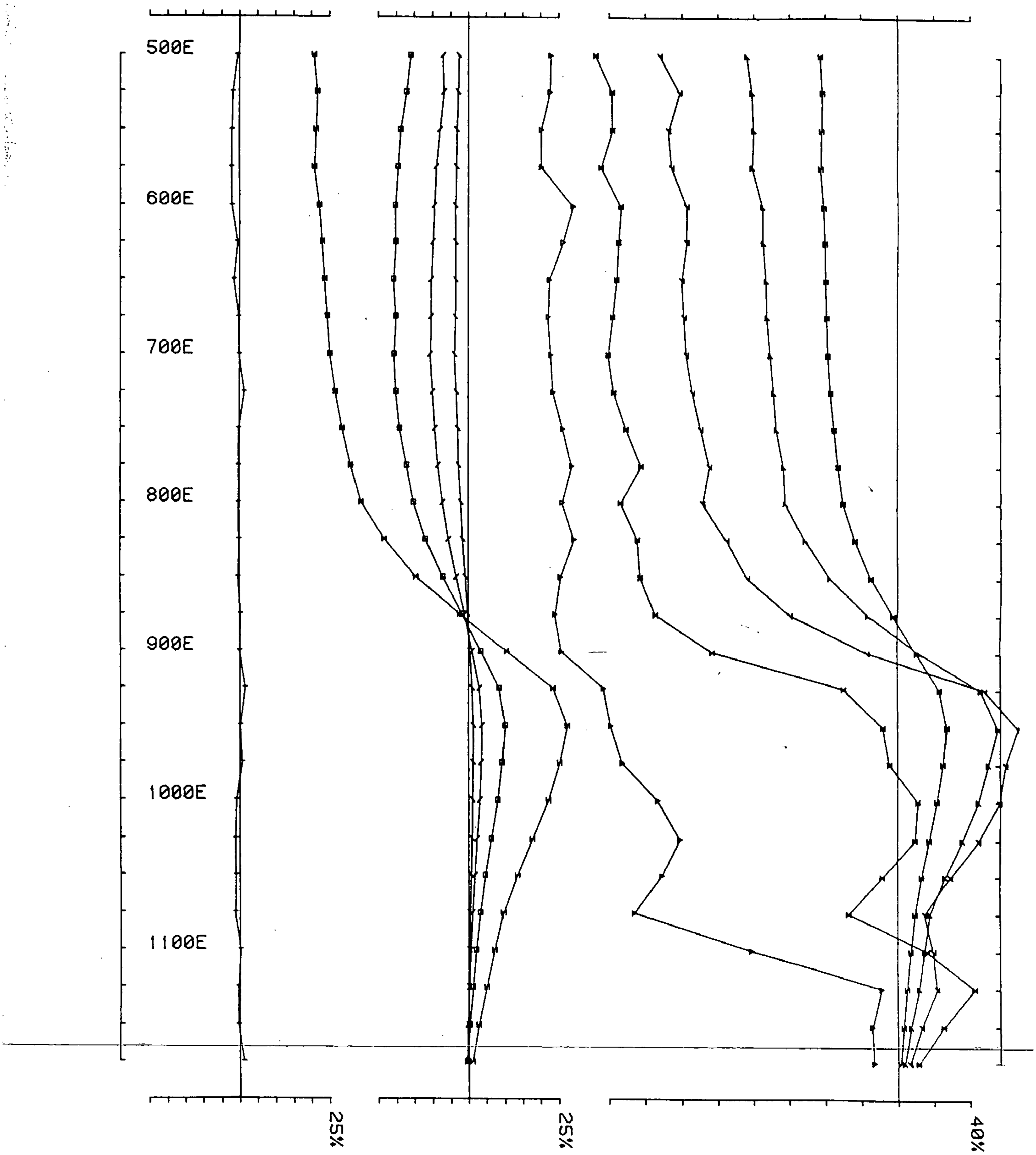
COMPILATION MAP	PLAN NO.
SURVEY BY : FG, GS	1982 JAN
SCALE : 1 : 5000	
DRAWN : FG, JM	1982 FEB

LAMONTAGNE GEOPHYSICS LTD.

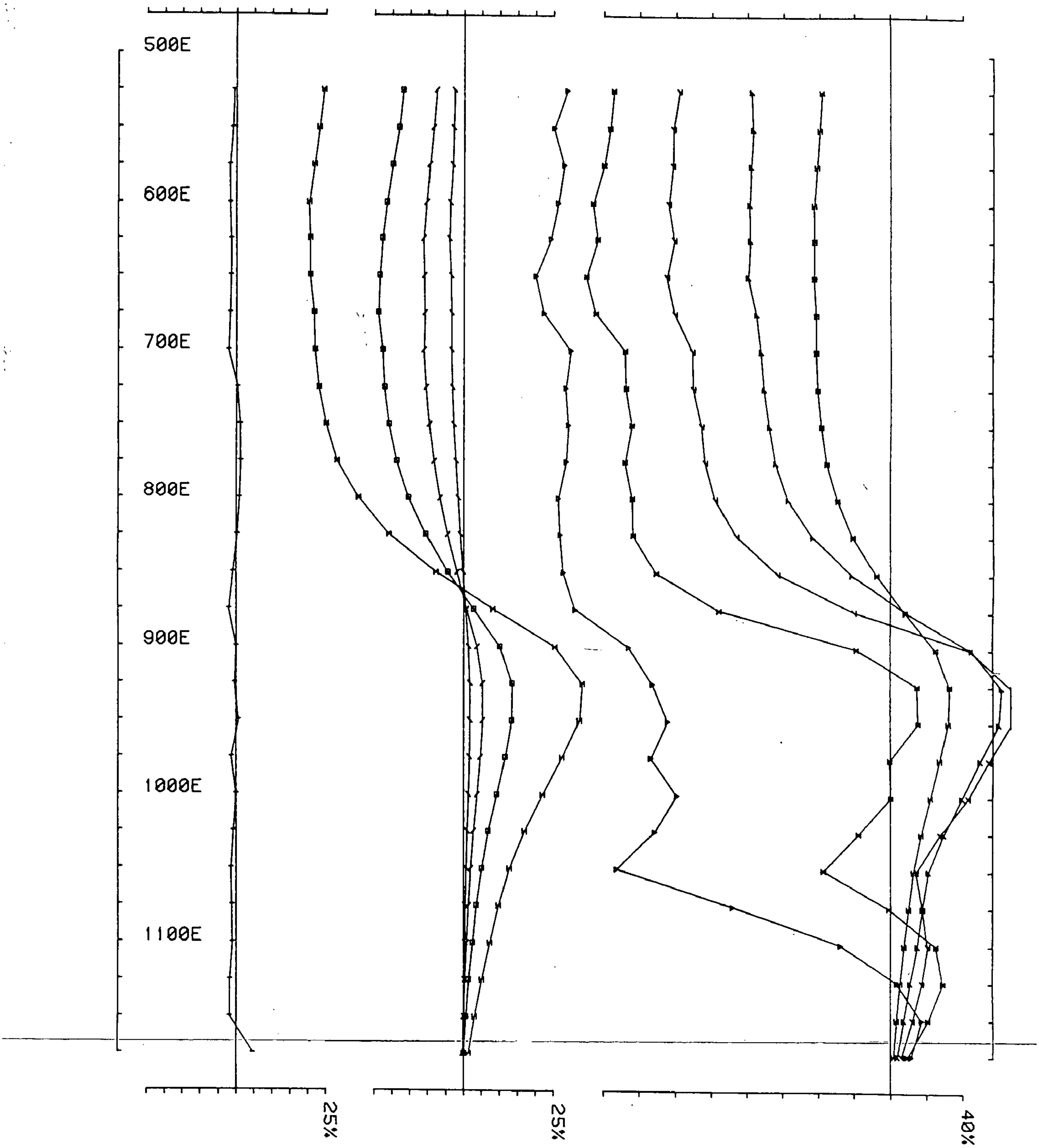
000151



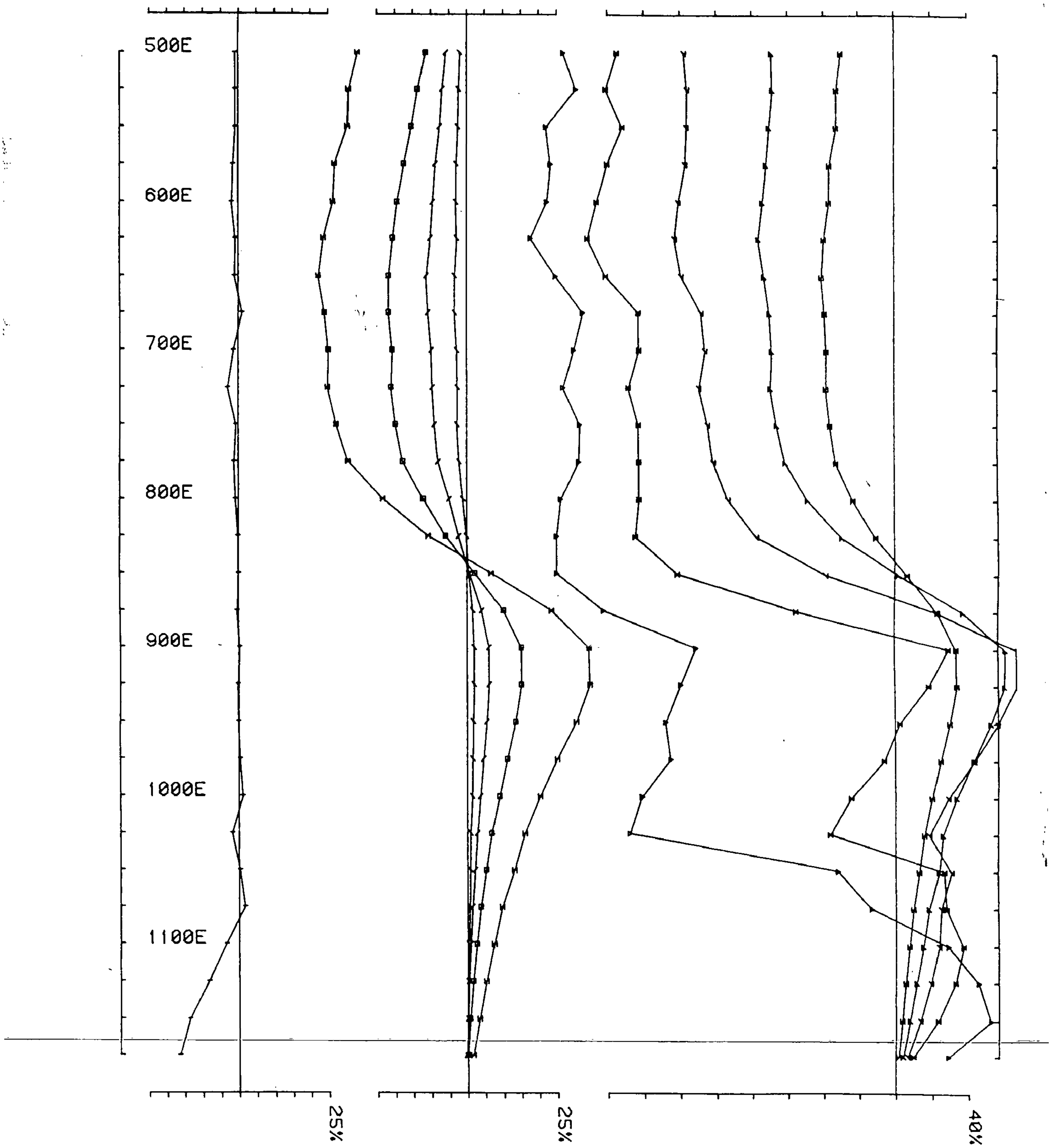
Area WOODCHESTER (ADELAIDE) SOUTH AUSTRALIA CRA Job 007002 freq(hz) 26.204
Loopno 0721 Line 300N component Hz secondary Ch 1



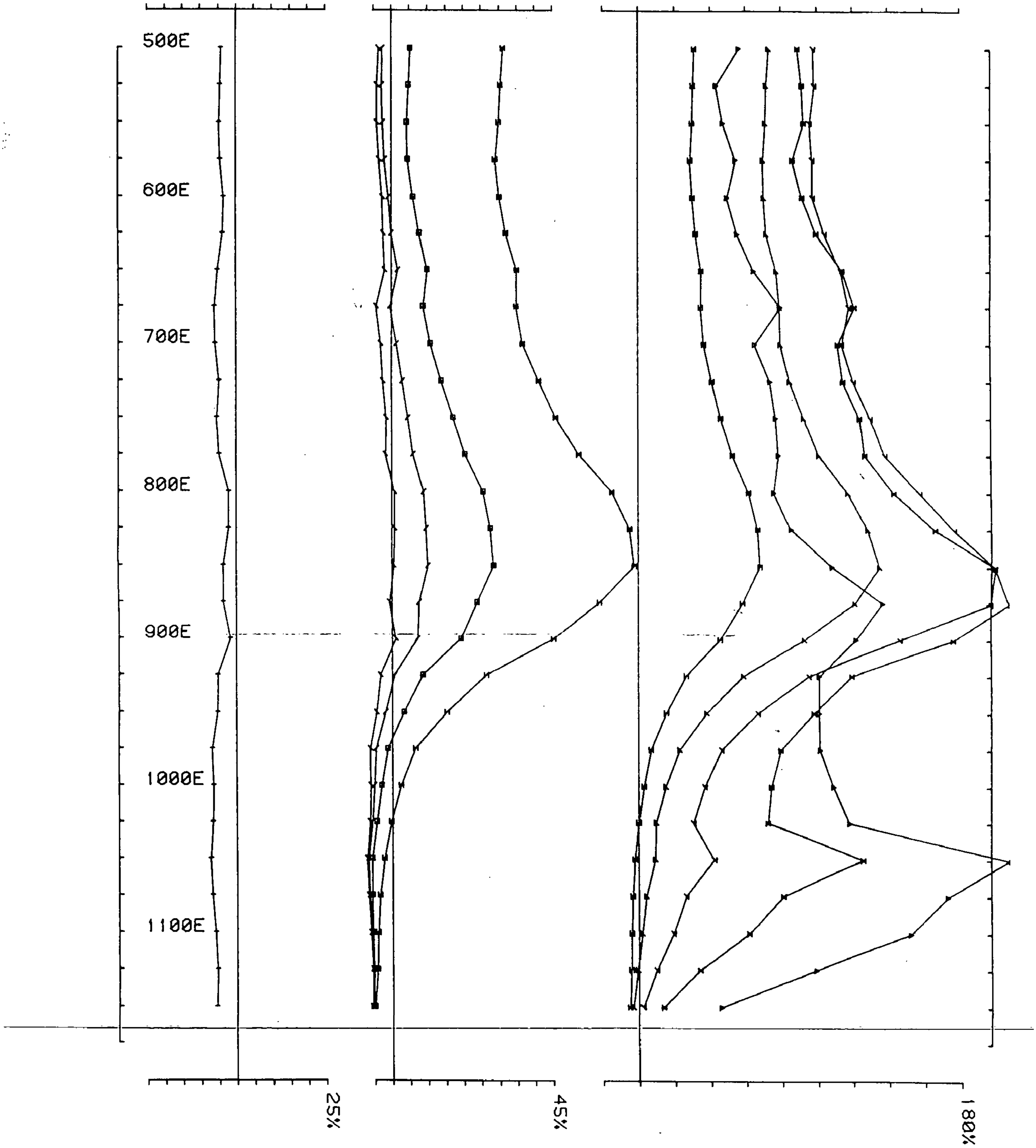
Area WOODCHESTER (ADELAIDE) SOUTH AUSTRALIA CRA Job 007002 freq(hz) 26.204
Loopno 0721 Line 400N component Hz secondary Ch 1



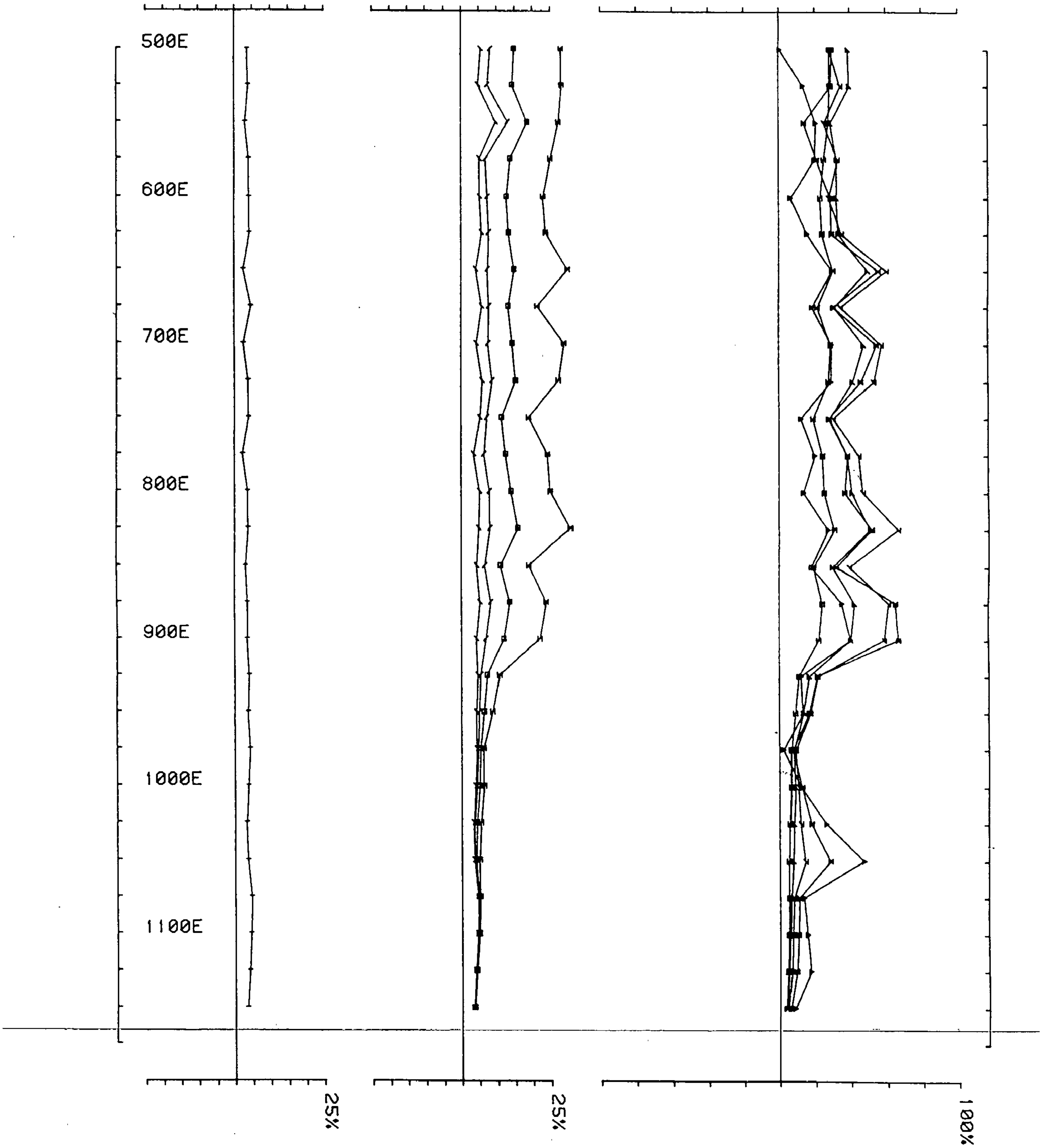
Area WOODCHESTER (ADELAIDE) SOUTH AUSTRALIA CRA Job 007002 freq(hz) 26.204
Loopno 0721 Line 500N component Hz secondary Ch 1



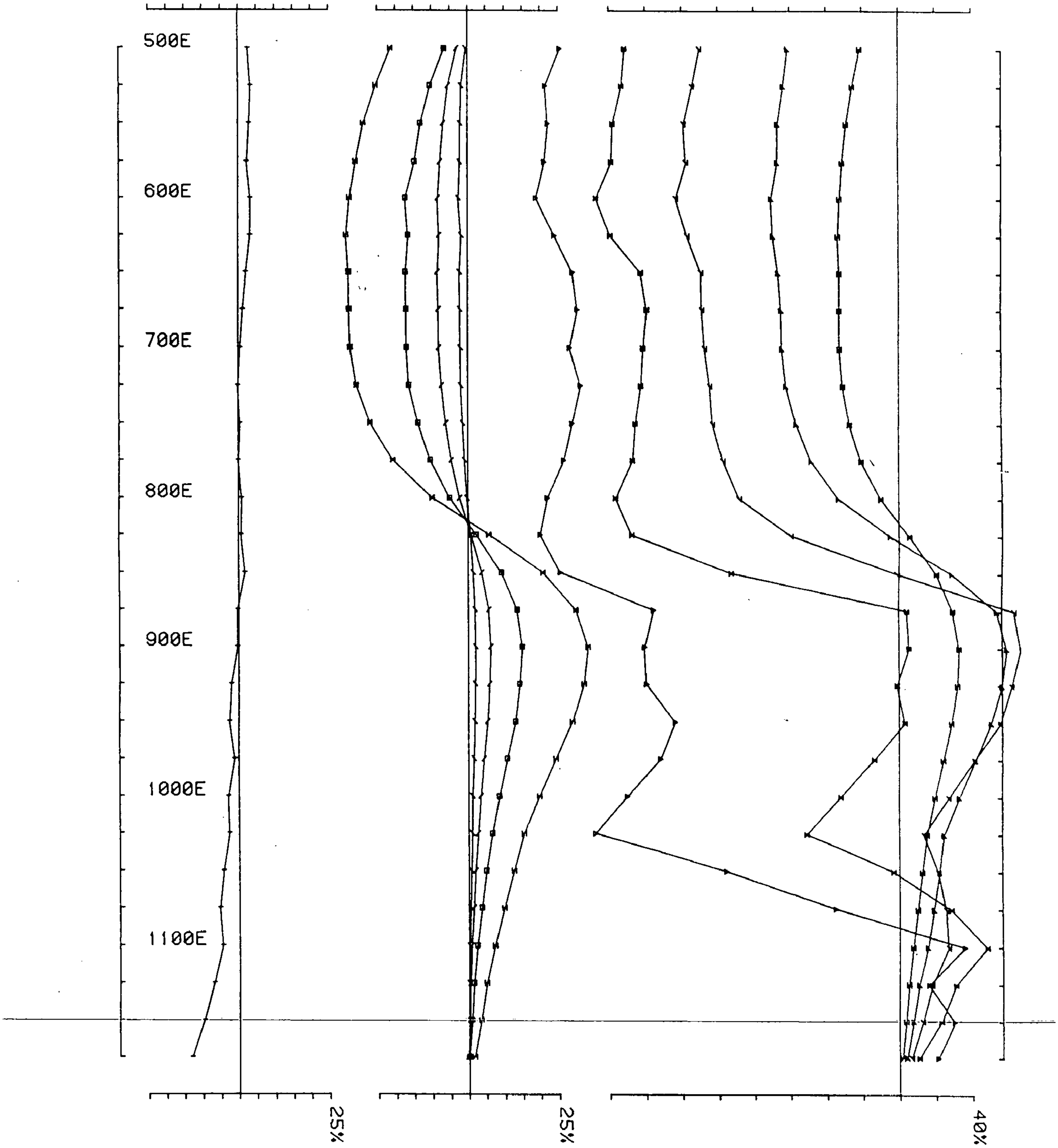
Area WOODCHESTER (ADELAIDE) SOUTH AUSTRALIA CRA Job 007002 freq(hz) 26.204
Loopno 0721 Line 600N component Hz secondary Ch 1



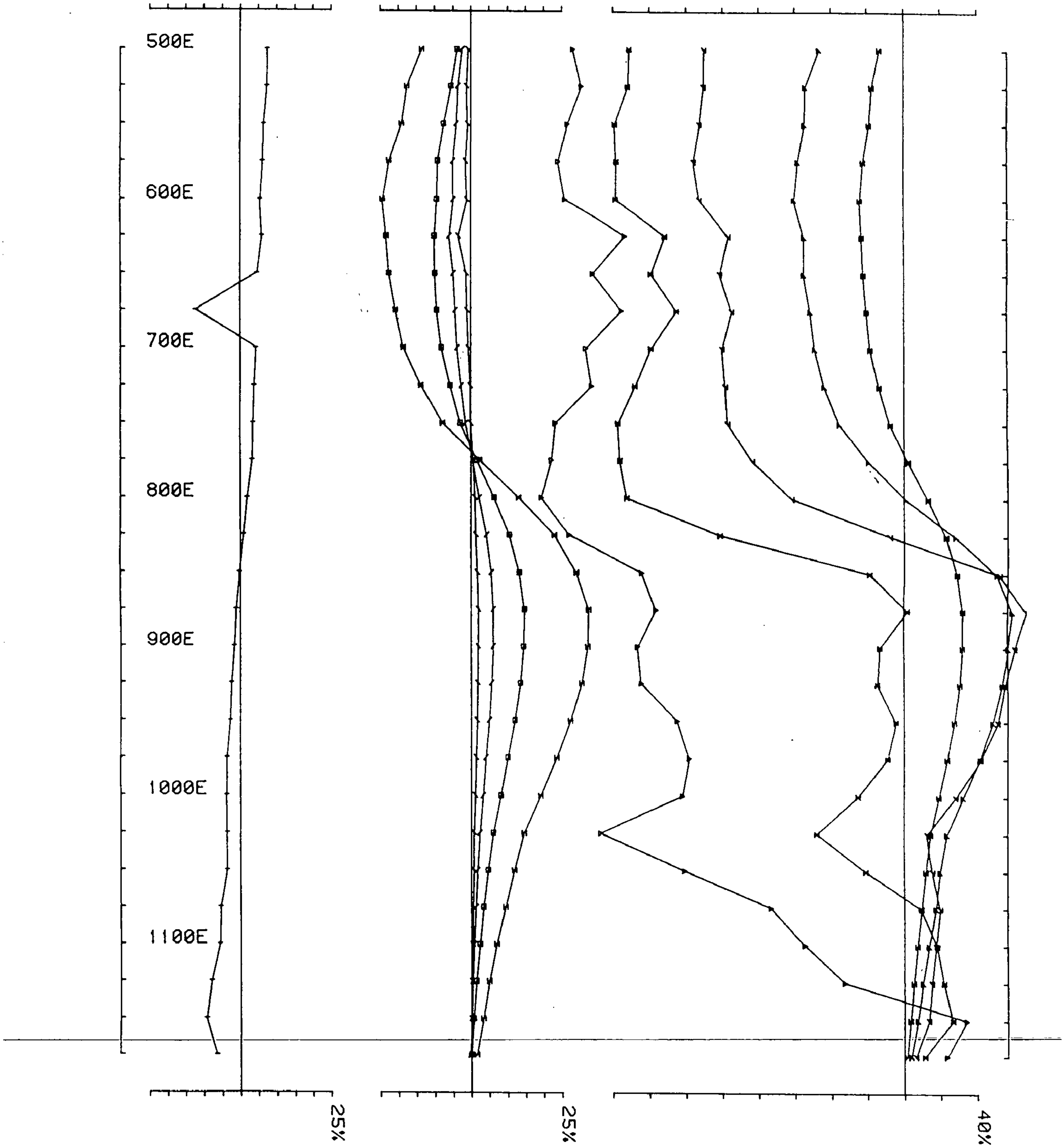
Area WOODCHESTER (ADELAIDE) SOUTH AUSTRALIA CRA Job 007002 freq(hz) 26.204
Loopno 0721 Line 600N component Hx secondary



Area WOODCHESTER (ADELAIDE) SOUTH AUSTRALIA CRA Job 007002 freq(hz) 26.204
Loopno 0721 Line 600N component Hy secondary



Area WOODCHESTER (ADELAIDE) SOUTH AUSTRALIA CRA Job 007002 freq(hz) 26.204
Loopno 0721 Line 700N component Hz secondary Ch 1



Area WOODCHESTER (ADELAIDE) SOUTH AUSTRALIA CRA Job 007002 freq(hz) 26.204
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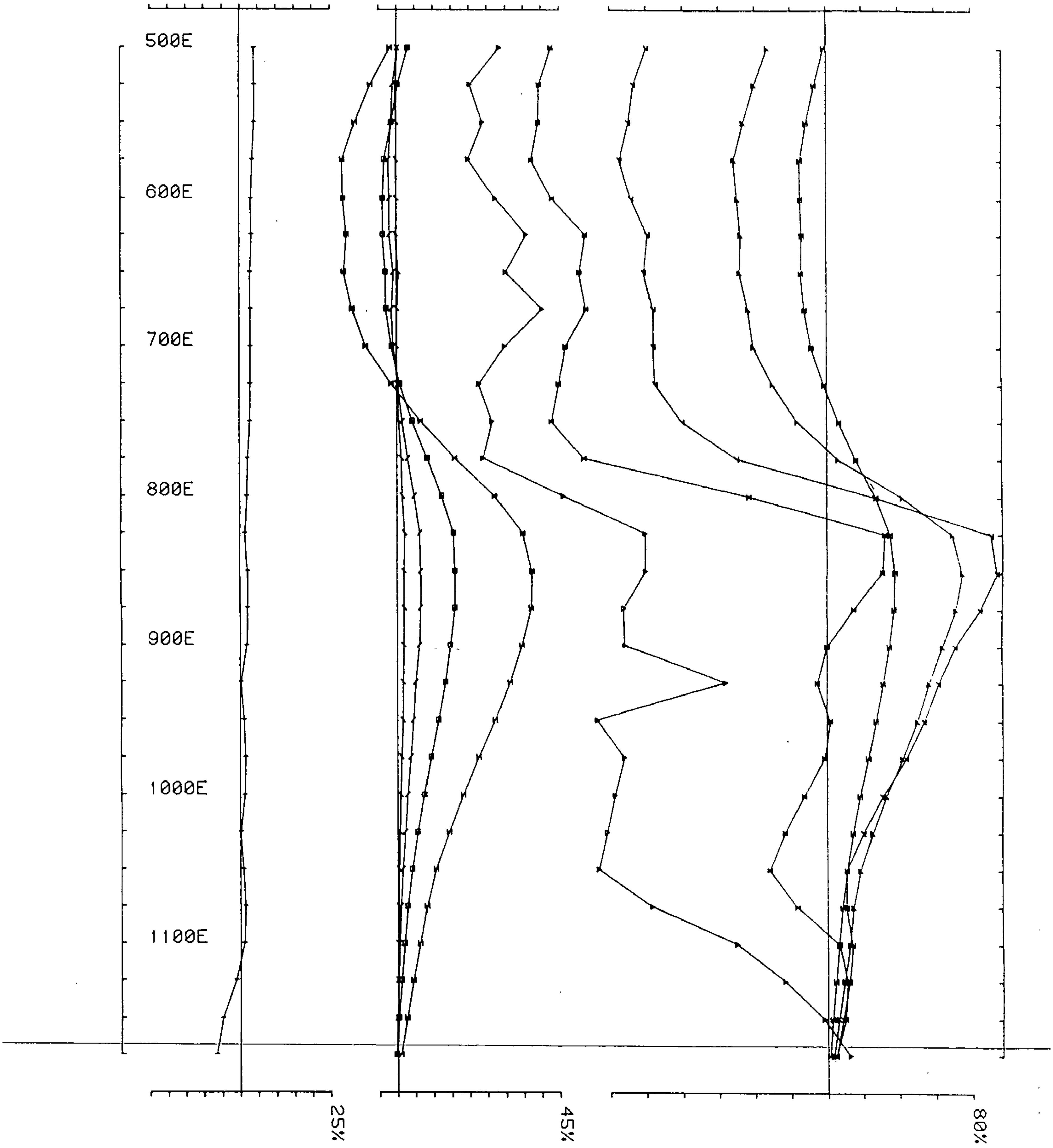

Area WOODCHESTER (ADELAIDE) SOUTH AUSTRALIA CRA Job 007002 freq(hz) 26.204
Loopno 0721 Line 900N component Hz secondary Ch 1

APPENDIX II

WOODCHESTER GRID MISE-A-LA-MASSE AND SELF POTENTIAL SURVEYS - FIELD DATA.

AREA: WOODCHESTER **LINE:** 3

INSTM'T: .... DATE: 26-2-82 OB'SR: ....

STN.	+ve	−ve	→	SF	SP (OBSERVED)
850E	215	200		+8	0
825E	210	200		+5	0
800E	205	220		−8	−2
775E	200	220		−10	−8
750E	190	210		−10	−8
725E	190	210		−10	−10
700E	180	230		−25	−20
675E	165	220		−23	−22
650E	185	220		−18	−12
625E	190	205		−8	−9
600E	160	210		−25	−15
575E	170	200		−20	−12
550E	165	200		−18	−10
525E	185	220		−18	−12
500E	190	220		−15	−10

AREA: WOODCHESTER **LINE:** 3

INSTM'T: .... DATE: .... OB'SR: ....

STN.	+ve	−ve	→	SF	SP (OBSERVED)
850E	205	190		+8	1
875E	200	180		+10	2
900E	220	180		+20	8
925E	210	180		+15	5
950E	210	170		+20	8
975E	160	140		+10	1
1000E	170	125		+23	13
1025E	150	110		+20	10
1050E	100	90		+5	1
1075E	100	70		+15	8
1100E	50	50		0	0
1125E	45	35		+5	0
1150E	14	32		−9	−5
1175E	5	25		−10	−8
1200E	−10	+10		−10	−6

AREA: WOODCHESTER **LINE:** 4 (2 AMPS)

INSTM'T: .... DATE: 26-2-82 OB'SR: ....

STN.		+ve		−ve	→	SP		SP
1200E		−5		−10		+2		2
850E		210		180		+15		8
825E		235		205		+15		4
[illegible]		225		190		+18		1
775E		210		210		0		2
750E		210		200		+5		0
725E		210		205		+2		0
700E		185		215		−15		−10
675E		175		205		−15 ~~[illegible]~~		−10
650E		155		200		−23		−15
625E		190		235		−23		−22
[illegible]		170		230		+30		−21
575E		180		225		−23		−20
550E		180		220		−20		−15
525E		185		225		−20		−15
500E		190		205		−8		−5

AREA: WOODCHESTER **LINE:** 4 (2 AMPS)

INSTM'T: .... DATE: 26-2-82 OB'SR: ....

STN.		+ve		−ve	→	SP		SP
825E (LINE 5)		325		235		+45		38
850E (LINE 5)		350		215		+68		56
850E		235		200		+18		1?
[illegible]		265		205		+30		21
900E		[illegible]		200		+45		35
925E		265		200		+33		20
950E		215		180		+18		8
[illegible]		185		[illegible]		+25		9
1000E		165		120		+23		3
1025E		155		110		+23		10
1050E		120		85		+18		6
[illegible]		80		60		+10		3
1100E		70		45		+13		2
1125E		65		30		+18		6
1150E		35		10		+13		3
1175E		5		0		+2		1

AREA: WOODCHESTER **LINE:** 5 (2 mins)

INSTM'T: P660 **DATE:** 25-2-81 **OB'SR:**

STN.		+ve		−ve	→	SP		SP	
850E		340		200		+70		56	
825E		300		200		+50		30	
800E		320		230		+45		22	
775E		300		240		+30		14	
750E		280		240		+20		9	
725E		270		230		+20		9	
700E		275		220		+23		10	
675E		245		225		+20		6	
650E		210		215		−3		−1	
625E		215		210		+2		0	
600E		175		195		−10		−4	
575E		170		190		−10		−5	
550E		155		170		−8		−3	
525E		195		190		+2		0	
500E		95		115		−10		−1	

AREA: WOODCHESTER **LINE:** 5 (2 [illegible])

INSTM'T: [illegible] **DATE:** 25-2-82 **OB'SR:**

STN.		+ve		−ve	→	SP		SP	
850E		320		195		+63		55	
875E		350		220		+65		52	
900E		340		220		+58		49	
925E		305		205		+50		38	
950E		230		175		+28		15	
975E		215		150		+33		20	
1000E		200		135		+33		20	
1025E		130		90		+20		10	
1050E		88		62		+13		7	
1075E		60		40		+10		5	
1100E		52		48		+2		0	
1125E		45		25		+10		0	
1150E		20		10		+5		0	
1175E		5		−1		+3		1	
1200E		5		−17		+11		0	

AREA: WOODCHESTER **LINE:** 6 (2 AMPS)

INSTM'T: .... DATE: 24-2-81 OB'SR: ....

STN.		+ve	mV	-ve	→	SP		SP	
1175E		·8		0		+4		+1	
1200E		NOT		READ				0	
		LUNCH							
800E		285	(280)	210	(210)	+37	(+35)	+15	(16)
= 81WCP2									
[illegible]		280	(260)	214	(204)	+33	(+28)	+3	(16)
750E		260	(230)	210	(160)	+25	(35)	+2	([illegible])
725E		200		200		0		-1	
700E		245		210		+17		0	
675E		230		190		+20		+3	
650E		210		180		+15		+1	
625E		190		190		0		0	
600E		180		190		-5		-1	
575E		90		115		-12		-8	
550E		96		110		-7		-2	
525E		102		108		-3		0	
500E		110		110		0		0	

AREA: WOODCHESTER **LINE:** 6 (2 AMPS)

INSTM'T: P660 DATE: 24-2-82 OB'SR: ....

STN.		+ve	mV	-ve	→	SP		SP	
775E		272		205		+34		NOT READ	
	= 81WCP2								
800E		240		200		+20		+8	
825E		280		200		+40		+26	
850		330		180		+75		+60	
875E		320		160		+80		+66	
900E		310		180		+65		+58	
925E		225		143		+42		+27	
950E		210		140		+35		+26	
975E		160		120		+20		+10	
1000E		80		92		-6		-3	
1025E		70		61		+4.5		0	
1050E		52		26		+13		+2	
1075		52		30		+11		+1	
1100E		38		30		+4		0	
1125E		29		21		+4		0	
1150E		21		13		+4		0	

AREA: WOODCHESTER **LINE:** 7 (2 amps)

INSTM'T:........ DATE: 24 - 2 - 82 OB'SR:........

STN.	+ve	-ve	→	SP	SP	
850E	340	175		+82	69	
825E	342	196		+73	61	
800E	262	190		+36	22	
775E	270	196		+37	20	
750E	238	202		+18	7	
725E	254	200		+27	11	
700E	252	192		+30	15	
675E	240	196		+22	8	
650E	256	170		+43	29	
625E	222	192		+15	7	Power line
600E	204	190		+7	0	
575E	190	192		-1	-1	
550E	182	188		-3	-1	
525E	140	188		-24	-15	
500E	190	190		0	-1	

AREA: WOODCHESTER **LINE:** 7 (2 amps)

INSTM'T:........ DATE: 24 - 2 - 82 OB'SR:........

STN.	+ve	-ve	SP	SP
850E	340	176	+82	72
875E	315	180	+67	53
900E	265	170	+47	32
925E	260	160	+50	38
950E	195	130	+32	21
975E	150	85	+32	21
1000E	90	70	+10	1
1025E	60	40	+10	2
1050E	60	28	+16	5
1075E	52	20	+16	10
1100E	40	16	+12	8
1125E	22	2	+10	2
1150E	12	0	+6	1
1175E	-1	1	0	3
1200E	-15	-1	-7	1

000167

AREA: WOODCHESTER **LINE:** 8 2(AMPS)

INSTM'T:............ DATE: 25-2-82 OB'SR:............

STN.		+ve	mV	−ve		SP		SP	
850E (LINE 7)		354		210		+72		56	REPEAT
825E (LINE 7)		334		210		+62		48	REPEAT
825E		292		200		+46		30	
800E		310		204		+53		41	
775E		278		180		+49		38	
750E		282		200		+41		28	
725E		250		200		+25		17	
700E		250		206		+22		10	
675E		225		197		+14		1	
650E		220		178		+21		1	
625E		230		190		+20		8	
600		222		190		+16		9	
575E		220		196		+12		1	
550E		200		202		−1		0	
525E		202		208		−3		0	
500		210		216		−6		−1	

AREA: WOODCHESTER **LINE:** 8 (2 AMPS)

INSTM'T:............ DATE: 25-2-82 OB'SR:............

STN.		+ve		−ve	→	SP		SP
825E		300		200		+50		41
850E		275		200		+38		28
875E		265		195		+35		20
900E		190		150		+20		11
925E		200		155		+22		12
950E		170		142		+14		2
975E		125		105		+10		1
1000E		80		70		+5		0
1025E		50		40		+5		0
	ON	EDGE	OF	ROAD		(WEST)		
1050E		29		29		0		0
1075E		25		17		+4		1
1100		30		0		+15		10
1125E		18		0		+9		9
1150E		0		0		0		0
1175E		−8		0		−4		0
1200E		−12		−12		0		0

AREA: WOODCHESTER LINE: 9

INSTM'T:.................... DATE: 25-2-82 OB'SR:....................

STN.	+ve	-ve →	SP	SP
875E	220	165	+27	12
850E	270	205	+32	22
825E	315	200	+57	48
800E	310	235	+38	29
775E	285	190	+48	38
750E	305	215	+45	30
725E	285	205	+40	24
700E	255	210	+22	21
675E	250	200	+25	12
650E	240	200	+20	11
625E	225	200	+12	0
600E	230	200	+15	3
575E	200	196	+2	0
550E	200	180	+10	0
525E	160	150	+5	0
	JUST WATERED BEFORE USE			
500E	160	165	-2	0

AREA: WOODCHESTER LINE: 9 (2 amps)

INSTM'T:.................... DATE: 25-2-82 OB'SR:....................

STN.	+ve	-ve →	SP	SP
850E	260	202	+29	20
875E	200	162	+19	10
900E	190	160	+15	1
925E	155	125	+15	3
950E	125	90	+18	2
975E	90	80	+5	0
1000E	55	53	+1	0
1025E	48	38	+5	0
1050E	26	18	+4	0
1075E	10	10	0	0
1100E	3	0	+1	0
	0	-1	0	0
1150E	0	-10	+5	0
1175E	-10	-10	0	0
1200E	-5	-15	+5	0

APPENDIX III

SERVICE REPORT: PETROGRAPHY AND MINERAGRAPHY.

ASSAY RESULTS

000170

PETROGRAPHY AND MINERAGRAPHY OF SIX SAMPLES OF ROCK CHIPS

CRA Exploration Pty. Ltd.
South Australia

3/1/6/0-GS4231/82 February 1982

The Australian
[M]ineral Development
Laboratories

[Fle]ming Street, Frewville.
South Australia 5063
[P]hone Adelaide 79 1662
Telex AA 82520

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

000171

26 February 1982

GS 3/1/6/0

CRA Exploration Pty. Ltd.,
31 Osmond Terrace,
NORWOOD, SA 5067.

Attention: Tony Venables

REPORT GS 4231/82

YOUR REFERENCE: DPO B 0445

MATERIAL: Rock chips

IDENTIFICATION: 835833-8

DATE RECEIVED: 12 February 1982

WORK REQUIRED: Petrographic and mineragraphic examination.

Investigation and Report by: Dr Michael Farrand

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

Keith Henley

for Norton Jackson
Managing Director.

bs/7

[Pilo]t Plant: Osman Place
Thebarton S.A.,
Telephone 43 8053
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Melbourne Vic.
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PETROGRAPHY AND MINERAGRAPHY OF SIX SAMPLES OF ROCK CHIPS

1. INTRODUCTION

Six samples of rock chips were received from CRA Exploration Pty. Ltd. for petrographic and mineragraphic examination with particular reference to the identification of sulphides and to the presence or absence of magnetite.

2. PROCEDURE

The rock chips were mounted in epoxy resin and thin sections and polished sections were prepared. They were examined in transmitted and reflected light respectively. Sample, thin section and polished section numbers are as follows:

Sample	Thin Section	Polished Section
835833	C35524	D6940
835834	C35525	D6941
835835	C35526	D6942
835836	C35527	D6943
835837	C35528	D6944
835838	C35529	D6945

3. RESULTS

3.1 Petrography

Sample: 835833; TSC35524

Three main rock types, with intermediate variations, are represented among the chips of this sample. The most abundant type is a greywacke. It consists of quartz, plagioclase, muscovite, chlorite, lithic fragments and opaque minerals. Percentages of these constituents vary between individual chips.

The quartz consists of angular to irregular grains with a rough preferred orientation along what is presumably bedding planes. The grain size of detrital quartz varies between 0.25 mm and a few microns. In a few of the chips, coarser grained quartz, in individual grains up to 1 mm in diameter and in patches several millimetres across, has been introduced subsequently to the diagenesis of the rock and does not conform to the sedimentary fabric.

Occasional grains of plagioclase are also present as detrital constituents of the sediment.

Flakes of a colourless mica, about 0.15 mm in length, have a strong preferred orientation along the bedding direction of the sediment. In one chip, a fine-grained sedimentary band consisting largely of mica, occurs between two coarser beds of greywacke. Coarser flakes of muscovite, up to 0.25 mm in length, have been introduced to the sediment in the same way as the coarser quartz grains.

Fine-grained flakes of a yellow chlorite are common within the matrix of the sediment.

The lithic fragments in the greywacke consist of fine-grained clay minerals and are of indeterminate origin.

Some of the opaque grains are probably original to the sediment. However, some opaque material has clearly been introduced with the coarser quartz and muscovite. This type of mineralization appears to be distinct from a second type which has a gangue of chlorite and carbonate and will be described later.

In general, the greywacke has a sedimentary rather than a metamorphic fabric and, apart from the coarser quartz and muscovite already mentioned, shows little signs of recrystallization.

The second main rock type represented among the chips is undoubtedly metamorphic. It is a mica schist with a strong metamorphic foliation. It consists of muscovite, quartz and opaque minerals.

The muscovite occurs as flakes normally less than 0.1 mm in length and with an extremely consistent preferred orientation. This foliation of the rock is slightly contorted and contains lenticular patches of quartz.

Quartz grains are generally elongated and, in the major part of the rock, do not exceed 0.1 mm in length. However, in lenticular patches single quartz crystals reach a length of 1 mm. Both the fine grains and the coarse patches of quartz adhere closely to the preferred orientation of the metamorphic foliation.

Almost continuous masses of opaque material also occurs along the metamorphic cleavage planes.

The third main lithology represented in the chips is a quartzite. The rock consists essentially of quartz but different chips contain varying amounts of opaque material and white mica. The orientation of elongated quartz grains, the banded nature of the opaque component and the strong orientation of mica flakes impart a metamorphic texture to this type of rock.

Quartz grains are in the order of 0.1 mm in diameter but lenses of recrystallized quartz contain grains in excess of 0.5 mm in length and are themselves up to 1.5 mm in length. The tendency towards elongation of quartz grains in the main part of the rock is not universal, many grains are equidimensional.

Flakes of muscovite up to 0.1 mm in length occur with the quartz grains and display a strongly marked preferred orientation. Coarser muscovite flakes, up to 0.25 mm in length, are occasionally encountered and are possibly the product of recrystallization.

Bands of opaque material are strictly oriented parallel to the elongation of the quartz grains and of the muscovite flakes.

Mineralization is of two types in the rocks represented by the chip samples. In the first type, a patchy development of coarse-grained quartz, muscovite and opaque material is distributed in blind pods throughout the three types of rock. It is not clear whether this is the result of recrystallization or of the introduction of mineralizing solution from an external source.

The second type of mineralization occurs as discordant veins with opaque minerals and a gangue of chlorite and carbonate. One such vein has chlorite along the margin, followed by a band of opaque material with a central band of carbonate, a second band of opaque material and a band of chlorite along the second margin of the vein. The carbonate is not coloured pink by alizarin red stain and hence is not calcite. It may be either siderite or dolomite. The chlorite includes both green and brown coloured varieties and has a moderately high birefringence. One vein containing opaque material and chlorite, also contains a patchy development of sphene.

Sample: 835834; TSC35525

The greywacke lithology is most commonly represented by the chips in this sample. The sediments are somewhat coarser grained than those of the previously described specimen and consist of quartz, plagioclase, muscovite, biotite, lithic fragments and opaque minerals.

Detrital quartz occurs in grains up to 0.5 mm across. Some grains are elongated but many are equidimensional and the sediments do not show an oriented fabric of either sedimentary of metamorphic origin.

Highly altered plagioclase occurs in grains up to 0.4 mm across and occasional grains of fresh plagioclase are also present.

Muscovite flakes are plentiful but are of relatively fine grain size, not often more than 0.1 mm in length, so that in many of the chips muscovite is not abundant. However, there is a transition towards highly mica-rich rocks and the content of mica within the chips is highly variable.

In contrast to the last specimen described, the greywackes in sample 835834 contain a second mica. Biotite is not present in all the chips but is present in many of them in flakes up to 0.2 mm in length. The biotite is interstitial to the quartz and tends to be somewhat patchy in distribution.

Lithic fragments consist of fine-grained sediments and are not abundant in these chips.

Fine-grained particles of opaque material are present as detrital grains but the majority of the opaque minerals have certainly been introduced to the rock as they occur in a gangue of coarse-grained chlorite.

The other main lithology represented among the chips is a fine-grained, mica-rich sediment. This rock has a strongly marked fabric due to the preferred orientation of the mica flakes. The fabric is partially metamorphic in origin since it is also marked by lenticular patches of coarse-grained quartz. Apart from this, however, there is little evidence of metamorphic differentiation.

The carbonate mineralization is not present in this sample. However, a patchy development of the coarse chlorite and sphene which were described in the previous sample also occurs in one of the chips of this sample. Apart from this type of mineralization, a considerable quantity of opaque material has been introduced to the sample. Irregular patches of opaque minerals are distributed throughout the sediments and bands of the same material are frequent in the mica-rich sediment. In some cases the opaque mineral has no gangue with it but at other points it carries a gangue of relatively coarse chlorite.

Sample: 835835; TSC35526

Chips of the greywacke lithology are subordinate in this sample to chips of the other two lithologies described for specimen 835833. These are rocks with a metamorphic cleavage and a composition dominantly either mica-rich or quartz-rich.

The greywacke in this sample is of finer grain than those previously described but does not differ from them in other respects.

The mica-rich rock has a strict orientation of mica flakes and also a considerable amount of recrystallized quartz in lenses which conform to the cleavage. The cleavage is too strongly marked to be of sedimentary origin and is weakly contorted. Muscovite flakes are in generaly fine-grained but in occasional, lenticular patches, recrystallization has produced grains of up to 0.7 mm in length.

In the quartz-rich lithology an oriented fabric is produced by consistent elongation of the quartz grains and by a small proportion of mica flakes which share the preferred orientation.

Most of the opaque material in these samples has clearly been introduced. Irregular bands of opaque minerals occur along the metamorphic cleavage, particularly of the mica-rich sediment. Some of the chips in this sample are composed almost entirely of opaque material, sometimes with a small amount of mica adhering to the rim. In other chips irregular lenses and patches of opaque material are subparallel to lenticular patches of recrystallized quartz. In a few cases, mica has also been recrystallized into coarser flakes. One chip is composed of a branching network of opaque material in a matrix of chlorite, epidote and a mineral of very low birefringence which contains fine polysynthetic twins and is possibly a zeolite.

Sample: 835836; TSC35527

By far the majority of the chips in this sample are composed of the greywacke lithology. The rock is of moderately coarse grain with quartz up to 0.5 mm in diameter. Mica is relatively scarce in this greywacke but lithic fragments are abundant. Coarse-grained chlorite is also abundant but is probably not a detrital constituent. It tends to occur in patches with opaque minerals. In a few chips, chlorite veins and patches form the dominant component of the rock. The chlorite is well crystallized and has a decussate texture. The mineral with low birefringence and polysynthetic twinning is also present as a moderately abundant component of some of the chips.

A few chips consist of the mica-rich lithology with the customary opaque material along the cleavages.

Opaque minerals occur in patches with chlorite and recrystallized quartz but are not as abundant in this sample as in the one last described.

Sample: 835837; TSC35528

This sample is almost identical to the one last described. It consists of chips of a coarse-grained greywacke type sediment with quartz grains up to 0.5 mm in diameter. Muscovite mica is relatively abundant in some of the chips and a fine-grained, structureless matrix forms a larger proportion of some of the chips than in the greywackes previously encountered in this suite.

Patches of decussate chlorite flakes and of the possible zeolite are well represented. In one patch of the zeolite a crystal of sphene is present.

Opaque material is not abundant but occurs as irregular patches associated with quartz, chlorite and the possible zeolite.

Sample: 835838; TSC35529

The mica-rich and quartz-rich lithologies are dominant among the chips of this sample. Only a very few of the chips have a greywacke lithology.

Opaque material is abundant in the specimen and occurs both as irregular bands and lenses along the cleavage of the micaceous chips and as irregular patches, together with coarse quartz in both mica-rich and quartz-rich lithologies. In some chips the opaque material forms a branching network of veins between lenses of recrystallized quartz.

3.2 Mineragraphy

Sample: 835833; PSD6940

The main reflecting mineral in this specimen is pyrrhotite which occurs in irregular masses and in bands along the foliation of the rocks. Grain size varies between 0.01 mm and 1.5 mm. The habit of the mineral is interstitial and the shape of the grains extremely irregular.

Pyrite also occurs, in somewhat lower abundance, as irregular masses and rather ragged bands. Many of the grains are poorly crystalline, particularly in the centre. Inclusions of marcasite are present in some grains.

Marcasite also occurs as well-shaped crystals in masses up to 0.6 mm across. The abundance of marcasite is not high in this sample.

A few grains of chalcopyrite are present either marginal to masses of pyrrhotite or adjacent to and not very distant from such masses. Grain sizes are in the order of 0.1 mm.

A few grains of sphalerite are also present, usually in the vicinity of chalcopyrite grains but also disseminated throughout the rock. Grain size is in the order of 0.2 mm.

Galena was carefully sought in this sample but only one extremely small grain was observed adhering to a grain of pyrrhotite. The galena was not more than 0.05 mm in diameter.

Sample: 835834; PSD6941

Pyrrhotite is again the most abundant reflecting mineral in the specimen, however, the abundance of the sulphide component as a whole is lower in this specimen than in the one just described. Pyrrhotite occurs as large masses, 0.8 mm in diameter, with a generally irregular shape. In places the pyrrhotite has been introduced along foliation planes of the host rock and in many cases is itself foliated. In other places it occupies interstitial spaces including fine reticulated branches filling the intergranular spaces of the silicate minerals.

Pyrite is present as relatively small masses in which the grains are of moderately good shape. The diameter of such masses is in the order of 0.25 mm.

Chalcopyrite occurs in this specimen in irregular patches of ragged grains up to 0.5 mm in diameter. The chalcopyrite is not confined to the immediate vicinity of pyrrhotite but is generally not too far distanct from such patches.

Small crystals of sphalerite, about 0.08 mm in diameter, are quite widely distributed throughout the specimen. There is a tendency for sphalerite to occur with and sometimes within grains of carbonate.

Galena was sought in this specimen but was not observed.

Sample: 835835; PSD6942

Pyrrhotite is again the most abundant sulphide and occurs interstitially to silicate minerals as irregular patches and has also been introduced along the foliation of the mica-rich rock chips. In such localities the form of the pyrrhotite echoes that of the silicates and the resulting habit is foliated pyrrhotite. In other localities it forms a branching network in the interstitial spaces of silicate grains.

Pyrite is present in moderately shaped to well shaped crystals about 0.2 mm in diameter. In a few such crystals small inclusions of an isotropic grey mineral were tentatively identified as galena.

Marcasite does not form independent crystals in this specimen but is present as inclusions in pyrite grains.

The sphalerite content of this specimen is quite substantial. It occurs in masses up to 0.6 mm in diameter and is disseminated throughout the rock independently of the presence or absence of iron sulphide minerals.

Chalcopyrite occurs as extremely fine-grained inclusions in grains of sphalerite. It is also present as independent grains which are generally associated closely with sphalerite and measure about 0.01 mm in diameter. One coarser patch of chalcopyrite was observed with a diameter of 0.1 mm. It occurred in contact with a mass of pyrrhotite.

No galena was identified in this specimen.

Sample: 835836; PSD6943

The pyrrhotite in this specimen is relatively fine-grained. It occurs as ragged and irregular grains of about 0.2 mm diameter. It is distributed quite generally throughout the specimen.

A few grains of pyrite are present and are particularly concentrated in one of the rock chips. The grains are of relatively good shape and measure up to 0.25 mm in diameter.

Marcasite again occurs as inclusions in pyrite and does not form independent grains.

Sphalerite is quite abundant in this specimen and occurs in disseminated fine grains of about 0.04 mm diameter which are distributed randomly throughout the specimen. Sphalerite also occurs with and within grains of carbonate gangue. One patch of coarse sphalerite was observed with a diameter of 0.2 mm.

Chalcopyrite occurs as large, irregular and ragged grains of up to 0.2 mm in diameter.

Sample: 835837; PSD6944

The sulphide content of this specimen is low. Pyrrhotite occurs as ragged and disseminated grains with a diameter in the order of 0.25 mm. A few grains of pyrite are also present. The crystal form of these grains is relatively good and their diameter in the order of 0.15 mm.

A very few grains of marcasite are also present. They tend to be well shaped and have a diameter of about 0.2 mm.

Sphalerite is present in grains of about 0.1 mm diameter and tend to be included in carbonate gangue.

A very few grains of chalcopyrite are present. They tend to be in contact with pyrrhotite grains and measure in the order of 0.1 mm in diameter.

Sample: 835838; PSD6945

In this specimen, the abundance of pyrrhotite is similar to, if not less than, that of pyrite and marcasite. The pyrrhotite occurs as ragged, disseminated grains, 0.2 mm in diameter, and also as irregular bands introduced along the cleavages of the rock chips.

Pyrite occurs in large, well-shaped grains which reach 1.5 mm in diameter.

Marcasite also is present in large well-shaped grains about 1.5 mm in diameter.

Sphalerite occurs as grains up to 0.35 mm in diameter but generally of substantially lower grain size. One grain of sphalerite was observed to include a large number of fine grains of chalcopyrite.

As well as its occurrence as fine inclusions in sphalerite, chalcopyrite occurs in larger grains, 0.02 mm across, at the margins of sphalerite grains. It is also present as rare independent grains up to 0.04 mm in diameter.

000179

COMLABS Pty. Ltd.

COMPUTERISED ANALYTICAL LABORATORIES

NATA REGISTERED No. 1526

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

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

OUR REF.: COM 820333

YOUR REF.: D.P.O. B 0446

RECEIVED
12 MAR 1982

Mr. G. Bubner,
CRA Exploration,
P.O. Box 254,
NORWOOD. S.A. 5067.

11.3.82

Dear Graham,

RE: JOB COM 820333

Enclosed are the assays for the samples delivered to our laboratory on the 25th February, 1982.

Yours sincerely,

P R Harvey

Phillip Harvey
Laboratory Manager

c.c: Mr. B. Dellow

COMLABS Pty. Ltd.
COMPUTERISED ANALYTICAL LABORATORIES

ANALYTICAL REPORT

000180

JOB COM820333   O/N : F 0446

Results in ppm

SAMPLE	Cu	Pb	Zn	%Fe
945313	28	280	150	14.0
945314	38	100	60	7.10

Method of Analysis : Cu Pb Zn : AAS1
Fe : AAS2A

000181

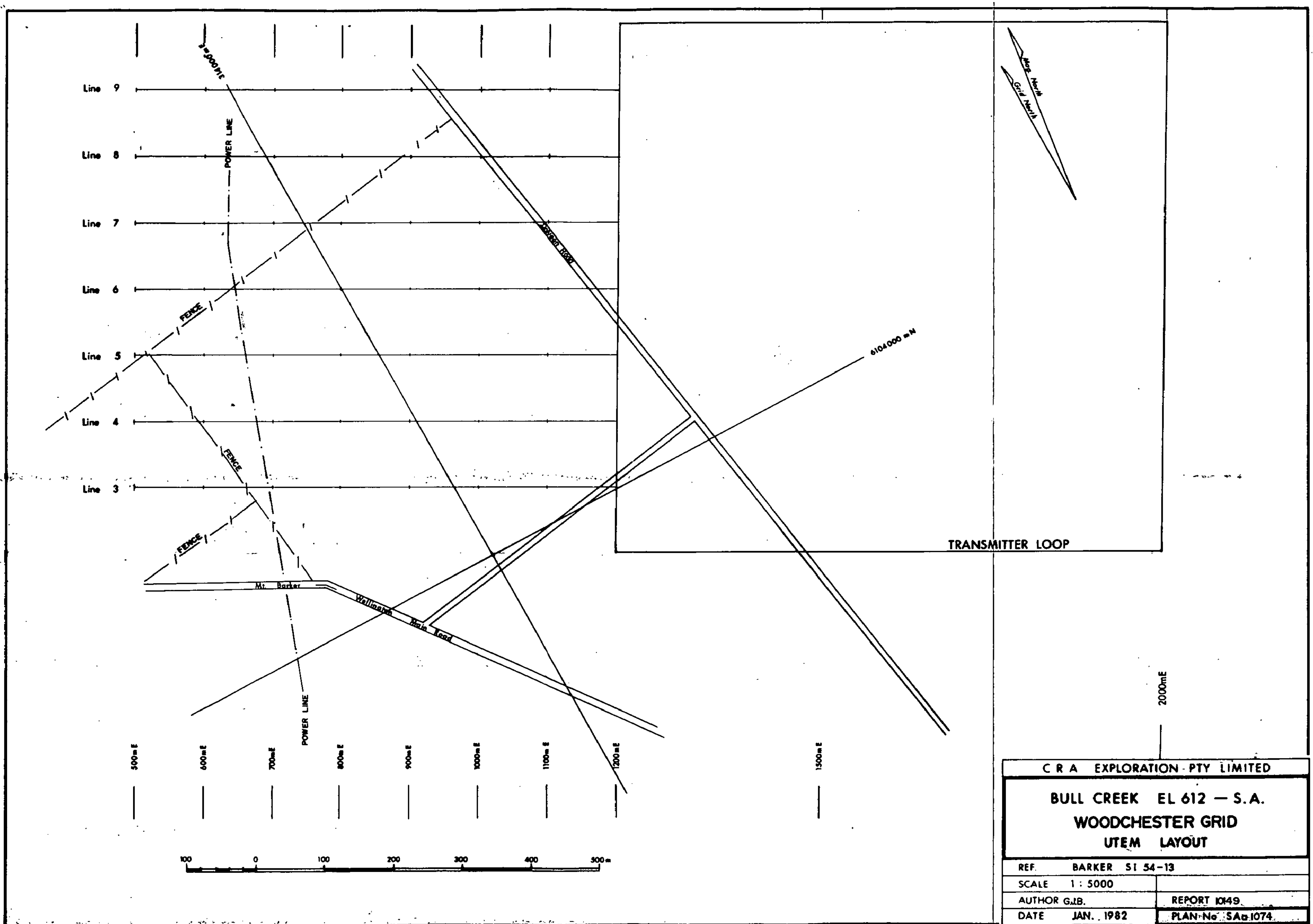
ANALYTICAL REPORT

JOB COMS20333 O/N : B 0446

Results in ppm

SAMPLE	Ag	Au	Sn	W
945313	<1	<0.05	10	<10
945314	<1	<0.05	6	<10

Method of Analysis : Ag : AAS3
Au : AAS5A
Sn W: XRF1



C R A EXPLORATION PTY LIMITED

BULL CREEK EL 612 — S.A.

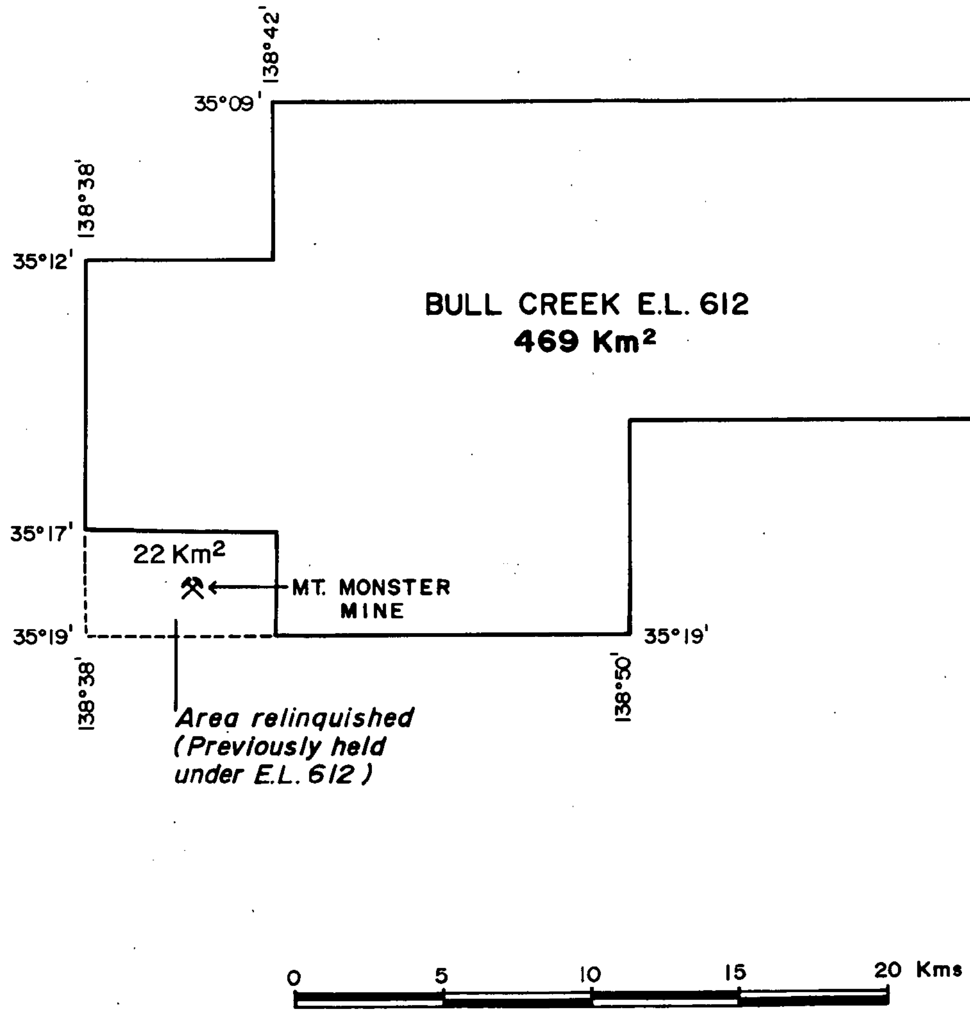
WOODCHESTER GRID

UTEM LAYOUT

REF.	BARKER SI 54-13	
SCALE	1 : 5000	
AUTHOR	G.I.B.	REPORT 10149
DATE	JAN. 1982	PLAN No SAa 1074

000182

000183



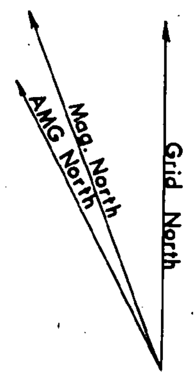
C. R. A. EXPLORATION PTY. LIMITED	
BULL CREEK E.L. 612 MODIFIED AREA FOR REAPPLICATION	
Ref. BARKER SI 54-13	
Scale 1:250000	Drawn J.C.R.
Author A.J.V.	Report No. 10149
Date FEB. 1982	Plan No. SAa 1328

Remote potential electrode (800m)

	500mE				600mE				700mE				800mE				900mE				1000mE				1100mE				1200mE
Line 9	0	0	0	0	-3	0	-11	-12	-21	-24	-30	-38	-29	-48	-21	-11	-1	-3	-2	0	0	0	0	0	0	0	0	0	0
Line 8	+1	0	0	-1	-9	-8	-1	-1	-10	-17	-28	-38	-41	-36	-28	-20	-11	-12	-2	-1	0	0	0	-1	-10	-9	0	0	0
Line 7	+1	+15	+1	+1	0	-7	-29	-8	-15	-11	-7	-20	-22	-61	-71	-53	-32	-39	-21	-21	-1	-2	-5	-10	-8	-2	-1	-3	-1
Line 6	0	0	+2	+8	+1	0	-1	-3	0	+1	-2	-3	-12	-26	-60	-66	-58	-27	-26	-10	+3	0	-2	-1	0	0	0	-1	0
Line 5	+1	0	+3	+5	+4	0	+1	-6	-10	-9	-9	-14	-22	-30	-56	-52	-49	-38	-15	-20	-20	-10	-7	-2	0	0	0	-1	0
Line 4	+5	+15	+15	+20	+21	+22	+15	+10	+10	0	0	-2	-1	-4	-8	-21	-35	-20	-8	-9	-8	-10	-6	-3	-2	-6	-3	-1	-2
Line 3	+10	+12	+10	+12	+15	+9	+12	+22	+20	+10	+8	+8	+2	0	-1	-2	-8	-5	-8	-1	-13	-10	-1	-8	0	0	+5	+8	+6

81WCP2 (Line 6)

81WCP1 (Line 4)



Results in mV

SCALE 1:5000

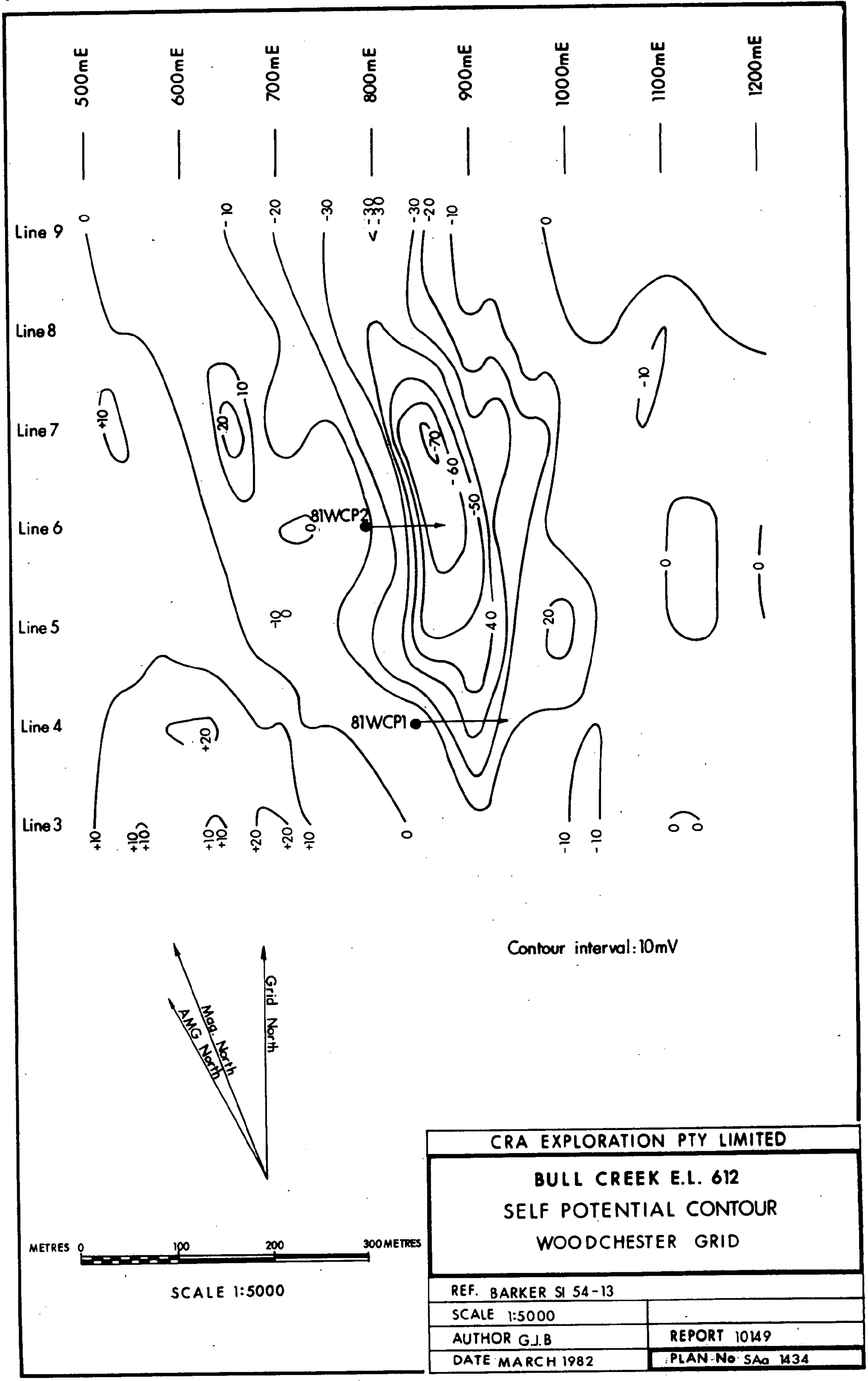
CRA EXPLORATION PTY LIMITED

BULL CREEK E.L. 612

SELF POTENTIAL SURVEY

WOODCHESTER GRID

REF. BARKER SI 54-13	
SCALE 1:5000	
AUTHOR G.J.B.	REPORT 10149
DATE MARCH 1982	PLAN No SAa 1433



CRA EXPLORATION PTY LIMITED

BULL CREEK E.L. 612
SELF POTENTIAL CONTOUR
WOODCHESTER GRID

REF. BARKER SI 54-13	
SCALE 1:5000	
AUTHOR G.J.B	REPORT 10149
DATE MARCH 1982	PLAN No SAa 1434

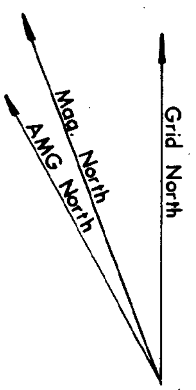
	500mE				600mE				700mE				800mE				900mE				1000mE				1100mE				1200mE
Line 9	81	77	95	99	107	106	110	112	116	122	130	119	136	129	127	93	87	70	54	42	27	21	11	5	1	0	-2	-5	-5
Line 8	106	102	100	104	103	105	99	105	114	112	120	114	128	124	119	115	85	89	78	57	37	22	14·5	10	7	4	0	-2	-6
Line 7	95	82	92	95	98	103	106	109	111	113	110	116	113	134	129	124	109	105	81	59	40	25	22	18	14	6	3	0	-4
Line 6	55	52	51	51	92	95	97	105	114	100	117	121	117	120	127	120	122	92	87	70	43	33	19	20	17	12	8		
Line 5	52	96	81	90	92	106	106	112	124	125	130	135	137	125	133	142	141	127	101	91	84	55	37	25	25	17	7	1	-3
Line 4	98	102	100	101	100	106	89	95	100	104	102	105	104	110	103	117	122	116	99	80	71	66	51	35	29	23	11	1	-4
Line 3	102	101	91	95	92	99	101	96	102	100	100	105	106	102	101	95	100	97	95	75	74	65	47	42	25	20	11	7	0

Remote potential electrode (1200m)

81WCP2

Remote current electrode (1480m)

81WCP1



Depth of electrode: 158 metres
Results in mV/A; average of readings observed during transmission of normal and reverse polarity current.

METRES 0 100 200 300 METRES

SCALE 1:5000

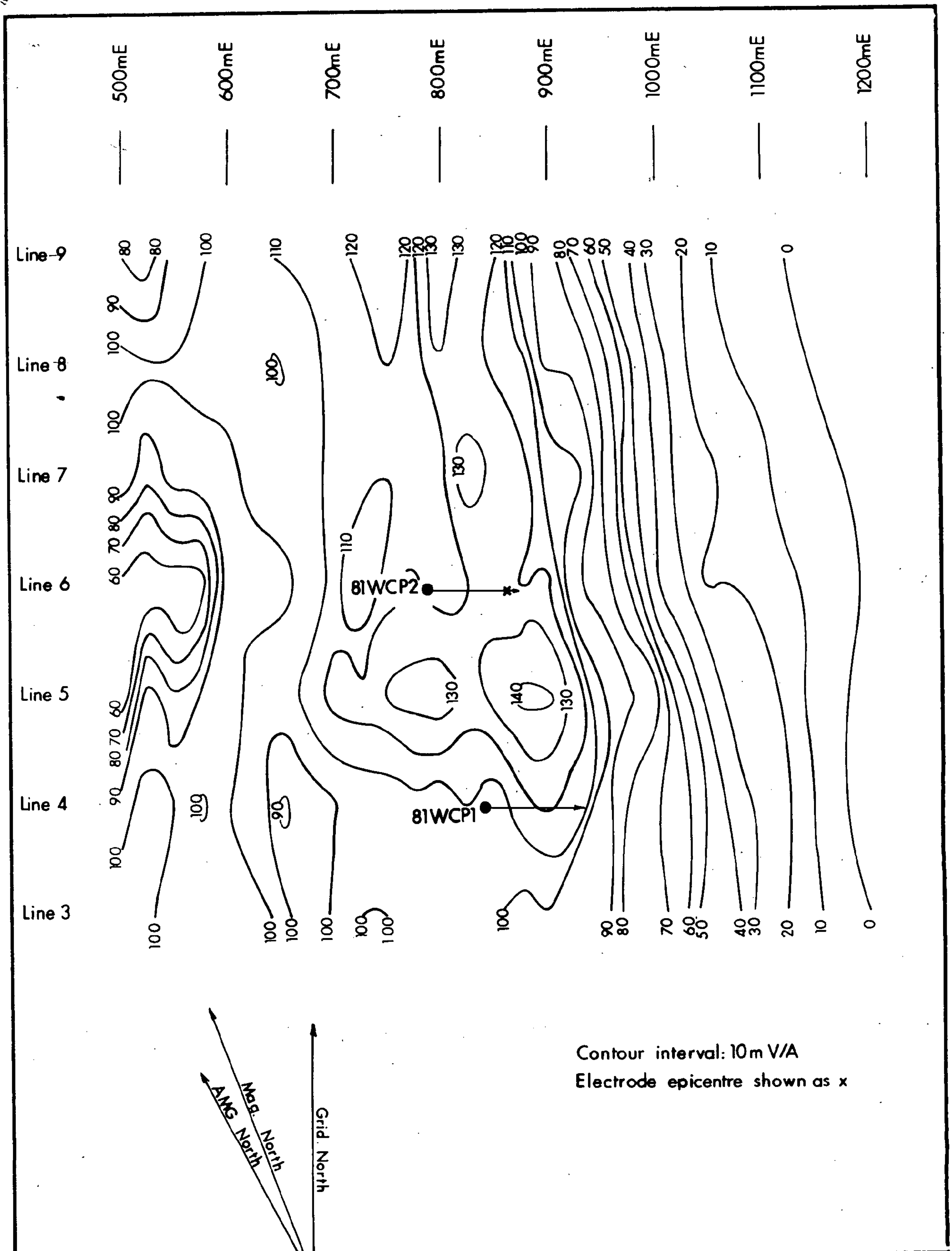
CRA EXPLORATION PTY LIMITED

BULL CREEK E.L. 612

MISE-A-LA-MASSE: 81WCP2

WOODCHESTER GRID

REF. BARKER SI 54-13	
SCALE 1:5000	
AUTHOR G.J.B.	REPORT 10149
DATE MARCH 1982	PLAN No SAa 1435



Contour interval: 10m V/A
Electrode epicentre shown as x

METRES 0 100 200 300METRES

SCALE 1:5000

CRA EXPLORATION PTY LIMITED

BULL CREEK E.L. 612
MISE-A-LA-MASSE CONTOURS : 81WCP2
WOODCHESTER GRID

REF. BARKER SI 54-13	
SCALE 1:5000	
AUTHOR G.J.B.	REPORT 10149
DATE MARCH 1982	PLAN No SAa 1436

III

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CRA EXPLORATION PTY. LIMITED

FIRST QUARTERLY REPORT FOR
BULL CREEK E.L. 1008, SOUTH AUSTRALIA
FOR THE PERIOD ENDING 6TH SEPTEMBER, 1982

AUTHOR: G.J. BUBNER

COPIES TO: CRAE LIBRARY
S.A.D.M.E.

DATE: 20TH SEPTEMBER, 1982

SUBMITTED BY: G.J. BUBNER

ACCEPTED BY: [signature]

CONTENTS

1. SUMMARY AND CONCLUSIONS

Further geophysical surveys were completed at the Woodchester Prospect. Surface and borehole Sirotem, GEM8 and I.P. data all display a prominent anomaly over the known pyrrhotite mineralization.

2. INTRODUCTION

Bull Creek E.L. ~~612~~ 612 comprising an area of 469 square kilometres was granted to CRA Exploration Pty. Limited for one year from 21st March, 1980, and renewed for a further twelve months to 20th March, 1982. A coincident area, excluding the Mount Monster Mine was granted as E.L. 1008 for one year from 7th June, 1982.

This report describes work carried out during the period 20th March to 6th September, 1982.

3. RECOMMENDATIONS

The grid at the Woodchester Prospect be maintained for future use as a geophysical test site.

Soil sampling and ground magnetometer traverses be carried out over three second-order drainage geochemical anomalies outstanding from the 1981 sampling programme.

4. WORK CARRIED OUT

Additional surveys comprising E.M., I.P. and magnetics were carried out in a test capacity over the pyrrhotite mineralization at the Woodchester Prospect.

4.1 E.M.

Lines 5.5 and 7.5 were surveyed at 50 metre intervals using a Sirotem MkII unit with 100 metre square displaced loops, and line 6 was read at 25 metre intervals with the roving vector receiver and a 200 metre square transmitter loop.

Profiles of the square loop response, and vertical and east-west components of the roving receiver are shown in Plan Nos.

Drillhole 81WCP2 was logged at 5 metre intervals with Sirotem using a 200 metre transmitter loop centred on line 6 at (a) 800mE and (b) 1000mE. Results are plotted in Plan Nos. SAa

Four lines of E.M. data was collected by Aerodata McPhar Pty. Ltd. using the GEM8 frequency domain system. Lines 4 and 6 were read with an in-line configuration, and lines 5 and 7 in the broadside mode. A complete report on this survey comprises Appendix I.

4.2 I.P.

One line of 50 metre dipole-dipole I.P. data was recorded on line 6, using a Huntec MkIV receiver. Results are plotted in Plan No. SAa

4.3 Magnetics

Lines 8 and 9 were surveyed with ground magnetics using a Scintrex MP-2 magnetometer, in conjunction with a Scintrex MBS-2 base station magnetometer. The complete grid of stacked profiles is plotted in Plan No. SAa 1032.

G.J. Bubner

G.J. BUBNER

GJB/dp

REFERENCES

Bull Creek E.L. 612 CRAE Reports 10149

WILLS, K.J.A. July 1980	First Quarterly Report for the Period Ending 20th June, 1980.
WILLS, K.J.A. November, 1980	Second Quarterly Report for the Period Ending 20th September, 1980.
WILLS, K.J.A. & COOK, I.A. February 1981	Third Quarterly Report for the Period Ending 20th December, 1980.
WILLS, K.J.A. April 1981	Fourth Quarterly Report for the Period Ending 20th March, 1981.
VENABLES, A.J. & BUBNER, G.J. July 1981	Fifth Quarterly Report for the Period Ending 20th June, 1981.
VENABLES, A.J. & BUBNER, G.J. October, 1981	Sixth Quarterly Report for the Period Ending 20th September, 1981.
VENABLES, A.J. January 1982	Seventh Quarterly Report for the Period Ending 20th December, 1981.
BUBNER, G.J. April 1982	Eighth Quarterly Report for the Period Ending 20th March, 1982.

LOCATION

Barker SI 54-13 1:250 000 sheet

KEYWORDS

Geophys-borehole, geophys-E.M., geophys-mag., geophys-I.P.

LIST OF ATTACHMENTS

Plan No.	Title	Scale
SAa 303	Bull Creek E.L. 1008	1: 250 000
SAa 1074	Woodchester Grid - UTEM layout	1: 5 000
SAa 1807	Transient E.M. Profile, Line 3: (7-8) Prospect Woodchester	1: 5 000
SAa 1808	Transient E.M. Profile, Line 6, (E-W Comp.) Prospect Woodchester	1: 2 500
SAa 1809	Transient E.M. Profile, Line 2, (5-6) Prospect Woodchester	1: 5 000
SAa 1810	Transient E.M. Profile, 81WCP2 (Loop 2) Prospect Woodchester	1: 500
SAa 1811	Transient E.M. Profile, 81WCP2 (Loop 1) Prospect Woodchester	1: 500
SAa 1812	Transient E.M. Profile, Line 6, (Vert. Comp.) Prospect Woodchester	1: 2 500

LIST OF APPENDICES

Appendix I: GEM 8 Test Survey, Woodchester Grid, Bull Creek E.L. 612, S.A.

APPENDIX I

GEM 8 TEST SURVEY

WOODCHESTER GRID

BULL CREEK E.L. 612, S.A.

GEM 8 TEST SURVEY

WOODCHESTER GRID
BULL CREEK EL 612
SOUTH AUSTRALIA

Carried out by

AERODATA MCPHAR PTY. LTD.

on behalf of

CRA EXPLORATION PTY. LIMITED

- CONTENTS -

LIST OF FIGURES

LIST OF APPENDICES

1. Introduction.

On the 6th and 7th April 1982 Aerodata McPhar carried out tests at the request of CRA, of the McPhar GEM8 ground EM system which was first introduced into Australia in March of 1982. The tests were carried out on the Woodchester Grid of the Bullcreek Exploration Licence 612 in South Australia.

2. Brief Description of the GEM8 System.

The GEM8 consists of an independent Transmitter and Receiver. Both units are of the size and weight that can be transported by one man. However, the transmitter system is generally carried in the back of a vehicle as was the case in this survey.
See Appendix 1. for a more complete description of the system.

2.1 GEM8 Transmitter.

The transmitter is powered by a small portable generator and provides current at switch selectable frequencies of 41, 82, 164, 328, 656, 1312, 2624, and 5248 Hz. This AC current is fed to a loop to provide a EM field. The loop can be either a horozontal or vertical multiturn loop or a single wire Turan loop. Currents in the loop generally range in the region of 2 to 30 amps.

2.2 GEM8 Receiver.

The receiver consists of two multi-turn coils at 90 degrees to each other. The electronics of the receiver system measure the relative amplitude of the signal in each coil and presents this as a ratio as one over the other. The electronics also measure the phase angle between the signals in each coil. This is presented as an angle between 0 and 360 degrees. At the time of reading the attitude of the coil system is noted from an inclinometer mounted on the coil system.

From this data tilt angle and elipicity (as a percentage) are calculated for the EM field at the receiver station.

As slight errors in the gain and phase response of the amplifiers in the receiver do exist provision is made so that duplicate reading can be made with coil x coupled to amplifier system x

...../2

000198

2.2 cont.

and coil y coupled to amplifier system y then with coil x coupled to amplifier y and coil y coupled to amplifier x.

3. Configuration of instrument used to collect data.

As two receiver units were used in this survey it was possible to collect both inline and broadside data from each transmitter set up. Two transmitter lines were used in this survey. Lines 4 and 6 (see figure 1.)

3.1 Transmitter in Line 4.

On line 4 the transmitter was moved from 1200 mE to 500 mE in 50m intervals. Receiver 1 was moved along line 4 so that it was always 200 mE of the transmitter to give in line data. Receiver 2 was moved along line 6 and was kept at the same easting as the transmitter to give broadside data. Thefrequencies used on these lines were channels 0 2 4 and 6 correcponding to 41, 164, 656 and 2624 Hz. The transmitter loop was a horizontal loop 5m in diameter.

3.2 Transmitter in Line 6.

An identical system was used on line 6 with receiver 1 being on line 6 200 mE of the transmitter and receiver 2 being on line 8 at the same easting as the transmitter. Frequencies used were channels 0, 2, 4 and 5 corresponding to 41, 164, 656 and 1312 Hz.

4. Processing Data.

The raw data of ratio and phase angle was entered into HP 41CV calculator in the field so that tilt angle and elipicity could be calculated on site. The raw data was also entered in a HP 9845 desk top calculator so that the raw data could be printed in a presentable form and plots of the data could be made.

See Appendix 1. "GEM-8 Technical Information" for information on method of calculating results.

All data recorded in the field has been presented in Appendix 2 Raw and Computed Data".

The abbreviations used in the tabulated data are as follows:

Freq = The frequency channel used when observing the data.
Channel 0 = 41 Hz
Channel 1 = 82 Hz
Channel 3 = 164 Hz etc.

Rtilt = The tilt angle of the receiver coil system.

Rxy = Observed ratio measurement using XY.

Pxy = Observed phase measurement using XY.

Ryx = Observed ratio measurement using YX.

Tilt = Computed tilt angle of EM field.

Elip = Computed Elipicity of the EM field.

Rb = Ratio bias.

Ph = Phase bias of one amplifier system with respect to the other.

All computed results of tilt angle and Elipticity have been plotted as stacked profiles. It should be noted that all data has been plotted at the Receiver station. In fact the values pertain to a point midway between the receiver and the transmitter for both inline and broadside data. This fact has to be considered when interpreting the data.

4.1 Removal of Topographic Effect.

As elevation differences between the receiver and transmitter directly affect the tilt angle and because at frequency 0 (41 Hz) any anomaly has a minimal effect on tilt angle, the tilt angle at frequency 0 has been subtracted from the tilt angle at other frequencies. This has been found to be a satisfactory method of removing topographic effects without going to the expense of levelling the survey grid.

5. Results and Interpretation.

All computed data has been presented in Appendix 3 (plotted data).
All lines have been plotted twice; without terrain correction and with terrain correction.
Only the terrain corrected plots have been considered in interpretation.
Interpretation positions of crossovers has been plotted on figure 1.

5.1 Line 4 In Line.

A pronounced crossover is shown at all frequencies centre on about 975 mE. Weaker crossovers, shown dominantly in the high frequencies, are centred on about 1225 mE and 825 mE.
When these positions are corrected for the Rx Tx spacing of 200 metres the anomalies are at:

825	mE	Major anomaly
725	mE	Minor anomaly
1125	mE	Minor anomaly

5.2 Line 6 In Line.

A pronounced crossover exists at 950 mE, a weaker one at 1150 mE. Thus when corrected by 100m for ½ the Tx Rx separation their position became:

850	mE	Major anomaly
1050	mE	Minor anomaly

5.3 Line 5 Broadside.

On this line, as the Tx was on line 4 and the Rx was on line 6 the data can be considered as relevant to line 5. As the data is broadside the plotted position of the receiver is the correct easting of any anomaly.

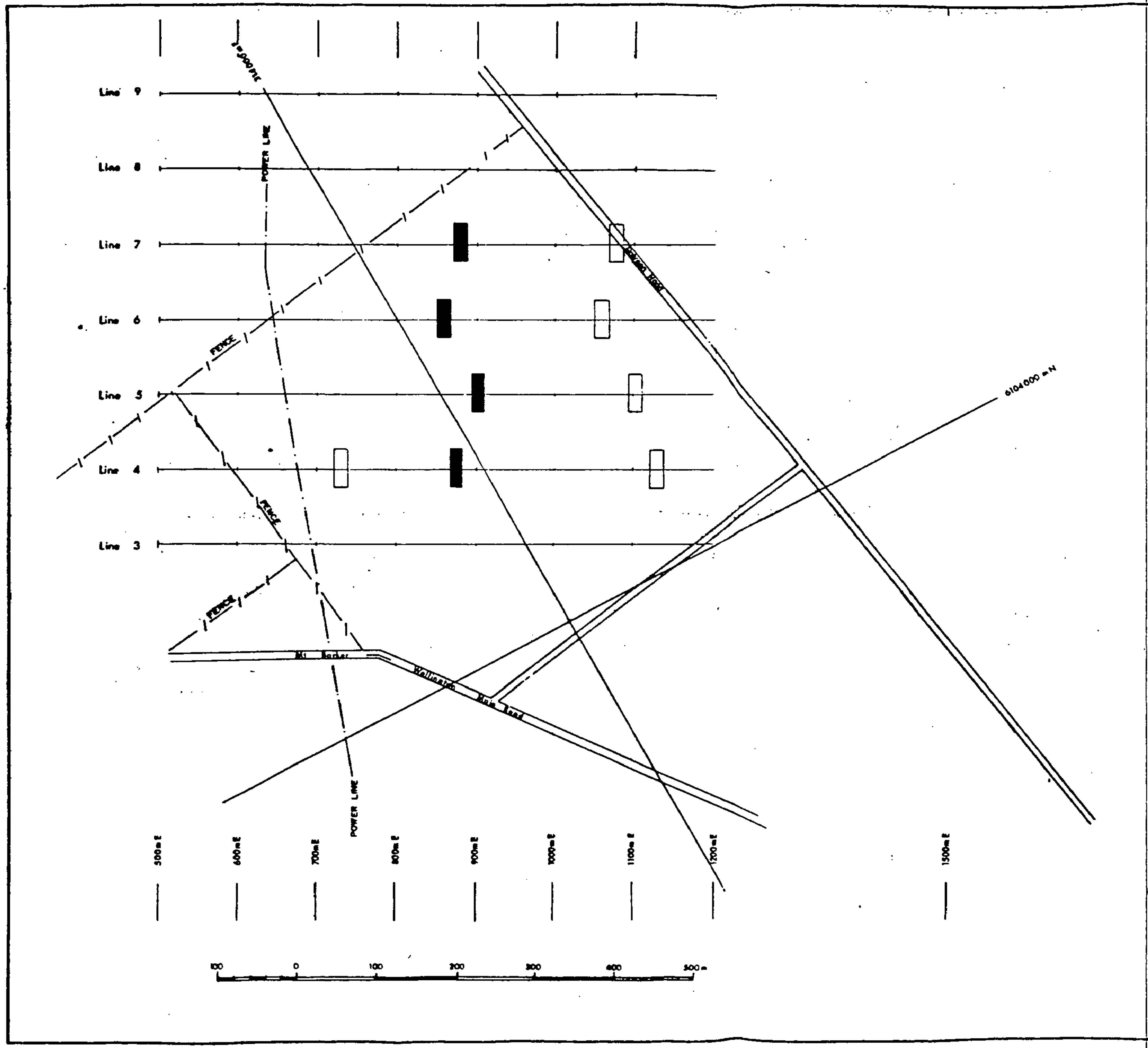
5.4 Line 7 Broadside.

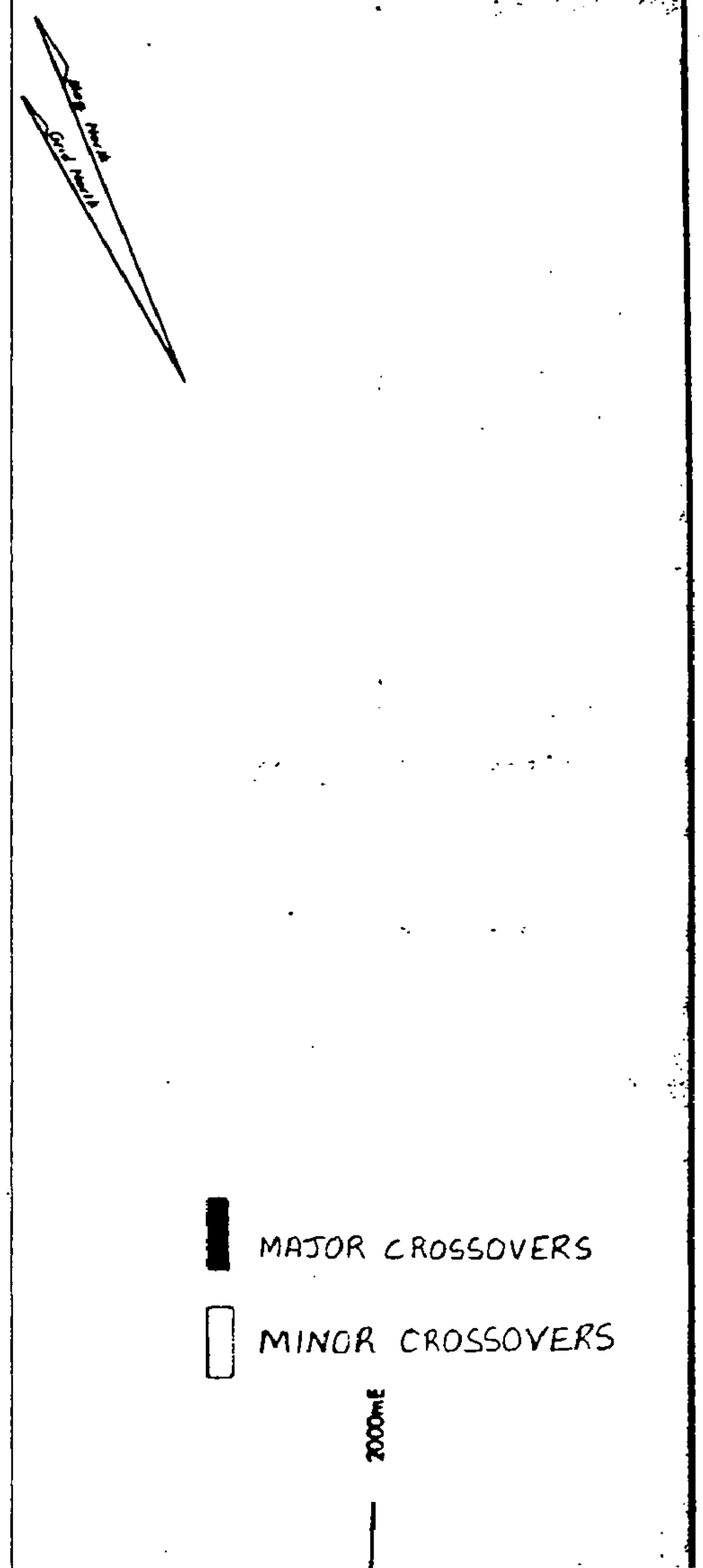
Again this line is similar to the line above in that the Tx was on line 6 and the Rx on line 8. Thus the data can be considered relevant to line 7 and the plotted positions of the receiver give the correct easting for any anomaly.

A very distinct crossover occurs at 875 mE with a minor one at 1080 mE. This minor crossover also coincides with a fence and may be regarded with some suspicion.

D.G. Sands
Senior Geophysicist
Aerodata McPhar Pty. Ltd.

24-4-82





C R A EXPLORATION PTY LIMITED

BULL CREEK EL 612 — S.A.

WOODCHESTER GRID

GEM 8 ANOMALIES

REF	
SCALE 1 : 5000	
AUTHOR	REPORT
DATE	PLAN No

000202

APPENDIX 1

GEM 8

GROUND ELECTROMAGNETIC SYSTEM

TECHNICAL INFORMATION

000204

GEM-8

GROUND ELECTROMAGNETIC SYSTEM

TECHNICAL INFORMATION

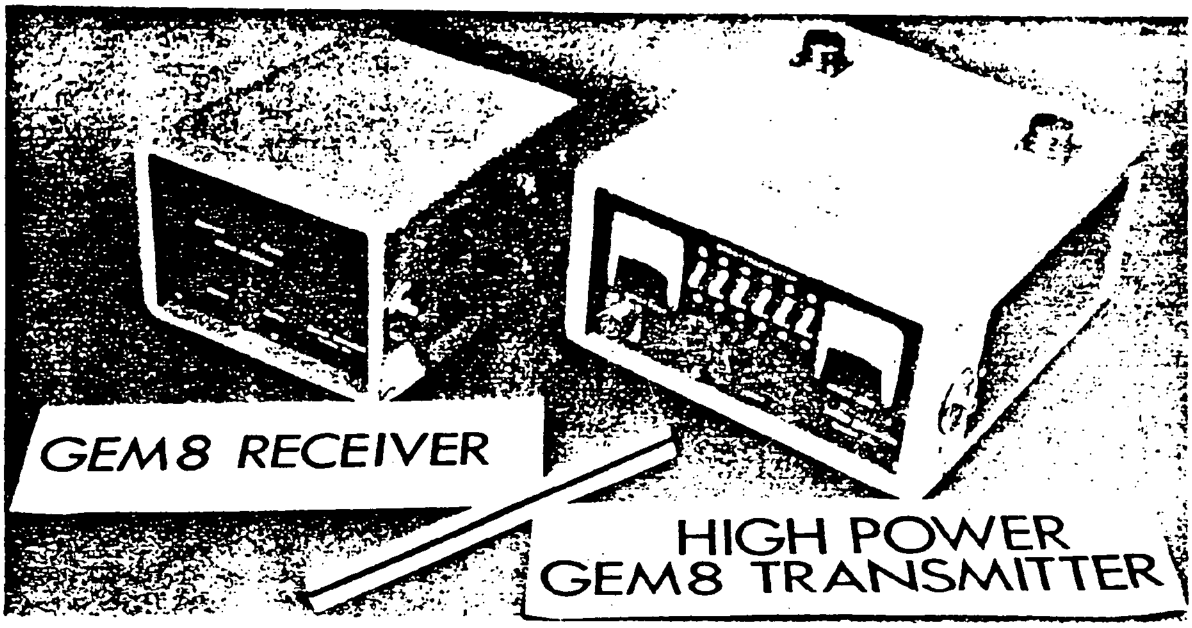
May, 1981

000205

McPHAR

GEM® 8

8 Frequency Ground Electro Magnetic System



- . Frequencies from 41 Hz to 5248 Hz.
- . 50 m to 2000 m coil separations, depending on system configuration.
- . Measures Ratio and Phase difference deriving Ellipse parameters.
- . No physical or radio link between transmitter and receiver.
- . Simple operation means accuracy is independent of operator experience.
- . Depth penetration in excess of 1000 meters.
- . Wide range of system configurations means flexible applications.
  - Horizontal or Vertical Loop Tx.
  - Fixed Tx, Inline or Broadside Surveying,
  - Parametric, Geometric or combined depth Sounding,
  - V/H terrain compensation similar result to SHOOTBACK without Tx-Rx exchange,
  - Multi-receiver operation,
  - Point and Gradiant mode TURAM surveying.

GEM8 is a flexible ground EM system with a range of capabilities normally requiring many individual instruments.

The Ellipse parameters are inherently normalized and do not require precise station setting. This means easy operation and inexpensive survey cost.

The receiver (Rx) console and coil is common to all configurations. The 5Kg console and air-core coil avoid field distortion problems associated with iron and ferrite cores and can be operated by inexperienced personnel.

GEM8 can help solve most EM exploration problems by appropriate selection of transmitter console, coil and power source, and the survey configuration.

One of our experts can help you configure the ideal system or survey for your needs.

GEM8 RECEIVER

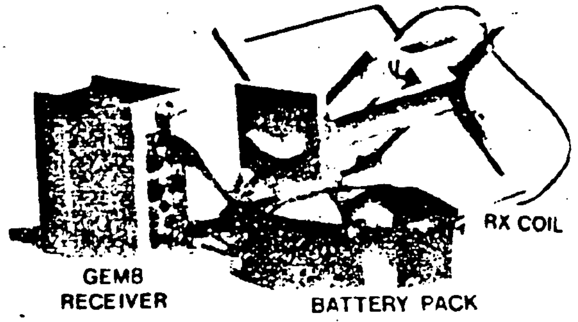
The receiving system,consisting of console, crossed-coils and power supply,is common to all configurations.

CONSOLE: The compact fibre-glass case with side mounted controls is easy to carry and convenient to use. Four windows in the front panel digitally display field measurements and instrument monitoring parameters.

CROSSED COIL: The coils are air-core to avoid field distortion, characteristic change by temperature, and electrostatic problems associated with iron and ferrite cores.

POWER SUPPLY: A leather waist belt containing the rechargeable battery pack can be worn comfortably for hours.

FIELD OPERATION: To avoid extraneous conductor effects, arbitrarily orient the coil on the ground, remote (2 m) from both operator and console. After noting the coil inclinometer reading, simply select the desired frequency and read the amplitude ratio and phase.



RESULTS: A simple calculation, using a pocket calculator, converts the ratio and phase to Tilt Angle and Ellipticity.These parameters are virtually independent of Rx-coil orientation and fluctuation of Tx-field and insensitive to inaccuracy in the Tx-Rx coil separation.

GEM8 TRANSMITTER

The transmitting system consists of a console, transmitter loop and power supply. Due to inverse cubic power law in distance, the primary field strength decreases from 64000 to 1 as Tx-Rx distance increases from 50m to 2000m. Therefore it is necessary to configure your Tx system with the proper choice of console, loop and power supply according to the survey scale.

CONSOLE: Compact fibre glass cases are easy to carry and operate. Power and voltage control permits choice of optimum signal strength and power consumption.

LOOP: Depending on the application, one or more 30m cables in series,portable framed coil on a tripod, or a large single conductor loop for TURAM operation is available.

POWER SUPPLY: Based on the power required, a JLO back-packed generator or rechargeable battery pack belt is available.

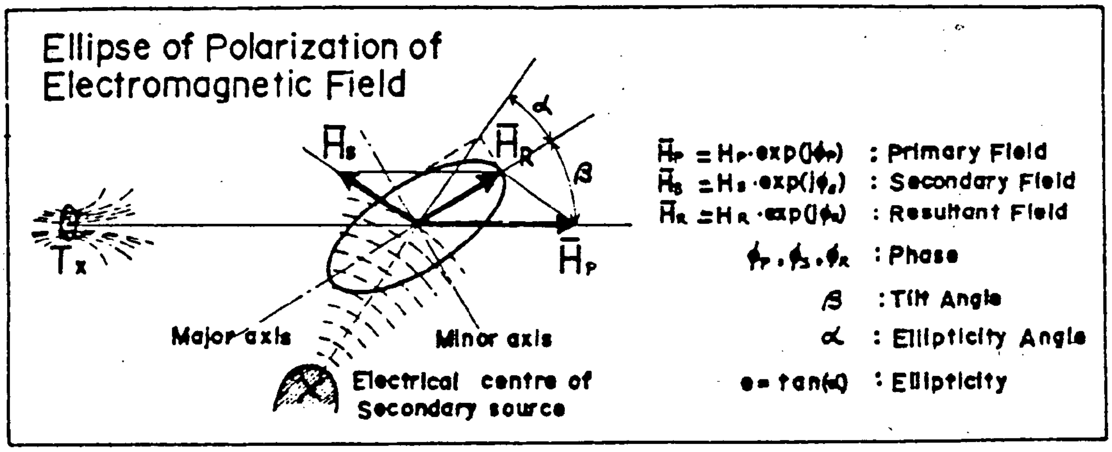
FIELD OPERATION: The Tx coil is quickly erected in position. Rotate the frequency selector to the desired position and the survey has begun. Depending on the power-console-coil configuration best suited to your needs and the local geological conditions, the response from the eight accessible frequencies permits depth sounding for strata definitions to better than half the Tx-Rx Separation. In addition the range of conductivities covered includes virtually all ore body types.

An electromagnetic field may be completely described by two parameters of the ellipse of polarization, the ellipticity and tilt angle. Work by N.R. Paterson and S.H. Ward have indicated the usefullness of these parameters as a means of obtaining geophysical information without resorting to a connecting reference cable between the transmitter and receiver. In 1970, S.H. Ward suggested that two orthogonal receiver coils could be used to determine the ellipse parameters without resorting to the "NULL" method.

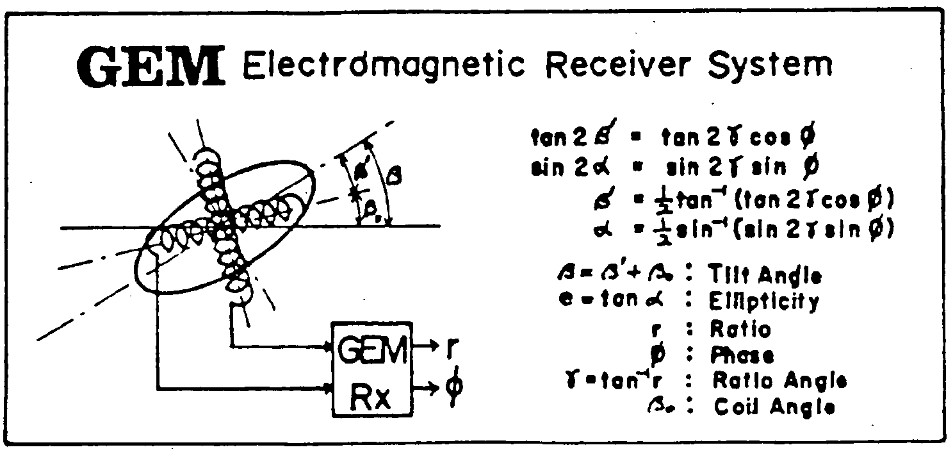
The ellipse parameters are insensitive to transmitter moment fluctuations and less sensitive to distance variations between transmitter and receiver than inphase and quadrature quantities as measured by loop-loop EM. Knowledge of the transmitter moment magnitude is unnecessary for interpretation since the ellipse parameters, inherently are normalized quantities.

Because the importance of EM measuring at multi-frequenceies and at lower frequency has been emphasized by S.H. Ward, N.R. Paterson and many other geophysicists, GEM8 measurements are made at eight frequencies as a standard provision; the lowest frequency is as low as 41 Hz.

Because the secondary electromagnetic field induced by a conductor in transmitting the primary electromagnetic field may be out of phase with the primary field, the resulting field at the receiving position is elliptically polarized. The parameters, ELLIPTICITY and TILT ANGLE, define the ellipse of polarization of an electro magnetic field, thus indicating the nature of the source of the secondary field.

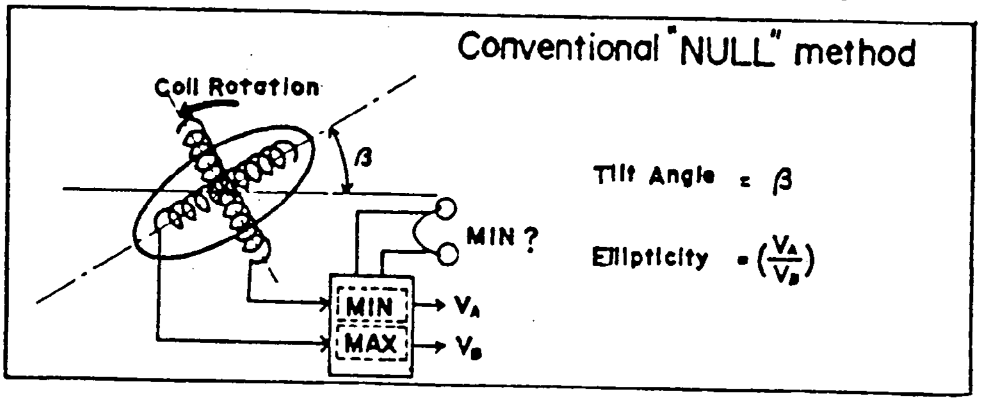


In the **GEM** system, the transmitter (Tx) generates an alternating electromagnetic field at the specified frequency. The receiver orthogonal coils (Rx-coils), placed on the ground at some distance from Tx, receive the electromagnetic field. The signal is digitally processed to give the amplitude ratio (r) and the phase difference (ϕ) between the two signals.

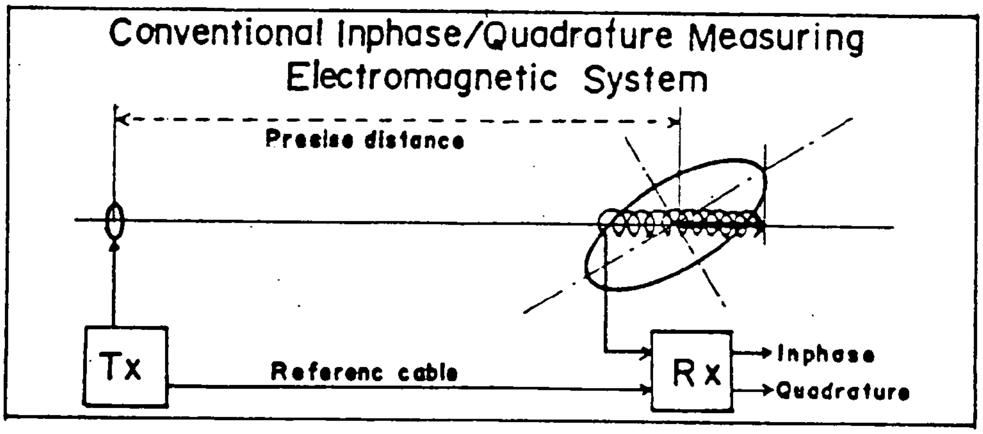


As indicated in the figure, two ellipse parameters are derived from the amplitude ratio and the phase difference between the Rx-coils. The Ellipticity is independent of the inclination of the Rx-coils. The Tilt Angle referred to the primary field direction can be obtained by subtracting or adding the inclinometer reading to the measured Tilt Angle. Therefore, leveling of the Rx-coil is not required.

Geophysical prospecting methods which measure ellipse parameters are not new. In conventional "NULL" methods, orthogonal coils are rotated until the output of the reference coil is minimized.As shown in the figure,the ratio of the signal amplitudes from the two coils and the angle between the horizontal and one coil axis at the "NULL" position are measured to determine ellipticity and tilt angle.



Other conventional EM systems (eg: the slingram method) measure a projection of the total field along the Tx-Rx axis. This projection is frequently defined in terms of inphase and quadrature components. These methods require a reference cable and precise Tx-Rx distance measurements as well as accurate leveling of the Tx and Rx coils.

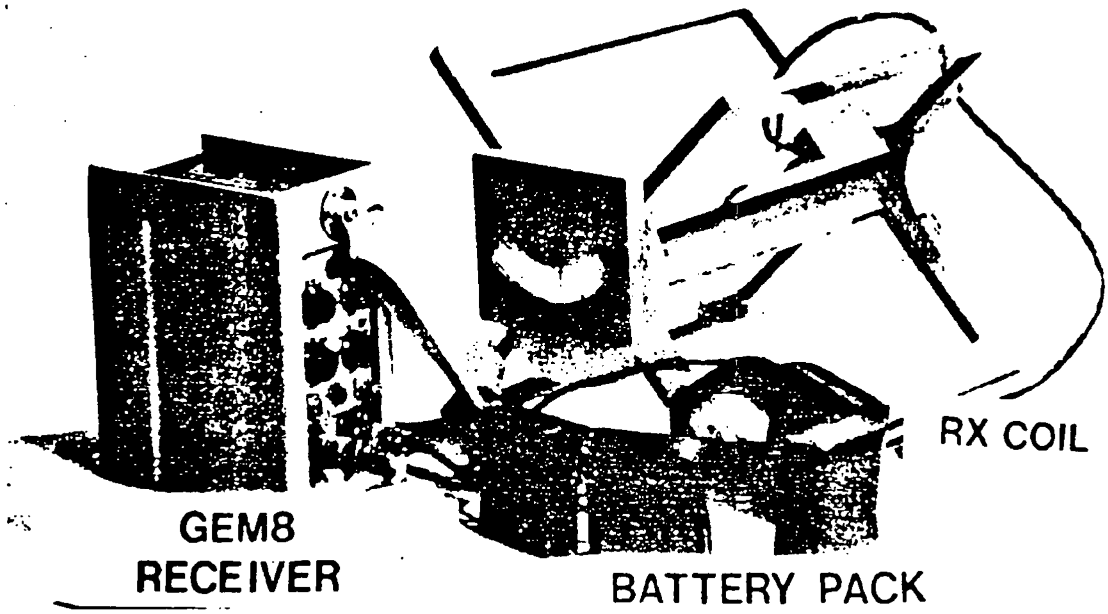


The **GEM** system has the following advantages:

1. No "Nulling", no "Leveling", no "Tuning", no "Tx-Rx link", (neither cable nor radio), no "Rx-coils leveling".
2. Inherently normalized parameters at Rx results in negligible effects from magnitude fluctuations of Tx field and variation of Tx-Rx distance.
3. Signal enhancement and phase/frequency filtering are achieved by sampling the signal at 16 points/cycle and stacking the samples.
4. Complete definition of the electromagnetic polarization ellipse compared to the measurement of a projection of one dimensional component of the field.
5. The ellipticity is derived with a sign (positive or negative) depending upon which way the ellipse rotates while conventional "NULL" methods give only absolute value (always positive).
6. Simple and effective terrain correction for tilt angle. The ellipticity parameter is independent of coil misorientation due to elevation difference between Tx and Rx.

GEM®

GROUND ELECTRO-MAGNETIC SYSTEM



GEM8 RECEIVER SPECIFICATIONS

ONSOLE: Rugged, splash-proof fibre glass case 5 Kg, 16 cm X 25 cm X 30 cm

ER SUPPLY: Rechargeable leather battery pack belt weighs only 4 Kg. Fully charged pack lasts 15 hours at 20°C.

CEIVER COIL: Rugged, self-standing air-core crossed-coils with inclinometer. 5 Kg, 50 cm X 50 cm X 50 cm

SPLAYS: Four 4-digit all-weather LCD (LED option) digital display windows on the front panel.

RAMETERS MEASURES:
RATIO - 4 digits, 3 decimal places, 0.1% accuracy
PHASE - 360 degrees, 4 digits, 1 decimal place, 0.1 degree accuracy

FREQUENCIES: 41 Hz, 82 Hz, 164 Hz, 328 Hz, 656 Hz, 1312 Hz, 2624 Hz, and 5248 Hz.

SENSITIVITY: 1 nano A/m (1×10^{-9} A/m)

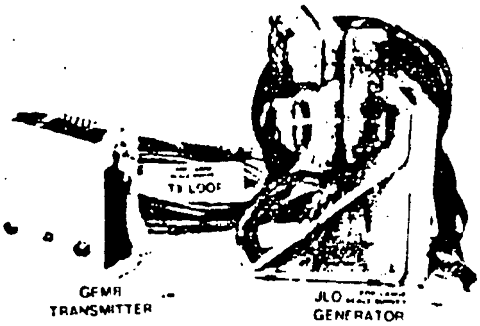
GAIN: 8 positions in factors of 2

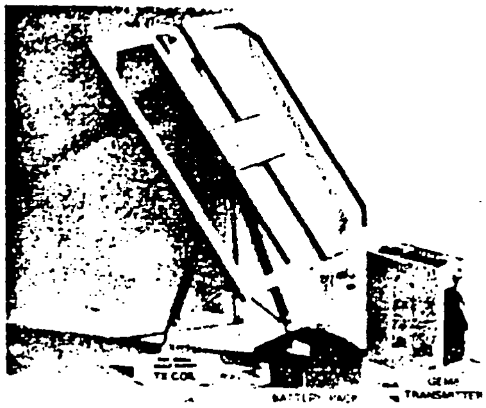
MONITORS: Battery level, Noise strength, Signal strength, Frequency and Gain indicater, and optional inclinometer reading.

REPEATABILITY: Tilt Angle .1 degree, Ellipticity .1%, under ideal conditions in the mid-frequency range. Field repeatability depends on coil separation, frequencies and field conditions.

SIGNAL ENHANCEMENT: The input signal is filtered by stacking 16 equi-spaced samples per cycle thus insuring complete signal definition.

gure 1 shows a block diagram of the GEM-8 receiver. After the signal from each coil is eamplified, two stages of sophisticated filtering reduces random noise to a negligible level. Exchange of the coils and processing channels permits elimination of all instru- nt bias and a virtually noise free read-out.





GEM8 TRANSMITTER SPECIFICATIONS

ONSOLE: Rugged, splash-proof fibre glass case, 11 kg, 17 cm X 33 cm X 38 cm for High Power System and kg, 16 cm X 24 cm X 30 cm for Portable System.

OWER SUPPLY: Depends on the survey scale and Tx loop.

JLO back-packed generator - 1.5kw maximum output, 34kg weight with gasoline, for large loop Tx.

Rechargeable leather batter pack belt - 17 ampere-hour, 6 kg for portable coil.

Other types of power source are available.

TRANSMITTER LOOP: Depends on the survey scale and method.

30 m cable - one or more in series. 19 conductors, neoprene, horizontal on the ground or vertical with a mast. Maximum moment at 41 Hz, with four 30 m cables is approximately 7.2 X 10^4 Am^2 and maximum Tx-Rx is 2000 m for good ground and noise conditions.

Portable framed coil - 1m X 1m mounted on a tripod for horizontal, vertical or V/H topo-cancel operation. Maximum moment at 41 Hz is approximately 500 Am^2 and maximum Tx-Rx distance is 300m for good noise condition.

TURAM loop - Single conductor loop of normal TURAM size (several km long). Survey distance from loop is several km depending on the loop size.

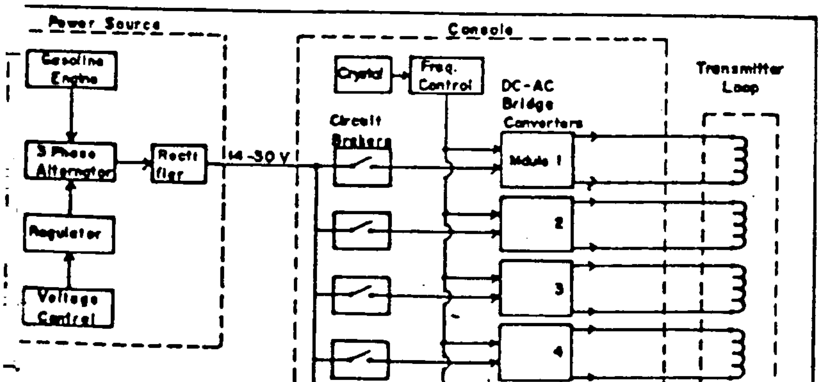
Other types of Tx loop are optional.

FREQUENCIES: 41 Hz, 82 Hz, 164 Hz, 328 Hz 656 Hz, 1312 Hz, 2624 Hz, and 5248 Hz.

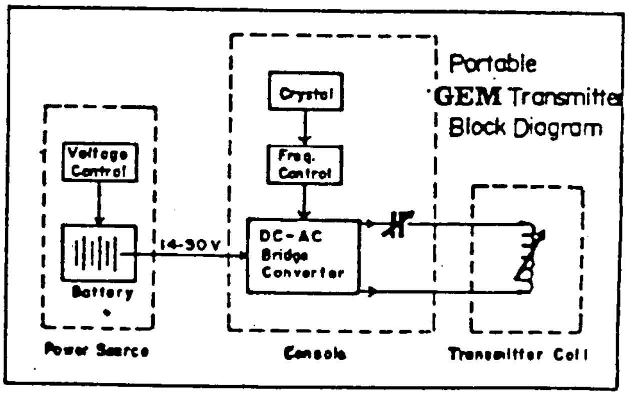
OUTPUT MOMENT: Variable depending on loop size, frequency, applied voltage and type of console.

OUTPUT CONTROL: Input voltage control and number control circuit breakers applied for high power transmitter console.

DIAGNOSTICS: Input voltage, output ampere and frequency indicator.



High Power GEM Transmitter Block Diagram



Portable GEM Transmitter Block Diagram

H.L-Tx MULTI-Rx/DEPTH SURVEY: Results give pseudo-section resistivity information like dipole-dipole IP or resistivity surveys. The multi-frequency measurements give more detailed information than resistivity survey.

POINT/GRADIANT MODE TURAM: Deep penetration surveys for large area coverage. Point mode survey can be performed by one-man Rx operator and with random station distribution. The point mode operation measures total field in terms of the ellipse of polarization parameters. There is no weak-field problem due to a large field tilt. A conventional TURAM method measures vertical component only and has a measurement problem when the field is tilted away from vertical.

FIXED V.L-Tx SURVEY: Locating deep conductors accurately.

ELECTROMAGNETIC DEPTH SOUNDING

Ward et al (1974) evaluated a multi-spectral electromagnetic system that has some of the characteristics of **GEM** This work was oriented towards the examination of the known massive sulphide deposits of the Cavendish Test Site in Ontario. While satisfied with the potential of the system, these investigators state:

"Existing interpretation techniques are limited both in scope and in application. The scope can be extended by expanding the range of simple single unit models upon which interpretation is based."

In their extensive discussion of electromagnetic induction methods, Grant and West (1965) point out that: "Depth sounding can be performed by the electromagnetic induction method in a manner analogous to the way it is done by D-C conduction." Further, it is also theoretically possible to achieve virtually simiiar results by varying the current frequency and keeping transmitting and receiving coils a fixed distance apart. Indeed, Slichter (1933) demonstrated that if an alternating magnetic dipole lies at the surface of a medium whose electrical conductivity is a function of depth only, the conductivity of the medium everywhere at depth may be completely determined by measurements of the field intensity at the surface. While this theorem has not, as yet, led to a practical method for direct interpretation, it is valuable in establishing the uniqueness of solutions to depth-sounding problems.

In spite of the firm theoretical foundation for electromagnetic depth sounding, it has not been popular. The D-C conduction method has tended to be used in place of electromagnetic method. Grant and West suggest that one of the reasons for the disuse of electromagnetic sounding is that theoretical curves for more than one surface layer overlaying a half space are not generally available.

Dey and Ward(1970) outline a complete solution of the boundary value problem of a horizontal magnetic dipole over a homogeneous and n-layered half-space. These authors suggest that the ellipticity, (a parameter derived from **GEM** measurements), is the best field parameter for use both with parametric and geometric sounding.

Other studies of multi-spectral depth sounding using tilt angle and ellipticity have been carried out by Ryu, Morrison, and Ward (1972); by Glenn and Ward (1976); and by Pridomore, Ward, and Motter (1979).

A number of studies suggest that practical automatic techniques for the direct interpretation of multi-frequency electromagnetic data can be developed. Daniels, Keller, and Jacobson (1976) outline a computer assisted method of depth sounding. They make use of an algorithm presented by Ghosh (1971) to evaluate and Hankel transform integral. Recently, Anderson (1979) has developed an algorithm that is more accurate than that suggested by Ghosh, without loss of efficiency.

Further, Lajoie, Alfonso-Roche, and West (1975) have suggested expressing the electromagnetic response of a layered earth in rectangular co-ordinates. A solution may then be obtained as a double inverse Fourier transform. The fast Fourier transform algorithm may be used to evaluate the fields.

With the assistance of the National Research Council of Canada, McPHAR is developing an automated computer interpretation method for the GEM8.

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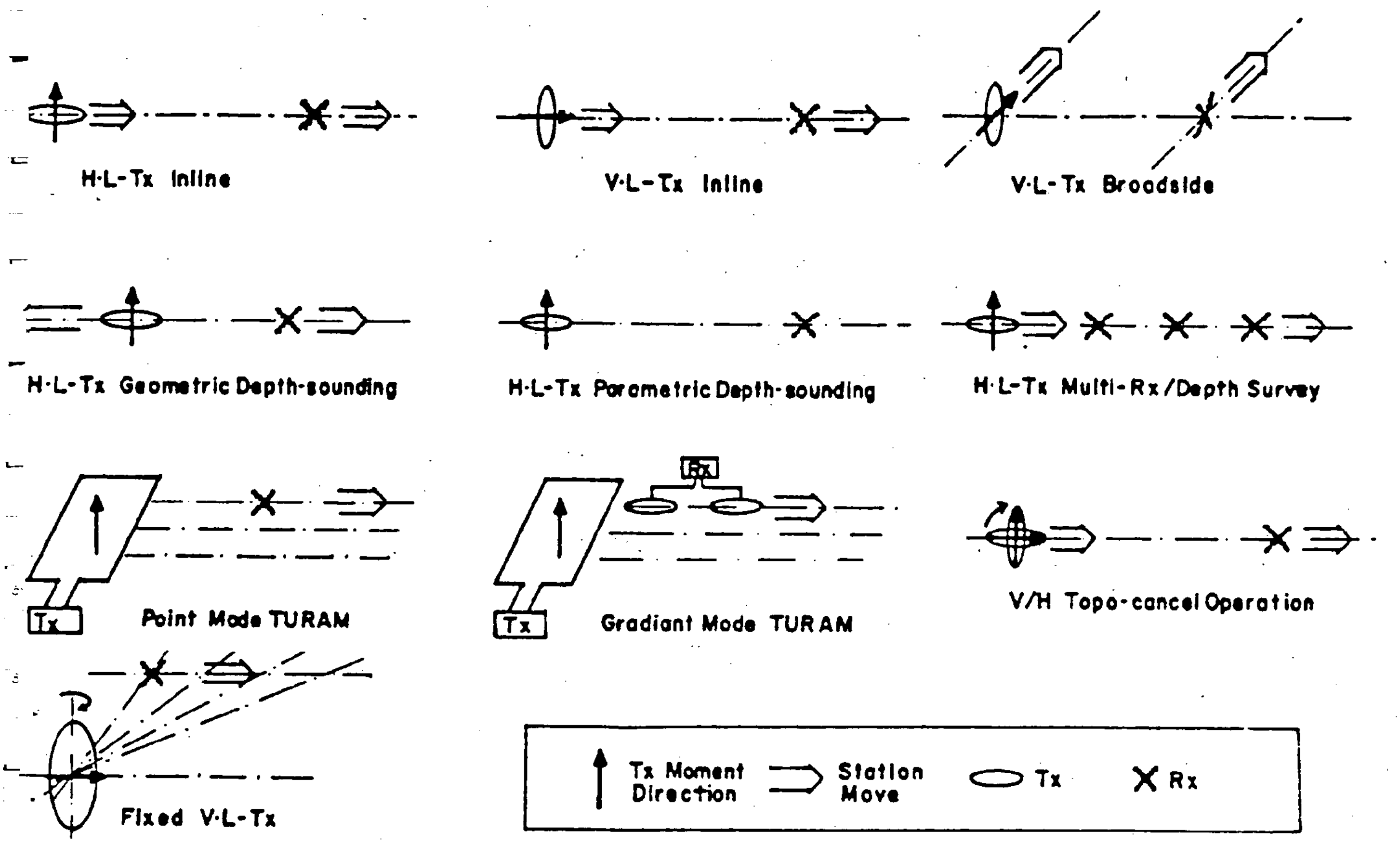
GEM Survey Confguration



The **GEM** system fully defines the field and requires no Tx-Rx reference link. These characteristics permit maximum flexability in survey design.

McPHAR can help you configure the ideal system and survey for your application.

H.L-Tx INLINE: Applied for horizontal profiling for conductor location. Suitable for massive sulfides and flat lying conductors. When all eight frequencies are applied at each station, the depth sounding capability gives continuous stratagraphic information.

V.L-Tx INLINE: Horizontal profiling for conductor search. When combined with measurements by H.L-Tx Inline, the results clearly indicated whether the conductor is vertical dyke type or flat lying.

V.L-Tx BROADSIDE: For accurate locating of conductors, due to the cross-over type response.

H.L-Tx GEOMETRIC DEPTH SOUNDING: For stratigraphic surveying, depth to basement or defining geothermal reservoirs.

H.L-Tx PARAMETRIC DEPTH SOUNDING: An alternative to GEOMETRIC DEPTH SOUNDING for use in rough terrain area. Suitable to quickly map stratigraphy because of innecessity of changing Tx-Rx separation.

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(Note: E_A and E_B are possible amplifier error sources)

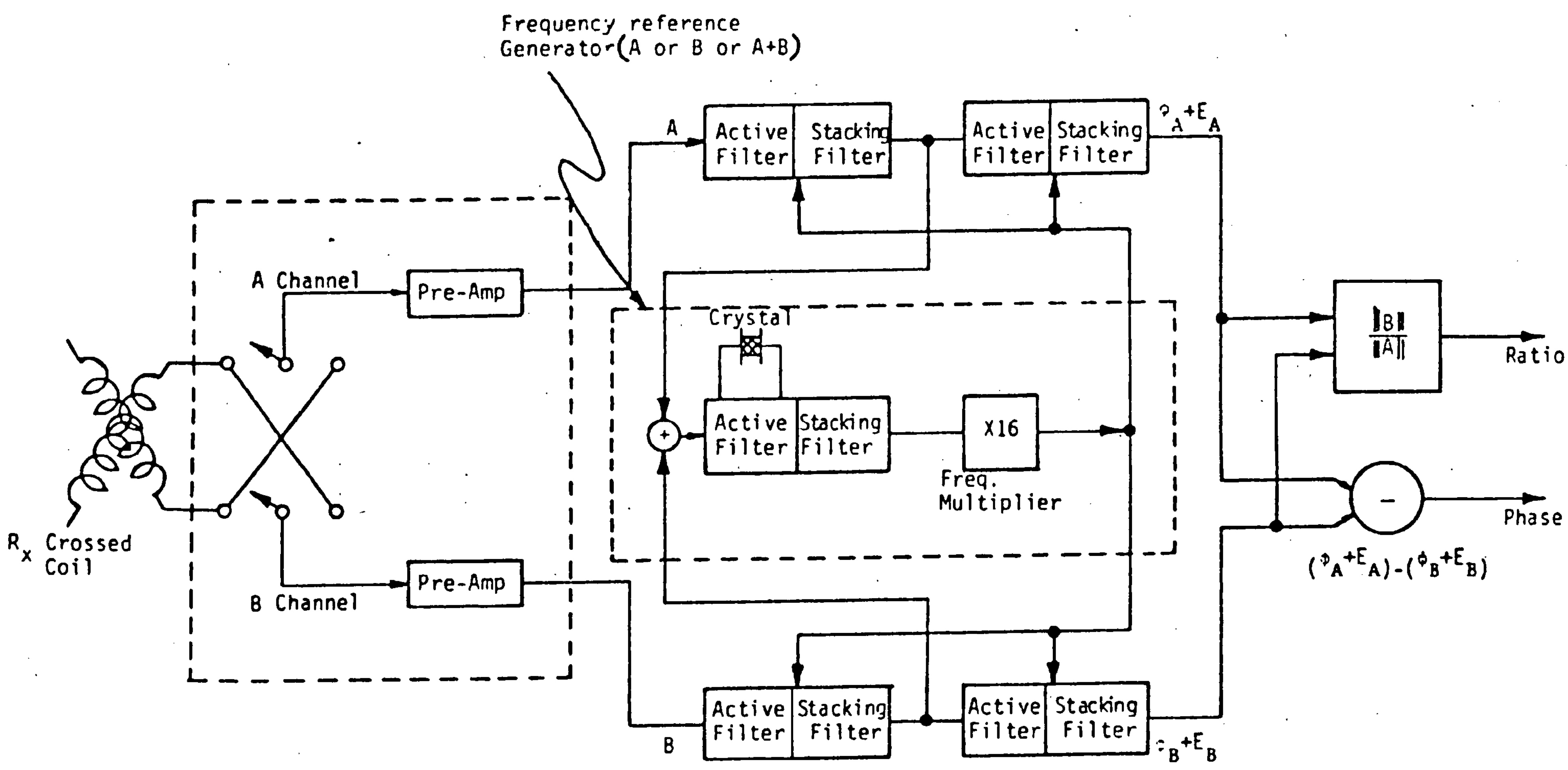

FIGURE 1: GEM-8 Receiver Block Diagram

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CALCULATION OF ELLIPSE PARAMETERS

GEM System Parameters

RATIO (r)) between the two coils of Rx crossed-coil

PHASE (ϕ) in degree)

Coil Angle (β_o) in degree

EQUATIONS TO DERIVE TILT ANGLE (β) AND ELLIPTICITY (e)

$\gamma = \tan^{-1} r$: (RATIO ANGLE)

$\beta' = \frac{1}{2} \tan^{-1} (\tan 2\gamma \cos \phi)$

$\alpha = \frac{1}{2} \sin^{-1} (\sin 2\gamma \sin \phi)$ = (Ellipticity Angle)

$\beta = \beta' + \beta_o$ in degree

$e = \tan \alpha$

This calculation can be performed by a simple hand held calculator. The chart figure overleaf is used to obtain, graphically, the tilt angle and ellipticity from the ratio and the phase.

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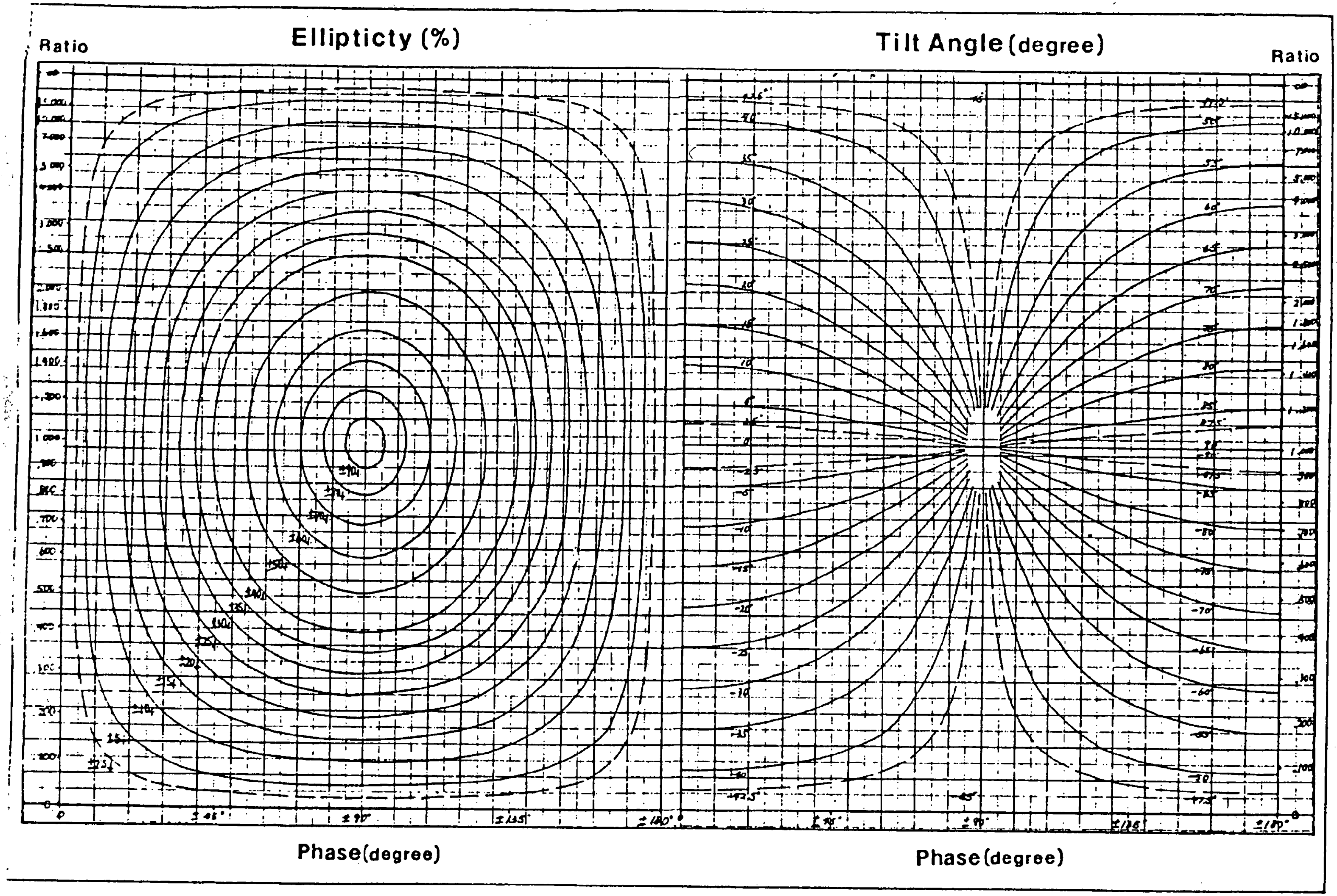
Ratio
Ellipticty (%)
Tilt Angle (degree)
Ratio
Phase (degree)
Phase (degree)

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VERTICAL CONDUCTOR RESPONSE

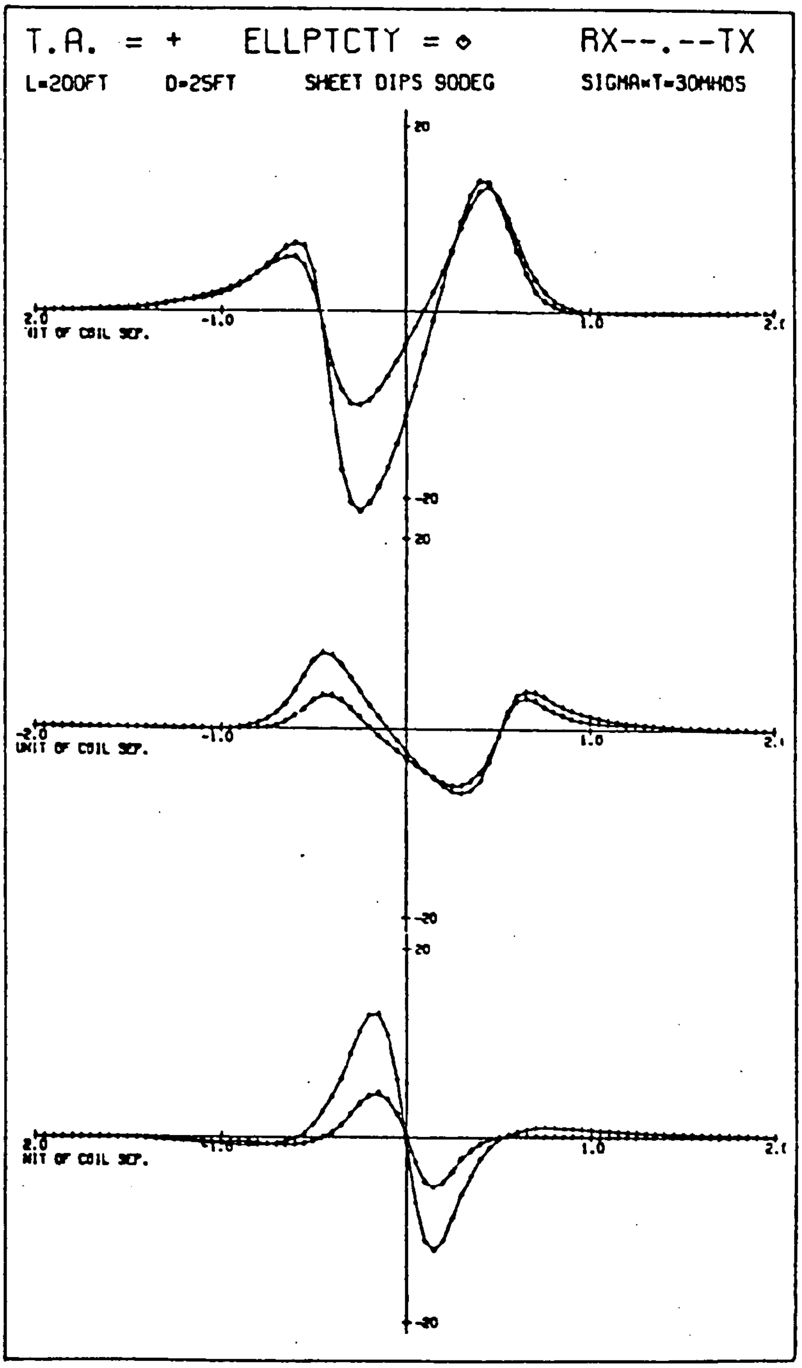
The right figure shows typical responses of tilt angle and ellipticity over vertical conductors. These are Horizontal Loop Tx Inline, Vertical Loop Tx Inline and Vertical Loop Tx Broadside from the top to the bottom in the figure:

The data was obtained using a scale model experiment of a thin conductor sheet in free space. The experiment was carried out for various σt (conductivity - thickness), depth and dip of the conductor.

The figures on the back of this page are summarized from responses for various dips and depths of conductors.

Although work by Ward and others has indicated the limitations of free-space modelling, these data indicate the response characteristics of the system and can simulate the response over conductors in high resistive host rock, such as Canadian shield, environments.

McPHAR is presently conducting studies using the tank model facility of the University of Toronto. These studies will give additional information on the effect of conductive terrains and conductive over-burdens.



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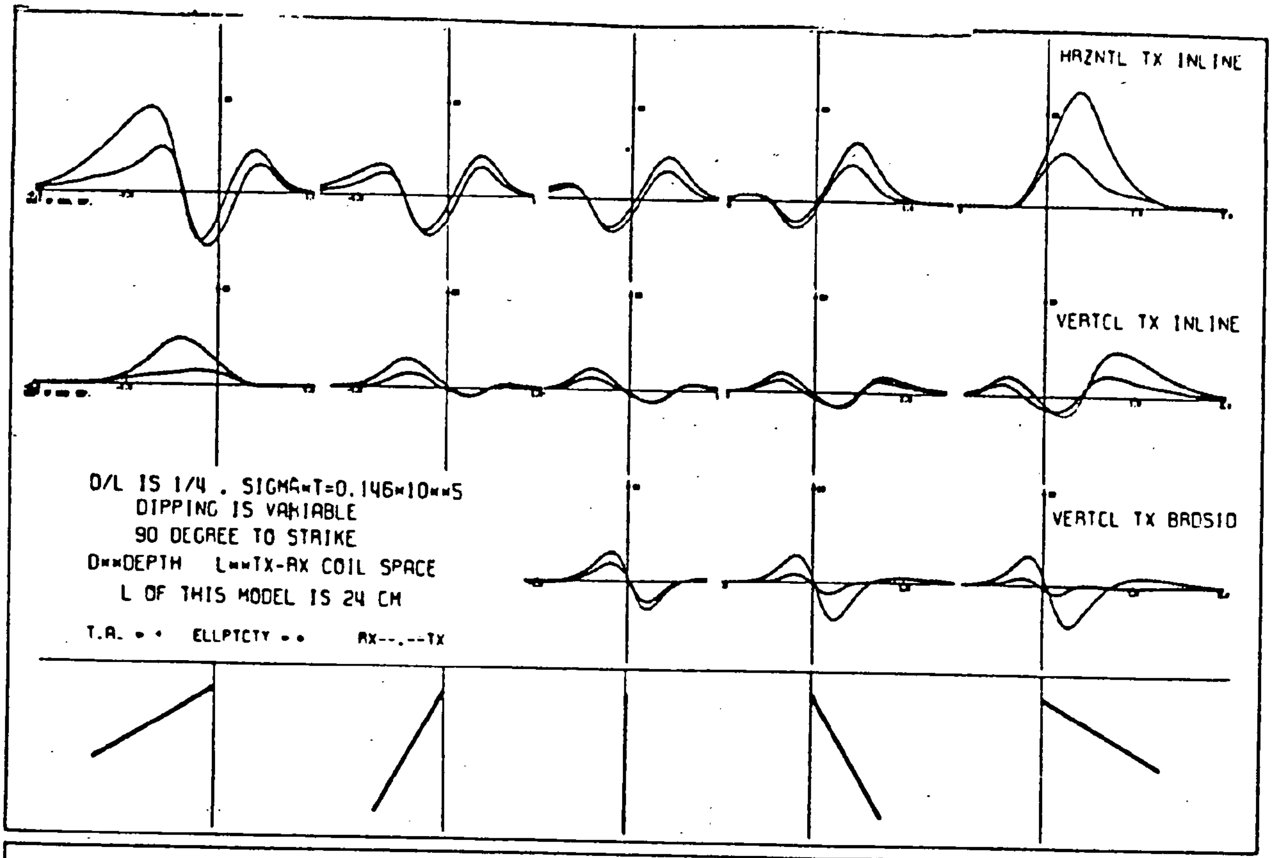
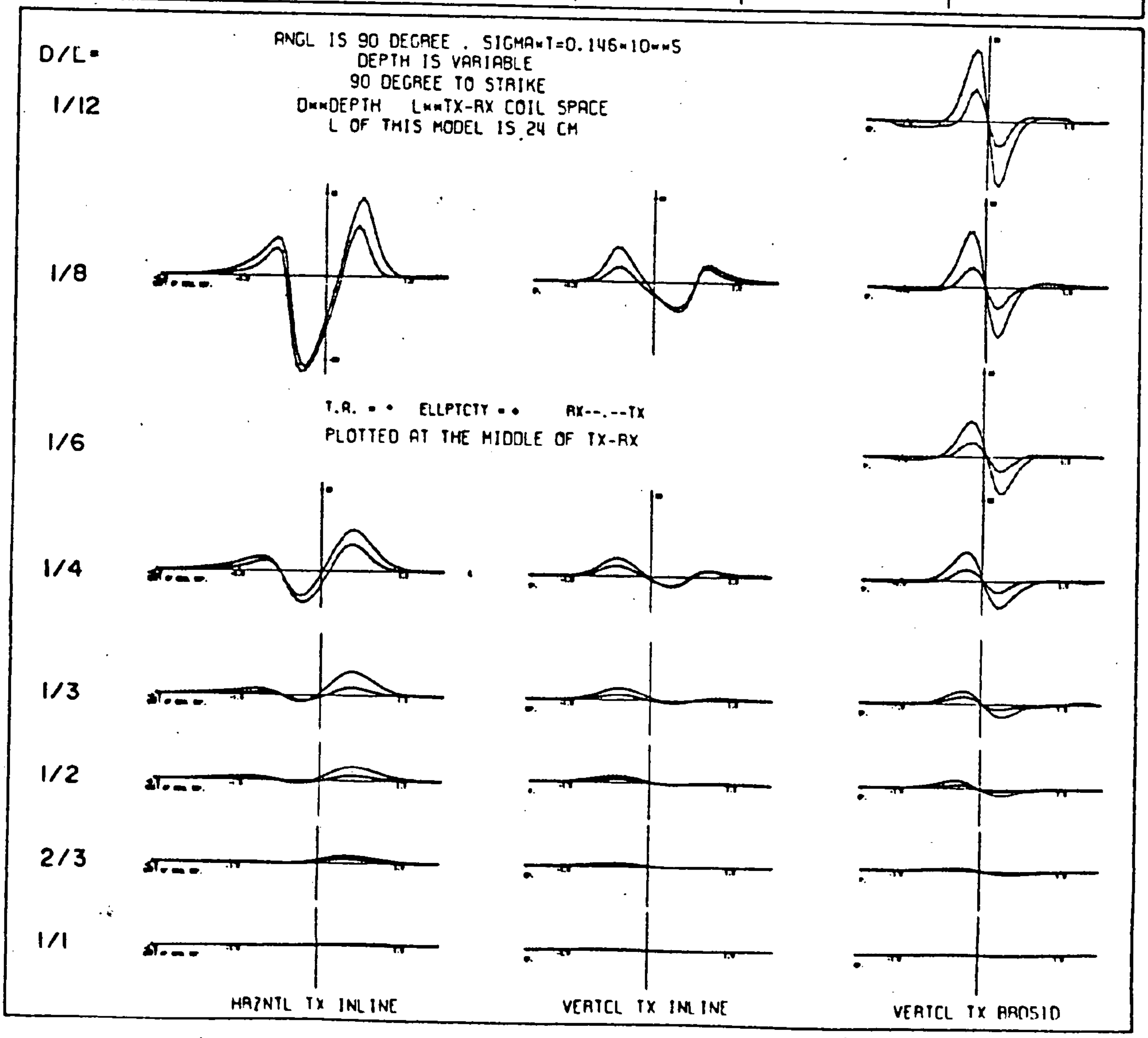

HRZNTL TX INLINE
VERTCL TX INLINE
VERTCL TX BRDSID
D/L IS 1/4 . SIGMA*T=0.146*10**5
DIPPING IS VARIABLE
90 DEGREE TO STRIKE
D**DEPTH L**TX-RX COIL SPACE
L OF THIS MODEL IS 24 CM
T.A. - • ELLPTCTY - • RX--.--TX


D/L=
ANGL IS 90 DEGREE . SIGMA*T=0.146*10**5
DEPTH IS VARIABLE
90 DEGREE TO STRIKE
D**DEPTH L**TX-RX COIL SPACE
L OF THIS MODEL IS 24 CM
1/12
1/8
T.A. - • ELLPTCTY - • RX--.--TX
PLOTTED AT THE MIDDLE OF TX-RX
1/6
1/4
1/3
1/2
2/3
1/1
HRZNTL TX INLINE
VERTCL TX INLINE
VERTCL TX BRDSID

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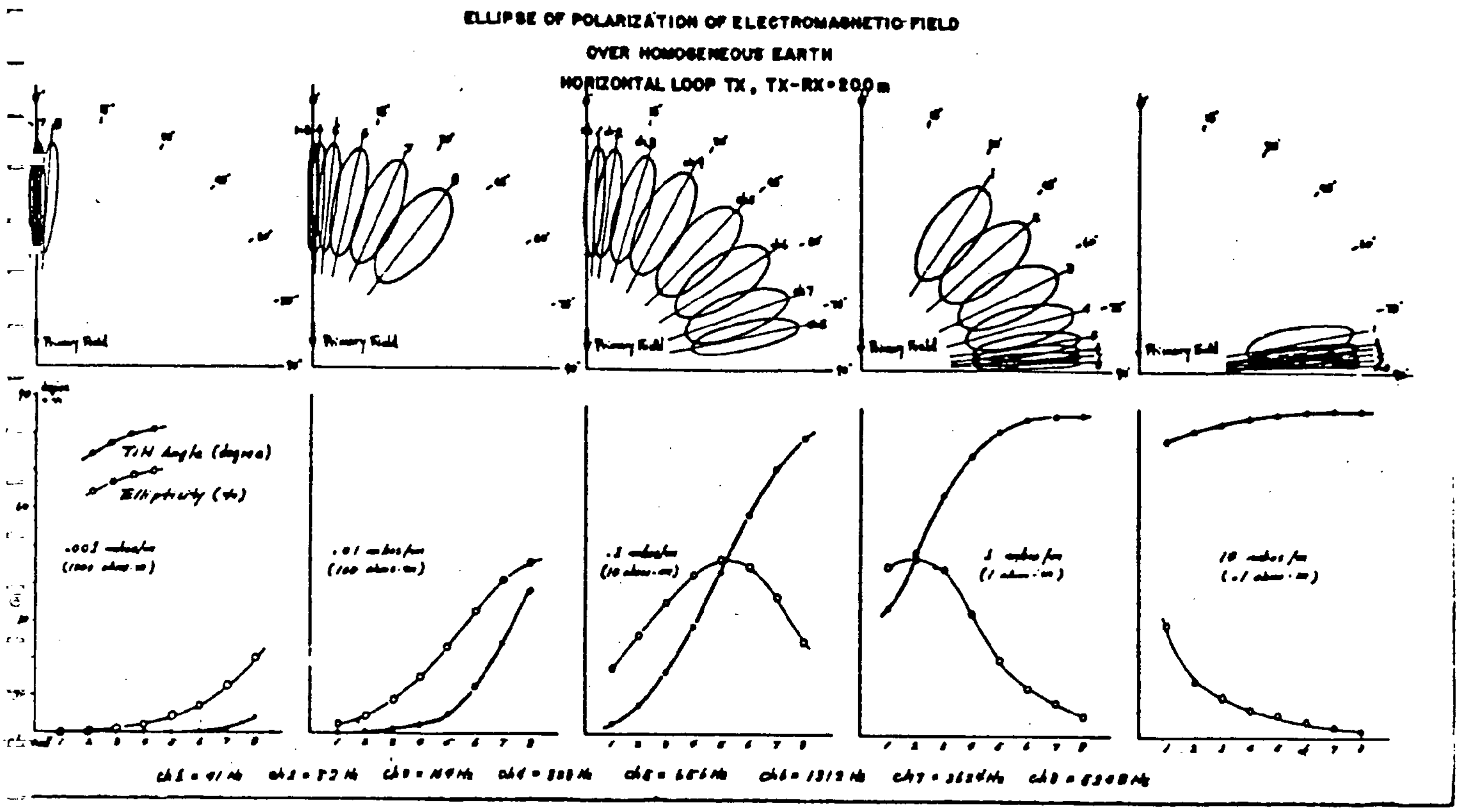

The figure above illustrates the ellipse of polarization response over homogeneous earth of various conductivities (σ). The case shown is for a horizontal loop Tx and vertical primary field at Rx. Similar to the thin sheet conductor case, the tilt angle increases as σ increases toward saturation. Ellipticity increases as σ increases to a maximum value, then decreases with further increases of σ. Similar characteristics are indicated for increasing frequency because the induction parameter of the earth is related to the product of σt and f (frequency).

GEM8 CONDUCTIVITY SPECTRUM is shown in the figure overleaf. The conductivity of various geology is indicated. Generally, the response from the host rock has a negative influence on conductor location surveys. Knowledge of the response from the geology of a survey area is important in survey planning and interpretation.

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REMOVAL OF TERRAIN EFFECTS

GEM parameters (tilt angle and ellipticity)are virtually independent of small fluctuations in Tx-Rx distance. In addition the ellipticity is not significantly dependant on coil mis-orientation due to Tx-Rx elevation differences. However, elevation differences do affect the tilt-angle. The tilt angle error is dependant on the angle formed between the horizontal and a line joining the Tx and Rx as shown in the figure overleaf. This error may be corrected using anyone of the following three methods.

METHOD 1: If the angle (θ) between a proper direction and actual Tx-Rx line is known, the actual direction of primary field at Rx can be derived from the simple formulas or graph shown. This method is suitable when the relative elevation of each station is known and the angle of the Tx plane is known. However it is difficult to measure an accurate plane angle; particulary for a large horizontal cable loop lying on the ground.

METHOD 2: If we assume that the tilt-angle response at a sufficiently low frequency is small, the measured tilt-angle represents the primary field direction. Thus this value may be used to correct measurements at other frequencies. GEM's tilt-angle response at 41 hz may be used in this way except in the presence of a very strong conductor. Thus this correction is suitable for most multi-frequency survey measurements.

METHOD 3: The third method, simpler and more reliable than the first two, is similar to the well known SHOOTBACK technique. However, no Tx-Rx exchange is required. Simply level the Tx coil for a reading, then rotate at 90 and repeat the reading. The two readings are added (see overleaf formulas) to eliminate tilt angle problems. The remaining tilt angle error is less than ± 0.1 degree when the elevation angle (θ) is within ± 7 degrees; less than ± 0.5 degrees when θ is within ± 18 degrees; and less than ±1 degree when θ is within ± 21 degrees. For extremely rough terrain, the first coil allignment may have to be within about ± 15 degrees for ± 0.5 degree accuracy. This method is suitable for horizontal profilling for conductor detection surveys using a framed Tx coil. It is especially suitable for a survey using a small portable Tx in rough terrain.

Tilt Angle Response at 41Hz
(Horizontal Loop Tx, Tx-Rx Separation = 200 m)

Over Homogeneous Earth

Resistivity (ohms/m)	Tilt Angle (degrees)
1000	nil
300	nil
100	nil
30	.5
10	3.5

Over Steeply Dipping Conductor (Depth = Tx-Rx Separation/8)

Conductivity-thickness (mhos)	Tilt Angle (degrees)
1	nil
3	nil
10	nil
20	.7
30	2.

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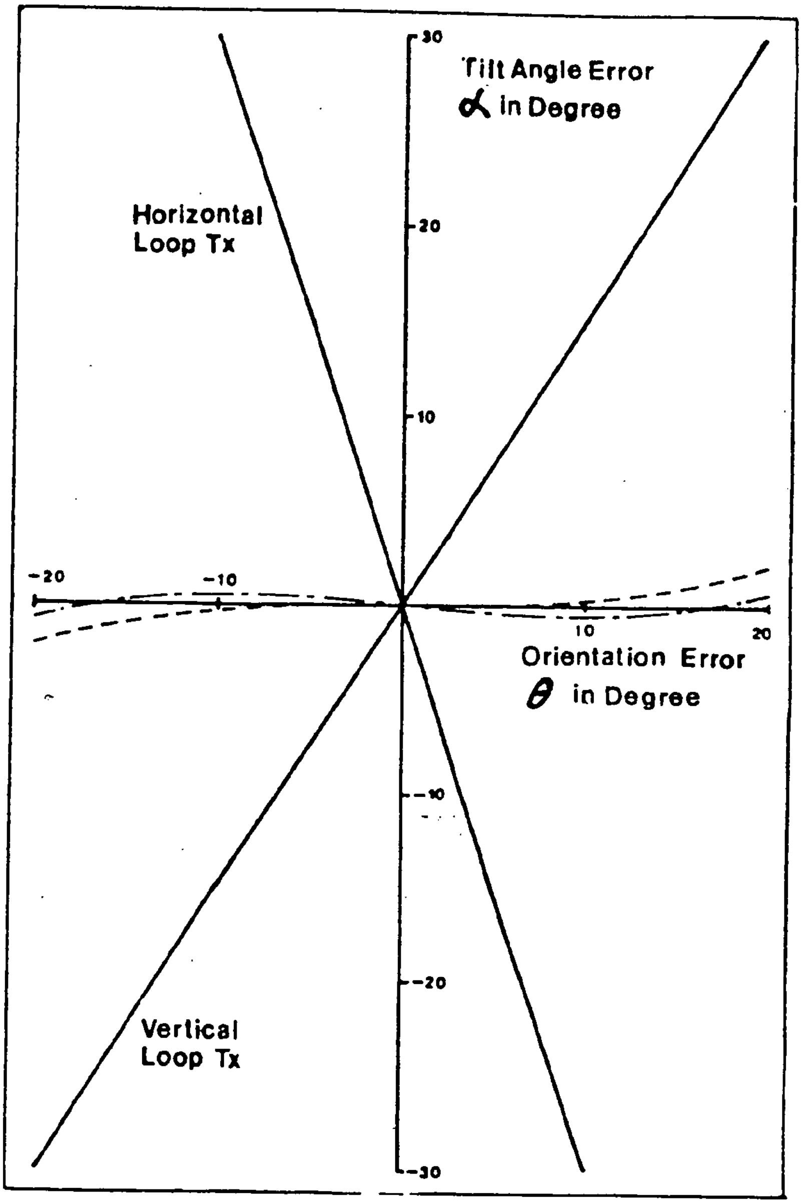


Horizontal Loop Tx:

$$\operatorname{Tan}\alpha = \frac{3\operatorname{Sin}\theta\operatorname{Cos}\theta}{3\operatorname{Sin}^2\theta - 1}$$

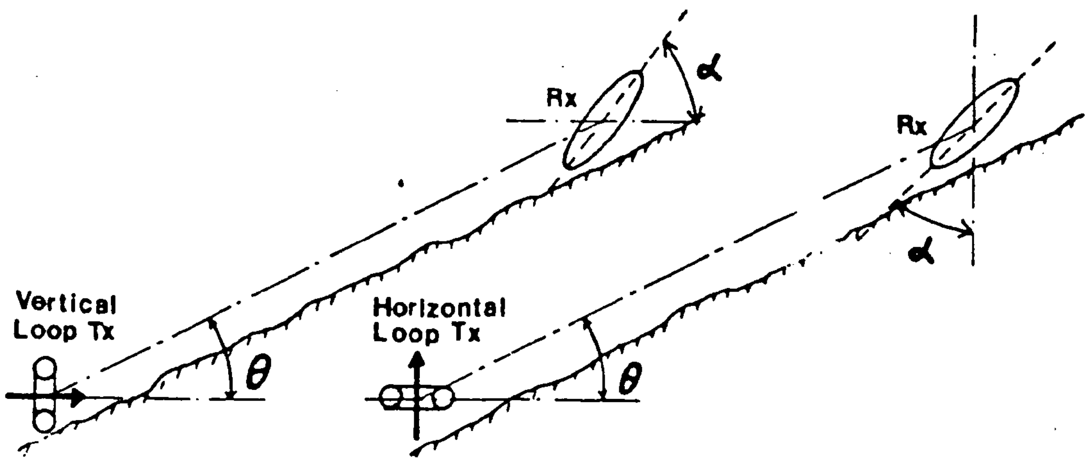
Vertical Loop Tx:

$$\operatorname{Tan}\alpha = \frac{3\operatorname{Sin}\theta\operatorname{Cos}\theta}{3\operatorname{Cos}^2\theta - 1}$$

After V/H Conpensation:

$\alpha = (\beta_H + 2\beta_V)/2$

$\alpha = (\beta_H + 1.9\beta_V)/2$



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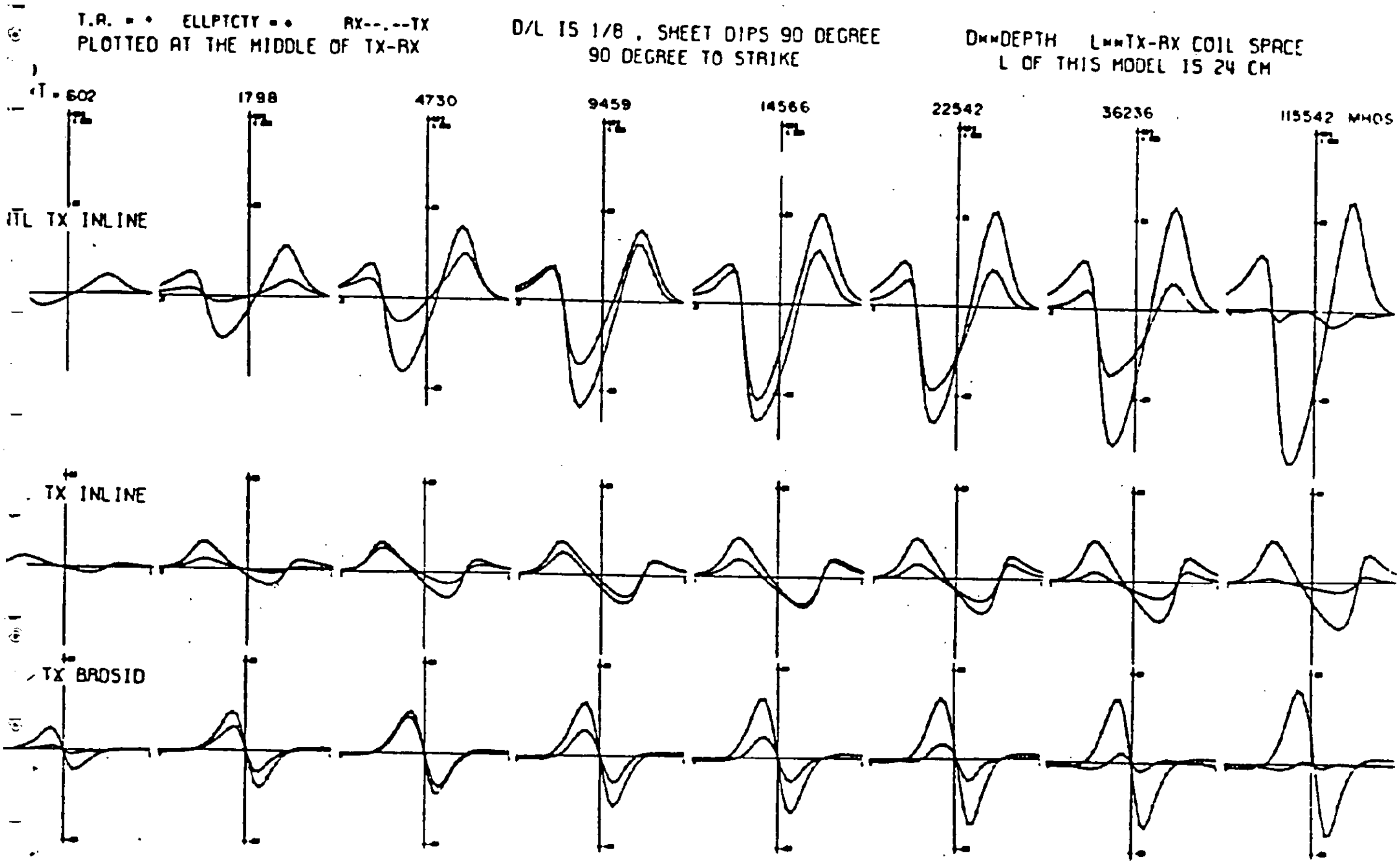
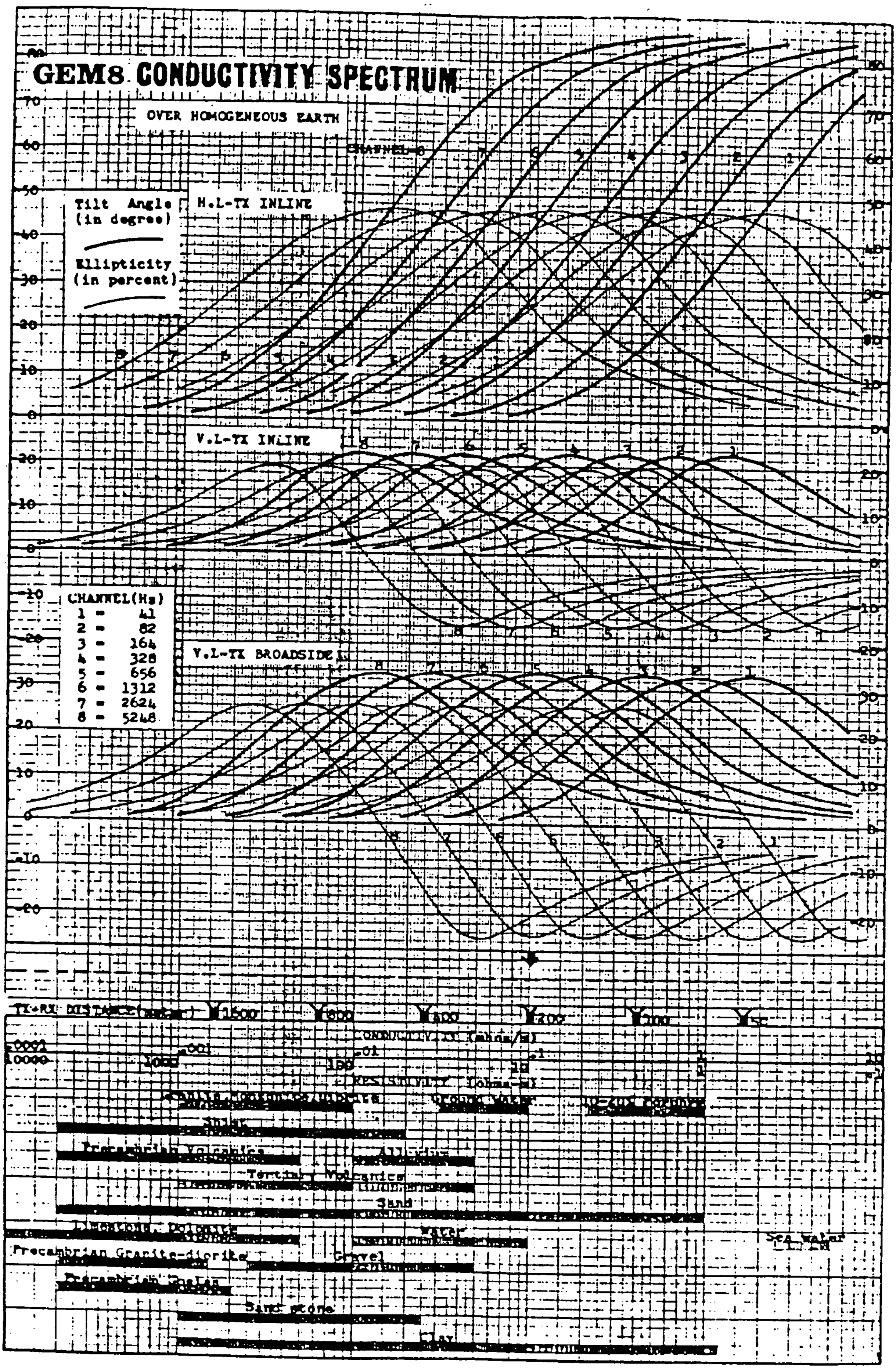
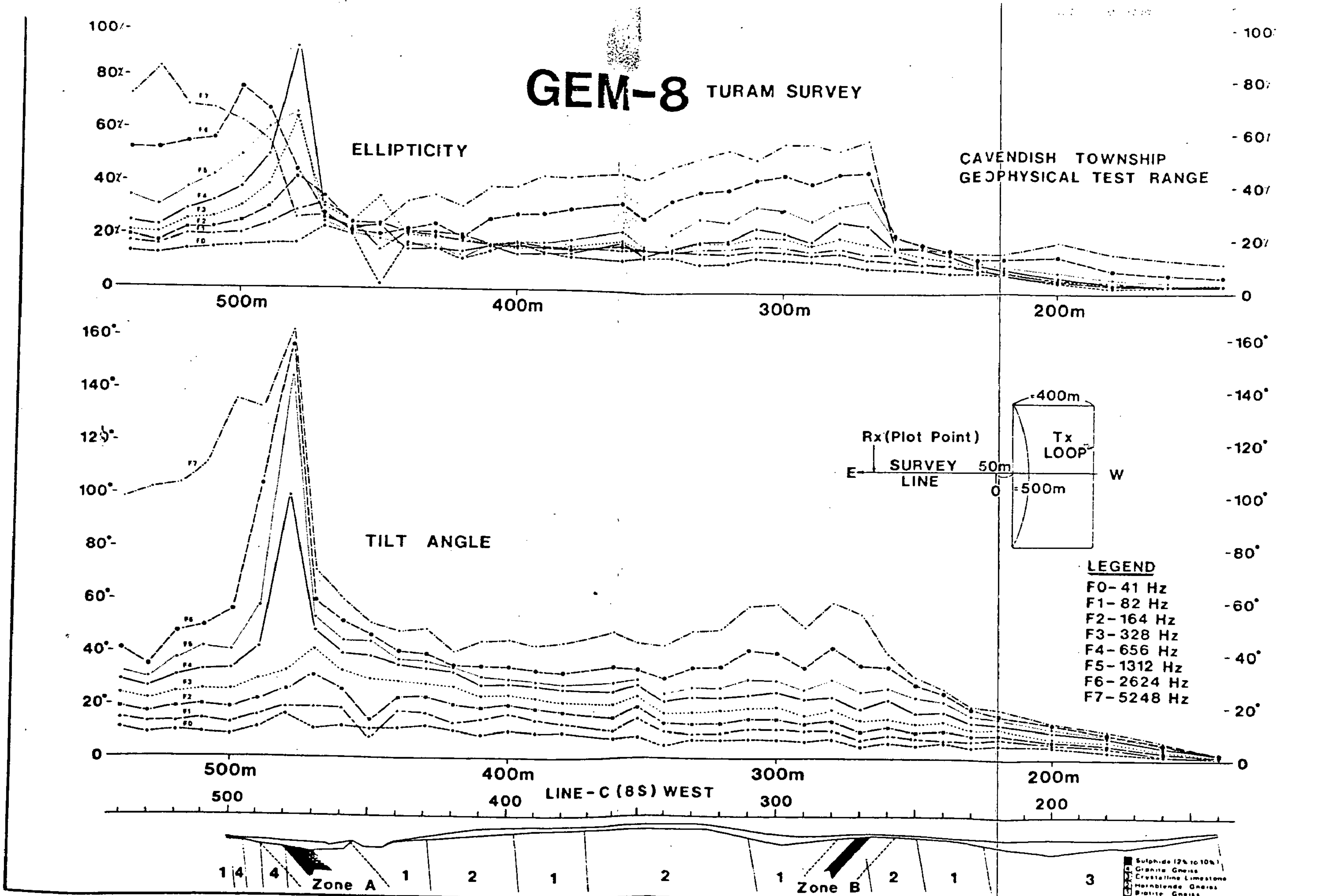


GEM responses of vertical sheet conductors of various σt (conductivity-thickness) are summarized in the figure above. We note a very small ellipticity response at low values of σt. As σt increases, the amplitude of the ellipticity increases to a maximum value near a σt of 14000 ℧/m. Beyond this value of σt, the ellipticity decreases with increasing σt. The tilt angle response, however, increases with increasing σt over the entire range shown toward saturation. This behavior is similar to the Quadrature and Inphase response of conventional EM System, and is diagnostic of anomaly sources.

All three of the above Tx-Rx configurations show similar anomaly behaviour.

The **GEM8** CONDUCTIVITY SPECTRUM (overleaf) shows the peak-to-peak response over steeply dipping dykes. This spectrum was constructed from experimental profiles. The lower portion of the figure indicates a variety of ore-body conductivity thicknesses. The range illustrated spans all economical mineral occurances. Although this spectrum is based on free space models it remains valid for the determination of apparent σt for real anomalies.


GEM8 CONDUCTIVITY SPECTRUM
OVER HOMOGENEOUS EARTH
Tilt Angle (in degree)
Ellipticity (in percent)
H.L-TX INLINE
V.L-TX INLINE
V.L-TX BROADSIDE
CHANNEL(Hz)
1 = 41
2 = 82
3 = 164
4 = 328
5 = 656
6 = 1312
7 = 2624
8 = 5248
TX-RX DISTANCE
CONDUCTIVITY (mhos/m)
RESISTIVITY (ohms-m)
Shale
Precambrian Volcanics
Alluvium
Tertiary Volcanics
Sand
Limestone, Dolomite
Water
Precambrian Granite-diorite
Gravel
Precambrian Gneiss
Sand stone
Clay
Sea water



GEM-8 TURAM SURVEY
CAVENDISH TOWNSHIP
GEOPHYSICAL TEST RANGE
ELLIPTICITY
100%
80%
60%
40%
20%
0
500m
400m
300m
200m
TILT ANGLE
160°
140°
120°
100°
80°
60°
40°
20°
0
Rx (Plot Point)
SURVEY
LINE
E
W
50m
0
400m
500m
Tx
LOOP
LEGEND
F0 - 41 Hz
F1 - 82 Hz
F2 - 164 Hz
F3 - 328 Hz
F4 - 656 Hz
F5 - 1312 Hz
F6 - 2624 Hz
F7 - 5248 Hz
LINE - C (8S) WEST
500
400
300
200
Zone A
Zone B
1
2
3
4
Sulphide (2% to 10%)
Granite Gneiss
Crystalline Limestone
Hornblende Gneiss
Biotite Gneiss

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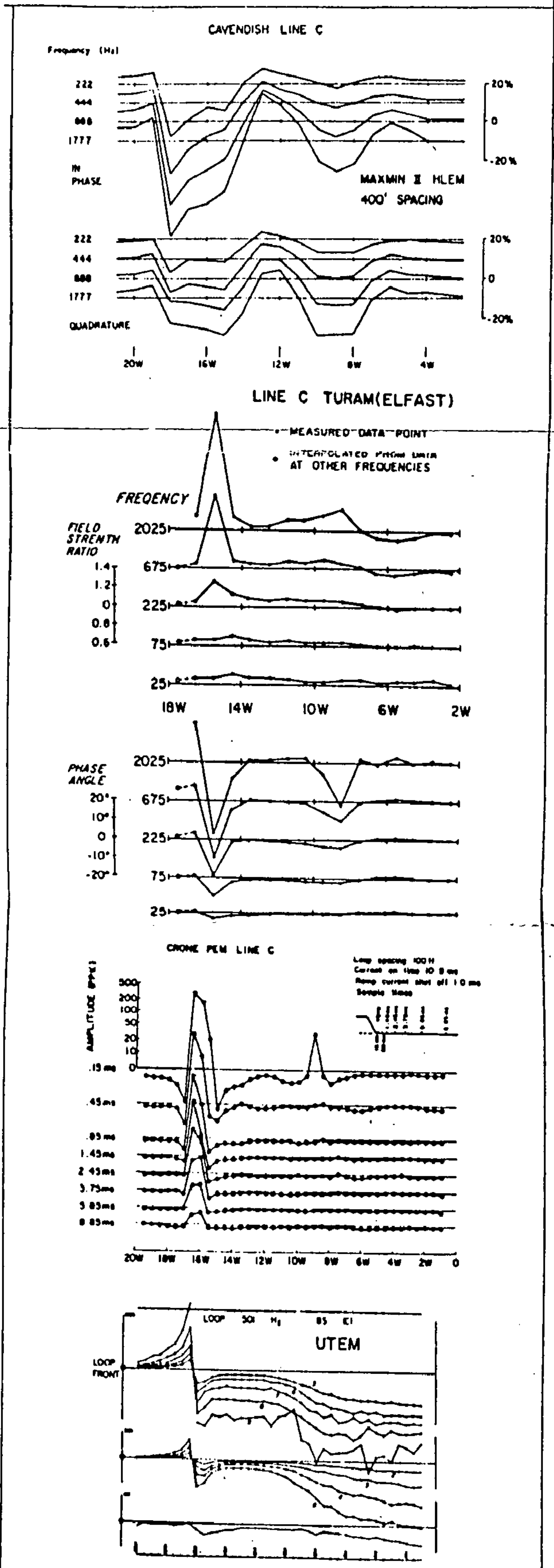

COMPARISON PROFILES FROM "THE CAVENDISH TEST SITE: A UTEM SURVEY PLUS A COMPILATION OF OTHER GROUND GEOPHYSICAL DATA" BY JAMES C. MACNAE, DEPARTMENT OF PHYSICS, UNIVERSITY OF TORONTO.

NOTE: GENERALLY POOR RESOLUTION OF ZONE B.

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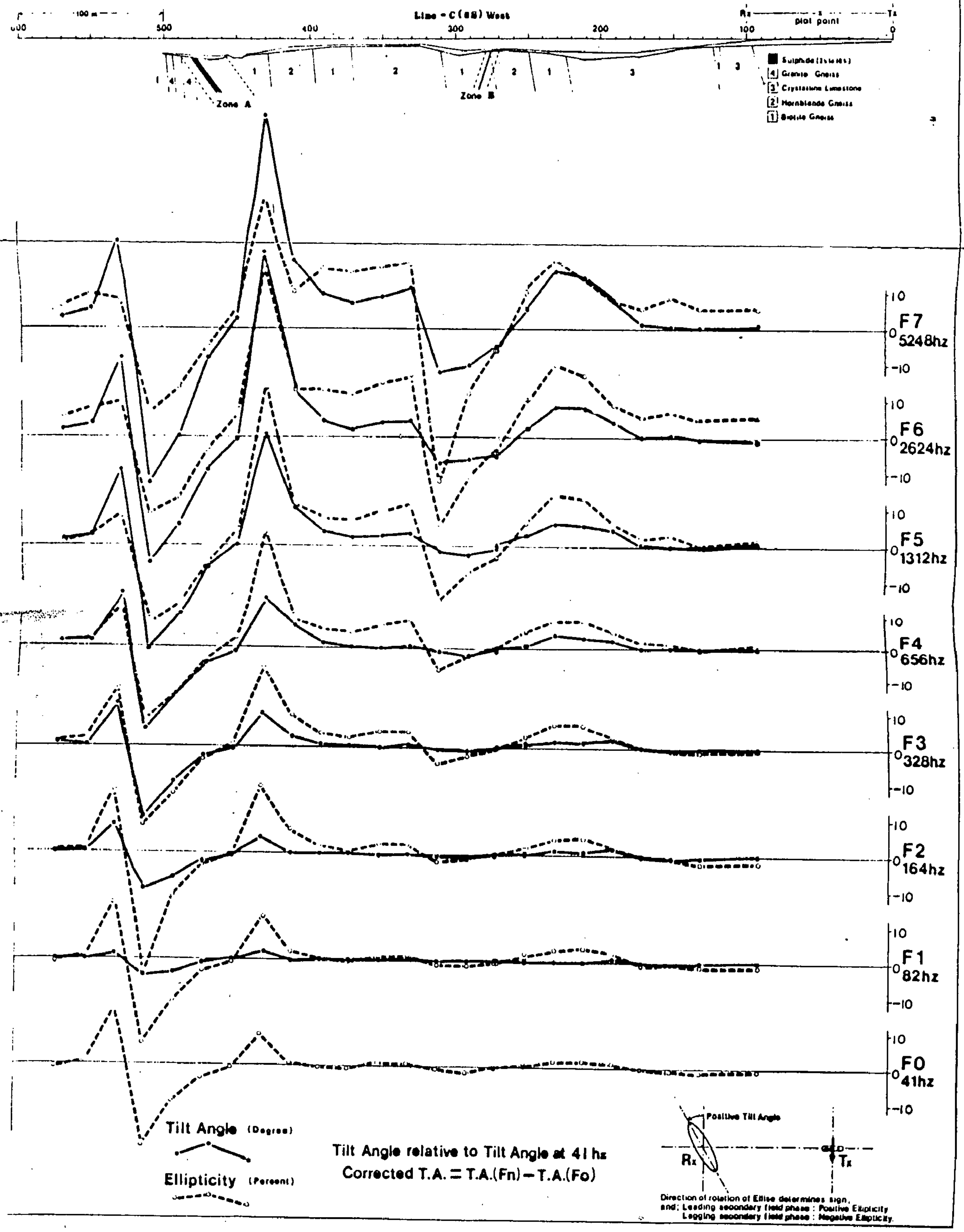
GEM8 SURVEY

Cavendish Township
Geophysical Test Range
ONTARIO, CANADA

Horizontal-Loop-Tx In-line
R–T separation = 100 m



APPENDIX 2

RAW AND COMPUTED DATA

WOODCHESTER GRID
LINE 4N
Tx-Rx 200m IN LINE

STATION (plotting point) 700E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-4	.540	354.0	1.365	353.0	-8.8	.4	.859	-6.5
2	-4	.707	341.0	1.655	328.0	-7.9	5.2	1.082	-25.5
4	-4	.717	7.2	1.145	340.0	-2.8	11.6	.906	-6.4
6	-4	1.085	1.5	.725	337.0	9.9	10.5	.887	-10.8

STATION (plotting point) 750E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-3	.545	355.0	1.345	352.0	-9.5	1.2	.856	-6.5
2	-3	.719	343.0	1.601	325.5	-8.3	7.1	1.073	-25.8
4	-3	.735	14.5	1.130	333.0	-3.5	17.9	.911	-6.3
6	-3	1.030	36.0	.765	309.0	8.8	39.3	.888	-7.5

STATION (plotting point) 800E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-2	.772	358.0	.958	351.0	-1.1	3.0	.860	-5.5
2	-2	1.033	344.0	1.135	325.5	.6	8.1	1.083	-25.3
4	-2	1.020	15.0	.835	331.5	5.1	19.1	.923	-6.8
6	-2	1.205	40.0	.640	294.0	16.1	46.1	.878	-13.0

STATION (plotting point) 850E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	2	1.755	354.0	.415	348.0	17.1	2.1	.853	-9.0
2	2	2.308	343.0	.491	326.5	18.4	5.5	1.065	-25.3
4	2	2.155	11.0	.382	336.0	20.8	10.9	.907	-6.5
6	2	2.145	23.5	.335	298.0	25.7	24.6	.848	-19.3

STATION (plotting point) 900E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-6	.687	359.0	1.083	344.0	-.5	6.4	.863	-8.5
2	-6	1.037	351.0	1.101	317.0	5.1	14.9	1.069	-26.0
4	-6	1.230	14.5	.690	324.0	15.0	21.4	.921	-10.8
6	-6	1.760	22.0	.442	323.0	26.3	20.6	.882	-7.5

STATION (plotting point) 950E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-7	.629	1.1	1.145	349.5	-1.5	4.8	.849	-4.7
2	-7	.942	350.4	1.352	320.8	1.7	12.8	1.129	-24.4
4	-7	.952	21.9	.842	317.5	9.1	28.8	.895	-10.3
6	-7	1.475	67.5	.545	285.8	35.8	54.3	.897	-3.4

STATION (plotting point) 1000E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-3	.935	356.6	.801	352.7	5.2	1.7	.865	-5.4
2	-3	1.220	339.7	1.025	331.5	5.5	3.6	1.118	-24.4
4	-3	.998	7.2	.795	340.3	6.3	11.7	.891	-6.3
6	-3	1.220	42.1	.640	311.5	15.5	38.9	.884	-3.2

STATION (plotting point) 1050E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-2	1.475	355.0	.475	352.0	17.4	1.1	.837	-6.5
2	-2	1.958	335.2	.649	333.8	17.1	.5	1.127	-25.5
4	-2	1.415	357.5	.551	345.3	15.1	4.8	.883	-8.6
6	-2	1.365	33.5	.572	320.9	16.6	29.3	.884	-2.8

STATION (plotting point) 1100E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-2	.825	354.5	.842	353.3	1.7	.5	.833	-6.1
2	-2	1.115	337.1	1.139	332.1	1.7	2.2	1.127	-25.4
4	-2	.903	3.5	.860	340.8	2.7	9.9	.881	-7.9
6	-2	1.435	20.5	.565	317.2	16.8	25.1	.900	-11.2

STATION (plotting point) 1150E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-3	.625	356.2	1.132	351.9	-5.4	1.8	.841	-6.0
2	-3	.860	345.0	1.356	325.2	-3.6	8.4	1.080	-24.9
4	-3	.817	14.5	.955	331.0	.6	19.1	.883	-7.3
6	-3	1.185	42.7	.675	309.4	14.3	40.8	.894	-4.0

STATION (plotting point) 1200E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-2	.881	354.7	.835	349.0	2.8	2.5	.858	-8.2
2	-2	1.212	344.0	1.065	327.2	3.9	7.3	1.136	-24.4
4	-2	1.082	15.9	.725	328.5	8.2	20.5	.886	-7.8
6	-2	1.505	52.3	.539	300.7	23.8	43.3	.901	-3.5

STATION (plotting point) 1250E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-2	.840	355.7	.830	352.9	2.2	1.2	.835	-5.7
2	-2	1.160	340.5	1.114	331.3	2.6	4.0	1.137	-24.1
4	-2	.989	359.5	.804	332.0	5.0	12.0	.892	-14.3
6	-2	1.320	27.8	.598	323.3	14.8	26.4	.888	-4.5

STATION (plotting point) 1300E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-2	.837	355.3	.839	353.2	2.0	.9	.838	-5.8
2	-2	1.133	343.1	1.139	331.0	1.9	5.3	1.136	-23.0
4	-2	.965	14.2	.810	330.7	4.7	19.1	.884	-7.6
6	-2	1.335	47.5	.615	297.4	19.4	46.2	.906	-7.6

WOODCHESTER GRID
LINE 5N
Tx LINE 4 Rx LINE 6

STATION (plotting point) 500E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	5	2.014	12.5	.849	12.0	7.0	.2	1.308	12.3
2	5	2.061	50.3	.889	45.0	6.7	2.1	1.354	47.7
4	5	2.090	46.5	.855	14.0	7.8	12.9	1.337	30.3
6	5	2.152	57.6	.561	318.9	19.0	34.4	1.099	8.3

STATION (plotting point) 550E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	0	1.633	11.3	1.041	12.8	6.4	-.6	1.304	12.1
2	0	1.700	46.5	1.121	47.5	5.9	-.4	1.380	47.0
4	0	1.631	32.2	1.093	27.3	5.7	2.1	1.335	29.8
6	0	1.446	8.3	.846	358.2	7.6	4.3	1.106	3.3

STATION (plotting point) 600E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-4	1.215	11.2	1.403	13.7	1.9	-1.1	1.306	12.5
2	-4	1.275	43.5	1.558	49.1	1.1	-2.4	1.409	46.3
4	-4	1.196	22.0	1.422	34.5	1.5	-5.4	1.304	28.3
6	-4	.882	349.7	1.371	26.2	-2.6	-15.7	1.100	8.0

STATION (plotting point) 650E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	3	1.244	13.3	1.393	12.0	-4.6	.6	1.316	12.7
2	3	1.309	47.8	1.561	43.6	-5.5	1.8	1.429	45.7
4	3	1.244	40.6	1.367	22.0	-4.4	8.1	1.304	31.3
6	3	1.348	28.3	.896	348.0	3.2	17.4	1.099	8.2

STATION (plotting point) 700E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-7	1.177	12.0	1.435	12.9	4.2	-.4	1.300	12.5
2	-7	1.274	46.5	1.662	45.5	3.2	.4	1.455	46.0
4	-7	1.185	38.6	1.490	27.5	3.7	4.8	1.329	33.1
6	-7	1.199	37.7	1.191	.7	7.1	16.3	1.195	19.2

STATION (plotting point) 750E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-3	1.390	12.1	1.236	11.0	4.7	.5	1.311	11.6
2	-3	1.225	53.8	1.076	51.0	4.9	1.2	1.148	52.4
4	-3	1.512	40.7	1.258	33.8	5.6	3.0	1.379	37.3
6	-3	1.313	35.5	1.335	4.5	2.8	13.6	1.324	20.0

STATION (plotting point) 800E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-4	1.217	15.5	1.329	7.8	2.7	3.4	1.272	11.7
2	-4	1.195	57.2	1.070	46.9	5.6	4.5	1.131	52.1
4	-4	1.610	43.0	1.175	34.6	8.5	3.6	1.375	38.8
6	-4	1.383	24.0	.978	21.8	8.9	.9	1.163	22.9

STATION (plotting point) 850E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-2	1.226	22.0	1.390	1.3	.2	9.0	1.305	11.7
2	-2	1.360	70.3	.917	33.0	7.9	16.1	1.117	51.7
4	-2	2.310	60.0	.806	18.4	17.3	15.9	1.364	39.2
6	-2	3.106	39.0	.471	4.0	26.4	10.3	1.210	21.5

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	3	1.740	16.0	.976	7.6	5.2	3.5	1.303	11.8
2	3	1.568	61.5	.760	40.8	7.0	8.5	1.106	51.2
4	3	2.206	61.0	.850	7.2	11.5	21.2	1.369	34.1
6	3	1.743	74.3	.668	306.7	21.2	50.3	1.079	10.5

STATION (plotting point) 950E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	0	1.610	10.0	1.050	14.0	6.1	-1.7	1.300	12.0
2	0	1.276	47.7	.948	56.4	4.3	-3.8	1.100	52.1
4	0	1.444	34.3	1.334	40.5	1.1	-2.7	1.388	37.4
6	0	1.256	32.5	1.198	7.0	.7	11.2	1.227	19.8

STATION (plotting point) 1000E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-4	1.195	10.4	1.401	12.0	1.7	-.7	1.294	11.2
2	-4	.995	48.3	1.208	54.2	1.2	-2.6	1.096	51.3
4	-4	1.180	27.0	1.617	40.7	-.5	-5.9	1.381	33.9
6	-4	.882	354.9	1.446	22.2	-3.2	-11.6	1.129	8.6

STATION (plotting point) 1050E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-1	1.328	14.1	1.288	8.1	1.4	2.6	1.308	11.1
2	-1	1.122	62.3	1.077	41.0	1.6	9.3	1.099	51.7
4	-1	1.679	68.4	1.135	358.1	7.8	30.9	1.380	33.3
6	-1	2.342	84.9	.542	291.6	37.9	46.1	1.127	8.3

STATION (plotting point) 1100E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-5	1.178	12.8	1.439	11.2	2.1	.7	1.302	12.0
2	-5	.992	55.5	1.221	51.2	2.0	1.9	1.101	53.4
4	-5	1.305	42.0	1.460	27.2	3.4	6.5	1.380	34.6
6	-5	1.310	22.0	.980	355.2	9.3	11.6	1.133	8.6

STATION (plotting point) 1150E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-2	1.351	11.2	1.230	11.8	2.8	-.3	1.289	11.5
2	-2	1.165	52.8	1.057	54.6	2.9	-.8	1.110	53.7
4	-2	1.387	36.0	1.310	39.1	2.3	-1.4	1.348	37.6
6	-2	1.174	21.2	1.234	24.7	.8	-1.5	1.204	23.0

STATION (plotting point) 1200E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-4	1.100	12.8	1.535	11.0	-.8	.8	1.299	11.9
2	-4	.948	57.5	1.326	49.4	-.8	3.5	1.121	53.5
4	-4	1.259	48.7	1.529	22.0	1.1	11.6	1.387	35.4
6	-4	1.456	30.5	.931	347.0	10.8	18.7	1.164	8.8

WOODCHESTER GRID
LINE 8N
Tx-Rx 200m IN LINE

STATION (plotting point) 850E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-2	1.750	3.5	.428	343.5	20.9	6.9	.865	-6.5
2	-2	2.830	349.0	.481	317.5	25.1	9.7	1.167	-26.8
4	-2	2.645	8.5	.270	328.0	30.1	10.1	.845	-11.8
5	-2	3.035	16.5	.245	330.0	32.2	10.5	.862	-6.8

STATION (plotting point) 900E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	1	.900	3.5	.835	347.0	.1	7.2	.867	-4.8
2	1	1.471	354.0	.967	315.0	5.3	16.8	1.193	-25.5
4	1	1.383	23.0	.540	308.0	14.8	29.8	.864	-14.5
5	1	1.550	46.5	.495	294.0	22.7	41.9	.876	-9.8

STATION (plotting point) 950E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-3	.811	358.0	.915	351.0	1.3	3.0	.861	-5.5
2	-3	1.186	342.5	1.162	325.0	3.3	7.7	1.174	-26.3
4	-3	.974	5.5	.754	328.0	6.9	16.4	.857	-13.3
5	-3	1.088	22.0	.688	321.5	10.5	26.2	.865	-8.3

STATION (plotting point) 1000E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-3	.665	351.0	1.110	356.0	-4.3	-2.1	.859	-6.5
2	-3	.846	330.0	1.587	338.0	-5.9	-3.3	1.159	-26.0
4	-3	.585	347.5	1.291	348.5	-8.1	-.4	.869	-12.0
5	-3	.578	354.5	1.308	347.0	-8.4	3.0	.869	-9.3

STATION (plotting point) 1050E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-3	.854	354.0	.864	353.5	2.8	.2	.859	-6.3
2	-3	1.132	336.0	1.182	332.5	2.4	1.5	1.157	-25.8
4	-3	.884	356.5	.892	339.5	2.9	7.4	.888	-12.0
5	-3	.963	8.0	.804	336.0	5.7	14.0	.880	-8.0

STATION (plotting point) 1100E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-5	1.017	358.2	.732	350.5	9.7	3.3	.863	-5.7
2	-5	1.416	345.5	.934	323.5	11.0	9.4	1.150	-25.5
4	-5	1.214	22.0	.645	319.0	15.3	26.6	.885	-9.5
5	-5	1.335	47.0	.591	302.5	22.2	43.3	.888	-5.3

STATION (plotting point) 1150E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-3	.989	356.5	.748	352.1	7.0	1.9	.860	-5.7
2	-3	1.367	340.5	.958	330.2	8.1	4.4	1.144	-24.7
4	-3	1.115	1.5	.705	336.5	9.7	10.7	.887	-11.0
5	-3	1.175	16.0	.659	331.0	11.8	19.0	.880	-6.5

STATION (plotting point) 1200E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-4	.874	355.0	.842	352.0	4.5	1.3	.858	-6.5
2	-4	1.178	336.5	1.086	331.5	5.2	2.2	1.131	-26.0
4	-4	.967	356.5	.807	346.0	6.6	4.6	.883	-8.8
5	-4	1.030	359.5	.755	347.5	8.5	5.2	.882	-6.5

WOODCHESTER GRID
LINE 7N
Tx LINE 6 Rx LINE 8

STATION (plotting point) 650E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-6	.895	11.3	1.880	11.3	-4.4	0.0	1.297	11.3
2	-6	.557	48.2	1.207	44.8	-4.8	1.4	.820	46.5
4	-6	1.019	45.7	2.071	31.9	-4.0	5.7	1.453	38.8
5	-6	.904	21.3	1.649	2.6	-2.6	7.8	1.221	12.0

STATION (plotting point) 700E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-6	1.327	10.6	1.280	11.2	6.5	-.3	1.303	10.9
2	-6	.836	44.9	.816	46.6	6.3	-.7	.826	45.8
4	-6	1.461	36.2	1.430	41.7	6.3	-2.4	1.445	39.0
5	-6	1.211	13.0	1.241	22.4	5.6	-4.1	1.226	17.7

STATION (plotting point) 750E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-2	1.419	12.7	1.189	8.8	4.5	1.7	1.299	10.8
2	-2	.965	51.3	.736	47.7	5.9	1.6	.843	49.5
4	-2	1.731	35.4	1.209	42.0	7.1	-2.8	1.447	38.7
5	-2	1.414	9.2	1.051	23.0	6.3	-6.0	1.219	16.1

STATION (plotting point) 800E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	6	2.009	18.6	.852	3.9	6.0	5.9	1.308	11.3
2	6	1.806	65.5	.522	37.7	11.1	10.1	.971	51.6
4	6	3.490	53.7	.549	18.1	18.1	10.6	1.384	35.9
5	6	3.601	40.8	.387	12.0	21.3	7.4	1.181	26.4

STATION (plotting point) 850E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-6	.874	16.0	1.948	6.5	-5.2	3.8	1.305	11.3
2	-6	.719	62.7	1.364	40.1	-3.2	9.4	.990	51.4
4	-6	1.238	61.7	1.595	10.2	2.0	22.7	1.405	36.0
5	-6	1.246	54.5	1.155	338.0	7.4	34.6	1.200	16.3

STATION (plotting point) 900E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-4	1.011	8.2	1.651	15.0	-3.0	-2.9	1.292	11.6
2	-4	.729	46.2	1.411	58.5	-5.3	-5.1	1.014	52.4
4	-4	.904	30.0	2.192	47.8	-8.4	-7.1	1.408	38.9
5	-4	.727	12.4	2.076	34.0	-10.6	-8.3	1.229	23.2

STATION (plotting point) 950E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-1	1.282	10.0	1.315	13.0	.6	-1.3	1.298	11.5
2	-1	.983	49.1	1.089	53.5	-.5	-1.9	1.035	51.3
4	-1	1.292	34.9	1.543	37.0	-1.5	-.9	1.412	36.0
5	-1	1.106	16.2	1.320	16.0	-1.5	.1	1.208	16.1

STATION (plotting point) 1000E

Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-6	1.134	11.2	1.480	12.0	2.2	-.3	1.295	11.6
2	-6	.912	50.9	1.221	52.3	1.8	-.6	1.055	51.6
4	-6	1.201	36.4	1.633	33.4	1.6	1.3	1.400	34.9
5	-6	1.030	16.0	1.370	16.2	1.9	-.1	1.188	16.1

STATION (plotting point) 1050E

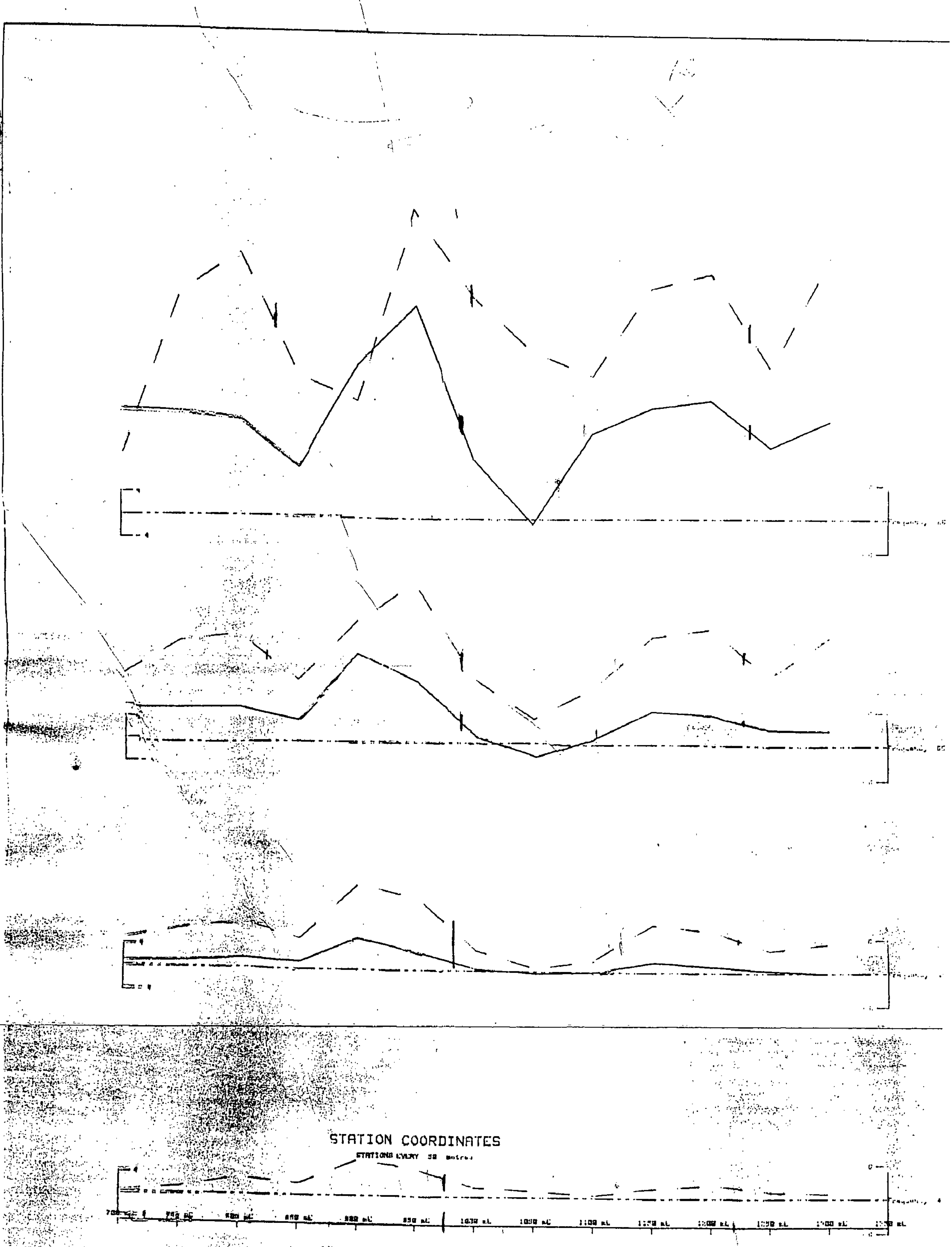
Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-1	1.420	11.2	1.225	10.9	3.1	.1	1.319	11.1
2	-1	1.154	51.5	1.022	49.7	2.7	.8	1.086	50.6
4	-1	1.512	39.5	1.279	28.9	3.4	4.6	1.391	34.2
5	-1	1.377	24.2	1.048	4.3	5.0	8.6	1.201	14.3

STATION (plotting point) 1100E

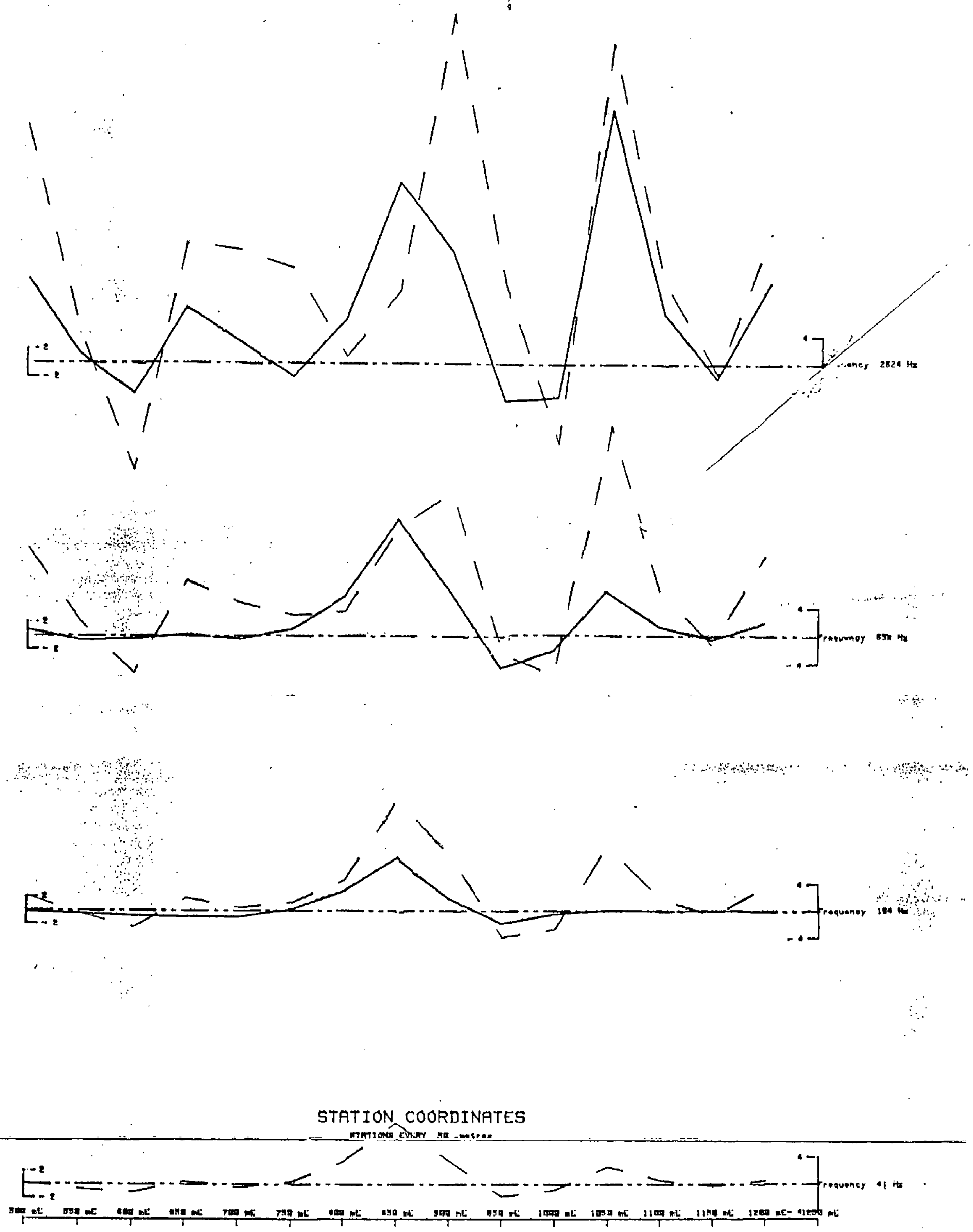
Freq	Rtilt	R xy	P xy	R yx	P yx	TILT	ELIP	R b	P b
0	-2	1.394	11.0	1.212	11.9	4.0	-.4	1.300	11.5
2	-2	1.177	48.6	1.035	51.7	3.8	-1.3	1.104	50.2
4	-2	1.433	30.0	1.334	38.9	3.0	-3.9	1.383	34.5
5	-2	1.172	7.3	1.202	23.0	1.6	-6.9	1.187	15.2

APPENDIX 3

PLOTTED DATA



WOODCHESTER GRID AREA LINE 4 N
TX-RX 200M IN LINE

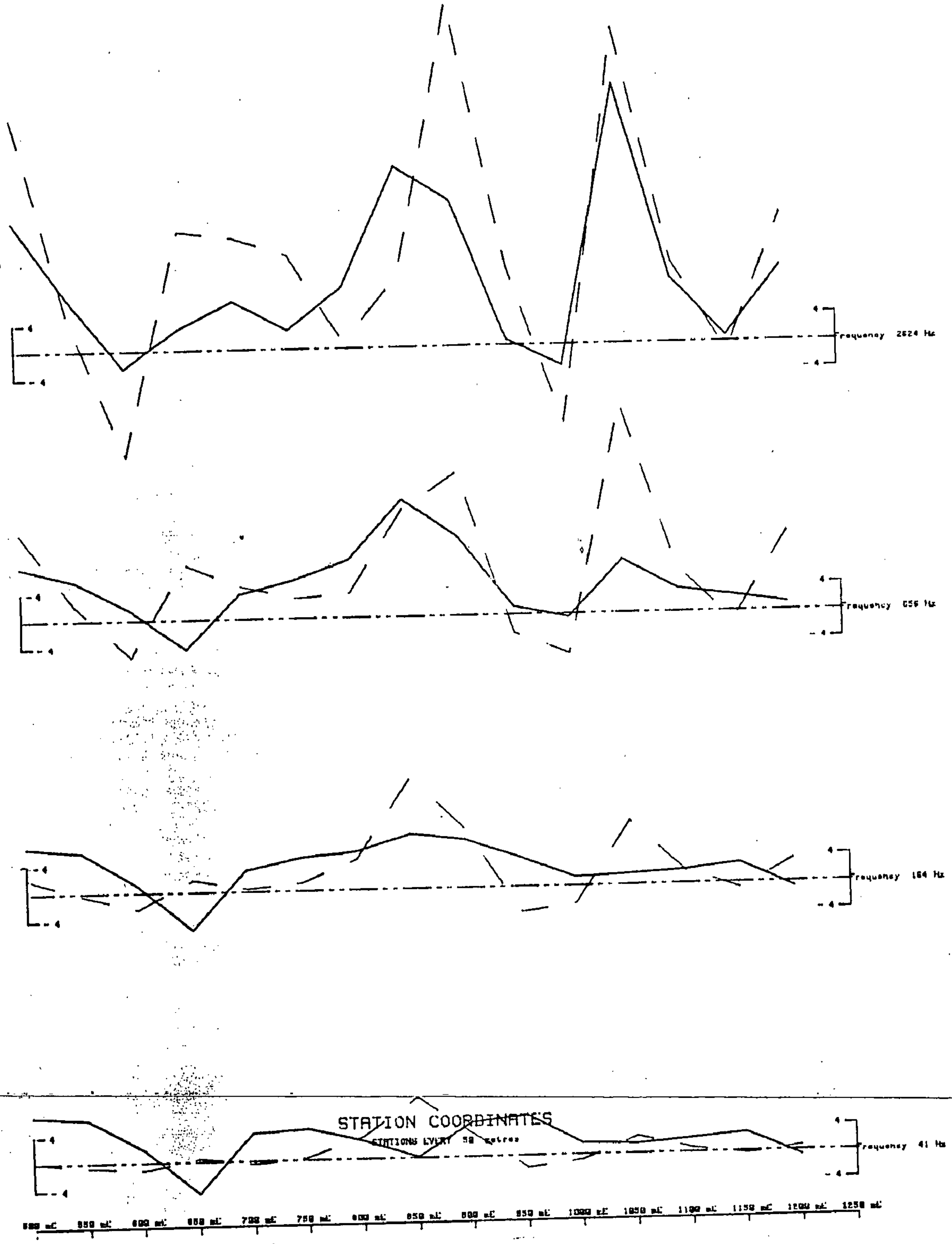


WOODCHESTER GRID AREA LINE 5 N
Tx LINE 4 Rx LINE 6

000236

Tilt Angle
CORRECTED FOR FREQUENCY ZERO

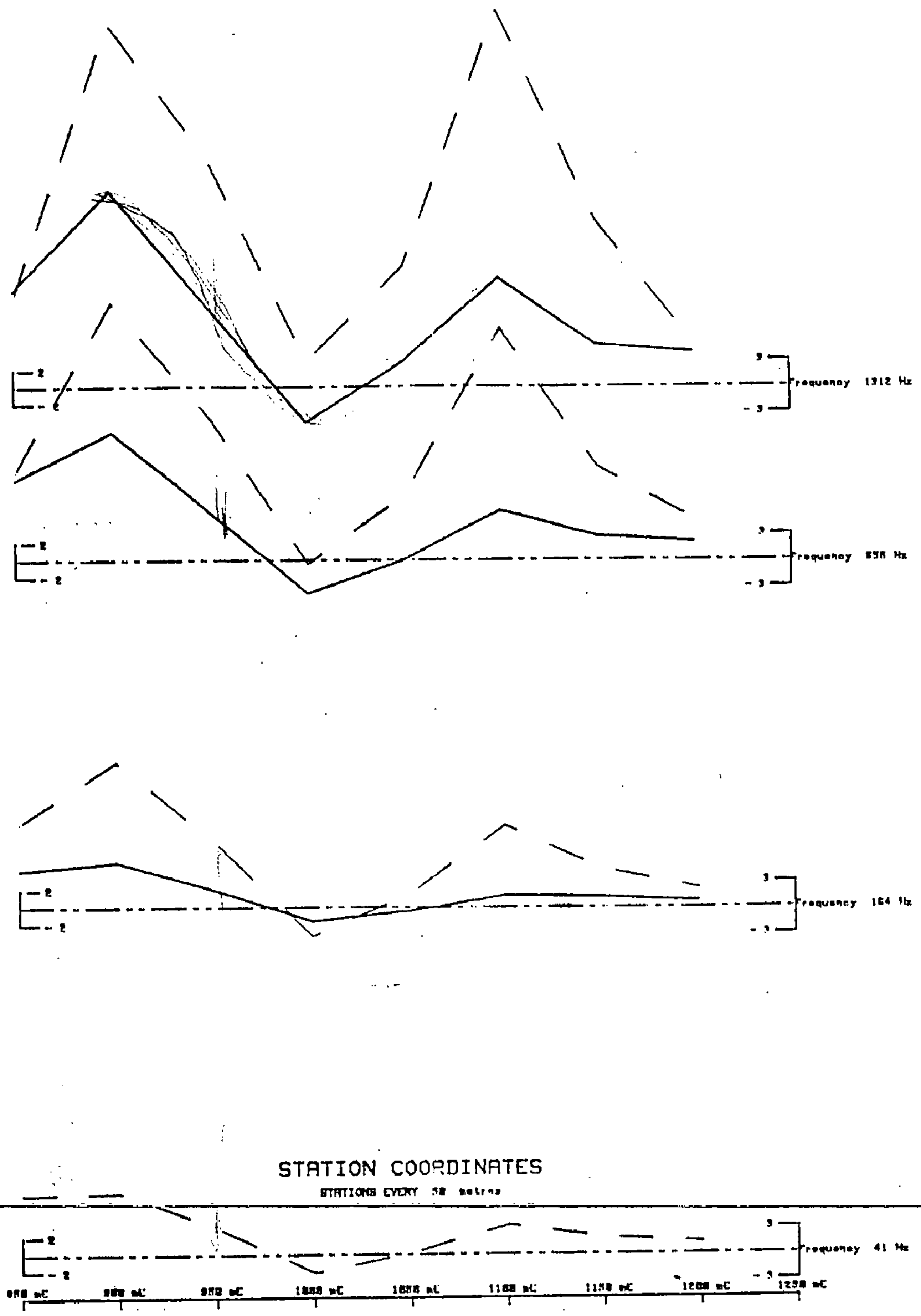
Ellipticity %



WOODCHESTER GRID AREA LINE 5 N
Tx LINE 4 Rx LINE 6

Tilt Angle
Ellipticity %

000237

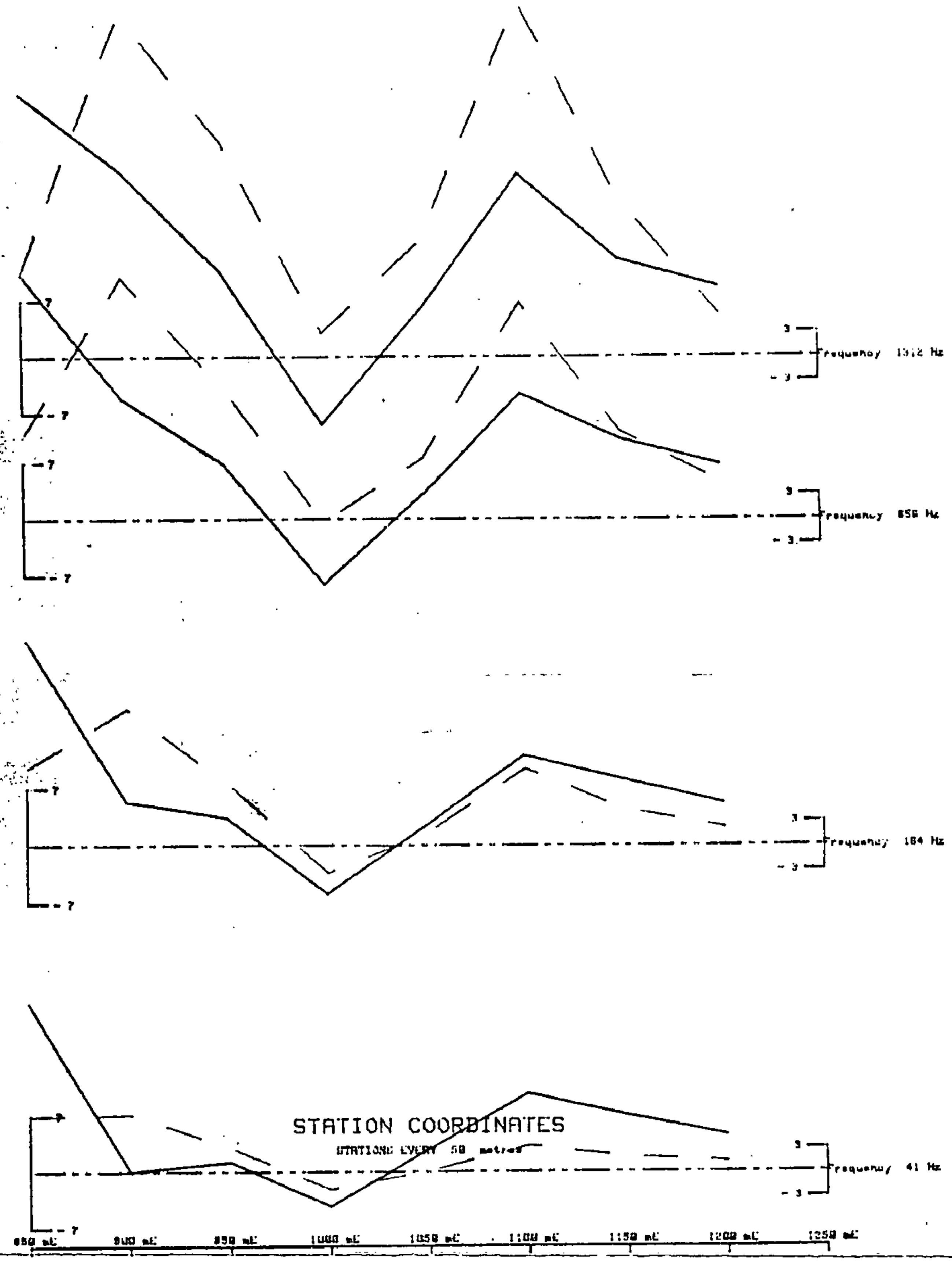


WOODCHESTER GRID AREA LINE 6 N
Tx-Rx 200m IN LINE

Tilt Angle
CORRECTED FOR FREQUENCY ZERO

Ellipticity

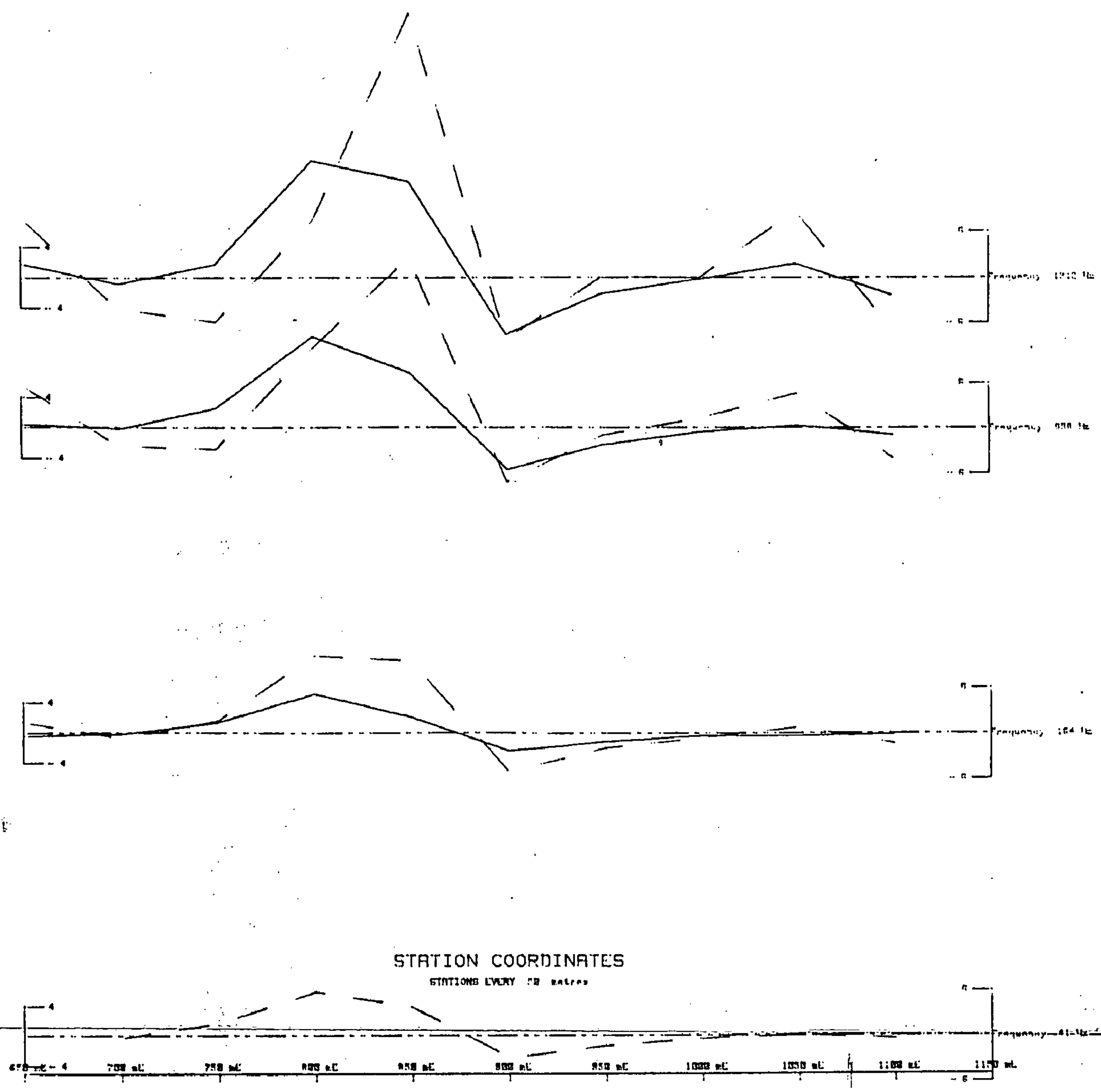
000238



WOODCHESTER GRID AREA LINE 6 N
Tx-Rx 200m IN LINE

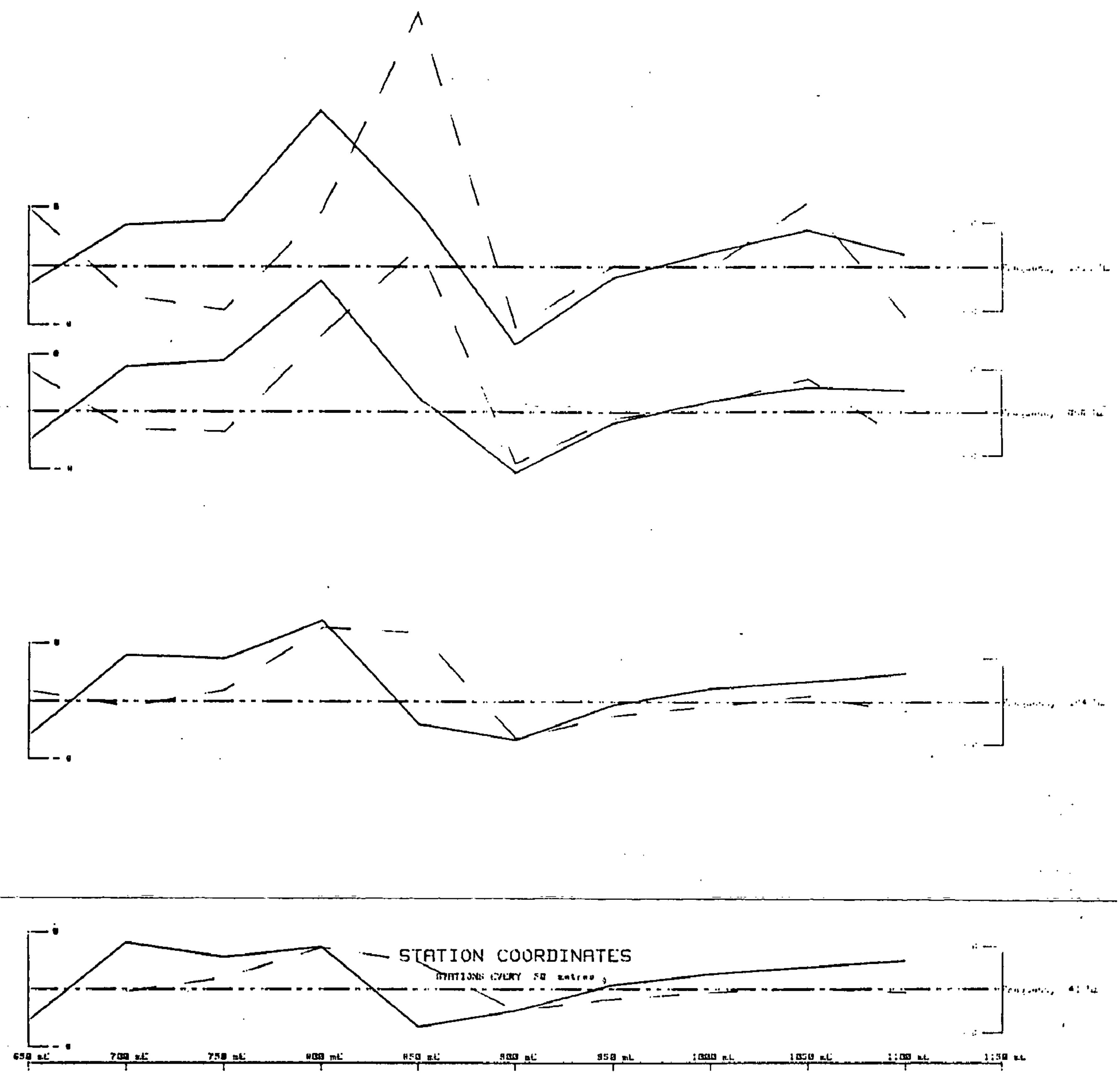
Tilt Angle
Ellipticity %

000239



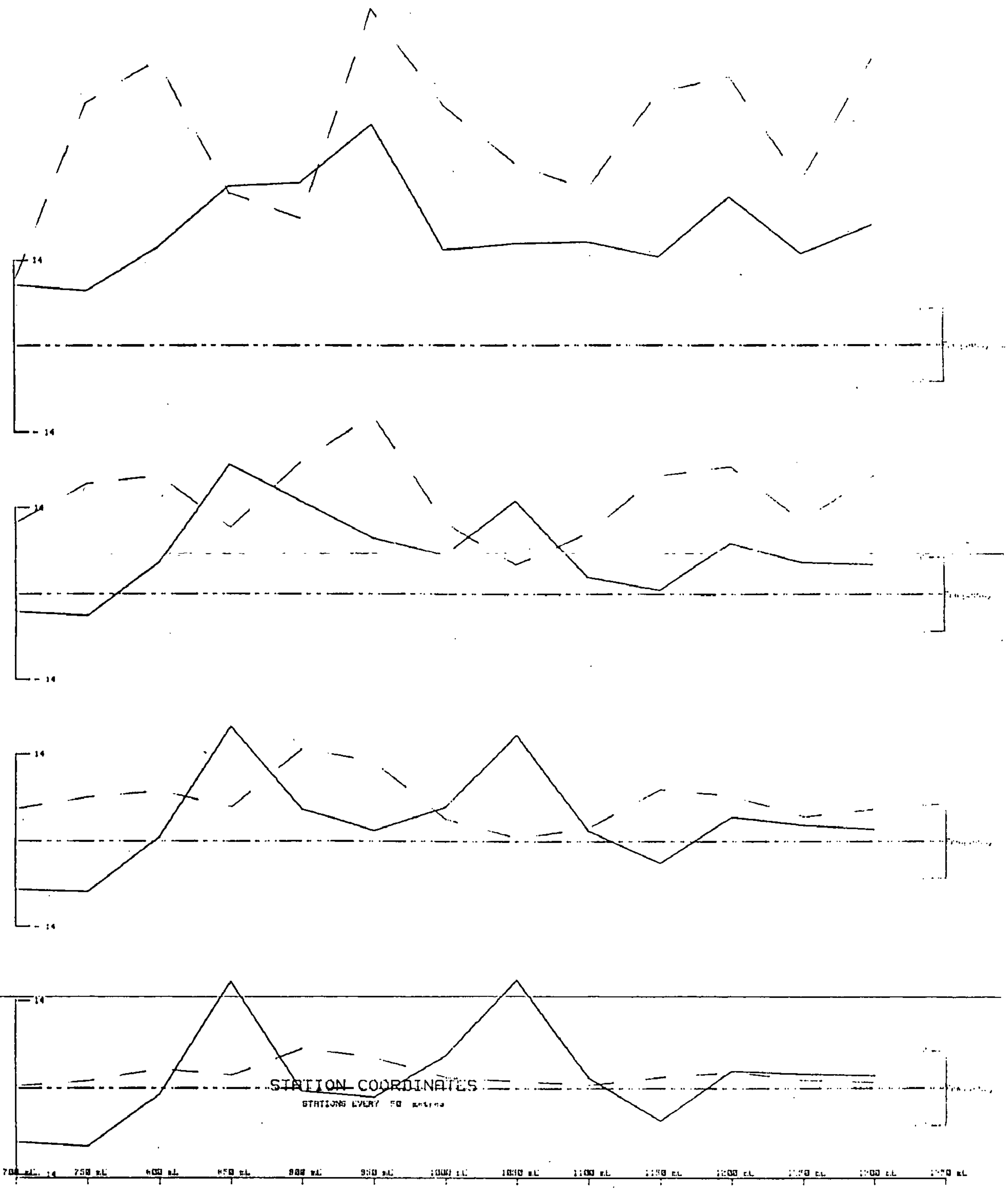
WOODCHESTER GRID AREA LINE 7 N
Tx LINE 6 ~~BROADSIDE~~
Rx LINE 8

000240



WOODCHESTER GRID AREA LINE ~~8~~ N
Tx LINE 6 ~~BROADSIDE~~
RX LINE 8

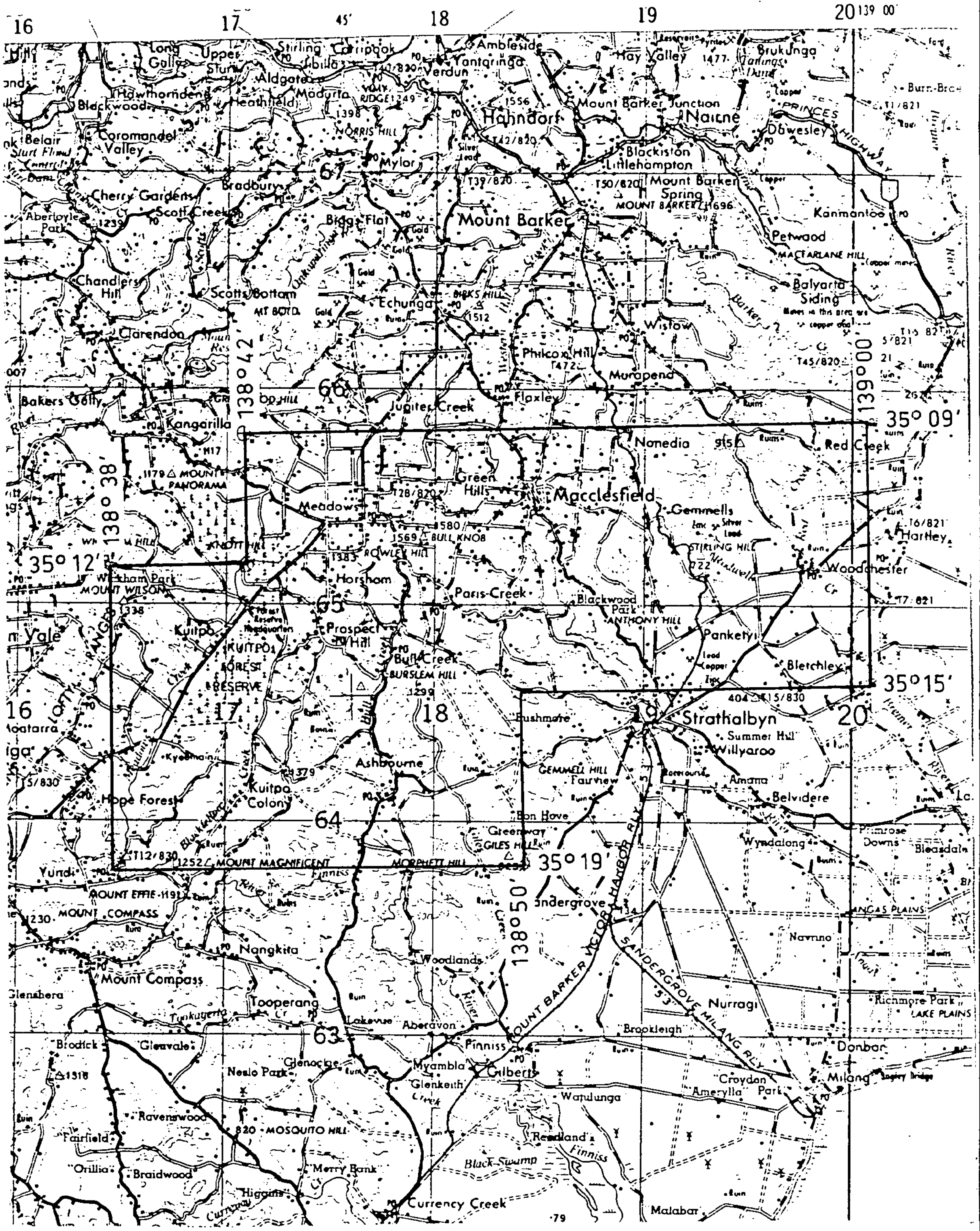
000241



WOODCHESTER GRID AREA LINE 4 N
Tx-Rx 200m IN LINE

000242

000243

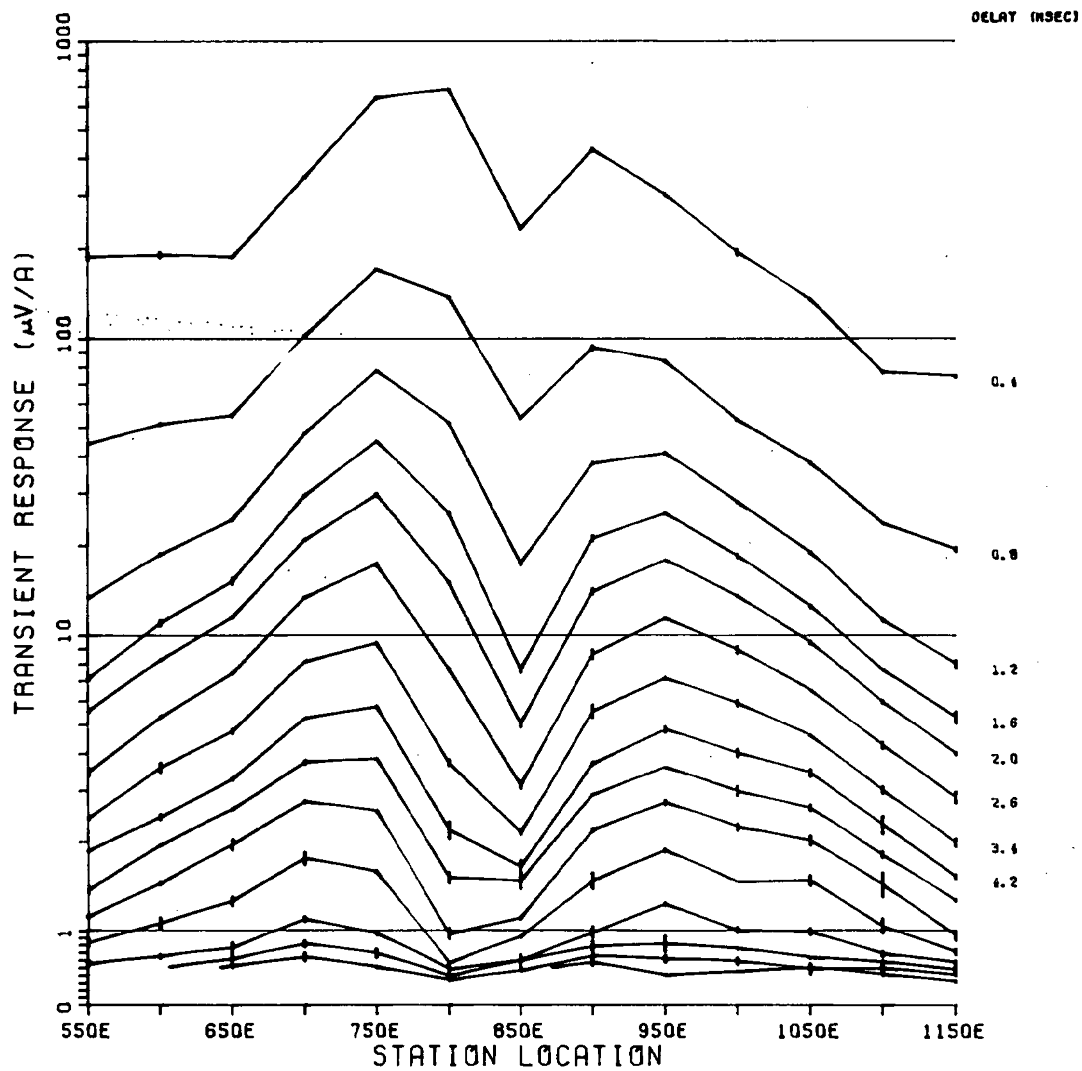


C.R.A. EXPLORATION PTY. LIMITED.

BULL CREEK, E.L. 612
LOCATION MAP

1:250,000 Sheet Ref.: BARKER SI54-13.

Geol.: K.J.W.	Date: 24-9-79	Drawn: D.R.W.
Report Nº: 11670	Scale 1:250,000	Plan Nº: SAa 303



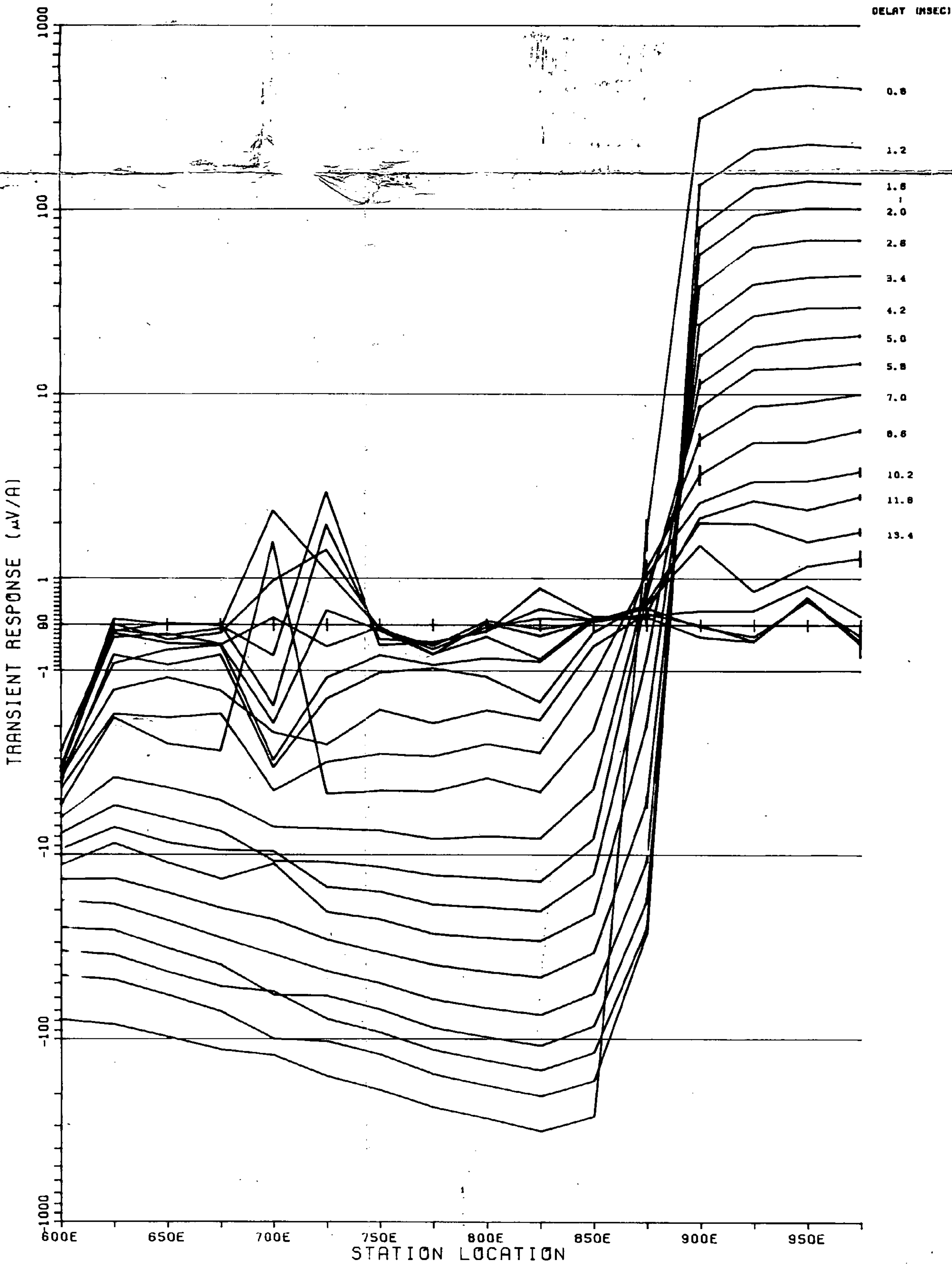
INSTRUMENT :SIROTEM
CONFIGURATION:100M SQUARE DISPLACED LOOPS
READING INTERVAL 50M

SCALE: 1:5000
DATE : 16/4/82
MAP : STRATHALBYN, S. A.

C. R. A. EXPLORATION PTY. LTD.
TRANSIENT E. M. PROFILE
LINE 3: (7-8), PROSPECT WOODCHESTER

GEOEX PTY LTD

Report No. 11670
SAa 1807



INSTRUMENT :SIROTEM
CONFIGURATION:200M SQUARE TRANSMITTER LOOP,
TURAM MODE (RVR) SURVEY
READING INTERVAL 25M

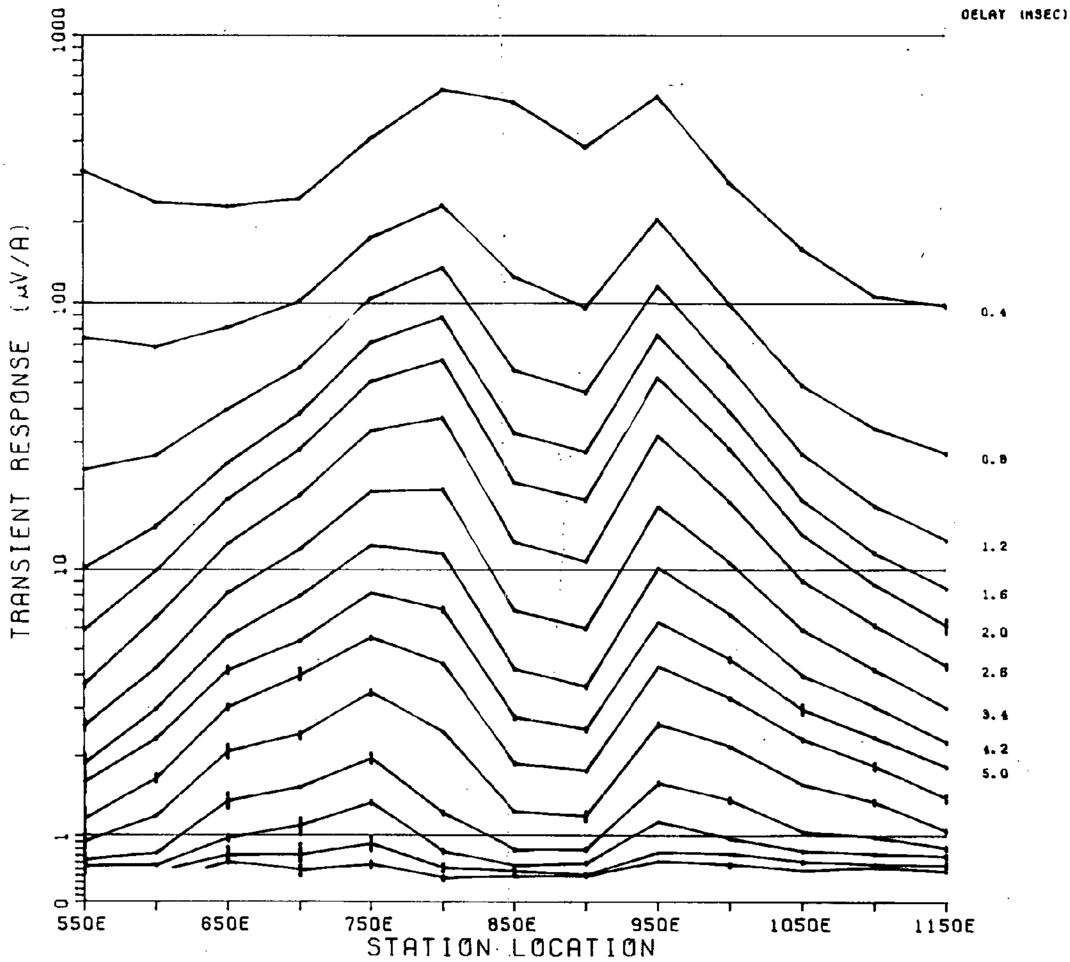
C.R.A. EXPLORATION PTY. LTD.
TRANSIENT E.M. PROFILE
LINE 6 (VERT. COMP.), PROSPECT WOODCHESTER

SCALE: 1:2500
DATE : 10/6/82
MAP : STRATHALBYN, S. A.

Report No. 11670
SAa 1812

GEOEX PTY LTD

000247



INSTRUMENT :SIROTEM
CONFIGURATION:100M SQUARE DISPLACED LOOPS
READING INTERVAL 50M

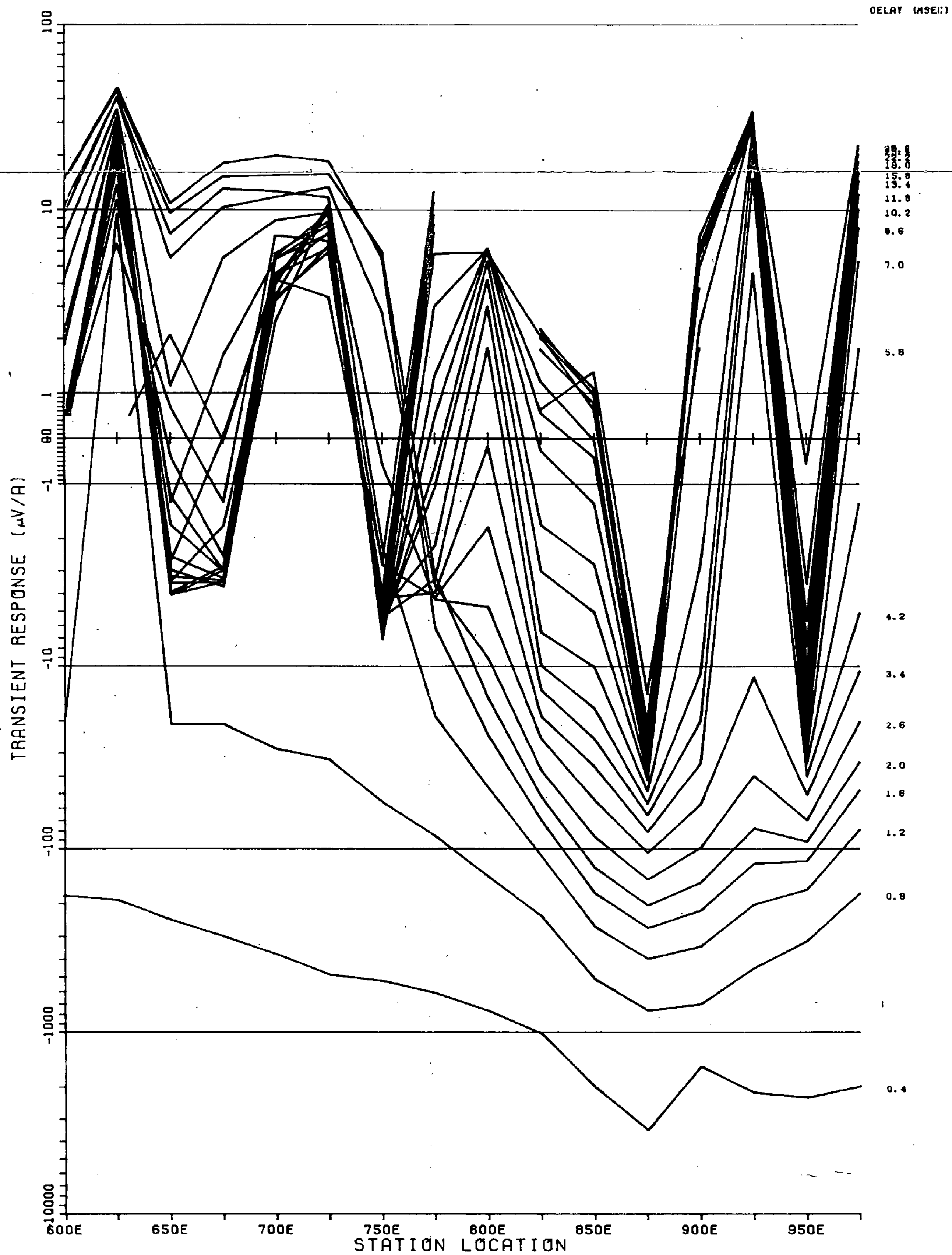
SCALE: 1:5000
DATE : 14/4/82
MAP : STRATHALBYN, S. A.

C. R. A. EXPLORATION PTY. LTD.
TRANSIENT E. M. PROFILE
LINE 2: (5-6), PROSPECT WOODCHESTER

GEOEX PTY LTD

Report No. 11670
SAa 1809

000246



INSTRUMENT :SIROTEM
CONFIGURATION:200M SQUARE TRANSMITTER LOOP,
TURAM MODE (RVR) SURVEY
READING INTERVAL 25M

SCALE: 1:2500
DATE : 10/6/82
MAP : STRATHALBYN, S. A.

C. R. A. EXPLORATION PTY. LTD.
TRANSIENT E. M. PROFILE
LINE 6 (E-W COMP.), PROSPECT WOODCHESTER

GEOEX PTY LTD

Report No. 11670
SAa 1808

000245

000248

CRA EXPLORATION PTY. LIMITED

SECOND QUARTERLY REPORT FOR BULL CREEK E.L. 1008, SOUTH AUSTRALIA FOR THE PERIOD ENDING 6TH DECEMBER, 1982

AUTHOR: G.J. BUBNER

COPIES TO: CRAE LIBRARY
S.A.D.M.E.

DATE: 6TH DECEMBER, 1982

SUBMITTED BY:

ACCEPTED BY:

11670

CONTENTS

1. SUMMARY AND CONCLUSIONS

Drillhole 81WCP2 was logged in a test capacity using a magnetic susceptibility/conductivity probe.

2. INTRODUCTION

Bull Creek E.L. 612 comprising an area of 469 square kilometers was granted to CRA Exploration Pty. Limited for one year from 21st March, 1980, and renewed for a further 12 months to 20th March, 1982. A coincident area, excluding the Mount Monster Mine was granted as E.L. 1008 for one year from 7th June, 1982 (Plan Nos. SAa 303).

This report describes work carried out in the three months ending 6th December, 1982.

3. RECOMMENDATIONS

Interpretation of aeromagnetic data continue in the light of investigations of magnetic targets in adjacent E.L.'s.

4. WORK CARRIED OUT

Drillhole 81WCP2, which intersected pyrite/pyrrhotite bands from 110 to 170 metres was logged using a Geoinstruments TH-3C magnetic susceptibility/conductivity probe. The drillhole location is shown in Plan No. SAa 1039, and the geophysical log in Plan No. SAa 1989.

G.J. BUBNER

GJB/dp

REFERENCES

Bull Creek E.L. 612 CRAE Reports 10149 and E.L. 1008 CRAE Reports 11670.

WILLS, K.J.A. July 1980	First Quarterly Report for the Period Ending 20th June, 1980.
WILLS K.J.A. November 1980	Second Quarterly Report for the Period Ending 20th September, 1980.
WILLS, K.J.A. & COOK, I.A. February 1981	Third Quarterly Report for the Period Ending 20th December, 1980.
WILLS, K.J.A. April 1981	Fourth Quarterly Report for the Period Ending 20th March, 1981.
VENABLES, A.J. & BUBNER, G.J. July 1981	Fifth Quarterly Report for the Period Ending 20th June, 1981.
VENABLES, A.J. & BUBNER, G.J. October 1981	Sixth Quarterly Report for the Period Ending 20th September, 1981.
VENABLES, A.J. January 1982	Seventh Quarterly Report for the Period Ending 20th December, 1981.
BUBNER, G.J. April 1982	Eighth Quarterly Report for the Period Ending 20th March, 1982.
BUBNER, G.J. September 1982	First Quarterly Report for the Period Ending 6th September, 1982.

LOCATION

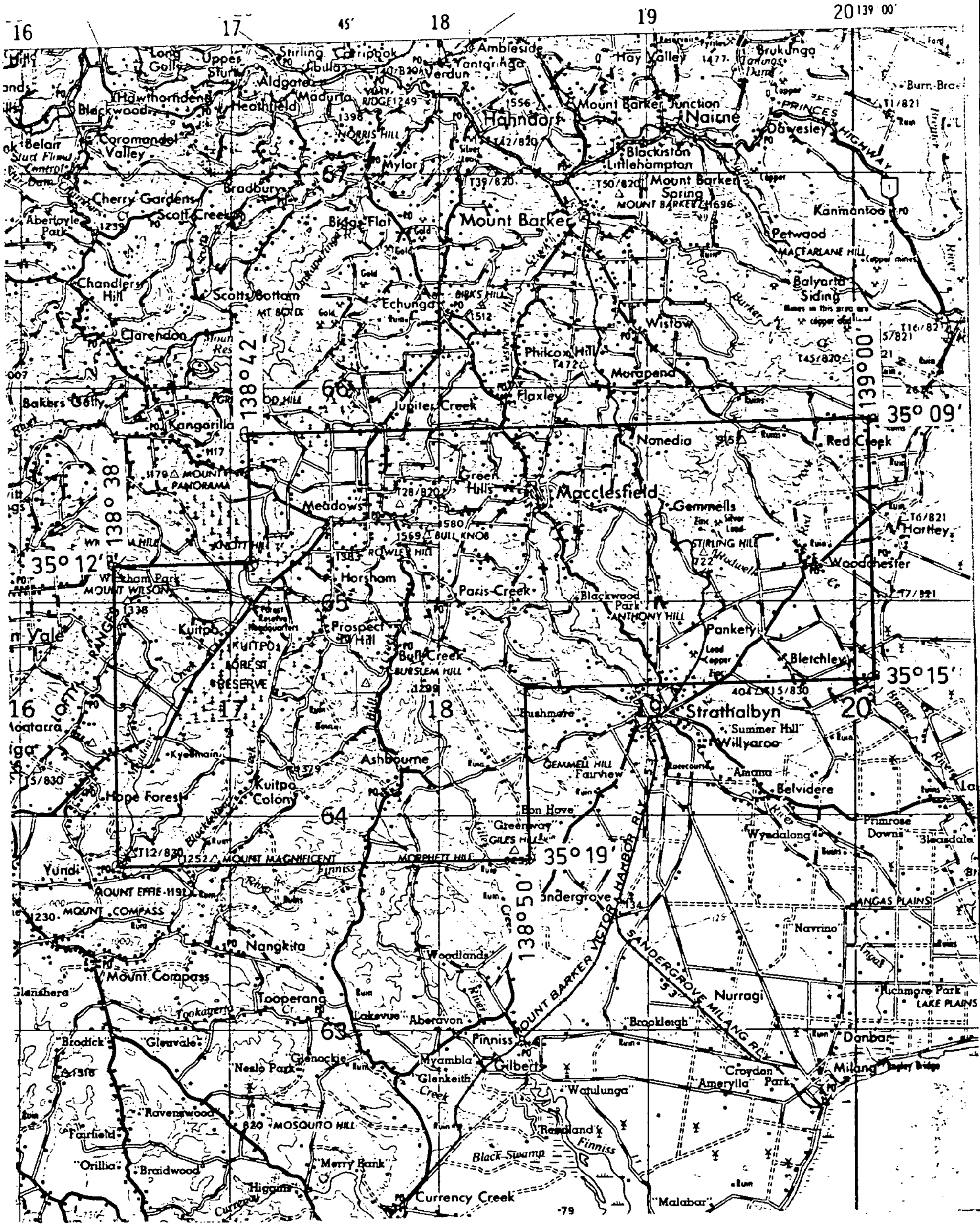
Barker SI 54-13 1:250 000 sheet

KEYWORDS

Geophys-borehole.

LIST OF ATTACHMENTS

Plan No.	Title	Scale
SAa 303	Bull Creek E.L. 1008	1:250 000
SAa 1039	Geological Plan of Woodchester Showing Trend of Brecciated Quartzite Zone and Proposed Borehole Sites	1: 5 000
SAa 1989	Geophysical Log 82WCP2	1: 200



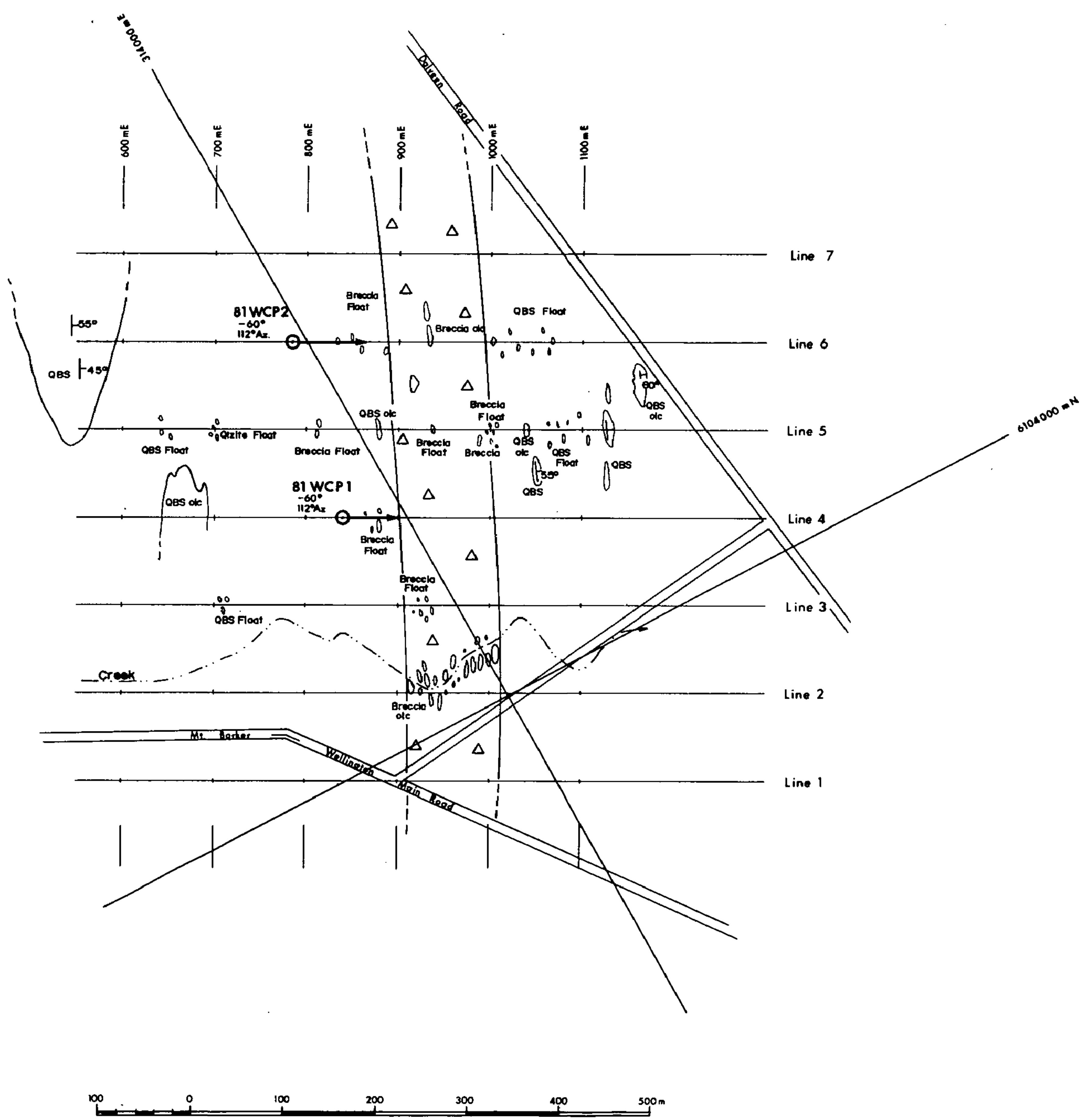
C.R.A. EXPLORATION PTY. LIMITED.

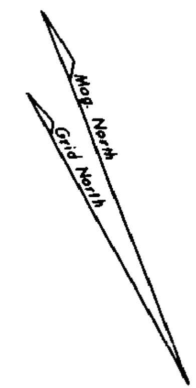
BULL CREEK, E.L.1008

LOCATION MAP

1:250,000 Sheet Ref.: BARKER SI54-13.

Geol.: K.J.W.	Date: 24-9-79	Drawn: D.R.W.
Report Nº: 11670	Scale 1:250,000	Plan Nº: SAa 303





LEGEND

△ △	Estimated trend of brecciated quartzite
QBS	Quartz-biotite schist (outcrop or float)
55°	Strike direction with dip in degrees

C R A EXPLORATION PTY LIMITED

BULL CREEK EL 1008 — S.A.

GEOLOGICAL PLAN OF WOODCHESTER SHOWING TREND OF BRECCIATED QUARTZITE ZONE AND PROPOSED BOREHOLE SITES

REF.	BARKER SI 54-13		
SCALE	1 : 5000		
AUTHOR	A.J.V.	REPORT	11670
DATE	Sept. 1981	PLAN No	SAa 1039

000254

III

000255

CRA EXPLORATION PTY. LIMITED

THIRD QUARTERLY REPORT FOR BULL CREEK E.L. 1008, SOUTH AUSTRALIA, FOR THE PERIOD ENDING 6TH MARCH, 1983.

AUTHOR: G.J. BUBNER

COPIES TO: CRAE LIBRARY
S.A.D.M.E.

DATE: 17TH MARCH, 1983

SUBMITTED BY:

ACCEPTED BY:

11670

CONTENTS

1. SUMMARY

No field work was carried out on E.L. 1008 for the quarter ended 6.3.1983.

2. INTRODUCTION

Bull Creek E.L. 612 comprising an area of 469 square kilometres was granted to CRA Exploration Pty. Limited for one year from 21st March, 1980, and renewed for a further 12 months to 20th March, 1982. A coincident area, excluding the Mount Monster Mine was granted as E.L. 1008 for one year from 7th June, 1982 (Plan No. SAa 303).

This report describes work carried out in the three months ending 6th March, 1983.

3. RECOMMENDATIONS

Interpretation of aeromagnetic data continues in the light of investigations of magnetic targets in adjacent E.L.'s.

4. WORK CARRIED OUT

No field work was conducted during the quarter.

A compilation of all geophysical data acquired over the Woodchester Prospect commenced in preparation for a report on the effectiveness of various techniques in exploring for base metal deposits in this environment.

G.J. BUBNER

GJB/pw

REFERENCES

Bull Creek E.L. 612 CRAE Reports 10149
& E.L. 1008 CRAE Reports 11670

Wills, K.J.A. July, 1980	First Quarterly Report For The Period Ending 20th June, 1980.
Wills, K.J.A. November, 1980	Second Quarterly Report For The Period Ending 20th September, 1980.
Wills, K.J.A. & Cook, I.A. February, 1981	Third Quarterly Report For The Period Ending 20th December, 1980.
Wills, K.J.A. April, 1981	Fourth Quarterly Report For The Period Ending 20th March, 1981.
Venables, A.J. & Bubner, G.J. July, 1981	Fifth Quarterly Report For The Period Ending 20th June, 1981.
Venables, A.J. & Bubner, G.J. October, 1981	Sixth Quarterly Report For The Period Ending 20th September, 1981.
Venables, A.J. January, 1982	Seventh Quarterly Report For The Period Ending 20th December, 1981.
Bubner, G.J. April, 1982	Eighth Quarterly Report For The Period Ending 20th March, 1982.
Bubner, G.J. September, 1982	First Quarterly Report For The Period Ending 6th September, 1982.
Bubner, G.J. December, 1982	Second Quarterly Report For The Period Ending 6th December, 1982.

LOCATION

Barker SI 54-13 1:250 000 sheet

KEYWORDS

Geophysics

LIST OF PLANS

Plan No.	Title	Scale
SAa 303	Bull Creek E.L. 1008	1:250 000

III

000259

CRA EXPLORATION PTY. LIMITED

FOURTH QUARTERLY REPORT FOR
BULL CREEK E.L. 1008, SOUTH AUSTRALIA,
FOR THE PERIOD ENDING 6TH JUNE, 1983.

AUTHOR: G.J. BUBNER

COPIES TO: CRAE LIBRARY
S.A.D.M.E.

DATE: 17TH JUNE, 1983

SUBMITTED BY:

ACCEPTED BY:

CONTENTS

1. SUMMARY

Planning has commenced for an INPUT survey, to be flown over part of Bull Creek E.L. 1008.

2. INTRODUCTION

Bull Creek E.L. 612 comprising an area of 469 square kilometres was granted to CRA Exploration Pty. Limited for one year from 21st March, 1980, and renewed for a further 12 months to 20th March, 1982. A coincident area, excluding the Mount Monster Mine was granted as E.L. 1008 for one year from 7th June, 1982 (Plan No. SAa 303).

This report describes work carried out in the three months ending 6th June, 1983.

3. RECOMMENDATIONS

It is recommended that an INPUT survey be flown over the eastern portion of the E.L., with follow up of anomalies generated to commence in 1984.

4. WORK CARRIED OUT

Specifications for an INPUT survey over the southern part of the Kanmantoo Trough were compiled. The survey area includes 100 square kilometres of Bull Creek E.L. 1008, which is that part of the E.L. east of longitude 138°54'18". Flight lines will be oriented east-west, at a spacing of 400 metres. Pending scheduling of the aircraft by Geoterrex Pty. Ltd., it is anticipated the survey will be flown in August, with ground follow up of anomalies to commence in late 1983 or early 1984.

G.J. BUBNER

GJB/pw

REFERENCES

Bull Creek E.L. 612 CRAE Reports 10149
& E.L. 1008 CRAE Reports 11670

Wills, K.J.A. July, 1980	First Quarterly Report For The Period Ending 20th June, 1980.
Wills, K.J.A. November, 1980	Second Quarterly Report For The Period Ending 20th September, 1980.
Wills, K.J.A. & Cook, I.A. February, 1981	Third Quarterly Report For The Period Ending 20th December, 1980.
Wills, K.J.A. April, 1981	Fourth Quarterly Report For The Period Ending 20th March, 1981.
Venables, A.J. & Bubner, G.J. July, 1981	Fifth Quarterly Report For The Period Ending 20th June, 1981.
Venables, A.J. & Bubner, G.J. October, 1981	Sixth Quarterly Report For The Period Ending 20th September, 1981.
Venables, A.J. January, 1982	Seventh Quarterly Report For The Period Ending 20th December, 1981.
Bubner, G.J. April, 1982	Eighth Quarterly Report For The Period Ending 20th March, 1982.
Bubner, G.J. September, 1982	First Quarterly Report For The Period Ending 6th September, 1982.
Bubner, G.J. December, 1982	Second Quarterly Report For The Period Ending 6th December, 1982.
Bubner, G.J. March, 1983	Third Quarterly Report For The Period Ending 6th March, 1983.

LOCATION

Barker SI54-13   1:250 000 sheet

KEYWORDS

Geophys.-E.M., Kanmantoo Trough

LIST OF PLANS

Plan No.	Title	Scale
SAa 303	Bull Creek E.L. 1008 Location Plan	1:250 000

111

000263

CRA EXPLORATION PTY. LIMITED

FIFTH QUARTERLY REPORT FOR BULL CREEK E.L. 1008, SOUTH AUSTRALIA, FOR THE PERIOD ENDING 6TH SEPTEMBER, 1983.

AUTHOR: G.J. BUBNER

COPIES TO: CRAE LIBRARY
S.A.D.M.E.

DATE: 19TH SEPTEMBER, 1983

SUBMITTED BY:

ACCEPTED BY:

CONTENTS

1. SUMMARY

A contract has been let for acquisition of airborne E.M. data over part of Bull Creek E.L. 1008.

2. INTRODUCTION

Bull Creek E.L. 612 comprising an area of 469 square kilometres was granted to CRA Exploration Pty. Limited for one year from 21st March, 1980, and renewed for a further 12 months to 20th March, 1982. A coincident area, excluding the Mount Monster Mine was granted as E.L. 1008 for one year from 7th June, 1982 (Plan No. SAa 303), and subsequently extended for another year on 7th June, 1983.

This report describes work carried out in the three months ending 6th September, 1983.

3. RECOMMENDATIONS

A major programme of ground follow up of anomalies generated by the INPUT survey be implemented in 1984.

4. WORK CARRIED OUT

During the quarter work on E.L. 1008 consisted of preparation for a major airborne E.M. (INPUT) survey to be carried out over an area of 467 square kilometres in the southern Kanmantoo Trough. Survey specifications are as follows:

Contractor:	Geoterrex Pty. Ltd.
Flight line spacing:	400 metres
Flight line direction:	east-west
Data acquisition:	Barringer MkV INPUT Magnetics Altimeter
Data recording:	Analogue and digital
Data presentation:	Flight path map (1:25 000) Conductor map

The area of E.L. 1008 to be flown by this survey, comprising 96 square kilometres, is shown in Plan No. SAa 2330. It is expected that flying will commence in late September.

G.J. BUBNER

GJB/pw

EXPENDITURE

Expenditure for the period ended 31st August, 1983, the nearest accounting period, amounted to $1 490.00, comprising:-

	$
Salaries and Wages	518
General Supplies	499
Tenement Payments	61
Contractors	71
General Overheads	341
	$1 490

REFERENCES

Bull Creek E.L. 612 CRAE Reports 10149
& Bull Creek E.L. 1008 CRAE Report 11670

Wills, K.J.A. July, 1980	First Quarterly Report For The Period Ending 20th June, 1980.
Wills, K.J.A. November, 1980	Second Quarterly Report For The Period Ending 20th September, 1980.
Wills, K.J.A. & Cook, I.A. February, 1981	Third Quarterly Report For The Period Ending 20th December, 1980.
Wills, K.J.A. April, 1981	Fourth Quarterly Report For The Period Ending 20th March, 1981.
Venables, A.J. & Bubner, G.J. July, 1981	Fifth Quarterly Report For The Period Ending 20th June, 1981.
Venables, A.J. & Bubner, G.J. October, 1981	Sixth Quarterly Report For The Period Ending 20th September, 1981.
Venables, A.J. January, 1982	Seventh Quarterly Report For The Period Ending 20th December, 1981.
Bubner, G.J. April, 1982	Eighth Quarterly Report For The Period Ending 20th March, 1982.
Bubner, G.J. September, 1982	First Quarterly Report For The Period Ending 6th September, 1982.
Bubner, G.J. December, 1982	Second Quarterly Report For The Period Ending 6th December, 1982.
Bubner, G.J. March, 1983	Third Quarterly Report For The Period Ending 6th March, 1983.
Bubner, G.J. June, 1983	Fourth Quarterly Report For The Period Ending 6th June, 1983.

LOCATION

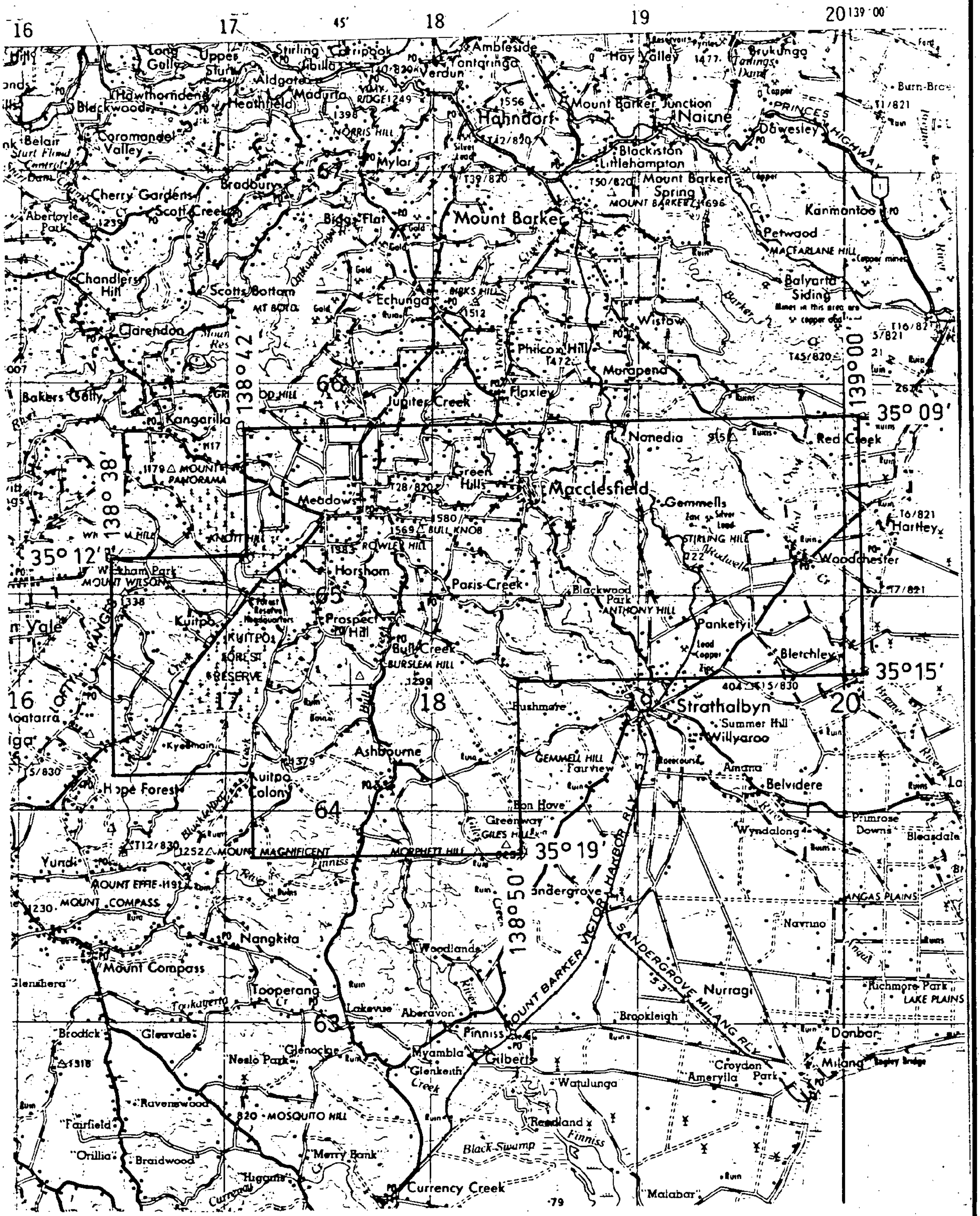
Barker SI 54-13   1:250 000 sheet

KEYWORDS

Geophys.-E.M.

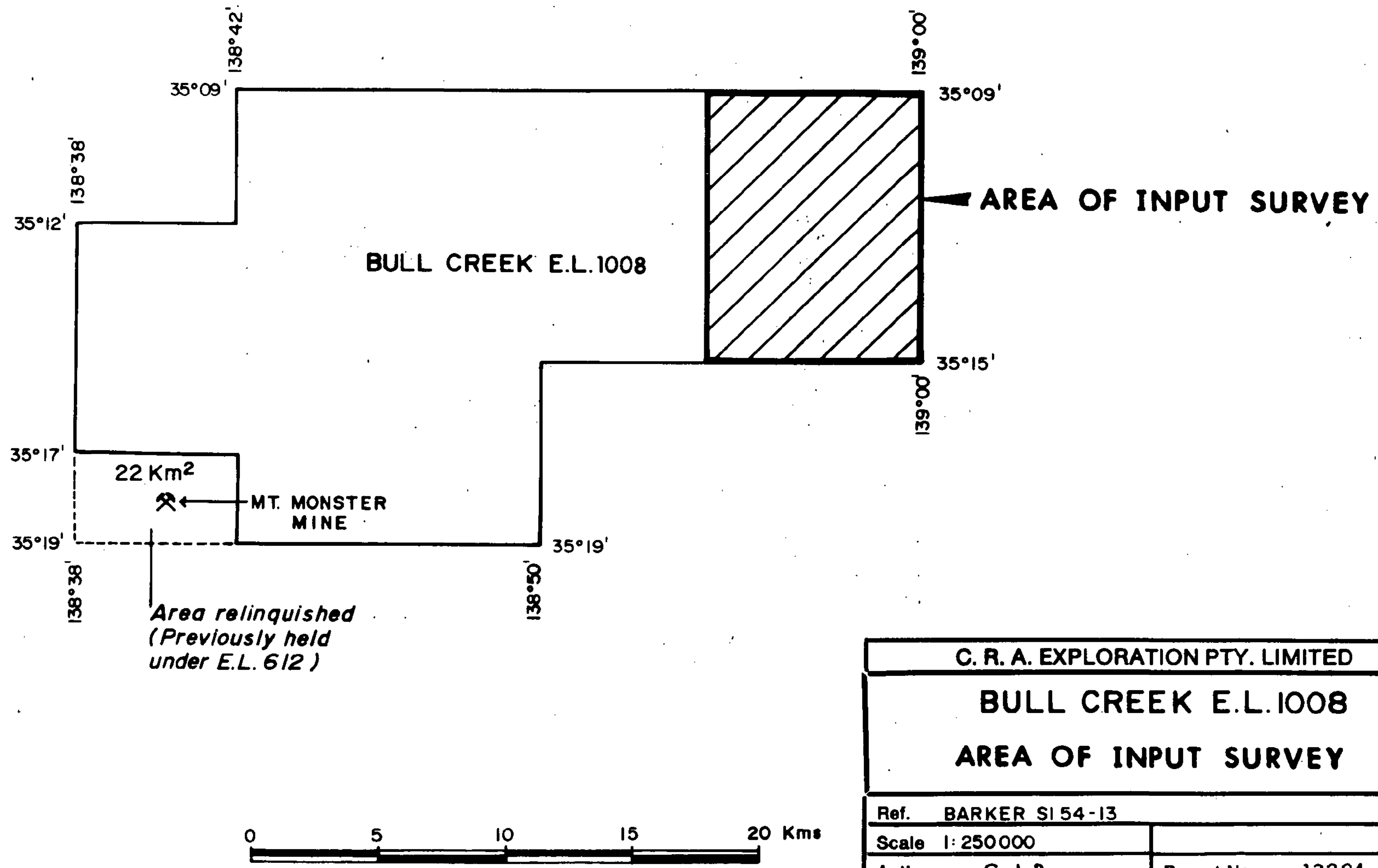
LIST OF PLANS

Plan No.	Title	Scale
SAa 303	Bull Creek E.L. 1008 Location Plan	1:250 000
SAa 2330	Bull Creek E.L. 1008 Area of INPUT Survey	1:250 000



C.R.A. EXPLORATION PTY. LIMITED.		
BULL CREEK, E.L.1008 LOCATION MAP 1:250,000 Sheet Ref.: BARKER S154-13.		
Geol.: K.J.W.	Date: 24-9-79	Drawn: D.R.W.
Report Nº: 12294	Scale 1:250,000	Plan Nº: SAa 303

000271



C. R. A. EXPLORATION PTY. LIMITED	
BULL CREEK E.L. 1008 AREA OF INPUT SURVEY	
Ref. BARKER SI 54-13	
Scale 1: 250000	
Author G. J. B.	Report No. 12294
Date Sept. '83	Plan No. SAa 2330

1(1

000272

CRA EXPLORATION PTY. LIMITED

SIXTH QUARTERLY REPORT FOR BULL CREEK E.L. 1008, SOUTH AUSTRALIA, FOR THE PERIOD ENDING 6TH DECEMBER, 1983.

AUTHOR: G.J. BUBNER

COPIES TO: CRAE LIBRARY
SADME

DATE: 14TH DECEMBER, 1983

SUBMITTED BY:

ACCEPTED BY:

CONTENTS

1. SUMMARY

240 line kilometres of INPUT were completed over a portion of E.L. 1008. Numerous conductors are indicated, and follow up will commence on receipt of the formal interpretation report.

2. INTRODUCTION

Bull Creek E.L. 612 comprising an area of 469 square kilometres was granted to CRA Exploration Pty. Limited for one year from 21st March, 1980, and renewed for a further 12 months to 20th March, 1982. A coincident area, excluding the Mount Monster Mine was granted as E.L. 1008 for one year from 7th June, 1982, (Plan No. SAa 303), and subsequently extended for another year on 7th June, 1983.

This report describes work carried out in the three months ending 6th December, 1983.

3. RECOMMENDATIONS

It is recommended that ground follow up of conductors selected in the interpretation report be commenced early in 1984.

4. WORK CARRIED OUT

An area comprising approximately the eastern quarter of Bull Creek E.L. 1008 was flown with airborne E.M. in early October, as part of a larger survey over adjacent E.L.'s. A total of 96 square kilometres was covered, including the Woodchester prospect and drillhole 81RVP1. Survey specifications are as follows:

Contractor:	Geoterrex Pty. Ltd.
Flight Line Spacing:	400 metres
Flight Line Direction:	east-west
Data Acquisition:	Barringer MkV INPUT Magnetics Altimeter
Data Recording:	Analogue and digital
Data Presentation:	Flight path map (1:25 000) Conductor map

The area involved in this survey is shown in Plan No. SAa 2330. A preliminary interpretation indicates numerous conductive horizons exist in the area, and field follow up will be initiated on the completion of the formal interpretation report.

G.J. BUBNER

GJB/pw

EXPENDITURE

Expenditure for the period ended 30th November, 1983, the nearest accounting period, amounted to $637.00, comprising:-

	$
Salaries and Wages	368
Vehicles	2
General Overheads	267
	$637

REFERENCES

Bull Creek E.L. 612 CRAE Reports 10149
& Bull Creek E.L. 1008 CRAE Reports 11670

Wills, K.J.A. July, 1980	First Quarterly Report For The Period Ending 20th June, 1980.
Wills, K.J.A. November, 1980	Second Quarterly Report For The Period Ending 20th September, 1980.
Wills, K.J.A. & Cook, I.A. February, 1981	Third Quarterly Report For The Period Ending 20th December, 1980.
Wills, K.J.A. April, 1981	Fourth Quarterly Report For The Period Ending 20th March, 1981.
Venables, A.J. & Bubner, G.J. July, 1981	Fifth Quarterly Report For The Period Ending 20th June, 1981.
Venables, A.J. & Bubner, G.J. October, 1981	Sixth Quarterly Report For The Period Ending 20th September, 1981.
Venables, A.J. January, 1982	Seventh Quarterly Report For The Period Ending 20th December, 1981.
Bubner, G.J. April, 1982	Eighth Quarterly Report For The Period Ending 20th March, 1982.
Bubner, G.J. September, 1982	First Quarterly Report For The Period Ending 6th September, 1982.
Bubner, G.J. December, 1982	Second Quarterly Report For The Period Ending 6th December, 1982.
Bubner, G.J. March, 1983	Third Quarterly Report For The Period Ending 6th March, 1983.
Bubner, G.J. June, 1983	Fourth Quarterly Report For The Period Ending 6th June, 1983.
Bubner, G.J. September, 1983	Fifth Quarterly Report For The Period Ending 6th September, 1983.

LOCATION

Barker SI 54-13 1:250 000 sheet

KEYWORDS

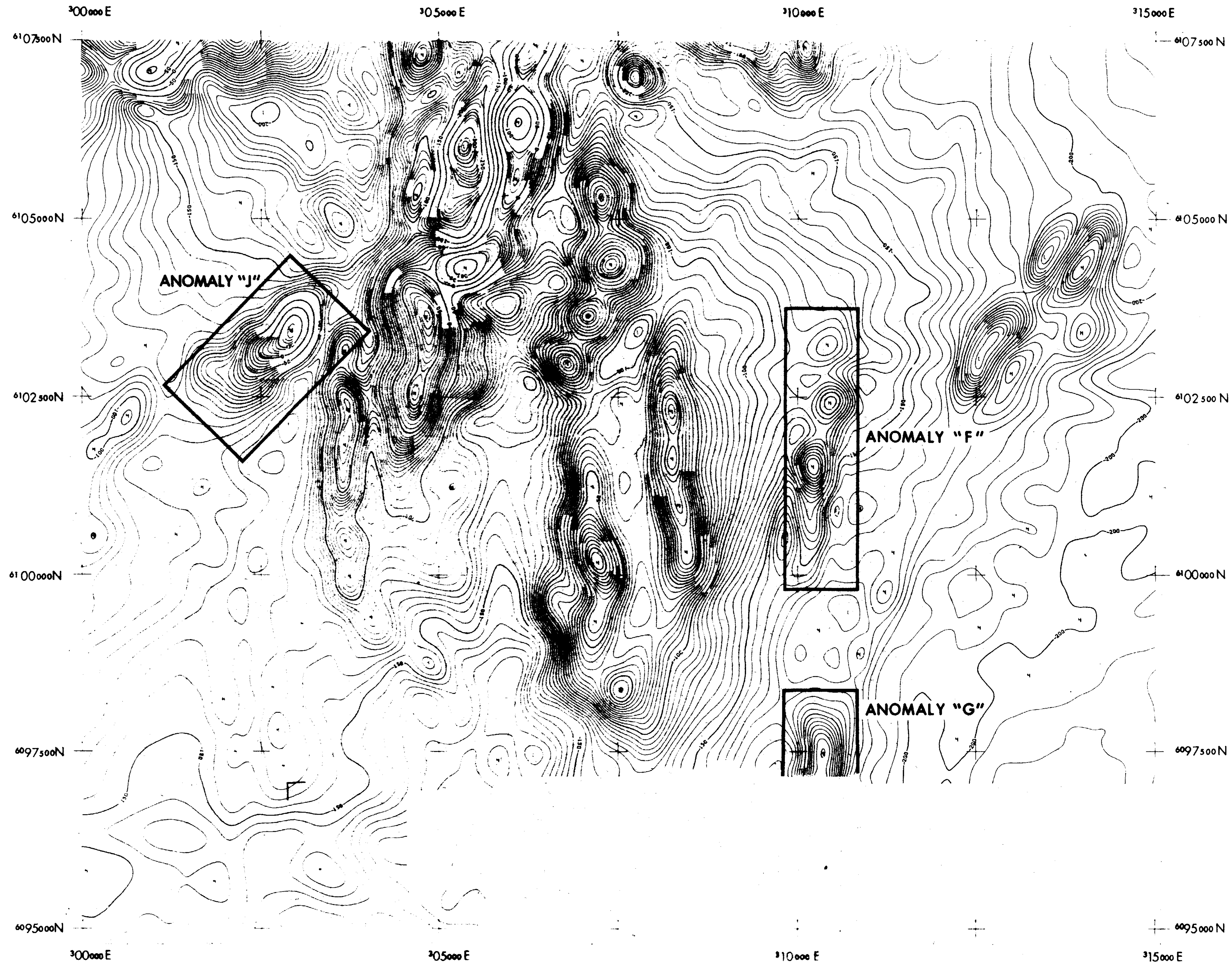
Geophys.-E.M.

LIST OF PLANS

Plan No.	Title	Scale
SAa 303	Bull Creek E.L. 1008 Location Plan	1:250 000
SAa 2330	Bull Creek E.L. 1008 Area of INPUT Survey	1:250 000

138°45" 35°07'30" +

139°00" + 35°07'30"



35°20" + 138°45"

+ 35°20" 139°00"

SCALE

METRES 1000 0 1 2 3 4 5 KILOMETRES

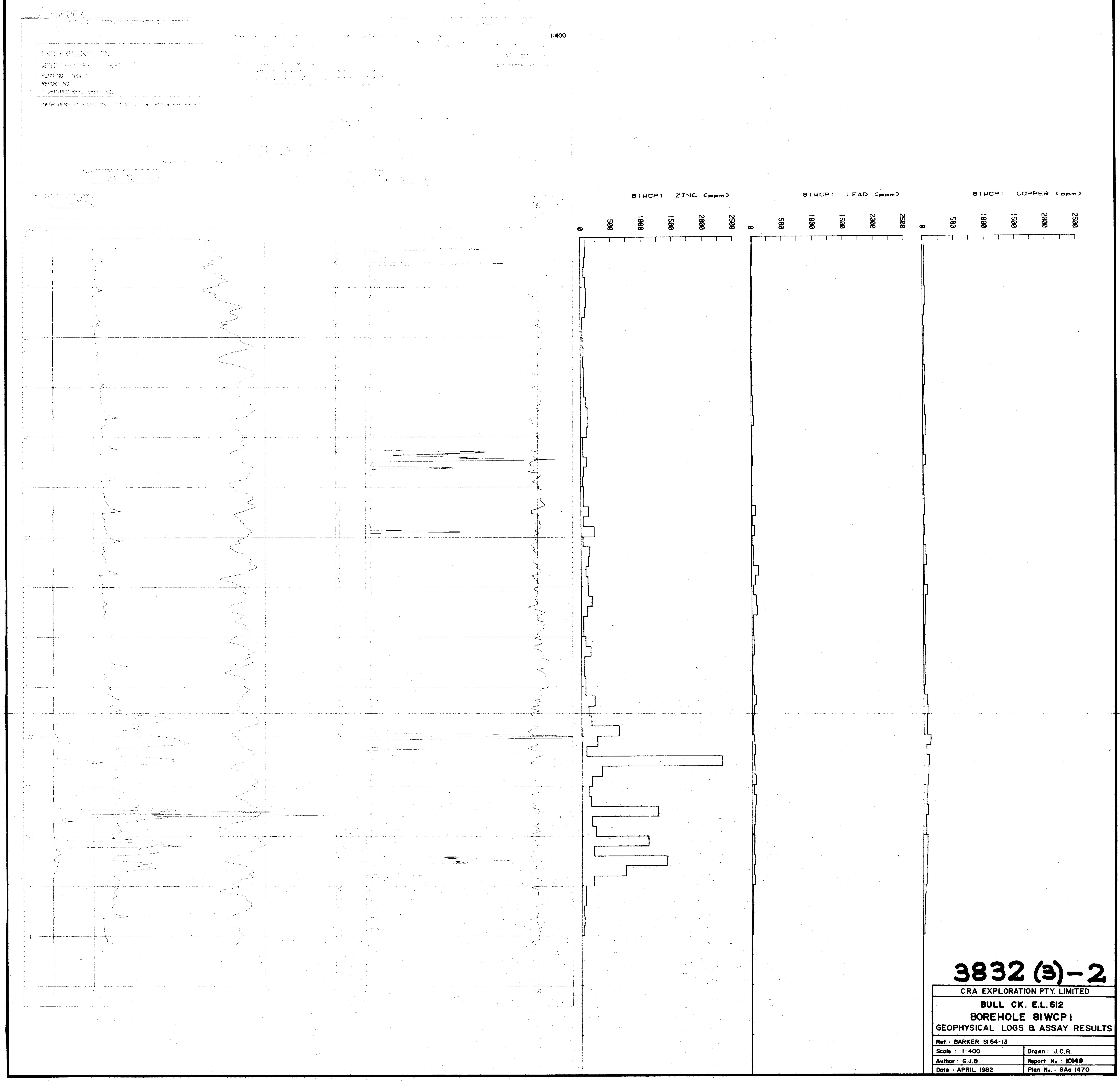
3832(3)-1

CRA EXPLORATION PTY. LIMITED

BULL CREEK E.L. 612

AEROMAGNETIC CONTOURS SHOWING LOCATION OF ANOMALIES "F", "G" & "J"

Ref: BARKER SI54-13	
Author: G.J.B.	Scale: 1:50,000
Drawn: S.J.B.	Report No: 10149
Date: APRIL 1982	Plan No: SAo 1469

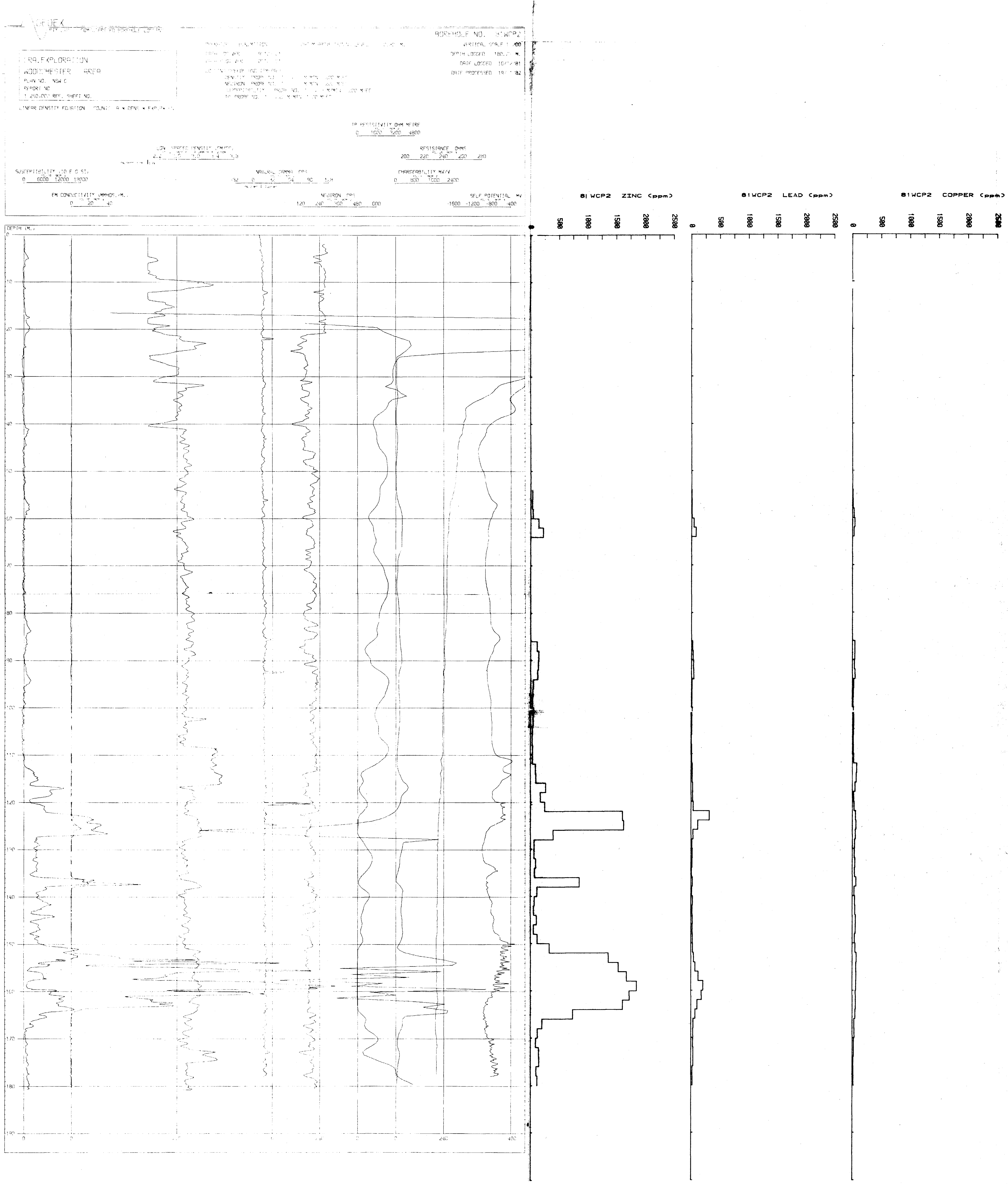


3832 (3)-2

CRA EXPLORATION PTY. LIMITED

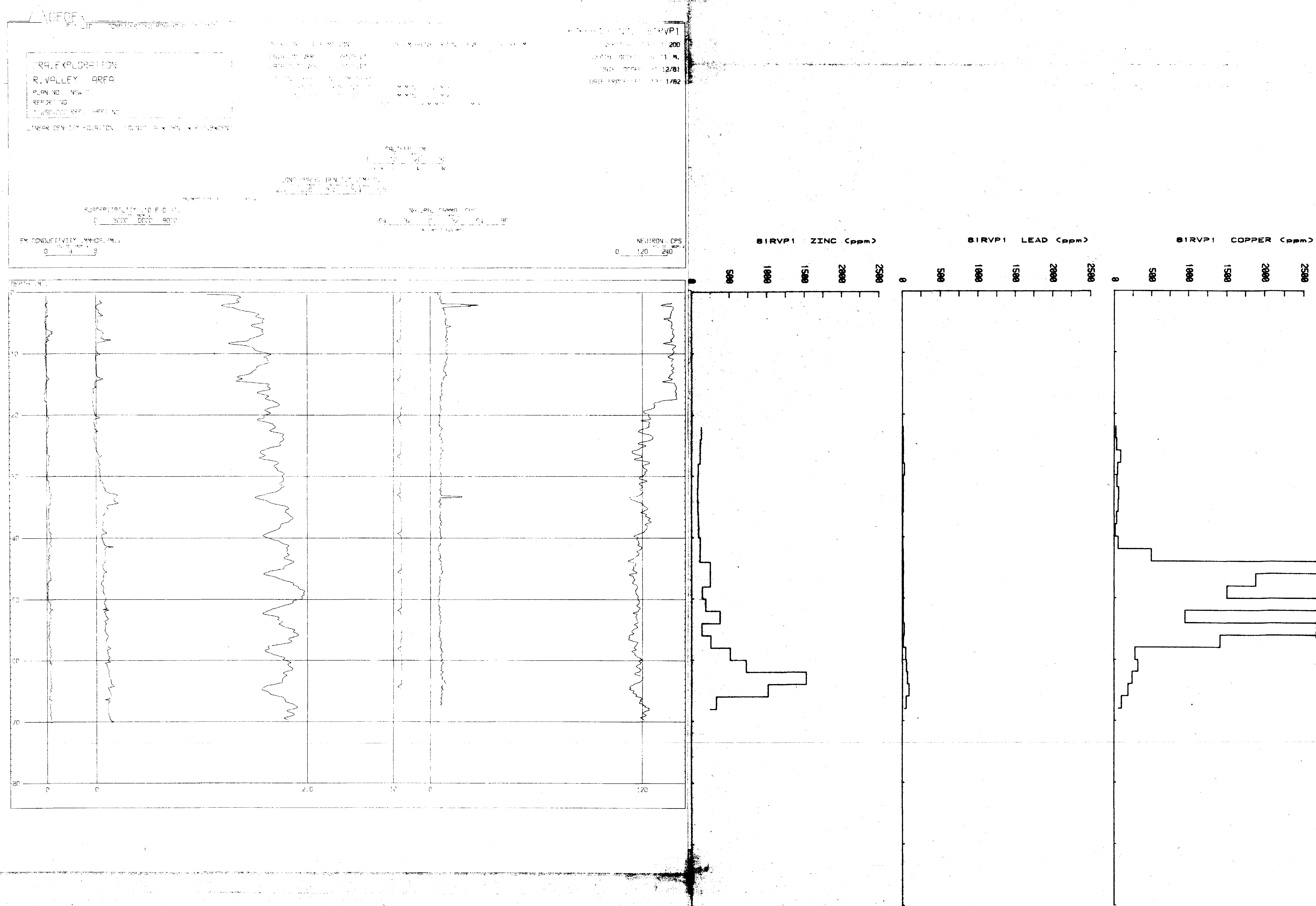
BULL CK. E.L.612
BOREHOLE 81WCP1
GEOPHYSICAL LOGS & ASSAY RESULTS

Ref.: BARKER SI54-13	
Scale: 1:400	Drawn: J.C.R.
Author: G.J.B.	Report No.: 10149
Date: APRIL 1982	Plan No.: SAa 1470



3832 (3) - 3

CRA EXPLORATION PTY. LIMITED	
BULL CK. E.L. 612 BOREHOLE 81 WCP 2 GEOPHYSICAL LOGS & ASSAY RESULTS	
Ref : BARKER 8153-13	
Author : G.J.B.	Drawn : J.C.R.
Scale : 1:400	Report No. : 10149
Date : APRIL 1982	Plan No. : SAs 1471



3832(3) – 4

CRA EXPLORATION PTY. LIMITED

BULL CK. E.L.612
BOREHOLE 81RVP1
GEOPHYSICAL LOGS & ASSAY RESULTS

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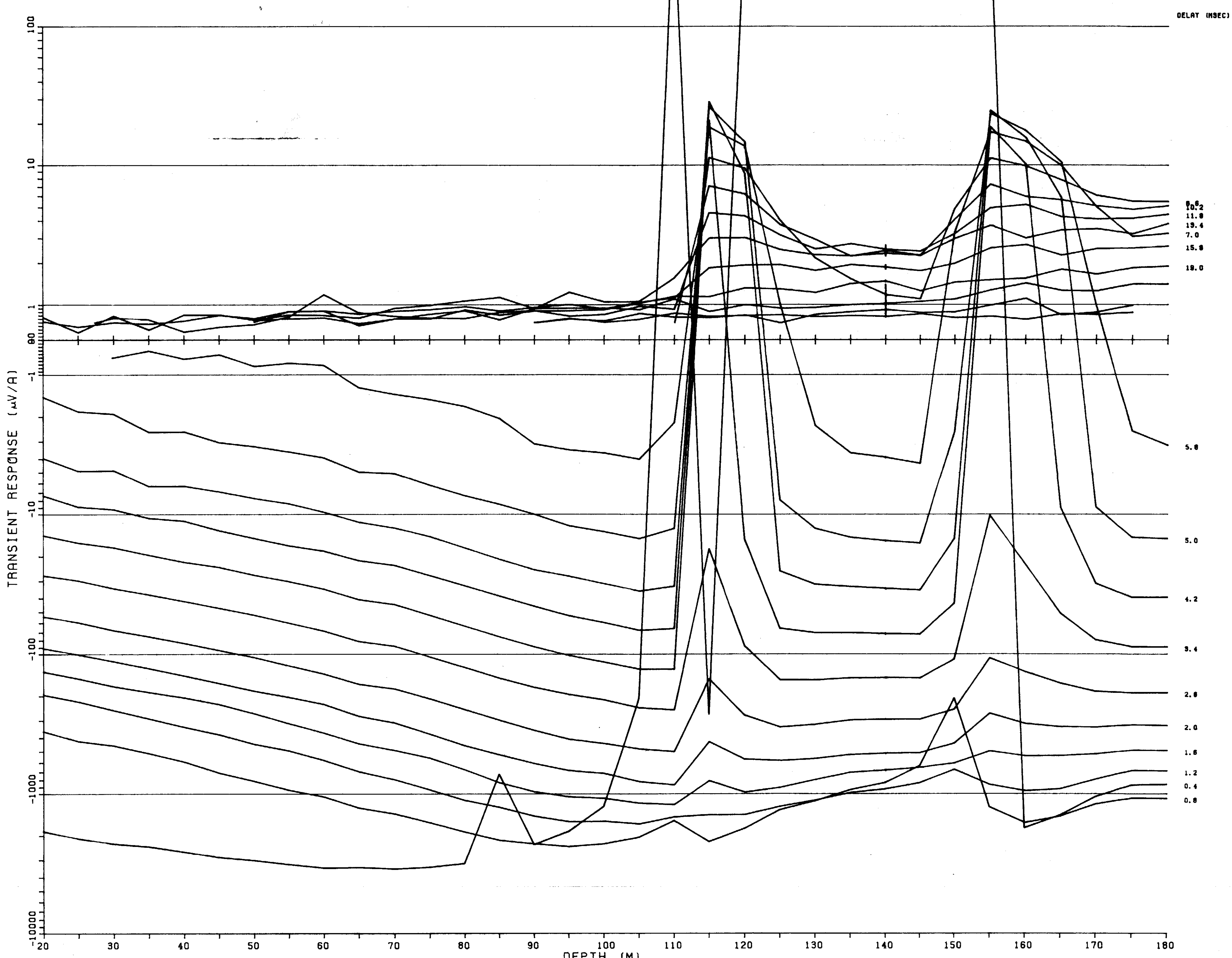
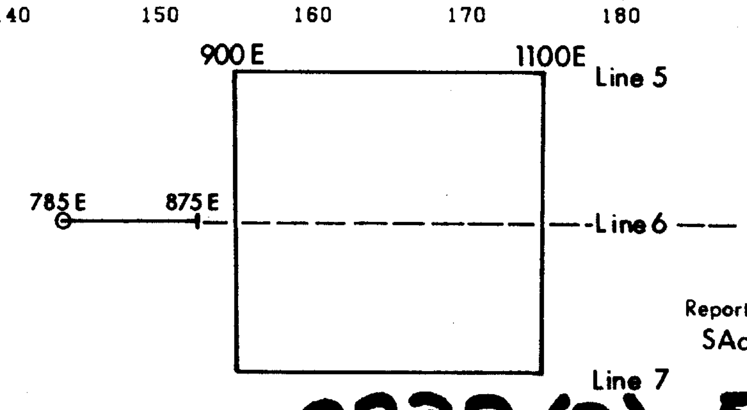
Author : G.J.B.	Drawn : J.C.R.
Scale : 1:400	Report No. : 10149
Date : APRIL 1982	Plan No. : SAg 1472





INSTRUMENT :SIROTEM
CONFIGURATION:200M SQUARE TRANSMITTER LOOP,
DRILL HOLE SURVEY
READING INTERVAL 5M

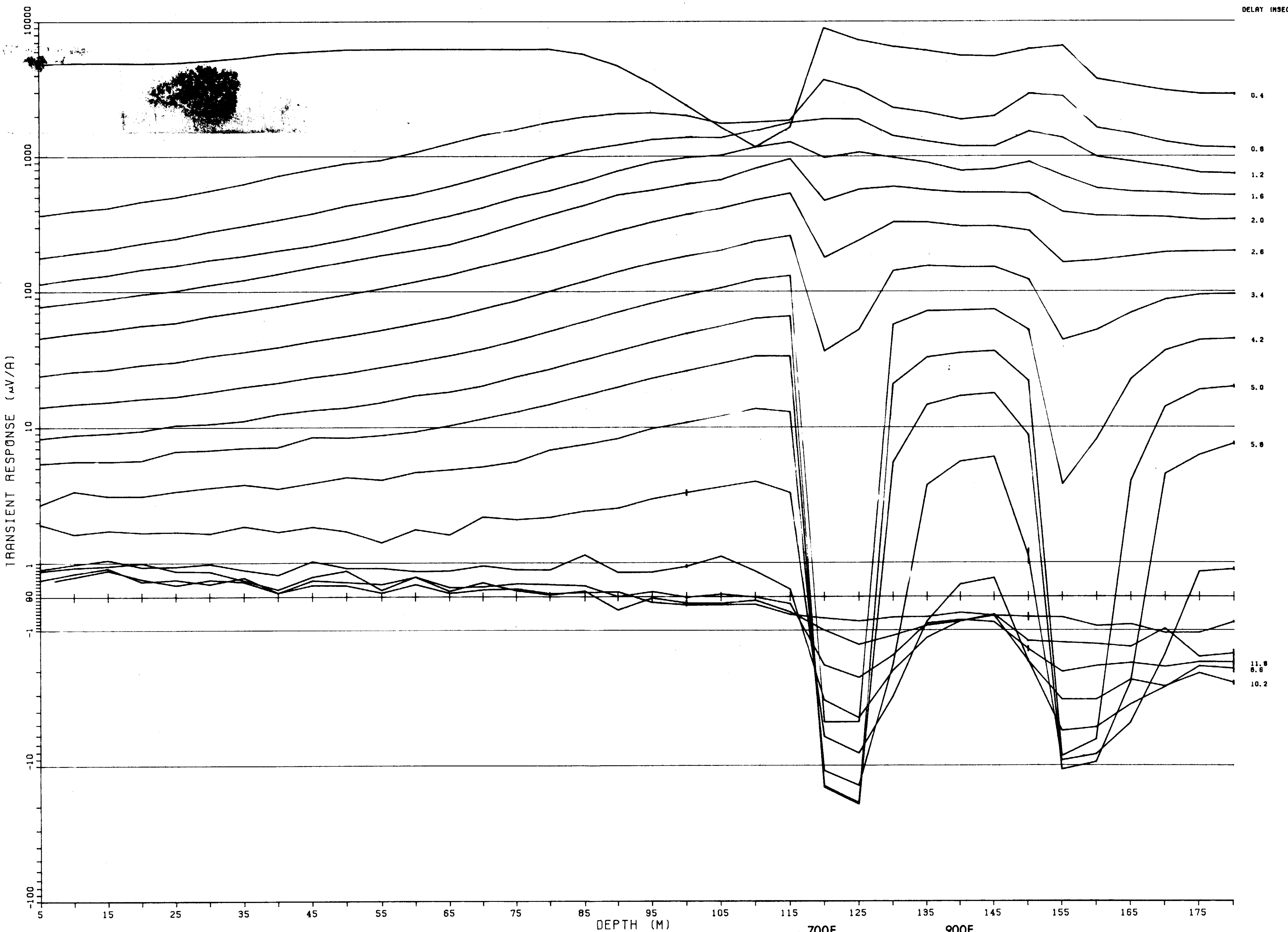
C. R. A. EXPLORATION PTY. LTD.
TRANSIENT E.M. PROFILE
81WCP2 (LOOP 2), PROSPECT WOODCHESTER

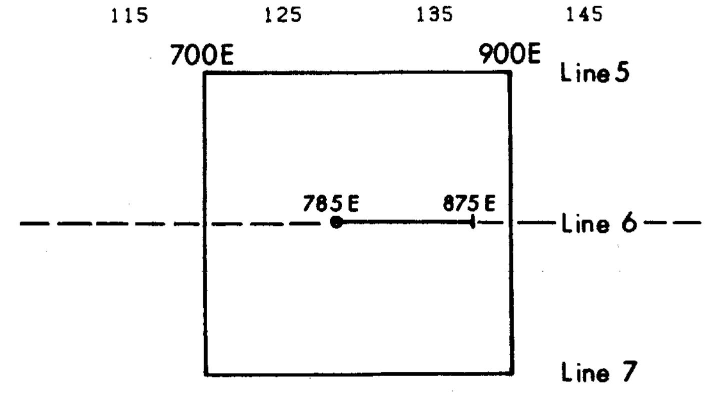
SCALE: 1:500
DATE : 16/4/82
MAP : STRATHALBYN, S. A.

GEOEX PTY LTD

Report No. 11670
SAa 1810

3832 (3)-5





INSTRUMENT :SIROTEM
CONFIGURATION:200M SQUARE TRANSMITTER LOOP,
DRILL HOLE SURVEY
READING INTERVAL 5M

SCALE: 1:500
DATE : 16/4/82
MAP : STRATHALBYN, S.A.

C.R.A. EXPLORATION PTY. LTD.
TRANSIENT E.M. PROFILE
81WCP2 (LOOP 1), PROSPECT WOODCHESTER

GEOEX
PTY LTD

Report No. 11670
SAa 1811

3832 (3)-6

DOWNHOLE LOG 81WCP2		Total Depth:	182m	Date:	1-12-82
BULL CREEK E.L. 1008		Depth Logged:	180m	Logger:	S.I.E. T450 E
WOODCHESTER PROSPECT		R.L. - A.H.D.:	128±1m	Ratemeter T.C.:	2
A.M.G. Co-ords: 313990mE, 6104470mN				Logging Speed:	5m/min
Lat. 35°11'08"; Long. 138°57'26"				Operator:	G.J.B.

3832(3)-7

000279

CRA EXPLORATION PTY. LIMITED

SEVENTH QUARTERLY REPORT FOR BULL CREEK E.L. 1008, SOUTH AUSTRALIA, FOR THE PERIOD ENDING 6TH MARCH, 1984.

AUTHOR: P. LEWIS

COPIES TO: CRAE LIBRARY
SADME

DATE: 5TH APRIL, 1984

SUBMITTED BY: Paul Lewis

ACCEPTED BY: Kevin D Tuckwell

12583

CONTENTS

1. SUMMARY

The formal interpretation report for the Murray Bridge INPUT survey was received from Geoterrex Pty. Limited. Twenty conductive zones were recognised within the Bull Creek licence area, of which eight anomalies were interpreted as bedrock conductors.

Five conductive zones associated with coincident geophysical and/or geochemical anomalies have been selected as high priority targets.

Two inclined percussion drill holes were completed at the Woodchester Prospect to test two coincident EM and magnetic anomalies. Both drill holes intersected disseminated fine grained sulphides (pyrite-pyrrhotite) locally to 30% in micaceous quartzite/quartz mica schist sequences. Elevated zinc assays (maximum 3750 ppm) were returned from the sulphide rich zones. Copper and lead assays were low. Gold and silver assays were below the detection limit. Conductivity responses were recorded over the sulphide intervals in both drill holes.

2. INTRODUCTION

Bull Creek E.L. 1008 (formerly E.L. 612) covers an area of 469 square kilometres centred approximately 35 kilometres south south east of Adelaide (Plan SAa 303). The licence was granted to CRA Exploration Pty. Limited as E.L. 612 on the 21st of March, 1980. A coincident area excluding the Mount Monster Mine was granted as E.L. 1008 on the 7th June, 1982. The term of the licence was extended to 24 months on the 7th June, 1983.

This report describes the work carried out during the quarter ending 6th March, 1984.

3. RECOMMENDATIONS

1. Soil geochemistry/magnetometer traverses be carried out over anomalies InMB4, InMB7 and InMB8 and InMB9.

2. Ground EM traverses be undertaken over geochemically anomalous zones with coincident bedrock conductors being drill tested.

3. All cultural anomalies be ground checked for man made sources.

4. SUMMARY OF PREVIOUS WORK

Previous work carried out by CRA Exploration in Bull Creek E.L. 1008 (formerly E.L. 612) is summarised below.

Geochemistry
- 215 -10#+20# stream sediment samples; analysed for Cu, Pb, Zn, most for Fe, Sn, W, U and Au.
- 217 drill core/cuttings samples; analysed for Cu, Pb, Zn, Ag, some for Co, Ni, Fe, Mn, Cr, Bi, Mo, As, Sn, W, Sb, U and Au; 6 petrographic descriptions.
- 2 rock chip samples; analysed for Cu, Pb, Zn, Ag, Fe, Au, Sn and W.

Geophysics
- aeromagnetic/radiometric survey; 300 metre line spacing, flown E-W at 80 metre mean terrain clearance.
- 35.5 line kilometres of ground magnetics.
- 37.6 line kilometres of ground EM.
- 5.5 line kilometres of ground I.P.
- 4.9 line kilometres of ground S.P.
- airborne EM survey over 96 km^2; 400 metre line spacing, flown E-W.

Drilling
- 3 percussion drill holes for a total of 294 metres.

Geology
- Geological mapping of the Strathalbyn and Woodchester Grid areas, at 1:5 000.

5. CURRENT EXPLORATION

5.1 INPUT Survey Interpretation

The formal interpretation report for the Murray Bridge airborne EM and magnetic survey was received from Geoterrex Pty. Limited. A copy of the report is presented in Appendix I. Forty-two anomalous conductive zones were recognised within the survey area. In addition a series of good INPUT responses were highlighted beyond the western end of the recovered flight path on lines 116-120 (InMB44). Twenty of the conductive zones fall within the Bull Creek licence area (Plan SAa 2692). Eight of these anomalies were interpreted as bedrock conductors and hence to represent potential targets for massive sulphide mineralisation. The remaining twelve anomalies were interpreted as being caused by cultural or surficial sources (refer Table 1, Appendix I). Available geochemical and geophysical data was reviewed and five anomalies (InMB4, InMB7, InMB8, InMB9 and InMB11) were selected as high priority targets. A programme of soil geochemistry/magnetometer traverses with a line spacing of 500 metres is planned over these anomalies. Ground EM traverses will be undertaken over geochemically anomalous zones and coincident bedrock conductors will be drill tested. All cultural anomalies will be inspected for the man made source.

Anomaly InMB11 was selected by Geoterrex as one of the high priority targets. This anomaly comprises two bedrock conductor responses coincident with a broad dipolar magnetic feature. Ground geophysical surveys (magnetics, EM, I.P. and S.P.) and drill testing of the eastern conductor (magnetic high) were undertaken by CRA Exploration in 1981 and 1982 (Venables et.al. 1981, Venables 1982, Bubner 1982a, Bubner 1982b). The results of this work was reviewed in line with the INPUT survey data and two further targets were recommended for drill testing.

5.2 Drilling

Two inclined (-60°) percussion drill holes were completed at the Woodchester Prospect during December, 1983 by John Nitschke Drilling using an Ingersol Rand T4 drill rig. Drill hole locations are shown on Plan SAa 1074.

Drill hole 83WCP3 was sited to test a coincident ground EM and magnetic anomaly at the northern end of the Woodchester Grid. The hole was completed at 170 metres in a micaceous quartzite. Disseminated and vein pyrite-pyrrhotite mineralisation (locally to 30%) was intersected from 66 metres to the end of the hole. The summary log is presented below.

WCP3 Line 9, 700E. Declined 60° to 114° MN

0 - 82 m	QUARTZ MICA SCHIST	1% pyrite below 66 m
82 - 170 m	MICACEOUS QUARTZITE	2% pyrite 82-106 m
		5% pyrite and pyrrhotite 106-115 m (magnetic)
		2% pyrite 115-120 m
		20% pyrite and pyrrhotite 120-125 m (magnetic)
		5% pyrite and pyrrhotite 125-153 m (magnetic) with trace galena, sphalerite 130-138 m
		1% pyrite 153-170 m

B.O.H. 170 metres

Drill hole 83WCP4 was sited to test the western INPUT bedrock conductor coincident with the magnetic low to the west of the Woodchester Grid. The hole was completed at 140 metres after penetrating a sequence of mica quartzites and quartz-mica schists. A pyritic quartz-mica schist unit (containing up to 20% fine grained disseminated pyrite) was intersected from 28 metres to 62 metres. The summary log is presented below.

83WCP4 Line 4, 260E. Declined -60° to 114° MN

0 - 62 m	QUARTZ MICA SCHIST	Trace pyrite 0-28 m 10-20% pyrite 28-62 m with trace sphalerite, galena 44-62 m
62 - 84 m	MICACEOUS QUARTZITE	2% pyrite
84 - 126 m	QUARTZ MICA SCHIST	Trace pyrite
126 - 140 m	MICACEOUS QUARTZITE	No sulphides.

B.O.H. 140 metres

The drill holes were sampled over two metre intervals and samples of the sulphide zones were submitted for copper, lead, zinc, silver and gold analyses. Elevated zinc assays were returned from the sulphide rich zones in both drill holes. The best intersections being 1350 ppm Zn from 110-130 metres (max. 1900 ppm) in 83WCP3 and 2030 ppm Zn from 38-56 metres (max. 3750 ppm) in 83WCP4. Copper and lead assays were low maximum values being 90 ppm and 370 ppm in 83WCP3 and 135 ppm and 510 ppm in 83WCP4. All silver and gold assays were below the detection limits of 1 ppm and 0.05 ppm respectively. Full assay results and detailed drill logs are presented in Appendix II. Drill hole sections are shown in Plans SAa 2597 and SAa 2598.

5.3 Downhole Geophysical Logging

Both drill holes were geophysically logged for conductivity magnetic susceptibility, natural gamma, density, resistance and S.P. using the portable SIE logger. Conductivity responses were recorded in 83WCP3 from 48-62 metres, 120-126 metres and 146-154 metres and in 83WCP4 from 53-82 metres. Downhole geophysical logs are presented in Plans SAa 2595 and SAa 2596.

P Lewis

P. LEWIS

PL/pw

EXPENDITURE

Expenditure for the period ended 29th February, 1984, the nearest accounting period was $27 709.00, as listed below.

		$
Drilling		9 120
Payroll		1 795
Supplies		607
Vehicle		259
Travel		42
Property		816
Contractors		14 086
Overheads		984
	Total	$27 709

REFERENCES

Bull Creek E.L. 612 CRAE Reports 10149 &
Bull Creek E.L. 1008 CRAE Reports 11670

Venables, A.J. & Bubner, G.J. October, 1981	Sixth Quarterly Report For The Period Ending 20th September, 1981.
Venables, A.J. January, 1982	Seventh Quarterly Report For The Period Ending 20th December, 1981.
Bubner, G.J. April, 1982	Eighth Quarterly Report For The Period Ending 20th March, 1982.
Bubner, G.J. September, 1982b	First Quarterly Report For The Period Ending 6th September, 1982.

LOCATION

Barker SI 54-13   1:250 000 sheet

KEYWORDS

Assay-drill, Copper, Drill-logs, Drill-percuss., Geophys.-borehole, Geophys.-EM, Lead, Pyrite, Pyrrhotite, Schist, Stratabound, Zinc.

LIST OF PLANS

Plan No.	Title	Scale
SAa 303	Bull Creek E.L. 1008 Location Plan	1:250 000
SAa 1074	Bull Creek E.L. 1008 Woodchester Grid	1: 5 000
SAa 2595	Bull Creek E.L. 1008 Downhole Log 83WCP3	1: 200
SAa 2596	Bull Creek E.L. 1008 Downhole Log 83WCP4	1: 200
SAa 2597	Bull Creek E.L. 1008 Drill Hole Cross-Section 83WCP3	1: 500
SAa 2598	Bull Creek E.L. 1008 Drill Hole Cross-Section 83WCP4	1: 500
SAa 2692	Bull Creek E.L. 1008 Location of INPUT Anomalies.	1: 50 000

LIST OF APPENDICES

Appendix I	Geoterrex Pty. Limited (1983), Interpretation Report Airborne Electromagnetic and Magnetic Survey Barringer INPUT System of the Murray Bridge Area in South Australia.
Appendix II	Detailed Drill Logs and Assay Results.

APPENDIX I

GEOTERREX PTY. LIMITED (1983),

INTERPRETATION REPORT AIRBORNE ELECTROMAGNETIC

AND MAGNETIC SURVEY BARRINGER INPUT SYSTEM

OF THE MURRAY BRIDGE AREA IN SOUTH AUSTRALIA.

000289

INTERPRETATION REPORT

AIRBORNE ELECTROMAGNETIC AND MAGNETIC SURVEY

BARRINGER "INPUT" SYSTEM

OF THE

MURRAY BRIDGE AREA

IN

SOUTH AUSTRALIA

FOR

CRA EXPLORATION LIMITED

BY

GEOTERREX PTY. LIMITED

(83-551)

Sydney, Australia
Flown October, 1983

G. Nader
Geophysicist.

TABLE OF CONTENTS

I. INTRODUCTION

During the period of October 5th to October 8th, 1983, Geoterrex Pty. Limited flew a combined electromagnetic and magnetic survey over the Murray Bridge area of South Australia on behalf of CRA Exploration Pty. Limited. The base for the duration of the survey was Adelaide.

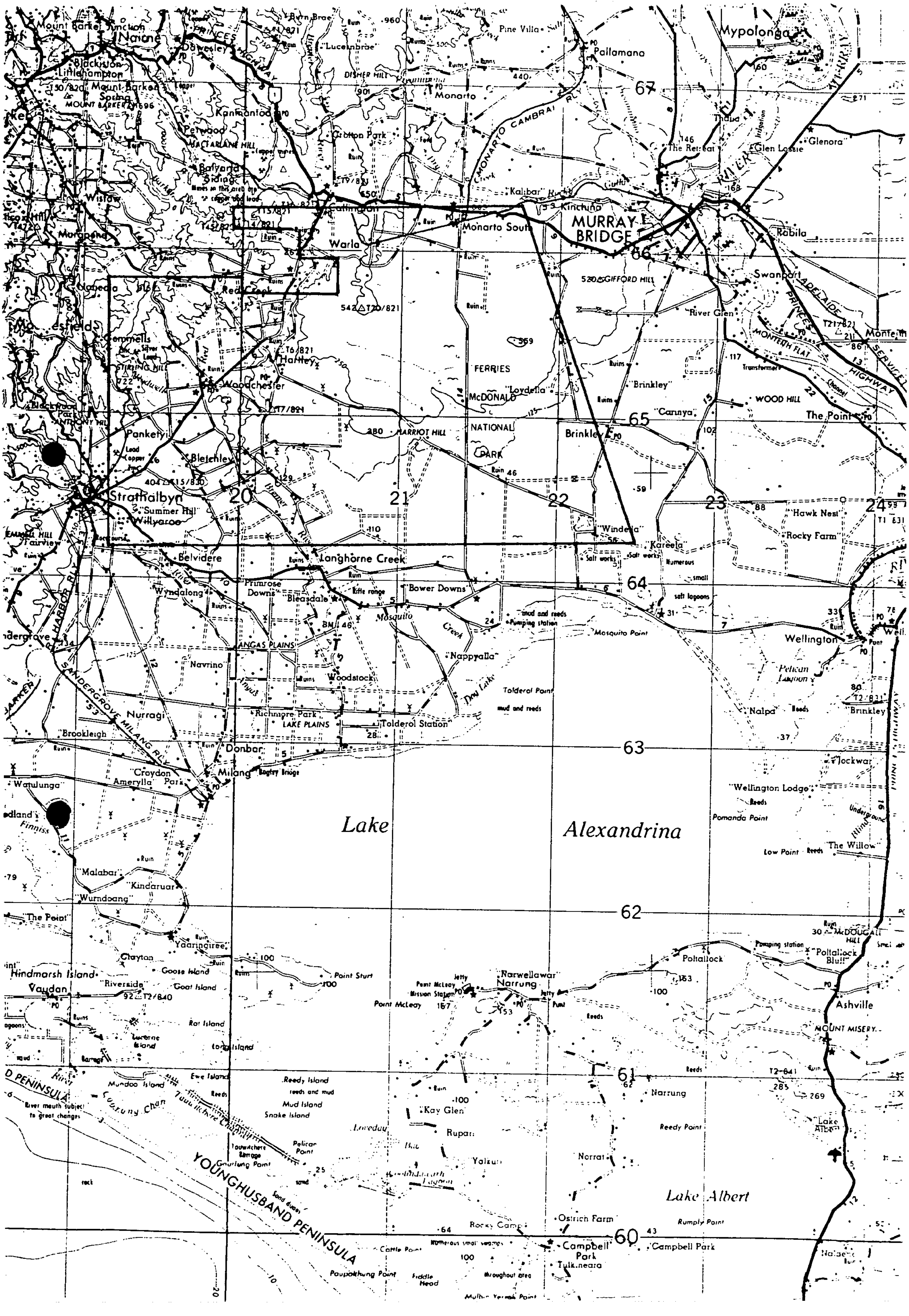
A total of 1211.3 kilometres were flown at a flight line spacing of 400 metres in an east west direction. No tie lines were flown. The purpose of the survey was to search for massive sulphides.

The project was conducted with a Super Canso PBY-5A and under registration VH-EXG, which is operated by H.C. Sleigh Aviation for Geoterrex Pty. Limited and was equipped with:-

- a Barringer Mark V 12 channel INPUT EM system
- a Geometrics G803 nuclear precession magnetometer
- a Geoterrex Madacs digital acquisition system
- a Sperry RT 220 radar altimeter
- a 50Hz monitor
- a Geocam 705 35mm continuous strip tracking camera
- a Honeywell 1912 visicorder

Navigation was by visual means from black and white government aerial photographs enlarged to a scale of 1:25,000. The aircraft was operated at a mean terrain clearance of 120 metres.

Compilation and interpretation of data was performed in Sydney and CRA Exploration office in Adelaide.


Mount Barker Junction
Nairne
Littlehampton
Mount Barker
Kanmantoo
Callington
Monarto
Monarto South
Pallamana
Mypolonga
MURRAY BRIDGE
Kinchina
Rabila
Swanport
Gifford Hill
River Glen
Monteith
Wistow
Woodchester
Hartley
Red Creek
Warla
FERRIES
McDONALD
NATIONAL
PARK
Brinkley
Strathalbyn
Bletchley
Belvidere
Langhorne Creek
Wyndalong
Bleasdale
Bower Downs
Mosquito Creek
Nappyalla
Woodstock
Navrino
Nurragi
Richmore Park
LAKE PLAINS
Tolderol Station
Donbar
Milang
Wellington
Pelican Lagoon
Nalpa
Wellington Lodge
Pomanda Point
The Willow
Low Point
Lake
Alexandrina
Malabar
Kindaruar
Wurndoang
The Point
Clayton
Hindmarsh Island
Goose Island
Point Sturt
Point McLeay
Narrung
Poltalloch
Ashville
MOUNT MISERY
Mundoo Island
Ewe Island
Reedy Island
Mud Island
Snake Island
Kay Glen
Loveday Bay
Lake Albert
Rocky Camp
Ostrich Farm
Campbell Park
YOUNGHUSBAND PENINSULA
Lake Alexandrina
20
21
22
23
24
60
61
62
63
64
65
66
67

II. PERSONNEL

The following Geoterrex personnel participated in the field phase of the survey:-

J. EDWARDS	PILOT
T. McKENZIE	CO-PILOT
W. MITCHELL	AIRCRAFT MECHANIC
L. WILLIAMS	ELECTRONICS TECHNICIAN
M. CURTIS/C. WORSLEY	DATA COMPILERS
G. BUTT	GEOPHYSICIST

The entire project was planned andsupervised by G. Butt and G. Nader of Geoterrex Pty. Limited in consultation with G. Bubner of CRA Exploration Pty. Limited.

III. DATA PRESENTATION

The geophysical data is presented in the following forms:

The maps are presented at a scale of 1:25,000.

- EM Anomaly Maps - maps of selected conductors
- Flight Path Maps
- Original Analogue Records of EM, magnetic and altitude data.
- Located data tape.

EM Anomaly Map

The EM Anomaly Map shows selected INPUT anomalies from the 12 slow resolution channels identified during the field phase of the survey. The anomalies are plotted in their correct lateral positions (i.e. the 4.0 second lag between the twelve SRC INPUT response and true ground position has been accounted for) on the flight lines and grouped according to similarity of amplitude and shape from line to line. The boundaries of these anomalous zones are determined from the half peak amplitude width on Channel 4. A diamond symbol indicates the anomaly peak and hence whether the anomaly is symmetrical or not. An estimate of the conductivity-thickness product has been determined from the matching of channel 4: channel 11 ratio to a vertical half plane or horizontal thin sheet. The plotting legend is outlined on the EM Anomaly Maps. The number at the upper left of the diamond is the ratio of channel 4 to channel 11 in parts per million of the primary field at the receiver. The number at the upper right is the aircraft altitude in metres.

Any significant association between an INPUT and magnetic anomaly is indicated by plotting the amplitude of the magnetic response beneath the diamond. If there is any offset between these peak responses an arrow indicating the direction of offset is drawn beneath the amplitude of the magnetic response.

During the course of data evaluation, groups of anomalies are outlined to show out interpretation of the extent of the geologically conductive zones. If any doubt exists the outlines are dashed. Conductors of interest are numbered to facilitate reference to the report.

The original visicorder records of the raw INPUT, altitude and magnetic data are presented bound in line number order. All calibration data is included and a copy of the analogue format is shown in Figure 2 of Appendix A.

The 3 rolls of negative 35mm continuous strip tracking film are delivered and labelled according to their flight number.

The controlled aerial photography, bearing all points, along with the tracking film is provided for accurate location of any follow up investigation.

The flight logs which contain all relevant information regarding the collection of geophysical data are presented bound in flight order.

Instrument sensitivities and settings are tabulated in Appendix C attached to this report.

IV. INTERPRETATION - General

Commonly used interpretation techniques rely mainly on qualitative review of data and refer to anomaly shape, symmetry, strike extent and variability within conductive zones. The apparent conductivity, as determined by the rate of decay of the INPUT response, is an important critereon in our analysis of conductors. Other important factors taken into account include:

- the shape and size of the INPUT anomalies
- the strike length and degree or isolation of the conductor
- the estimated conductance of the conductor
- the form of conductors particularly with respect to direction and dip of geological and cultural structures
- the associated geophysical parameters such as aeromagnetics
- variation of response characteristics within a given conductor
- the geological environment and response of the system known to mineralization.

Conductors delineated by an EM survey can be separated into categories based on their probable origins, namely bedrock, surficial and cultural.

The term cultural is used for those conductors thought to be due to any man-made construction. These are responses due to fences, telephone and powerlines, etc.

Surficial conductors refer to sources in the overburden, in the weathered portion of the bedrock or in those formations not usually considered as host material for sulphide orebodies. In the context of this report the word surficial should not be used in the geological sense but rather as a geophysical term.

The term bedrock conductors is reserved for those responses thought to originate from the unaltered portion of favourable rocks and which are usually caused by massive sulphides, graphites (carbonaceous material) magnetite and serpentinite.

Quantitative analysis of INPUT data is restricted mainly to a general consideration of amplitudes and decay rates to establish depth and apparent conductivity. A plot of INPUT channel amplitudes versus channel delay time, permits the dependence of response on conductor geometry and size to be seen from another perspective. The response obtained from dipping sheet-like and horizontal strip conductors may be recognised as concave and linear curves respectively. It is possible, therefore, to distinguish between flat-lying surficial conductors and dipping bedrock conductors, although flat-lying bedrock features, in general, resemble the former.

Interference due to conductive overburden complicates the identification of bedrock conductors. It is expected that the decay pattern of a response due to a bedrock conductor embedded in or located below a flat-lying conducting medium, would consist of two distinct segments (plotted on a log-log scale) because of their differing rates of decay.

These segments become more pronounced for greater parametric difference between the overburden and bedrock conductor, but the method fails if there is little or no difference between overburden and target body. This method (Verma 1975*) is useful in areas of extensive high conductivity.

* Verma, S.K.: 1975.
Resolution of responses due to conductive overburden and orebody through time-domain EM measurements; a field example, G.P. 23 No. 2: 292-299.

V. GEOLOGY

Cambrian Kanmantoo Group metasediments occur throughout the survey area. A thick monotonous sequence of greywackes, phyllites, schists and metasediments of the Brukunga Formation are the dominant rock types within this region of the Kanmantoo Trough. Notable within the sequence are sedimentary sulphides such as pyrite and pyrrhotite as indicated from drill hole results within the area. Regionally the Pyrite which is syngenetic is best illustrated in the Nairne Pyrite Member which forms a persistent lens many kilometres long.

The rapid sedimentation of the Kanmantoo Trough was succeeded by the Delamerian Orogeny resulting in significant folding and faulting. Several periods of deformation have been noted within the sediments of the Kanmantoo Group. "En echelon" style of folding has been mapped out in rock types within the vicinity of the Aclare Mine region, whereas further south, large parasitic or drag folds are evident.

Minor sulphide intersections of galena and sphalerite have been logged from various drill holes, however, pyrrhotite and pyrite appear to be the dominant sulphide minerals present.

Ultramafic rock types have also been drilled which suggest the area may be geologically favourable to the occurrence of kimber-lites or carbonatites and hence prospective for diamonds.

VI. INTERPRETATION OF THE "MURRAY BRIDGE AREA" SURVEY DATA

The INPUT survey has delineated many northeast and northsouth striking zones which correlate very well with the known geology of the area.

The majority of interpreted bedrock conductors occur in the west and northern parts of the survey area. Within the central and southern parts of the area, the conductivity of the overburden is extremely high, masking any measureable signals from any potential bedrock conductor. In view of the close proximity of the survey area to Lake Alexandrina, this increased conductivity in the southern and central areas probably reflects an increase in the salinity of the overburden.

Several potential targets for the occurrence of sulphide mineralization have been mapped. Of these, zones MB-11 and MB-28 are considered to be the most favourable locations for massive sulphide mineralization. At this point, it should be emphasised that some lower priority zones which are thought to be associated with cultural sources should be significantly upgraded to priority 1 zones if ground investigations prove that no "man made source" is evident. Bearing this in mind, it is considered that zone MB-27 may be a potential sulphide target.

Magnetically the area is active. Most of the INPUT zones correlate well to known magnetic trends. Pyrrhotite is the most probable source of the associated magnetic anomalies. The INPUT survey has proved its usefulness as a mapping tool defining broad fold structures (e.g. MB-4) and large linear trends, however the flight line spacing is considered too small to have adequately defined small "parasitic" folds. If mineralization is expected to occur within such folds, then detailed geophysical followup is recommended to delineate these small structural trends within the areas of interest.

A series of very good INPUT anomalies occur to the west of the survey area beyond the recovered flight path of lines 116, 117, 118, 119 and 120. These anomalies should be plotted and investigated as they are considered to be of a high priority.

Finally, it is considered that zone MB-33 may be worth investigating for the existence of a tertiary channel.

INPUT Classification

In this section all selected conductors of interest are discussed and classified according to the following priority system:

Priority 1 — Zones satisfy most of the criteria associated with a bedrock source which could be due to massive sulphides. They contain responses indicating a moderate to highly conductive source and may be isolated or part of an extensive trend.

Priority 2 — Zones also satisfy most of the criteria associated with bedrock features but anomalies display characteristics such as faster rate of decay or broader width which preclude them being listed as Priority 1.

Zones which are rated as Priority 3 targets are almost certainly of surficial or cultural origin, but a small degree of uncertainty is present.

Initial interpretation was directed towards separating likely bedrock responses from those due to surficial or cultural sources. Surficial features possibly related to selective weathering of geological units are presented, but not discussed, as they provide an aid to geological mapping.

Priorities assigned to zones are made primarily on the merits of the INPUT responses, with some influence from the magnetic data. Geological and geochemical information must be further analysed to determine the ultimate priority for followup.

The priority rating system refers to the probability that the conductive source of given zones is related to massive sulphide mineralization.

Summary of Selected Conductors

Priority 1	Priority 2	Priority 3
MB-1	MB-2	MB-5
MB-4	MB-3	MB-6
MB-7	MB-12	MB-9
MB-8	MB-18	MB-10
MB-11	MB-23	MB-14
MB-13	MB-26	MB-15
MB-16	MB-27	MB-17
MB-25	MB-30	MB-19
MB-28	MB-31	MB-20
MB-29	MB-34	MB-21
	MB-39	MB-22
		MB-24
		MB-32
		MB-33
		MB-35
		MB-36
		MB-37
		MB-38
		MB-40
		MB-41
		K-1

TABLE 1

ZONE MB-4 Priority 1

Line 134.1E	Fiducial 413700	Ratio 800/-
Line 135.1W	Fiducial 423420	Ratio 1000/30
	Fiducial 423520	Ratio 1400/130
	Fiducial 423570	Ratio 1000/100
Line 136.1E	Fiducial 424835	Ratio 1500/200
	Fiducial 425100	Ratio 1100/90
	Fiducial 425188	Ratio 1100/160
Line 137.1W	Fiducial 434300	Ratio 600/90
	Fiducial 434720	Ratio 1700/200
Line 138.1E	Fiducial 436450	Ratio 1500/190
Line 139.1W	Fiducial 445320	Ratio 800/60

Mag Association: This zone is associated with a strong aeromagnetic structure as depicted on the aeromag contour map. Whether the EM and magnetic anomalies are coincident is not clear.

Location: This zone appears to be associated with a geological fold (photo?).

Remarks: The EM zone appears to be delineating a folded conductive source at a geological contact. A geological fold is supported by the aeromagnetic data although the association between the EM and magnetic data is not clear. The EM signatures within this zone typify a bedrock source. Small anomaly amplitudes and low to moderate CTP's characterise this zone. The shape of the INPUT anomalies suggests a shallow dipping or flat lying conductive source. The multiple peaks on line 135.1W are indicative of a shallow traverse flight angle at the hinge of a fold.

Recommendations: This zone is highly recommended for followup. The EM responses on lines 135.1E at 423520, 136.1E at 424835 and 425188, 137.1W at 434720 and 138.1E at 436450 should all be tested with ground EM (e.g. Sirotem) or any other suitable EM technique.

ZONE MB-5

Priority 3

Line 135-1W	Fiducial 425030	Ratio 600/-
Line 136-1E	Fiducial 425460	Ratio 400/-

Mag Association: None.

Location: Paddock near homestead.

Remarks: This is a low priority zone trending north east and has primarily been selected because of the short strike length of 800 metres and small amplitude response. The very low CTP and poorly defined anomalies greatly detract from an interpreted bedrock conductor.

Recommendations: Low priority followup.

ZONE MB-6 Priority 3

Line 123.1 W	Fiducial -	Ratio -
to		
Line 136.1E	Fiducial 426110	Ratio 2000/140

Mag Association: Region of low magnetic relief.

Location: Northeast of Woodchester, and east of Red Creek - subdivided farm lots.

Remarks: This is a very broad northeast striking zone consisting of INPUT anomalies with medium to large amplitudes and relatively fast decay rates. The INPUT signature exhibits a distinct Channel 1 to Channel 12 peak offset. The channel peak shift is very large on some lines (e.g. 131.1W and 133.1W) where it could be considered that the INPUT system is detecting a bedrock conductor beneath conductive overburden. The conductive zone becomes broader to the south as the EM response diminshes.

A low priority has been given to this zone as it cannot be determined from the INPUT system as to whether the source of the INPUT signature is due to a highly weathered geological unit or a bedrock conductor beneath conductive overburden.

Recommendations: No followup is recommended on this zone unless there is geological or geochemical evidence which indicates that further investigation is required.

ZONE MB-7 Priority 1

Line 128.1W	Fiducial 355810	Ratio 1500/-
Line 129.1W	Fiducial 369610	Ratio 600/-
Line 130.1E	Fiducial 378740	Ratio 300/-
Line 131.1W	Fiducial 388310	Ratio 1400/-
Line 132.1E	Fiducial 389790	Ratio 500/40

Mag Association: Broad weak magnetic high (10 nT) on 130.1E. The aeromagnetic contours show a weak linear north east magnetic trend slightly offset to the west but sub-paralleling the electromagnetic zone.

Location: Outlines a photogeological trend on the western margins of the INPUT survey boundaries, north west of the "Strathalbyn Grid".

Remarks: This EM zone is mapped as a 2.2 km conductive unit trending north east and open to the south west. The zone is approximately 300 metres wide and is characterised by small amplitude anomalies with low CTP. The secondary peaks associated with the EM response on lines 128.1W and 129.1W most likely indicate a westerly dip effect. The shape of these anomalies strongly indicates a bed-rock source. The linearity of this zone and the magnetic association possibly suggests a conductive source similar to the Nairne Pyrite Member within the Kanmantoo Trough.

Recommendations: Follow up is recommended on this zone particularly on lines 128.1, 129.1 and 131.1.

ZONE MB-8 Priority 1

Line 131.1W Fiducial 388228 Ratio 900/-

Mag Association: No apparent magnetic association.

Location: Gully?

Remarks: This zone outlines a single peaked INPUT anomaly with small amplitude and exhibiting a very low CTP. It should be noted that the conductive source was traversed at a height of approximately 140 metres which has significantly diminished the amplitude response. The spatial distance between this anomaly and the EM response on the same line within zone MB-7, is considered too great to be interpreted as a major and minor peak from a single source. In view of this, zone MB-8 has been interpreted as an isolated INPUT response and should be considered as a high priority target area. The notable channel 1 to channel 12 peak migration is possibly a dip effect.

Recommendations: Initial ground EM followup is recommended to better define the presence of two conductors on line 131.1W. EM-37 would be better used here than Sirotem because of its greater resolution capabilities.

ZONE MB-9

Priority 3

Line 126.1 W	Fiducial 343240	Ratio 200/-
Line 127.1E	Fiducial 345245	Ratio 300/-
Line 129.1W	Fiducial 369304	Ratio 300/-
Line 131.1W	Fiducial 387990	Ratio 150/-
Line 132.1E	Fiducial 390062	Ratio 400/-
Line 133.1W	Fiducial 399500	Ratio 400/-

Mag Association: None.

Location: Within hilly terrain. Extending north towards "Archer Hill" and south towards "Highland Valley".

Remarks: This zone consists of very small amplitude EM anomalies within a north south strike direction. The anomalies are poorly defined and very weak displaying very low CTP's. The southern portion of this zone extends into the built up area of the "Highland Valley" and it is not clear whether these anomalies are cultural or geological.

Recommendations: Low priority follow up.

ZONE MB-10 Priority 3

Line 127.1E Fiducial 345396 Ratio 500/-
Line 128.1W Fiducial 355240 Ratio 100/-

Mag Association: None.

Location: Approx. 2 kms west of "Woodchester Grid".

Remarks: This is a very weak electromagnetic zone striking north west and consisting of two INPUT responses with small amplitudes and very low CTP's. This zone is limited to a strike length of 750 metres. The anomaly on line 127.1E may be due to a fence.

Recommendations: Very low priority.

ZONE MB-11 Priority 1

Line 126.1W	Fiducial 342684	Ratio 600/50
Line 127.1E	Fiducial 345690	Ratio 300/-
	Fiducial 345790	Ratio 300/-
Line 128.1W	Fiducial 354910	Ratio 1300/150
	Fiducial 355020	Ratio 200/-
Infill Line 155.1E	Fiducial 371980	Ratio 1200/80
	Fiducial 372065	Ratio 600/100
Line 129.1W	Fiducial 368730	Ratio 1400/130
	Fiducial 368850	Ratio 300/-
Line 130.1E	Fiducial 378740	Ratio 300/-

Mag Association: Broad dipolar magnetic anomaly. Possible second magnetic source on line 126.1 associated with EM signature.

Location: This zone corresponds to the "Woodchester Prospect".

Remarks: The INPUT system has delineated two main conductive zones associated with a significant aeromagnetic anomaly over the "Woodchester Prospect". The exact relationship between the two EM zones cannot be ascertained from the INPUT survey alone, although a folded synformal structure has been interpreted. The shape of the responses on lines 127.1E, 128.1W and 155.1E indicates a synformal structure with steeply dipping limbs. The EM response on line 129.1W infers a change in dip direction on the western limb of this structure where an easterly dip has been geophysically interpreted. The eastern limb of the structure on this line is "near vertical" or steeply dipping to the east. From the INPUT results it can be postulated that zone MB-11 forms a synform or syncline with a north south fold axis which has possibly been overturned in the north. Various conductance estimates along the eastern limb of the fold vary between 15 and 25 siemens, which supports the conductance estimates given from ground EM systems over this prospect (e.g. UTEM).

ZONE MB-11 (Continued)

The conductance on the western limb (not covered by the Woodchester Grid) is generally very low, however an estimate of 10 siemens has been made from the EM response on line 155.1E. It should be noted that the displacement of the two peaks on line 155.1E may be a dip effect and not a true positional change.

Recommendations: In conclusion, this zone is a high priority area for the presence of sulphides. The EM responses on line 128.1W at 354910, line 155.1E at 371980 and line 129.1W at 368730 are recommended for followup. Furthermore, geological followup or ground EM should be undertaken to establish the validity of an interpreted synform.

Finally, it should be noted that the EM anomaly on line 126.1W has an associated magnetic high. The EM response at this location is poorly defined, however, this may be explained in terms of a shallow flight traverse angle across a conductor with low mineral content. Ground EM is recommended to better define this source. The circular magnetic anomaly at this location indicates a magnetic source at a significant depth.

Priority 2

ZONE MB-12

Line 122.1E — Fiducial 496050 — Ratio 300/-

Line 123.1W — Fiducial 506490 — Ratio 900/-

Mag Association: None.

Location: Cultivated paddock, south of dirt track.

Remarks: This is a northwest striking conductive zone open to the northwest. The EM response on both lines has been affected by an adjacent powerline response, however the shape of the anomalies does suggest the presence of a bedrock conductor. There is some uncertainty as to whether the anomaly on line 122.1E is an EM response from a fence.

Recommendations: Ground followup is recommended on this zone. The EM response on line 122.1E should be carefully assessed as to whether it is cultural or geological. If ground geophysics is to be conducted, a non-electrical technique (e.g. gravity or self potential) is recommended to avoid power line interference.

ZONE MB-13 Priority 1

Line 124.1E Fiducial 508160 Ratio 1000/70

Mag Association: Strong linear north east trending magnetic signature offset to the east of this EM zone.

Location: Approximately 100 metres south of "Stirling Hill".

Remarks: This is a small amplitude, isolated INPUT anomaly, whereby the conductive source is estimated to have a low conductance. The isolation of this zone and the anomaly shape are the main reasons for the high priority given.

Recommendations: Geological and geochemical followup are initially recommended.

ZONE MB-14 Priority 3

Line 123.1W	Fiducial 506199	Ratio 900/-
Line 124.1E	Fiducial 508308	Ratio 500/-

Mag Association: None.

Location: Area south of Rodwell creek and southeast of Stirling Hill.

Remarks: This is a northeast trending zone of limited strike length (approx. 950m). The INPUT responses are small in amplitude and exhibit a fast decay rate and very low conductance. No association with any cultural features can be made so it is possible that a bedrock conductor exists. The short strike length is the main reason for this selection.

Recommendations: Low priority followup.

ZONE MB-15 Priority 3

Line 123.1W	Fiducial 506125	Ratio 300/-
Line 124.1E	Fiducial 508380	Ratio 400/-

Mag Association: None.

Location: Apparent association with a fence.

Remarks: This is a north-south trending zone of limited strike extent. The EM anomalies on both lines exhibit a fast decay rate and low CTP. The anomaly on line 124.1E coincides with a fence, however there is slight offset between a fence and the EM anomaly on line 123.1W.

Recommendations: Very low priority. Most likely a cultural conductor.

ZONE MB-16

Priority 1

Line 124.1E | Fiducial 508520 | Ratio 500/40

Mag Association: Distinct broad dipolar (reverse polarity) magnetic anomaly. 34nT peak to peak at altitude of 114m to the north-east of this INPUT anomaly.

Location: West of dirt track in cleared area.

Remarks: This zone comprises an isolated INPUT response which shows no association with any cultural features. The small amplitude and moderately defined anomaly shape suggests a bedrock conductor is present. The EM response indicates a conductive source with low conductance. The spatial relationship of this EM zone with a broad reverse polarity magnetic expression similar to the drilled magnetic anomaly at the "Woodchester Prospect", is strong evidence for the presence of sulphide mineralisation. The source of the magnetic and INPUT responses are not considered to be the same.

Recommendations: High priority zone recommended for ground follow-up. Initially, geological mapping and geochemical sampling should be conducted, followed by ground geophysical testing of this EM conductor.

ZONE MB-17

Priority 3

Line 122.1E   Fiducial 496460   Ratio 600/-

Mag Association: None.

Location: Approximately 150 metres east of house/shed in fenced paddock.

Remarks: This INPUT response is a narrow relatively small amplitude anomaly within a broader surficial conductive horizon. The fast decay rate and low CTP do not favour a bedrock conductor, however the shape of the anomaly does warrant a low priority rating. This conductive zone is considered to be due to a localised conductivity enhancement within a broader surficial unit.

Recommendations: Low priority.

ZONE MB-18 | Priority 2

Line 118.1E	Fiducial 471410	Ratio 1500/-
Line 119.1W	Fiducial 482020	Ratio 1100/-
Line 120.1E	Fiducial 484155	Ratio 1000/-

Mag Association: Coincident with northeast trending aeromagnetic anomaly designated as Anomaly "F".

Location: Encompasses railway line.

Remarks: This is a northeast striking zone of limited strike length (approx. 1400m). The anomalies on lines 118.1E and 119.1W coincide with a fence and railway track respectively. The EM response on line 120.1E is located marginally to the west of the railway line which leads to some ambiguity as to whether it is a cultural or geological source. The anomalies on the lines flown east Viz. 118.1 and 120.1 have associated secondary peaks manifested on channel 1 and channel 2 and the signatures are similar in shape. This infers that the INPUT response maybe due to a geometrical effect from a bedrock conductor rather than from a cultural conductor. The narrowness and very fast decay rate of the anomaly on line 119.1W typifies a cultural source. All three anomalies display power line interference on their late channels.

Recommendations: This zone should be followed up to establish whether all three INPUT responses are due to cultural sources or not. If a non cultural source can be established then this zone should be upgraded as a potential sulphide target, as it is associated with a strong north-south magnetic trend. A ground geophysical technique such as gravity may be useful. Any ground EM followup work should be concentrated on line 120.1E where the INPUT anomaly location is displaced from known culture (i.e. railway track).

ZONE MB-19 Priority 3

Line 117.1W	Fiducial 469428	Ratio 5000/50
Line 118.1E	Fiducial 471610	Ratio 4100/100
Line 120.1E	Fiducial 484339	Ratio 2000/-
	Fiducial 484398	Ratio 1700/20

Mag Association: Region of low magnetic gradient.

Location: Fenced paddocks - farm land.

Remarks: This INPUT zone consists of a broad surficial unit of very low conductance. The selected anomalies probably represent conductivity enhancement within flat-lying surficial conductor, however the selected anomaly peaks on lines 117.1W, 118.1E and 120.1E (484339) are most likely due to fences (cultural source). The EM response on line 120.1E (484398) shows no obvious correlation to culture and is the reason for the selection of this zone.

Recommendations: Very low priority - most probable source is grounded fence within conductive clay horizon. Any followup should be limited to line 120.1E at fiducial 484398.

ZONE MB-20 Priority 3

Line 117.1W Fiducial 468970 Ratio 1400/100

Mag Association: None.

Location: Coincides with fence - farm land.

Remarks: A single well defined INPUT anomaly is the main reason for selecting this zone. The anomaly displays a medium to large amplitude and shows a distinct channel peak offset. The most probable causative source of this INPUT response is a cultural conductor (fence), however, an "edge effect" caused by current channelling at the contact of a thick resistive-conductive unit is an alternative explanation.

Recommendations: Low priority - probable cultural conductor.

ZONE MB-21 Priority 3

Line 111.1E	Fiducial 418279	Ratio 6800/800
Line 112.2W	Fiducial 429960	Ratio 9700/220

Mag Association: Associated with a northsouth aeromagnetic trend known as "Anomaly G".

Location: South of the Strathalbyn Mine within sub-divided lots - power line?

Remarks: This is a northeast trending zone of limited strike length (950 m). The EM response on line 111.1E coincides with a shed/powerline and is most likely due to a cultural conductor. The INPUT anomaly on line 112.2W has no obvious cultural association. Both anomalies are well defined, sharp responses with medium to large amplitudes. A broad surficial conductive unit occurs to the east of this INPUT zone.

Recommendations: The anomalies described above do have bedrock characteristics, subsequently ground followup is recommended to establish the source of the INPUT response as either a cultural or bedrock conductor. The zone should be upgraded or downgraded accordingly.

ZONE MB-22

Priority 3

Line 111.1E	Fiducial 419470	Ratio 5000/100
Line 112.2W	Fiducial 428954	Ratio 7400/90
Line 113.2W	Fiducial 444040	Ratio 5700/100

Mag Association: No magnetic association. Crosscuts high magnetic gradient .

Location: Subdivided lots. Anomaly on line 112.2W coincides with a fence.

Remarks: Zone MB-22 has been electromagnetically mapped as a northwest trending zone of limited strike length (1.5 km). The INPUT signature consists of well defined, sharp anomalies with medium to large amplitudes. The very narrow response on line 112.2W coincides with a fence which is most certainly the source of this anomaly. The responses on lines 111.1E and 113.2W show no obvious correlation to any culture, although a "man made" source cannot be discarded.

Recommendations: This is a low priority zone. Field followup is recommended to establish the presence or absence of cultural features. Two additional anomalies on line 111.1E (419360, 419262) located to the west of MB-22 should also be checked. The anomaly at fiducial 419360 has positional coincidence with a fence.

ZONE K-1

Line 123.1W	Fiducial 505156	Ratio 5200/180
Line 124.1E	Fiducial 509342	Ratio 7000/100

Mag Association: 3nT magnetic high on line 124.1E.

Location: The peak position on line 124.1E is located near an old Quarry or Mine.

Remarks: Due to the near symmetrical INPUT response on line 124.1E, which displays favourable anomaly shape and amplitude, this zone is considered interesting for the possible occurrence of Kimberlite or Carbonatite intrusions. The anomaly on line 124.1E has a 3nT coincident magnetic anomaly which also lends weight to the selection of this zone. The conductive zone can be shown to have a distinct linearity, which considerably downgrades the potential of a kimberlitic source. However, in view of the anomalous response on line 124.1E and the fact that the Kanmantoo Trough is considered prospective for diamonds, this zone may be worth investigating.

VII. CONCLUSIONS AND RECOMMENDATIONS

Table 1 summarizes the interpretation of the INPUT data and the classification of zones according to their priority in the search for conductive massive sulphides. The categorization is established primarily on the merits of the INPUT data with support from the magnetic and geological information.

In general, the northern and western parts of the survey area are considered most suitable to electromagnetic prospecting as illustrated by the delineation of many formational conductors. Elsewhere the area is very conductive and the EM method is not considered to be suitable.

Zones MB-11 and MB-28 are interpreted to be the most prospective locations for the occurrence of massive sulphides and followup of both these zones is highly recommended.

Any ground geophysical followup should include EM, magnetics and the gravity technique.

Field investigations are recommended for those low priority zones where some ambiguity exists as to whether a cultural conductor is present or not. It should be pointed out that the potential of these zones may significantly increase if no "man made" sources are present.

For those conductive areas where tertiary channels are prospective targets, then the employment of the automatic interpretation program may be useful to map out variations in the overburden thickness.

In conclusion, the INPUT survey is considered to have been a technical success and any future work to the north of the area (as discussed with CRA and EZ personnel) would be highly recommended.

Respectfully submitted,
GEOTERREX PTY. LIMITED

GEORGE L. NADER
GEOPHYSICIST

APPENDIX A

INPUT EQUIPMENT AND PROCEDURES

1. BARRINGER INPUT SYSTEM

a) General:

The INPUT (Induced Pulse Transient) method is based upon the study of the decay of secondary electromagnetic fields created in the ground by short pulses generated from an aircraft. The time-varying characteristics of the decay curve are analysed and interpreted in terms of information concerning the conductivity characteristics of the terrain.

The principle of separation in time between the production of the primary field and the detection of the measured secondary signal gives rise to an excellent signal-to-noise ratio and an increased depth of penetration compared to conventional continuous wave electromagnetic systems. It also makes the INPUT system relatively independent of air turbulence.

At a normal survey altitude of 120 metres above terrain, the typical effective depth penetration is estimated at about 180 metres below surface, depending on the conductivity contrast between the conductive body and surrounding rocks, the size and attitude of the conductor and the presence or lack of conductive overburden. In optimum conditions a penetration of 210 metres subsurface can be achieved.

One of the major advantages of the INPUT method lies in good differentiation between flat-flying surface conductors and bedrock conductors so that the latter can be detected even under a relatively thick cover. Typical uses involve the search for sedimentary sulphides in thick basins and the search for graphitic lithologies under younger cover.

However, the application of the airborne INPUT electromagnetic method is limited to the solution of problems that are characterized by a reasonable resistivity contrast. The method is not considered to be applicable to the direct search for disseminated mineralization, except where a resistivity contrast exists.

b) <u>Equipment</u>:

The INPUT system was developed by Barringer Research Limited of Toronto, Canada.

The transmitted primary field is discontinuous in nature (Fig. 1A) with each pulse lasting 1000 micro-seconds; the pulse repetition rate is 288 per second.

The electromagnetic pulses are created by means of powerful electrical pulses fed into a 3-turn shielded transmitting loop surrounding the survey aircraft and fixed to the nose and tail of the fuselage and to the wing tips.

The secondary field reception is made by means of a receiving coil wound on a ferrite rod and mounted in a "bird" towed behind the aeroplane on a 140 metre co-axial cable. The axis of the pick-up coil is horizontal and parallel to the flight direction and a Faraday shield is used to reduce noise levels. Periods of 2400 microseconds between - successive primary pulses (Fig. 1B) are used for detecting the secondary field and the transient voltage (Fig. 1C) thus produced corresponds in time to the decay of the eddy currents in the ground.

The analysis of the bird signal is made in the INPUT receiver by sampling the decay curve at 12 points, or gates, the centre and width of which have a fixed relationship with respect to time zero (t_o) corresponding to the termination of the pulses. The centres of the 12 sampling gates are set at a mean delay of 300, 400, 500, 600, 700, 800, 900, 1100, 1300 & 2100 microseconds after time zero (Fig 1D).

The signals received at each sampling gate are processed in two multi-channel receivers to give one set of six and one set of twelve continuously varying analogue voltages. Each trace represents the coherent integration of one channel of the transient sample, the time constant of integration being variable. Presently, one set of twelve channels is recorded at a time constant of 2.6 seconds (Standard Resolution Channels, SRC), the other set of six at a time constant of 0.6 seconds (High Resolution Channels, HRC).

This integration delay plus the time separation between the receiving bird and tracking camera installed in the aircraft introduces a delay which has to be taken into consideration and corrected prior to correlating the electromagnetic data with the other simultaneously recorded data. This delay is approximately 4 seconds for the normal time constant and 2 seconds for the fast time constant.

c) Compensation Procedure

During primary field transmission eddy currents are induced in the aircraft frame as well as in conductive ground. The airframe eddy currents produce a secondary field which needs to be cancelled out in order to measure the ground-related effects. To compensate for this effect a special device is used which feeds into each channel of the INPUT receiver a signal equal in amplitude and waveform but opposite in polarity to the signal induced by the airframe eddy current. The compensation signal is derived from the voltage induced in the receiving coil by the primary field; this voltage is constantly proportional to the inverse cube of the distance between the bird and the aircraft. Thus, swinging of the bird and changes of coupling are automatically corrected. The compensation adjustment is a simple procedure carried out during flight at a terrain clearance of 600 metres to eliminate the interference of ground conductors.

d) Time Sharing

In order to operate both the INPUT system and the proton magnetometer system simultaneously, the INPUT transmitter is switched off each second for a time period long enough to allow for a noise free magnetometer reading. The affect of this switching can be seen as a 1 Hertz ripple on the HRC INPUT channels.

II. MAGNETOMETER

The magnetometer is a Geometrics G-803 nuclear precession unit especially adapted to operate in conjunction with the INPUT equipment. Readings are taken every 1.0 second with a sensitivity of plus or minus 1 nanotesla and recorded at a full scale of 5 inches for 200 nanoteslas. The coarse trace is recorded at a full scale of 5 inches for 1,000 nanoteslas. The sensing head is mounted at the end of a 3 metre stinger, on the tail of the PBY aircraft.

III. SPECTROMETER (Optional)

A Nuclear Data 256 channel spectrometer is used. Its input is taken from the photomultiplier tubes attached to either 16 or 33 litres of NaI detectors, through an Ortec summing amplifier. Separate amplification is available for each individual detector to allow correct photomultiplier output voltage matching. The detectors are mounted in insulated containers and maintained at a constant temperature above the ambient temperature. The analogue voltage outputs from the photomultiplier tubes, which represent the gamma ray spectrum, are fed to the spectrometer (ADC) and converted into digital signals. These digital signals are then processed by the Madacs acquisition system. The acquisition system also measures "live-time" which is the total time per sample period in which the ADC is processing incoming analogue signals.

The equivalent energy values for the various channel positions are noted in Appendix C. (No spectrometer data was acquired.)

For calibration purposes software routines are employed which allow:

- calculation and adjustment of both thorium and cesium window positions as a channel number. This channel number is comparable with the expected peak channel location. This check is accurate to .01 of a channel window width (0.12 KeV).

  The use of both thorium and cesium peaks ensures the spread of the 256 channels is linear.
- display of the thorium or cesium photopeak on the oscilloscope or on the analogue chart, in order to allow calculation of system resolution. These peaks can be plotted for individual crystals or for the entire crystal array.
- automatic calculation of the various window responses to either a uranium or thorium source. The background values are automatically subtracted from the data recorded in the presence of either source and results are displayed on the television monitor.

They are then recorded on the flight log by the operator.

- memory storage of spectral data. This data can be plotted at any stage during a flight or at the end of flight, even after the system has been powered down.

A software facility is also provided to enable correction for compton scattering effects on the analogue data (not the digital data).

IV. TRACKING CAMERA

The tracking camera is a 35mm continuous strip camera equipped with a wide angle lens. The 35mm film is synchronized with the geophysical record by means of fiducial marks printed every 2.0 seconds. These time readings are not from an incrementing counter, they are read from digital information provided by the MADACS system.

V. ALTIMETER

A Sperry radar altimeter is used. This instrument has an accuracy of +/- 2.5%. Data is recorded in units of feet.

VI. Hz MONITOR

A Hz monitor tuned to the local domestic power distribution frequency, is employed to assist in the detection of powerlines and their resultant anomalies.

VII. MADACS DIGITAL ACQUISITION SYSTEM

The MADACS is a computer based software system using an Interdata processor, model 6/16 with 32k memory. This computer is linked with a Digi-Data, model 1600 magnetic tape drive with a true read after write feature which allows checking of the recording process as many times as the particular application permits. The checking procedure includes elimination of errors due to bad tape spots. Use of multiple buffers permits recording and processing data simultaneously with acquisition of new data, with no resulting dead time.

The system uses a Cybernex TV monitor to display acquired data and operator messages and is fully interactive with a Cybernex alpha numeric keyboard which can be used remotely for special installations.

The key feature of this system is that all the data collecting, verifying, buffering and recording is software-controlled and thus may be economically altered to fit almost any requirements. Many critical parameters are automatically monitored during flight, with visual and aural alarms provided.

Survey parameters are displayed during flight in the same units as the basic sensor, making operator comparisons simple. A suite of programs is provided for checking and trouble-shooting the hardware.

The MADACS is used to control and command the operation of all three geophysical systems (INPUT, magnetometer and spectrometer) as well as ancillary equipment such as the camera, altimeter, tape drive, analogue chart recorders and sometimes electronic navigation systems. The basis is a precision clock recording time to 0.1 seconds. Time is digitally recorded in seconds after midnight, so that a six figure number such as 360000 corresponds to a time of ten a.m. Fiducials are generated on digital tape, camera and analogue chart at two second intervals. The fiducial numbers do not increment by units; they are in fact calculated from the time by the computer. Using this method, any data are uniquely defined by their flight number and their time. This system thus does not require digital recording of line numbers, part numbers or direction, thus avoiding a source of digital recording errors.

INPUT and altitude data are digitally recorded five times each second. Either SRC or HRC data can be recorded on digital tape, but not both. Six channels are recorded plus transmitter current and altitude. Digital INPUT data can be positive or negative depending on the zero level voltage dictated by the compensation circuitry. The output voltages of the INPUT receiver are converted to digital units by analogue-to-digital converters (ADC's) and it is here that gains are adjusted to ensure that in conductive areas large anomaly amplitudes (large output voltages) can be kept within the dynamic range of the ADC's.

Magnetic data are recorded once per second and to an accuracy of 1nT. However the software allocates two decimal places to these readings to allow for future replacement of the G803 with a more sensitive instrument.

Radiometric data is accumulated over one second periods. Channels 1 through to 255 are recorded between thresholds set according to Appendix C. Channel 0 records counts in a higher MeV range which corresponds to cosmic gamma radiation. The counts accumulated within certain energy windows, corresponding to those radioactive isotopes of most interest, are calculated from Channels 0 to 255 by the computer and recorded separately each second. These windows are those commonly used for thorium, uranium, potassium, total count and cosmic, as well as an additional uranium window termed auxiliary uranium.

Spaces are left in the format for frame number (if a frame camera is used) and for navigation information (if an electronic navigation system is used).

Manual information such as start time and flight number are keyed in each morning at the start of the flight.

The MADACS system is provided with 12 digital-to-analogue converters (DAC's) to provide outputs to the analogue recording units. The DAC's can be individually subjected to a software routine which checks that their response to a complete range of digital inputs is linear.

VIII. DIGITAL RECORDING

600 or 1200 foot tapes are written in IBM compatible binary with full parity, cyclic redundancy and longitudinal check characters. Read-after-write checking ensures data is correctly recorded. The recording density is 800 b.p.i. and the recording format is described in Appendix C.

IX. ANALOGUE RECORDING

The MADACS system controls a read-after-write facility whereby most of the analogue channels are read after the data are recorded onto digital tape. Altitude, radiometric and magnetic data are programmed for automatic zero calibration at the start of each flight line.

a) Honeywell Visicorder

This is an optical galvanometer recorder used to record INPUT, magnetic and Hz monitor data. An example of its analogue output is displayed in Figure 2.

The data traces, in order from the top of the chart, are:

- 50 Hz monitor.
- 12 SRC INPUT channels.
- altimeter (read-after-write).
- total magnetic field (2000nT FSD) (read-after-write).
- total magnetic field (200nT FSD) (read-after-write).
- six HRC INPUT channels (read-after-write). (Pairs of channels have been summed.)

The fiducial system is used to generate vertical "event" lines on the charts. Lines every 10 seconds are dual, and the dual lines every 50 seconds are labelled with their appropriate time value. Time increases from left to right.

The SRC INPUT data deflect downwards for positive anomalies.

The HRC INPUT and magnetic data deflects upwards for positive anomalies.

During calibration procedures, a test signal of known strength is used to generate from the INPUT receivers an analogue response of known amplitude on each channel. Generally one of two standard sets of amplifications is used, depending whether the survey is to be flown in a generally conductive or generally resistive area. The actual gains used are noted in Appendix C.

b) Mars 6 Recorder (Optional).

Radiometric, altitude and magnetic data are recorded on this 6 - channel, heat pen recorder. Figure 3 shows the usual arrangement of channels on this recorder. Provision is made in the software for full scale values to be changed for each channel, depending on activity in the area to be surveyed. Time increases from right to left and is indicated by an event mark every 10 seconds. These event marks are annotated at regular intervals with their appropriate time values.

Thorium, uranium, potassium and total count values all increase upwards as do the terrain clearance and Magnetic data increase upwards.

X. PROCEDURES

a) Field Operations:

The flight line spacing is normally in the range of 200 metres to 1 kilometre. During survey flights, the altitude of the aircraft is maintained at approximately 120 metres above the ground with the bird flying about 40 metres above the ground.

The heading of the aircraft is such that two adjacent lines are normally flown in opposite directions. Visual navigation is based on airphoto mosaics or in some cases on topographic maps of suitable scale.

During surveys the calibration of the altimeter is checked by flying straight and level over the runway at a barometric altitude AGL of 120 metres. The compensation adjustment is checked during ferry from the base to the survey area.

b) Calibration

Before each flight the gains and zero levels for each INPUT channel are checked and adjusted if necessary. This is carried out at an altitude of 600 metres, away from ground effects. These items are again monitored during each flight and at the end of each flight. The information is recorded on digital tape and analogue chart. If the survey area is resistive, the zero levels are best determined from data recorded over the resistive regions at normal survey altitude. While at 600 metre altitude the compensation procedure is followed to ensure effects of airframe transients are cancelled. Any adjustments are made prior to zero level monitoring since compensation adjustments affect zero level voltages.

All checks and adjustments are performed at high altitude where they can be clearly monitored and recorded for subsequent digital processing.

If radiometric data is being collected a test line may be required before and after each flight. Background gamma radiation levels are monitored and recorded at high altitude during the INPUT calibration procedures. Spectrum positioning checks and source checks are performed before and after each flight.

c) Compilation

At the end of each flight, all records and films are developed, edited and all synchronized fiducial marks are checked. Then, the actual flight path recovery is made by picking visible marks common to both 35mm film and photo mosaics.

Identified points with their time value are plotted on the mosaic. Then, the electromagnetic anomalies are transferred from the records onto a mosaic overlay by interpolation according to their own fiducial number.

The position of the INPUT anomalies must be corrected to take into account the separation between the bird and the aircraft as well as the delay introduced in the integration circuitry. This offset, or lag, is plotted towards the smaller fiducial numbers (to the left on the record). It varies, depending whether the SRC or HRC data is used.

The INPUT anomalies are represented on a map by means of symbols that condense the most significant characteristics:

i) the location of the centre and half-peak width of the electromagnetic anomaly.

ii) the number of INPUT channels affected by a noticeable deflection.

iii) an estimate of the CTP and its match to a vertical half plane, horizontal thin sheet or half space model.

iv) the peak amplitudes of the fourth and eleventh channels in ppm.

v) the altitudes at which the anomalies were recorded

vi) the amplitude of any magnetic features which coincide with INPUT anomalies;

vii) associated response on the Hertz monitor.

The only subjective elements introduced by this processing are in the decision as to whether a deflection corresponds to a genuine anomaly or to a noise source (electrostatic atmospheric discharge, compensation noise, etc.) and in the correlation of the anomalies from line to line to delineate a conductive zone.

To aid in this correlation process various computer products can be utilized. These are profile maps or contour maps of one or more channels, multiplots or printouts showing calculated parameters such as decay time constant or half-space model correlation. These latter parameters can also be contoured or plotted as profile maps.

INPUT SIGNAL

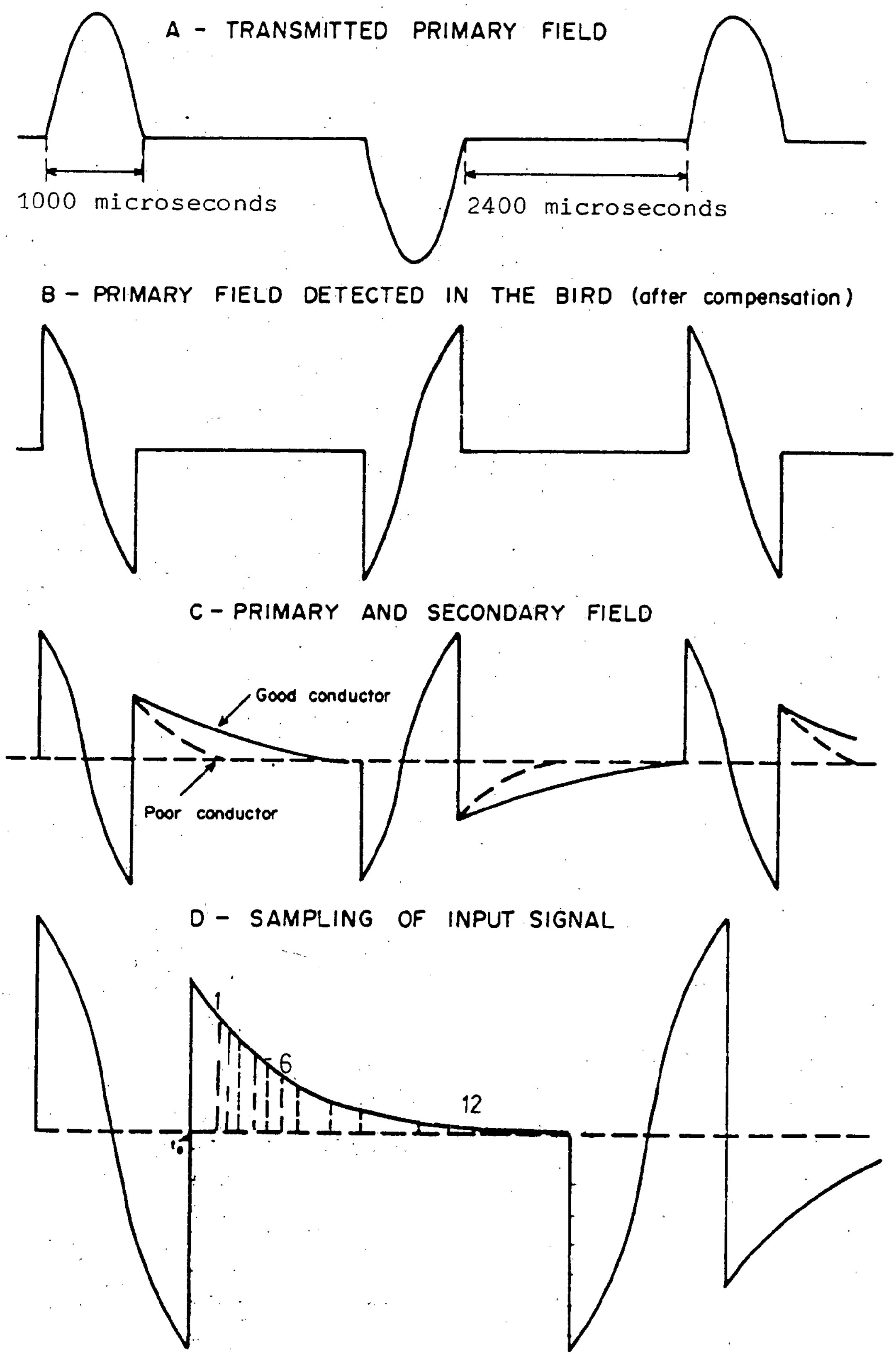
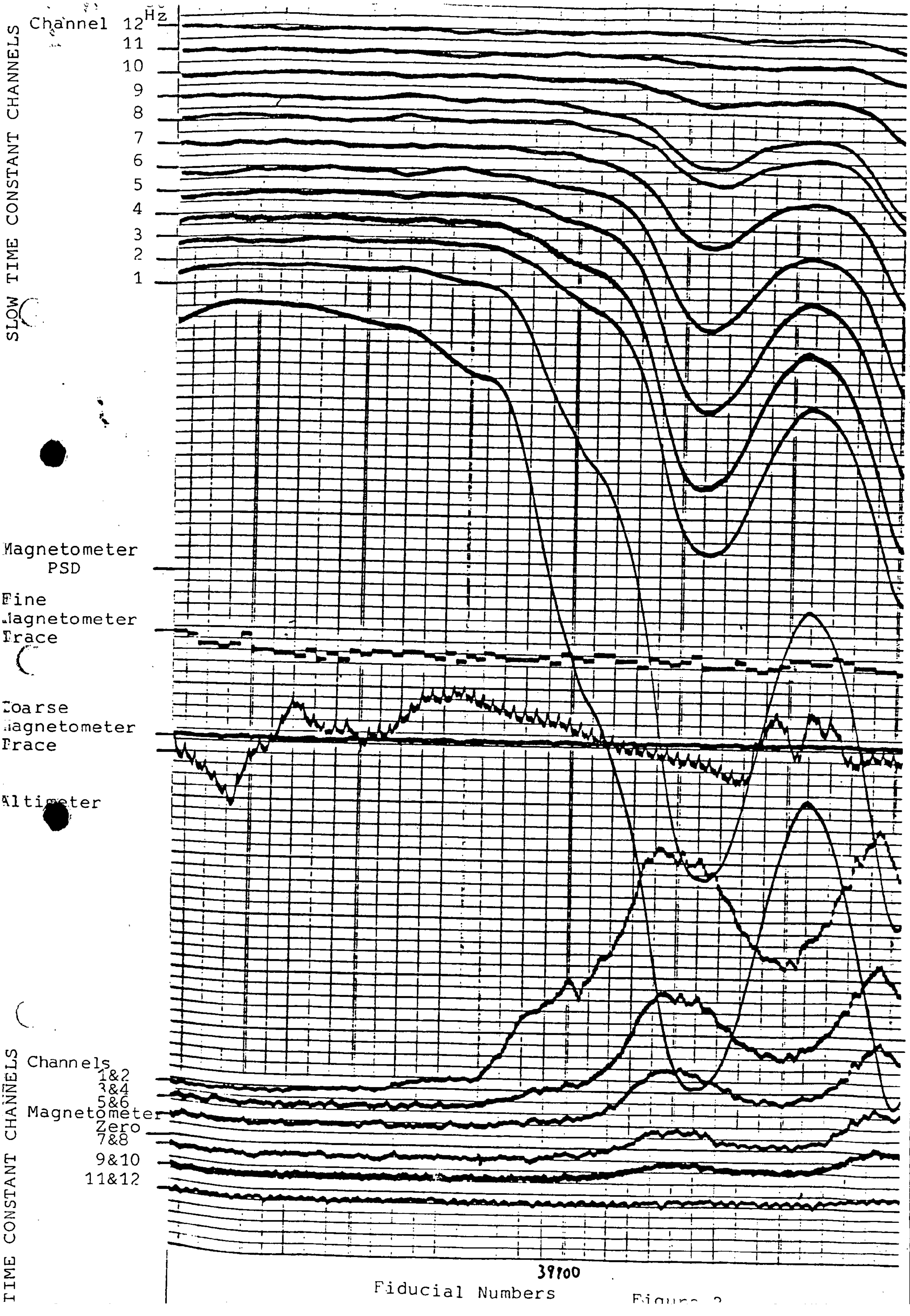


FIGURE 1.



SLOW TIME CONSTANT CHANNELS
Channel 12 Hz
11
10
9
8
7
6
5
4
3
2
1
Magnetometer PSD
Fine Magnetometer Trace
Coarse Magnetometer Trace
Altimeter
TIME CONSTANT CHANNELS
Channels 1&2
3&4
5&6
Magnetometer Zero
7&8
9&10
11&12
39100
Fiducial Numbers

Figure 2

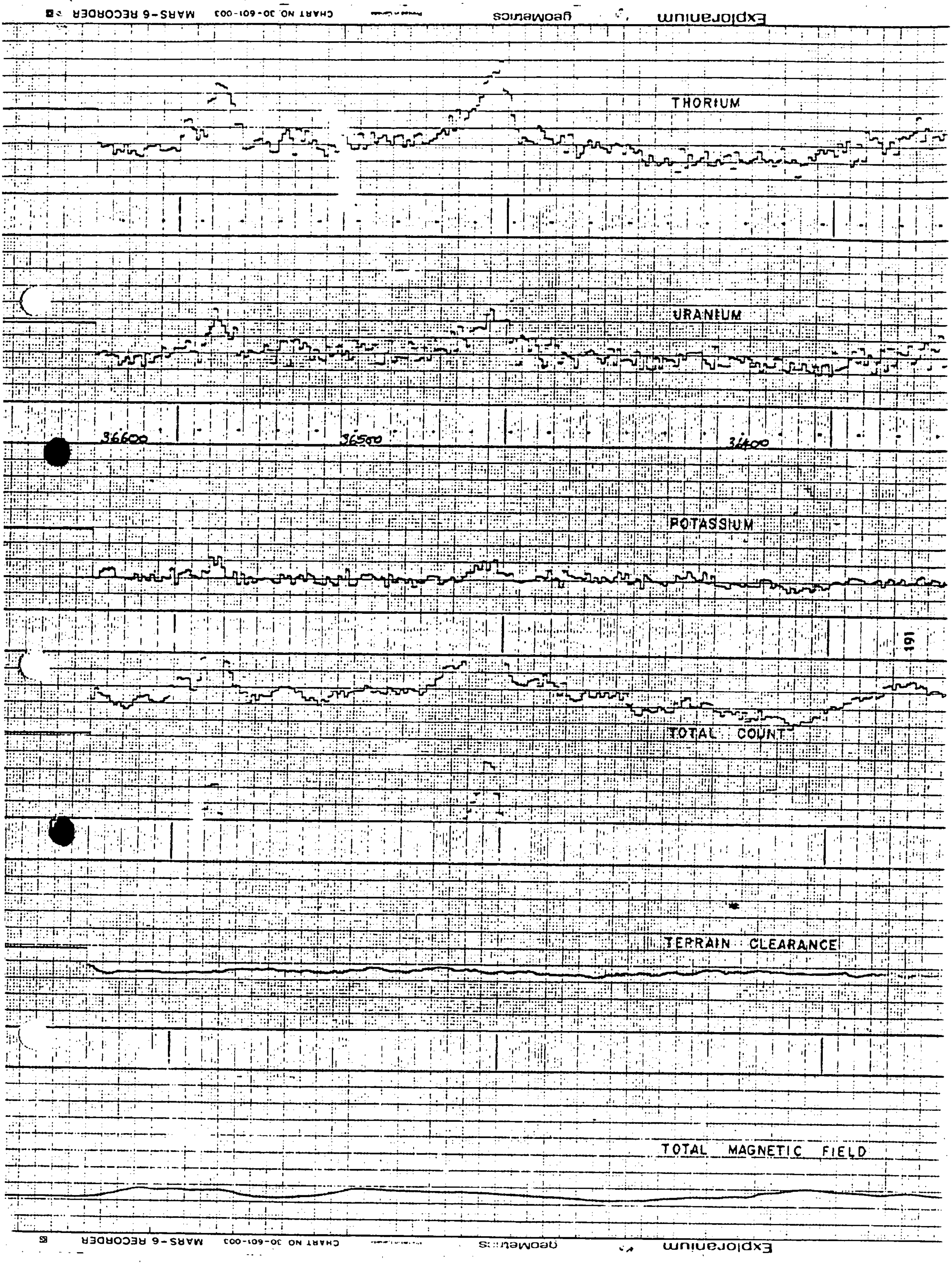

THORIUM
URANIUM
36600
36500
36400
POTASSIUM
191
TOTAL COUNT
TERRAIN CLEARANCE
TOTAL MAGNETIC FIELD

FIGURE 3

APPENDIX B

INPUT INTERPRETATION

I. INTRODUCTION

Although the approach to interpretation varies from one survey to another depending upon local conditions, the following generalizations may provide the reader with some helpful background information.

The main purpose of the interpretation is to determine the probable origin of the conductors detected during the survey and to suggest recommendations for a further exploration programme by taking into account a limited amount of available geophysical data. This is possible through an objective analysis of all characteristics of the different types of conductors and correlating magnetics, if any. Then, the maps of electromagnetic results are compared to the available geological maps. A certitude is seldom reached, but a high probability is obtained in the appreciation of the conductive causes in most cases. One of the most important problems is usually the differentiation between non-economic surface conductors and bedrock conductors.

II. TYPES OF CONDUCTORS

a) Bedrock Conductors:

The different types of bedrock conductors that are normally encountered are the following:

1. Graphites (including a large variety of carbonaceous rocks) occur in the sedimentary formations of the Precambrian as well as in volcanic tuffs, often concentrated in shear zones. They correspond generally to long, multiple conductors often lying in parallel bands. They are not magnetic unless associated with pyrrhotite or magnetite. Their conductivity is variable but generally high.

2. Massive sulphides Syngenetic sulphides often correspond to long multiple conductors and their conductivity, which varies considerably, may be very high, as for graphites. Pyrrhotite, often associated with other sulphides may be the cause of coincident magnetic anomalies. Generally, sulphides are not as frequently encountered as is graphite.

   Isolated orebodies of massive sulphides give rise to short conductors of high conductivity. They quite often present a direct magnetic anomaly and are easily recognized. However, some sulphide orebodies are not magnetic, some are not very conductive (discontinuous mineralization), and they can be located among formational conductors so that one must not be too dogmatic in the selection of the prospects.

Sedimentary sulphide orebodies often give rise to conductors with large dimensions, often without the narrow anomaly usually associated with volcanogenic sulphides. They may be found in large pyritic basins which also display high conductivity. They are often flat lying or gently dipping.

3. Magnetite and some serpentinized ultra-basic rocks are conductive and very magnetic.

4. Manganese oxides may give a weak electromagnetic response.

b) Surface Conductors:

1. Clayey alluvium or residual soils, some swamps and brackish groundwater are usually poorly conductive to moderately conductive.

2. In unglaciated areas lateritic formations, residual soils and the weathered layer of the bedrock often cause surface anomalous zones, the conductivity of

which is generally low to medium but can be very high. Their presence is often related to the lithology of the underlying bedrock and can be used as a guide in exploration for such targets as kimberlite pipes. The latter lithology is very friable and can weather to a thick, highly conductive clay.

c) Man-made Conductors (Cultural):

1. Power Lines These frequently produce a conductive type response on the INPUT record. In the case of direct radiation of their field, the anomaly shows phase changes with the different channels which are recognized easily, in the case of a grounded wire, or steel pylon, the anomaly may look very much like a bedrock conductor.

2. Grounded fences or pipelines These will invariably produce responses much like a bedrock conductor. Whenever they cannot be identified positively a ground check is recommended.

3. General Culture Metal barns or houses, tailings ponds, dumps, etc., may produce INPUT anomalies. However, their instances are rare and can generally be verified by identification on the path recovery film.

III. ANALYSIS OF THE CONDUCTORS

The apparent conductivity alone is not generally a decisive criterion in the diagnosis, and other factors are also very important:

- the pattern of conductors
- the shape and size, both with respect to the direction of flight
- the associated geophysical parameter (aeromagnetics, radiometrics)
- the position with respect to the direction of structures
- the geological environment
- the local variations of characteristics within conductive zones.

A first objective of the interpretation is to classify each zone under one of these three categories, according to its most likely origin. The characteristics of each of the three major classifications are discussed below in subsections a, b and c.

For any particular anomaly or zone the criteria used to analyze it are applied as rigorously and consistently as possible in order to establish the correct classification. In the majority of zones finally selected, the evidence is never totally conclusive.

Consequently, the ultimate priority or classification is the one which appears to be the most probable, bearing in mind that every zone which is discussed in detail has some chance of being a bedrock conductor. In the case of targets such as kimberlite pipes, certain types of surficial conductors will take the highest priority.

The experience of handling a large amount of INPUT data and observing the ground followup results over a large portion of this data has confirmed the validity of our interpretational criteria.

a) Bedrock Conductors

This category is comprised of those anomalies which do not fit the criteria laid down for classifications b and c. It is difficult to assign a specific set of values which signify bedrock conductivity because any individual zone or anomaly might exhibit some, but not all, of these values and still be a bedrock conductor.

The criteria considered as favourable pointers to a bedrock conductor are:

1. Intermediate to high conductivity. Channels eleven

and 12 are generally affected. Where the conductivity drops (i.e. four to eleven channel ratios greater than 15) it is difficult to distinguish narrow surficial conductors from bedrock ones.

2. Good anomaly shape: Narrow, relatively symmetrical, anomalies with well defined peaks are preferred to wider anomalies with rounded peaks. The leading flank should show a gradual increasing response with no abrupt change in slope or tendency to go negative, the latter is often associated with cultural conductors.

3. No serious displacement of anomaly peak position with line direction, i.e.; edge effect. Some displacement can be expected from a wide bedrock source or banded bedrock source which is not resolved into more than a single peak. However, major displacements in peak position appears to be associated with surficial conductors only. (Note the possible exception of flat lying sedimentary sulphides).

4. Small to intermediate amplitude. Large amplitudes do occur but generally, the amplitude of the response is smaller than for thick, extensive surficial

conductors. The amplitude varies to the depth of the source.

5. A degree of continuity. Maintenance of any, or all, of characteristic 1, 2, 3 and 4 is strong evidence in favour of a bedrock conductor.

6. Associated magnetic response with similar strike. A related magnetic response is usually interpreted as signifying a lithologic unit carrying the magnetic and conductive material. However this criteria is often not significant in sedimentry sulphide exploration.

However, as discussed in subsection b, some basic rocks which weather to produce a conductive upper layer will possess this magnetic association. In the absence of characteristics 1, 2, 3 or 4, the related magnetic response does not help to distinguish between surficial conductivity related to a bedrock feature and genuine bedrock conductivity.

Interference, then, with conductive overburden can make the identification of a bedrock conductor somewhat difficult but a careful and consistent comparison of residual responses to the above criteria results in a better level of success. The use of quantitative analysis of amplitude decay can improve the success rate in areas of conductive overburden.

Residual anomalies, basically, are those which, in comparison to other deflections, appear to be located "on" rather than "part of" the already deflected traces.

Most obvious bedrock conductors occur in long, relatively monotonous, sometimes multiple zones following formational strike. Graphitic material is usually the most probable source. Massive syngenetic sulphides running for many miles are known in nature but, in general, they are not common.

Other sources of bedrock conductivity are massive magnetite and serpentine. We rely heavily on the amplitude and dimensions of the associated magnetic activity plus the geological setting of the conductor to distinguish these cases.

The criteria used for the selection of a bedrock conductor which is considered to have a good chance of being a massive sulphide are:

- high conductivity,
- good anomaly shape,
- small to intermediate amplitude,
- characteristic anomaly decay,
- isolation,
- short strike length,
- preferably a localized, small amplitude magnetic anomaly of the same width.

If the magnetic anomaly has similar lateral dimensions, with an amplitude up to 400 gammas, and correlates directly with the EM response, there is a strong possibility of pyrrhotite being present.

We must consider, however, the possibility of localized occurrences of massive sulphides within or near formational conductors. The selection of targets from within these extensive belts is a difficult problem. They are singled out primarily on the basis of a marked local increase in conductivity and/or amplitude or some evidence for a relatively localized occurrence. Variations within the conductive formations themselves can account for these characteristics, so the reliability of this type of selection is considered to be low.

Localized magnetic correlations within long formational conductors can be taken as evidence of pyrrhotite. In some environments, however, this criterion is very difficult to apply due to the prevalent association of conductors to magnetically active rock types. The compilation of the magnetic data into isomagnetic contour maps assists this type of selection.

b) Surficial Conductors

This term is used for geological conductors in the overburden, either glacial or residual, and in the weathered layer of the bedrock. Most surficial conductors are probably caused by clay minerals. In some environments, salty deposits give rise to highly conductive surficial features.

Other possible electrolytic conductors are residual soils, swamps, brackish groundwater and lake or river-bottom deposits.

Many conductive surficial features have low or intermediate conductivity so they are not usually mistaken for highly conducting bedrock features. Many of them are very broad features and their anomaly shapes are typical of broad horizontal sheets. However, in some areas surficial conductivity can be extreme and flying is not recommended in areas where this problem is well established, unless the type of survey target can be located from the varying thickness of its conductive cover e.g. basement depressions, channels.

When the conductivity is higher, it is often still possible to identify a flat-lying surficial conductor, thanks to a typical asymmetry in the INPUT responses observed on both edges of the conductor (edge effect) when flying adjacent lines in opposite directions (Figure 1). Flying from A to B, the coupling between the transmitting coil and the flat-lying conductor AB is maximum when the coil is over the leading edge A and minimum when the coil is over the edge B. The INPUT response appears stronger over Point A than over Point B. The phenomenon is reversed when flying from B to A. The actual limits of the conductive zone correspond, in fact, to the envelope of the leading edges of staggered anomalies. In practice there are many variations on this basic pattern caused by variations in width, thickness and conductivity. For an understanding of the variability of transmitter-conductor-receiver coupling refer to Figure 2 and 3.

Other surficial conductors may be recognized by analysing the radio-altimeter trace, e.g. conductive deposits in the valleys or increased thickness of the weathered zone on top of the hills. Also, a comparison to the altimeter profile is essential when flying over a surface layer of apparently high conductivity where a sudden dip of short duration (or small hill) can cause an apparent sharp anomaly.

However, the existence of surficial conductors related to bedrock lithology does introduce ambiguities into the interpretation. There are instances where we cannot distinguish between weakly conductive serpertine or poorly developed graphite within the bedrock and weakly conducting soils or a weathered layer above the bedrock. This does not generally detract from the prime purpose of the survey, which is the location of highly conducting massive sulphides, but it does complicate the overall analysis of the data.

If the anomaly shapes show a dependence on line direction, a surficial or flat-lying bedrock is probable; if they show multiple peaking and a lack of dependence on line direction a bedrock source is probable; but with the weaker anomalies the shape is often insuffiently clear for a reliable interpretation.

Formational surficial conductors seem to be most commonly related to rocks of intermediate to basic composition, as they tend to follow magnetic highs. (This is also true of most of the formational bedrock conductors.) However, there are also examples of formational surficial conductors in acidic environments.

A surficial response of direct economic interest is that recorded over the weathered part of kimberlite pipes. These responses are usually isolated and often very strong, especially in tropical areas where extensive weathering may occur.

Surficial conductors are not completely portrayed on the EM Map because weaker INPUT responses are not usually plotted. Sometimes, the distribution of this type of conductor is indicated by the stronger sections which are plotted and by the conductor outline which delineates the entire zone. Alternatively, when the amplitude of one of the early channels is contoured, these weak zones are delineated.

Any outlined conductive zones which are not assigned an identification number can be taken as interpreted surficial features. Similarly, any isolated anomalies which bear no zone number and no "C" designation are interpreted as surficial.

(c) Cultural Conductors

The majority of cultural anomalies occur along roads and are accompanied by a 50 Hz response. Power lines are clearly the most common source. Although some power lines are recognised immediately on the records by virtue of phase reversals or an abnormal rate of decay, many yield INPUT anomalies of a normal "high conductivity" character which could be mistaken for bedrock responses. There are also many power lines which cause no INPUT response whatsoever.

Fences, pipelines, communication lines, railways and other man-made conductors can give rise to INPUT responses, the strength of which will obviously depend on the grounding of these objects.

Our analysis of suspected cultural anomalies is helped a great deal by the 50 Hz monitor. It is important to note, however, that the 50 Hz response must be sharply peaked in order to be a reliable indicator and it is equally noteworthy that the 50 Hz response along a power line will occasionally vanish on one or more lines.

The exact location of an INPUT anomaly with respect to the associated 50 Hz response is important. In cases where a definite cultural conductor is known, the lag between the monitor and INPUT responses is consistent from line to line. Any departure of the lag interval from the "normal" would raise suspicion of an additional conductor being present.

The direction of the power line must also be considered, as the inductive response diminishes, sometimes markedly, with reduced coupling when the power line makes a shallow angle with the flight line. In other cases, the shallow angle results in a broadening of the anomaly shape and of the 50 Hz response.

Geological conductors often carry this 50 Hz response in the vicinity of power lines but these anomalies usually have the appearance of broad swells on the monitor record rather than sharp peaks.

Invariably, there are a few borderline cases, hence the nomenclature "Hz?" appears occasionally on the EM maps.

It is also necessary to utilize the tracking film. The exact positions of all anomalies, with the exception of the obvious broad surficial features, are checked on the film and possible cultural sources or the lack thereof, are noted on the work sheets. In this way, cultural features which may not be apparent on the planimetric maps are located. In the same way small offsets of plotted EM anomalies from cultural features can be very significant in the interpretation of the data.

Another facet of this analysis is the line-to-line comparison of anomaly character along suspected man-made conductors. In general, cultural anomalies should be very narrow, sometimes exhibiting small negatives on their leading edge, and the lag for plotting is often slightly greater than for geological conductors. The INPUT amplitude, the rate of decay, and the anomaly width should not vary a great deal along any one man-made conductor. A marked departure from the average response character along any given feature gives rise to the possibility of a second conductor. A further characteristic of cultural anomalies is that the HRC response amplitude will often be larger than that of the SRC response due to the extreme narrowness of the target.

Any monotonous string of narrow anomalies along a road with a sharp 50 Hz response can be discarded immediately. Even the more localized narrow anomalies can usually be eliminated if a potential cultural source is evident on the tracking film and there is a sharp 50 Hz response. A response over a farm or a farm track can be eliminated with confidence if the source of power to the farm is obvious. Similarly, an apparently isolated response along a road can often be discarded by checking for feeble, unplotted anomalies on adjacent lines or for 50 Hz responses with no INPUT anomalies.

Anomalies identified as cultural with a very high degree of reliability (designated by "C") can be ignored in the followup programme. In those cases where any reasonable element of doubt remains as to the type of source and/or where the anomalies have sufficiently favourable character to be considered sulphide prospects, a "C?" is shown and the conductive zone is outlined and a ground check is usually recommended.

In most cases a visual examination of the site will suffice as it is only necessary to verify the presence of a man-made conductor. In a few instances we know already that one cultural conductor is present and the object of the ground check is to determine if there is a second cultural source, a variation in the construction of the single source, a change in the grounding conditions, or perhaps a bedrock source. This type of check is obviously more difficult to accomplish.

EDGE EFFECT

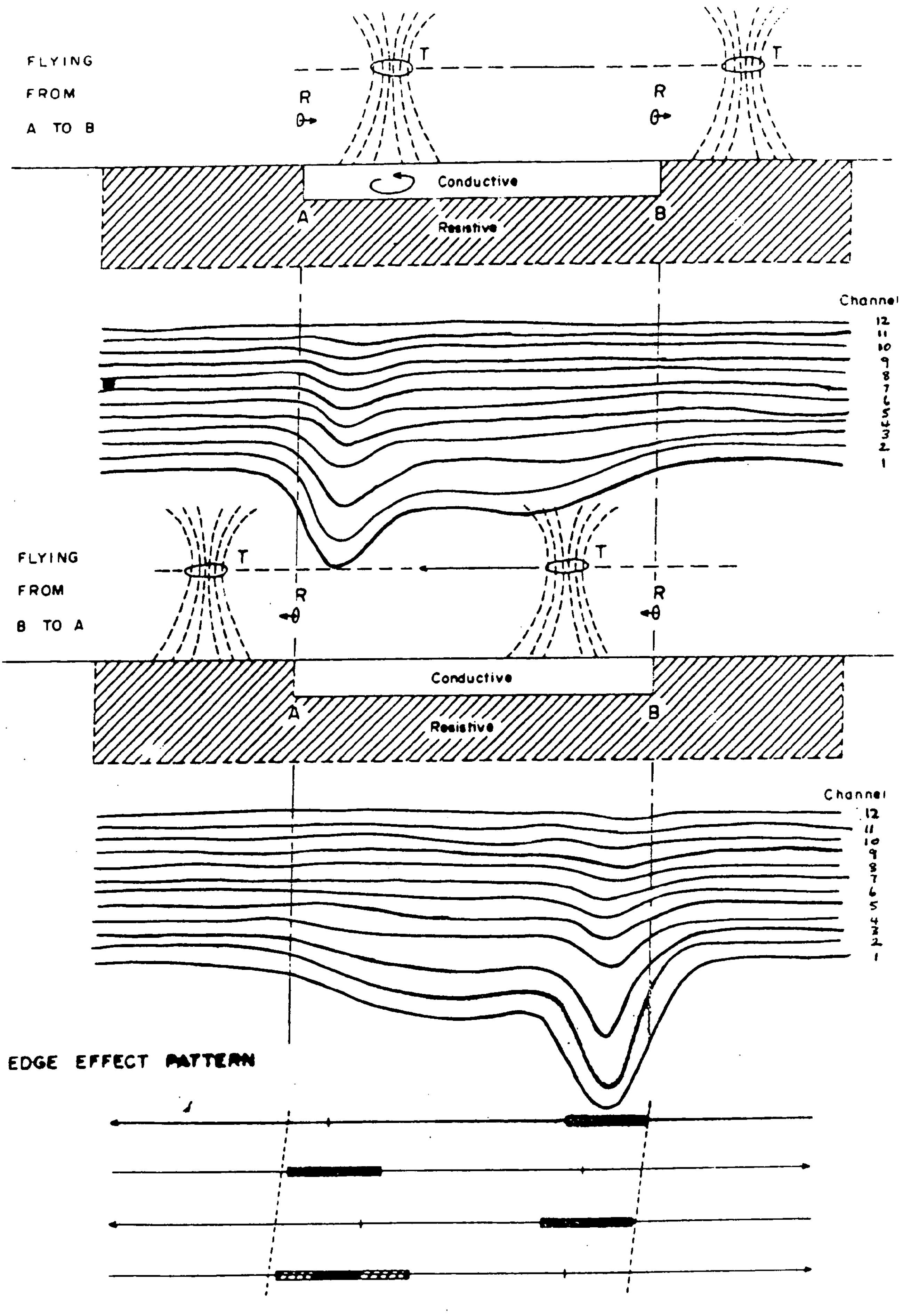


FIGURE 1.

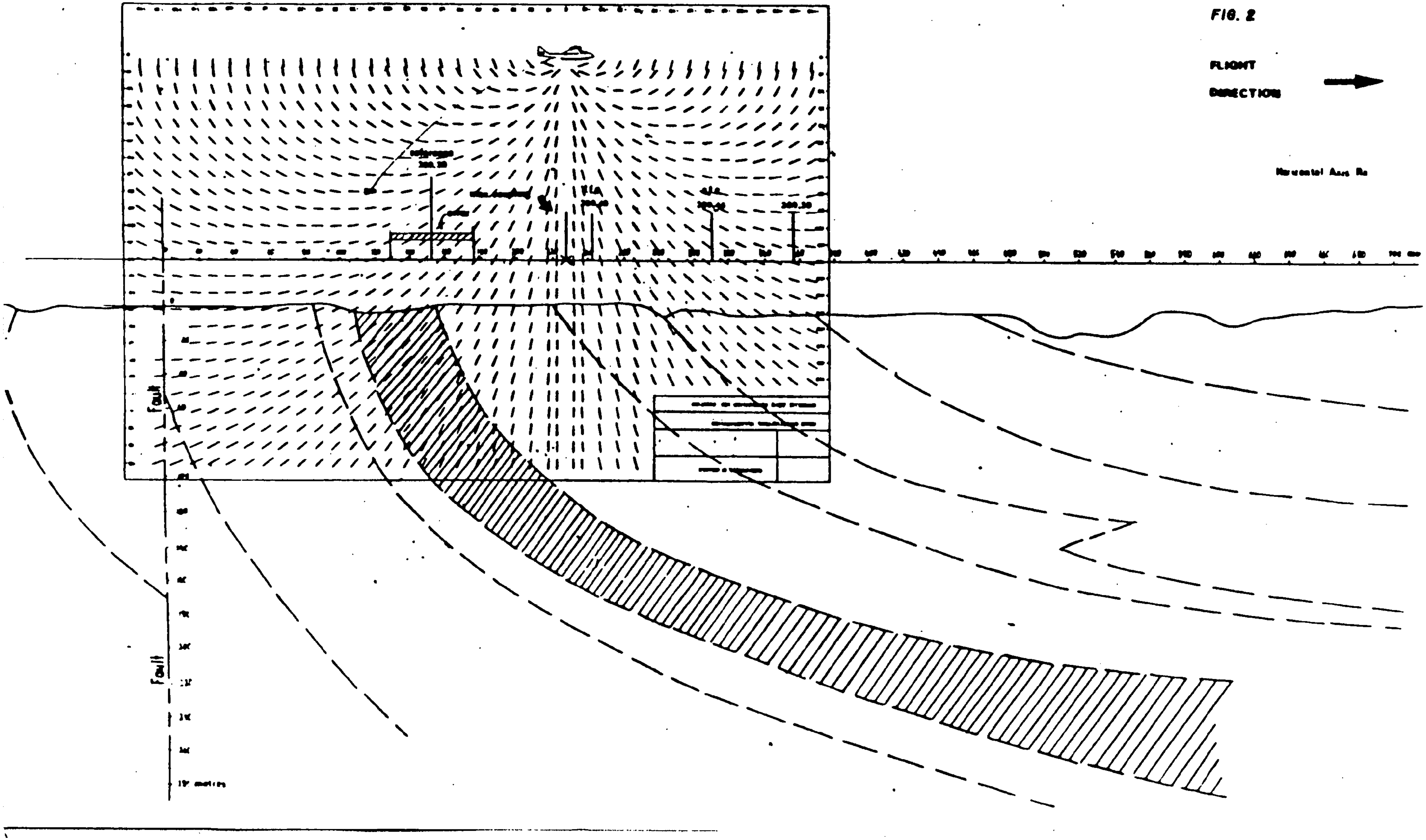
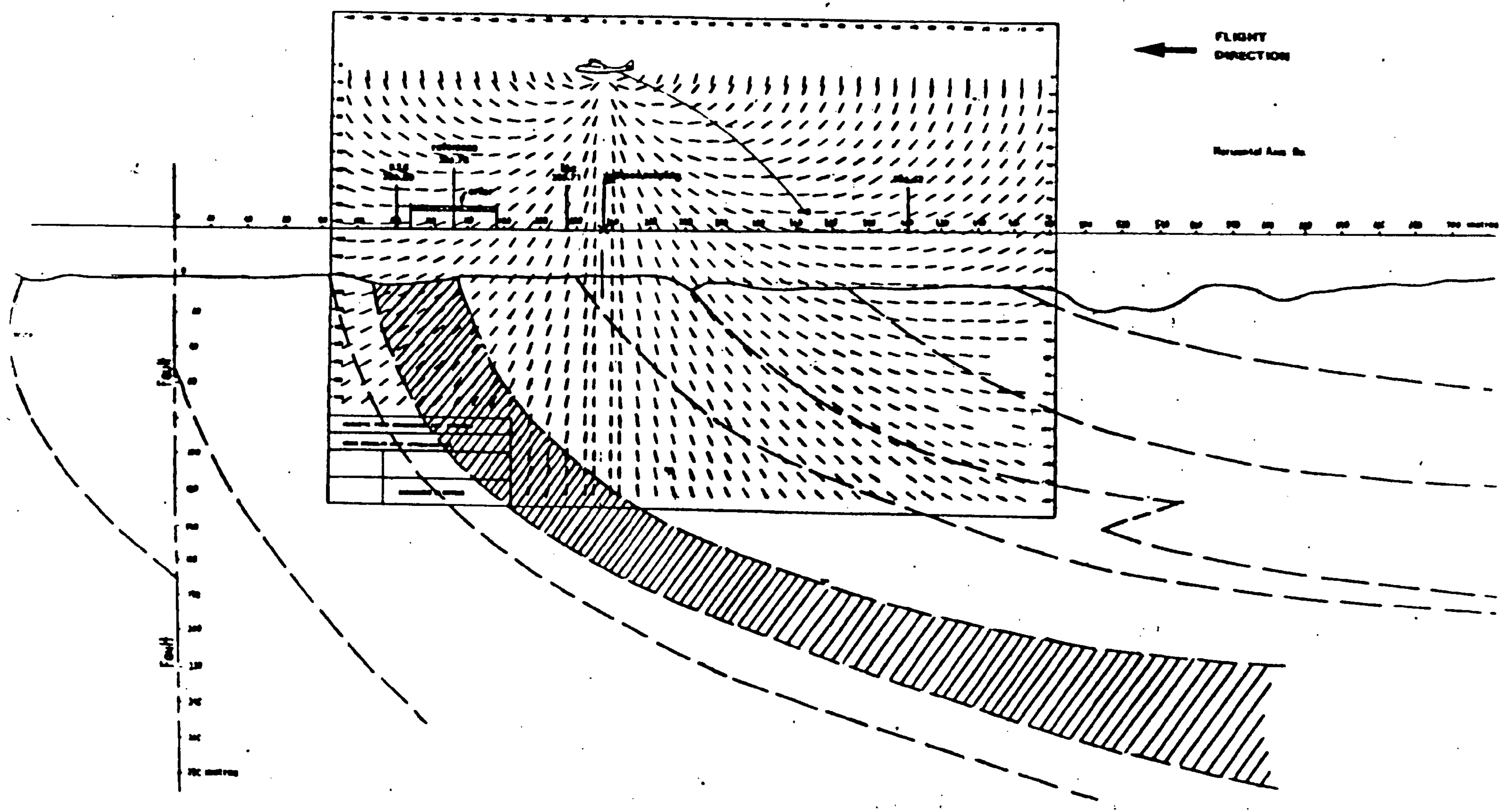


FIG. 2

FIG. 3



APPENDIX C

INSTRUMENT SPECIFICATIONS AND CALIBRATIONS

1. INPUT MARK V-12

Transmitter height above ground level (agl) = 120 metres
Receiver height (a.g.l) = 40 metres
Transmitter Receiver Separation = 107 metres

Transmitter : Half sine wave current pulse
Repetition rate = 288 pulses per second
Pulse width = 1.0 millisecond

Receiver

Channel No.	Channel Centre	Channel Width	Sensitivity (or gain)
1	300	200	2 mV = 1" chart deflection
2	400	"	1.25"
3	500	"	1.5"
4	600	"	1.75"
5	700	"	2.0"
6	800	"	2.25"
7	950	300	2.5"
8	1100	400	2.75"
9	1300	"	3.0"
10	1500	600	3.0"
11	1800	"	3.0"
12	2100	"	3.0"

* All times are in microseconds after transmitter turn off.

Primary field signal measured at the receiver coil in normal configuration: = 1.0 volts
1 x 10^6 parts per million ≡ ½ peak to peak primary field signal measured at the receiver in normal configuration.
100 digital units = 1" chart deflection.

Synchronisation lag: Slow time constant - 4.0 seconds (for vertical conductors)
Fast time constant - 2.0 seconds "

2. MAGNETOMETER

Geometrics G803 Proton Precession
Stinger Mounted
Sensor Height = 120 metres
Sample interval = 1.0 seconds

Sensitivity = 1.0 nT

Full scale chart deflection = 100 nT (fine scale)

= 1000 nT (coarse scale)

3. ALTIMETER

Sperry RT 220 radar altimeter

Sample interval = 0.2 seconds

Accuracy = +/- 1.5% (+/- 2 metres at 120 metres)

Analogue chart Scale = 1" per 30 metres

4. ANALOGUE RECORDER

Honeywell Visicorder

Top - 50 Hz monitor

12 slow time constant INPUT traces (positive down)

Terrain clearance (positive down)

2 Magnetometer traces (positive up)

6 summed pairs of fast time constant INPUT traces (positive up)

Bottom - Fiducial numbers (Realtime, seconds after midnight)

Chart speed - 6" per minute.

5. FIELD TAPE FORMAT

The tape structure used on this survey is set to record INPUT, magnetic and radiometric data.
The following is the tape description for a single physical block:

Byte Position	Number of Bytes	Description
1-4	4	Block Number
5-6	2	Flight Number
7-8	2	Spare halfword
9-10	2	"
11-12	2	"
13-16	4	Magnetometer (0.01 nT)
17-18	2	Thorium Count
19-20	2	Uranium Count
21-22	2	Auxillary Uranium Count
23-24	2	Potassium Count
25-26	2	Total Count
27-28	2	Cosmic Count
29-30	2	Live Time (milliseconds)
31-40	10	Input Channel 1 @ T-.9, .7, .5, .3, .1 secs.
41-50	10	Input Channel 2
51-60	10	" " 3
61-70	10	" " 4
71-80	10	" " 5
81-90	10	" " 6
91-100	10	" " 7
101-110	10	" " 8
111-120	10	" " 9
121-130	10	" " 10
131-140	10	" " 11
141-150	10	" " 12
151-160	10	" " 13
161-170	10	" " 14
171-180	10	" " 15
181-190	10	Altimeter @ T - .9, .7, .5, .3, .1 seconds
191-194	4	Time at end of sample
195-196	2	Fiducial number
197-198	2	(Doppler track or heading
199-318	120	Radiometric channels 0-59 2 bytes per channel
319-514	196	Radiometric channels 60-255 - 1 byte per channel
515-516	2	(Doppler along distance)
517-518	2	(Doppler cross distance)

* INPUT channels 13-15 are 50 Hz, loop current and primary Field.

* Unused fields are set to zero

* Positions shown in parenthesis were not used for this job.

TAPE DENSITY - 9 track, 800 bpi

BLOCK SIZE - 518 bytes

RECORDING MODE- binary (IBM compatible)

APPENDIX II

DETAILED DRILL LOGS AND ASSAY RESULTS

000371

A.M.G. 314120 mE ; 6104750 mN.
Lat. 35° 10' 59" ; Long. 138° 57' 31"

C.R.A. EXPLORATION PTY LIMITED

DRILL CORE LOG

PROJECT: WOODCHESTER PROSPECT

CO-ORDINATES: GRID LINE 9 700E — AZIMUTH: 114° MAG. — DRILLERS: JOHN NITSCHKE PTY. LTD. — COMMENCED: 21-12-83 — DEPTH: 170.0 M — HOLE No. 83WCP3

RL COLLAR: 130 METRES A.H.D. — INCLINATION: -60° — DRILL TYPE: INGERSOLL-RAND T4 — COMPLETED: 22-12-83 — CASING LEFT: 6 M. P.V.C. — DPO No(s): B0912

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)	Pb	Zn	Cu	Ag	Au
94	96		20		Micaceous Quartzite, grey; rare pyrite on fracture planes; quartz veinlets		1157228	94	96		20	110	32	<1	<0.05
96	98		25		Micaceous Quartzite, grey; 1% pyrite on fractures and in veins.		" 29	96	98		24	80	50	<1	<0.05
98	100		30		Quartz-mica schist, grey; 2% pyrite on fractures		" 30	98	100		34	105	40	<1	<0.05
100	102		30		Micaceous Quartzite, grey; 2% pyrite on fractures and as coatings		" 31	100	102		110	165	20	<1	<0.05
102	104		35		Micaceous Quartzite, grey; 2% pyrite; minor chlorite alteration.		" 32	102	104		290	690	28	<1	<0.05
104	106		40		Micaceous Quartzite, grey; 3% pyrite		" 33	104	106		190	480	28	<1	<0.05
106	108		150		Micaceous Quartzite, grey; 3% pyrite and pyrrhotite as fracture fillings and coatings		" 34	106	108		65	105	60	<1	<0.05
108	110		600		Micaceous Quartzite, grey; 3% pyrite and pyrrhotite		" 35	108	110		55	105	75	<1	<0.05
110	112		750		Micaceous Quartzite, grey; 2% pyrite and pyrrhotite		" 36	110	112		60	1750	60	<1	<0.05
112	114		1500		Quartz-mica schist, grey; 3% sulphides; pyrrhotite > pyrite		" 37	112	114		70	1100	85	1	<0.05
114	116		2000		Quartz-mica schist, grey; 3% sulphides, mainly pyrrhotite		" 38	114	116		120	1050	90	1	<0.05
116	118		1750		Micaceous Quartzite, grey; 5% sulphides, (po > py) as coatings and veinlets		" 39	116	118		195	1850	80	1	<0.05
118	120		400		Micaceous Quartzite, grey; 2% sulphides, po + py, as coatings and veinlets		" 40	118	120		190	1400	34	1	<0.05
120	122		350		Micaceous Quartzite, grey; 2% sulphides, mostly pyrite		" 41	120	122		150	520	28	<1	<0.05
122	124		500		Micaceous Quartzite, grey; 2% sulphides, po + py, as coatings and veinlets		" 42	122	124		210	700	46	1	<0.05
124	126		2000		Micaceous Quartzite, grey; 20% sulphides, mostly po, in veinlets and as coatings		" 43	124	126		195	1450	80	1	<0.05
126	128		1500		Micaceous Quartzite, grey; 30% sulphides, mostly po, as veins and stringers		" 44	126	128		270	1750	70	2	<0.05
128	130		350		Micaceous Quartzite, grey; 20% sulphides, mostly pyrite		" 45	128	130		370	1900	40	1	<0.05
130	132		200		Micaceous Quartzite, grey; 5% sulphides, po + py		" 46	130	132		140	700	26	<1	<0.05
132	134		200		Micaceous Quartzite, grey; 5% sulphides, mostly py, chlorite alteration.		" 47	132	134		90	350	26	<1	<0.05
134	136		150		Micaceous Quartzite, grey; 5% sulphides, mostly py, chlorite alteration, rare gl/sph?		" 48	134	136		50	220	24	<1	<0.05
136	138		70		Micaceous Quartzite, grey; 2% pyrite, chlorite alteration, quartz veining.		" 49	136	138		30	120	18	<1	<0.05
138	140		65		Micaceous Quartzite, grey; 1% pyrite, chlorite alteration.		" 50	138	140		44	125	22	<1	<0.05
140	142		65		Micaceous Quartzite, grey; 1% pyrite as coatings and on fracture planes.		" 51	140	142		36	100	24	<1	<0.05
142	144		60		Micaceous Quartzite, grey; 1% pyrite as coatings and on fracture planes.		" 52	142	144		34	90	22	<1	<0.05
144	146		65		Micaceous Quartzite, grey; 1% pyrite as coatings and on fracture planes.		" 53	144	146		26	85	22	<1	<0.05
146	148		90		Micaceous Quartzite, grey; 2% pyrite as coatings and veins		" 54	146	148		70	190	20	<1	<0.05
148	150		200		Micaceous Quartzite, grey; 5% sulphides, mostly pyrite as veins		" 55	148	150		95	350	30	<1	<0.05
150	152		450		Micaceous Quartzite, grey; 5% sulphides, mostly pyrite		" 56	150	152		210	950	40	<1	<0.05
152	154		900		Quartz-mica schist, grey; 5% sulphides, po + py.		" 57	152	154		350	1500	65	1	<0.05
154	156		900		Quartz-mica schist, grey; 5% sulphides, po + py.		" 58	154	156		180	850	90	1	<0.05
156	158		150		Micaceous Quartzite, grey; 2% pyrite		" 59	156	158		44	130	28	<1	<0.05
158	160		125		Micaceous Quartzite, grey; trace sulphides		" 60	158	160		46	120	25	<1	<0.05
160	162		55		Micaceous Quartzite, grey; 1% pyrite in quartz veins.		" 61	160	162		34	80	26	<1	<0.05
162	164		80		Micaceous Quartzite, grey; trace sulphides		" 62	162	164		26	80	20	<1	<0.05
164	166		50		Micaceous Quartzite, grey; trace sulphides.		" 63	164	166		38	65	22	<1	<0.05
166	168		50		Micaceous Quartzite, grey; 2% pyrite as coatings.		" 64	166	168		38	80	22	<1	<0.05
168	170		90		Micaceous Quartzite, grey; 2% pyrite as coatings.		" 65	168	170		48	115	36	<1	<0.05
					B.O.H. 170.0 METRES										

SUMMARY AND SPECIAL COMMENTS: Magnetic anomaly due to pyrrhotitic intervals at 106-115 m, 120-128 m and 148-154 m. E.M. anomaly due to sulphidic zone at 120-128 m.

LOGGED BY: G.J. BUBNER — DATE: 22-12-83

SHEET 2 OF 2

CRAE 117
PLAN No M 414

A.M.G. 313490mE; 6104540mN
Lat. 35° 11' 06"; Long. 138° 57' 06"

C R A. EXPLORATION PTY LIMITED

DRILL CORE LOG

PROJECT WOODCHESTER PROSPECT

CO-ORDINATES GRID LINE 4, 260E AZIMUTH 114° MAG. DRILLERS JOHN NITSCHKE PTY. LTD. COMMENCED 22-12-83 DEPTH 140.0 M HOLE No. 83WCP4

RL COLLAR 150 METRES A.H.D INCLINATION - 60° DRILL TYPE INGERSOLL-RAND T4 COMPLETED 22-12-83 CASING LEFT 6 M. P.V.C. DPO No(s) 80913

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)	Pb	Zn	Cu	Ag	Au
0	2				Micaceous Quartzite; weathered										
2	4				Micaceous Quartzite; weathered; and quartz										
4	6				Micaceous Quartzite; weathered; and quartz										
6	8				Quartzite, partly weathered; locally trace pyrite; occassional quartz										
8	10				Quartzite, partly weathered; locally trace pyrite; and feldspar										
10	12				Quartzite partly weathered; and quartz-mica schist; trace pyrite										
12	14				Quartz-feldspar-mica-schist, weathered; minor quartz										
14	16				Quartz-feldspar-mica-schist, weathered; minor quartz										
16	18				Quartz-feldspar-mica-schist, weathered; minor quartz										
18	20				Quartz-feldspar-mica-schist, weathered and unweathered										
20	22				Quartz-feldspar-mica-schist, occassionally weathered										
22	24				Quartz-feldspar-mica-schist, occassionally weathered										
24	26				Quartz-feldspar-mica-schist, weathered and unweathered; fragments of clay after feldspar										
26	28				Quartzite; trace pyrite (50%) and weathered Quartzite (60%)										
28	30				Quartz-mica schist, very fine grained, puggy, fresh; pyrite (5-10%); white clay										
30	32				Quartz-mica schist, very fine grained, puggy, fresh; pyrite (5-10%); white clay		1157266	30	32		335	950	180	1	<0.05
32	34				Quartz-mica schist, very fine grained, puggy, fresh; pyrite (5-10%); white clay		" 67	32	34		250	1400	80	1	<0.05
34	36				Quartz-mica schist, very fine grained, puggy, fresh; pyrite (5-10%); white clay		" 68	34	36		75	1050	100	<1	<0.05
36	38				Quartz-mica schist, grey, fine grained; siliceous veinlets; pyrite (20%)		" 69	36	38		120	940	135	<1	<0.05
38	40				Quartz-mica schist, grey, fine grained; siliceous veinlets; pyrite (20%)		" 70	38	40		145	2000	80	<1	<0.05
40	42				Quartz-mica schist, grey, fine grained; siliceous veinlets; pyrite (20%)		" 71	40	42		310	2100	75	1	<0.05
42	44				Quartz-mica schist, grey, fine grained; pyrite (20%) mainly on cleavage		" 72	42	44		310	2250	70	<1	<0.05
44	46				Quartz-mica schist, grey, fine grained; pyrite (20%); possible minor v.f.g. gl/sph		" 73	44	46		370	2950	75	1	<0.05
46	48				Quartz-mica schist, grey, fine grained; pyrite (10-15%); possible minor v.f.g. gl/sph		" 74	46	48		400	2650	70	1	<0.05
48	50				Quartz-mica schist, grey, fine grained; pyrite (10-15%); possible minor v.f.g. gl/sph		" 75	48	50		510	2450	60	1	<0.05
50	52				Quartz-mica schist, grey, fine grained; pyrite (20%); possible minor v.f.g. gl/sph		" 76	50	52		125	1550	60	<1	<0.05
52	54				Quartz-mica schist, grey, fine grained; pyrite (10%); possible minor v.f.g. gl/sph		" 77	52	54		80	1200	65	<1	<0.05
54	56				Quartz-mica schist, grey, fine grained; pyrite (20%); possible minor v.f.g. gl/sph		" 78	54	56		50	1100	90	<1	<0.05
56	58				Quartz-mica schist, grey, fine grained; pyrite (20%); possible minor v.f.g. gl/sph		" 79	56	58		55	470	110	<1	<0.05
58	60				Quartz-mica schist, grey, fine grained; pyrite (10-15%); possible minor v.f.g. gl/sph		" 80	58	60		80	690	100	<1	<0.05
60	62				Quartz-mica schist, grey, fine grained; pyrite (10-15%); possible minor v.f.g. gl/sph		" 81	60	62		60	3750	100	<1	<0.05
62	64				Micaceous Quartzite, grey; pyrite (5%)		" 82	62	64		75	970	50	<1	<0.05
64	66				Micaceous Quartzite, grey; pyrite (3-5%)		" 83	64	66		36	175	30	<1	<0.05
66	68				Micaceous Quartzite, grey; pyrite (5%)		" 84	66	68		40	200	34	<1	<0.05
68	70				Micaceous Quartzite, grey; pyrite (2-5%)		" 85	68	70		32	230	40	<1	<0.05
70	72				Micaceous Quartzite, grey; pyrite (1%)		" 86	70	72		42	380	30	<1	<0.05
72	74				Micaceous Quartzite, grey; trace pyrite		" 87	72	74		28	165	24	<1	<0.05
74	76				Micaceous Quartzite, grey; pyrite (1%)		" 88	74	76		28	145	36	<1	<0.05
76	78				Micaceous Quartzite, grey; pyrite (1%)		" 89	76	78		28	190	50	<1	<0.05
78	80				Micaceous Quartzite and quartz-mica schist, grey; pyrite (1%)		" 90	78	80		24	240	70	<1	<0.05
80	82				Micaceous Quartzite, grey; 1% pyrite in quartz veins		" 91	80	82		32	210	50	<1	<0.05
82	84				Micaceous Quartzite, grey; trace pyrite		" 92	82	84		30	220	44	<1	<0.05
84	86				Quartz-mica schist and Quartzite, grey; pyrite (1%)		" 93	84	86		30	220	48	<1	<0.05
86	88				Quartz-mica schist and Quartzite, grey; trace pyrite		" 94	86	88		28	210	40	<1	<0.05
88	90				Quartzite; trace pyrite		" 95	88	90		32	260	46	<1	<0.05
90	92				Quartzite; trace pyrite		" 96	90	92		44	210	42	<1	<0.05
92	94				Quartzite; trace pyrite		" 97	92	94		34	200	24	<1	<0.05

CRAE 117
PLAN No M 414

SUMMARY AND
SPECIAL COMMENTS

LOGGED BY D.R. KENNEDY DATE 22-12-83

SHEET 1 OF 2

A.M.G. 313490 mE; 6104540mN
Lat. 35° 11' 06"; Long. 138° 57' 06"

C.R.A. EXPLORATION PTY. LIMITED

DRILL CORE LOG

PROJECT WOODCHESTER PROSPECT

CO-ORDINATES GRID LINE 4,260E AZIMUTH 114° MAG. DRILLERS JOHN NITSCHKE PTY. LTD. COMMENCED 22-12-83 DEPTH 140.0 M HOLE No. 83WCP4

RL COLLAR 150 METRES A.H.D. INCLINATION -60° DRILL TYPE INGERSOLL-RAND T4 COMPLETED 22-12-83 CASING LEFT 6M P.V.C. DPO No(s) BO 913

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)	Pb	Zn	Cu	Ag	Au
94	96				Micaceous Quartzite, dark grey; trace pyrite; vein quartz with mica.		1157298	94	96		90	260	60	<1	<0.05
96	98				Micaceous Quartzite, dark grey; vein quartz with chlorite. No sulphides		" 299	96	98		46	210	38	<1	<0.05
98	100				Micaceous Quartzite, dark grey. No sulphides		" 300	98	100		32	165	28	<1	<0.05
100	102		40		Micaceous Quartzite, dark grey. No sulphides		" 01	100	102		44	160	26	<1	<0.05
102	104		50		Micaceous Quartzite, dark grey. No sulphides.		" 02	102	104		32	130	20	<1	<0.05
104	106		45		Micaceous Quartzite, dark grey; trace pyrite; barren vein quartz.		" 03	104	106		32	170	26	<1	<0.05
106	108		55		Micaceous Quartzite, dark grey; No sulphides		" 04	106	108		22	120	22	<1	<0.05
108	110		35		Micaceous Quartzite, dark grey. No sulphides.		" 05	108	110		30	170	34	<1	<0.05
110	112		35		Micaceous Quartzite, dark grey; trace pyrite		" 06	110	112		50	210	50	<1	<0.05
112	114		75		Mud, fine grained (shear?), (70%); Micaceous Quartzite (30%)		" 07	112	114		60	180	60	<1	<0.05
114	116		120		Micaceous Quartzite, dark grey; trace pyrite		" 08	114	116		95	170	50	<1	<0.05
116	118		25		Micaceous Quartzite, dark grey; trace pyrite		" 09	116	118		40	140	55	<1	<0.05
118	120		55		Micaceous Quartzite, dark grey; trace pyrite.		" 10	118	120		40	145	38	<1	<0.05
120	122		45		Micaceous Quartzite, dark grey; trace pyrite		" 11	120	122		30	125	40	<1	<0.05
122	124		40		Micaceous Quartzite, dark grey. No sulphides.		" 12	122	124		30	110	42	<1	<0.05
124	126		35		Micaceous Quartzite, dark grey; trace pyrite on joints		" 13	124	126		30	115	42	<1	<0.05
126	128		55		Micaceous Quartzite, dark grey. No sulphides		" 14	126	128		32	120	38	<1	<0.05
128	130		35		Micaceous Quartzite, dark grey. No sulphides.		" 15	128	130		24	120	40	<1	<0.05
130	132		30		Micaceous Quartzite, dark grey. No sulphides.		" 16	130	132		24	110	40	<1	<0.05
132	134		35		Micaceous Quartzite, dark grey. No sulphides.		" 17	132	134		22	110	34	<1	<0.05
134	136		40		Micaceous Quartzite, dark grey. No sulphides		" 18	134	136		28	105	36	<1	<0.05
136	138				Micaceous Quartzite, dark grey. No sulphides.		" 19	136	138		42	100	48	<1	<0.05
138	140				Micaceous Quartzite, dark grey. No sulphides.		" 20	138	140		42	140	46	<1	<0.05
					B.O.H. 140.0 METRES										

CRAE 117
PLAN No M 414

SUMMARY AND SPECIAL COMMENTS

LOGGED BY D.R. KENNEDY DATE 22-12-83

SHEET 2 OF 2

000370

A.M.G. 314120mE; 6104750mN.
Lat. 35°10' 59" ; Long. 138°57'31"

C.R.A. EXPLORATION PTY. LIMITED

DRILL CORE LOG

PROJECT WOODCHESTER PROSPECT

CO-ORDINATES GRID LINE 9 700E AZIMUTH 114° MAG. DRILLERS JOHN NITSCHKE PTY. LTD. COMMENCED 21-12-83 DEPTH 170.0 M. HOLE No. 83WCP3

RL COLLAR 130 METRES A.H.D. INCLINATION -60° DRILL TYPE INGERSOLL-RAND T4 COMPLETED 22-12-83 CASING LEFT 6 M. PVC. DPO No(s) B 0912

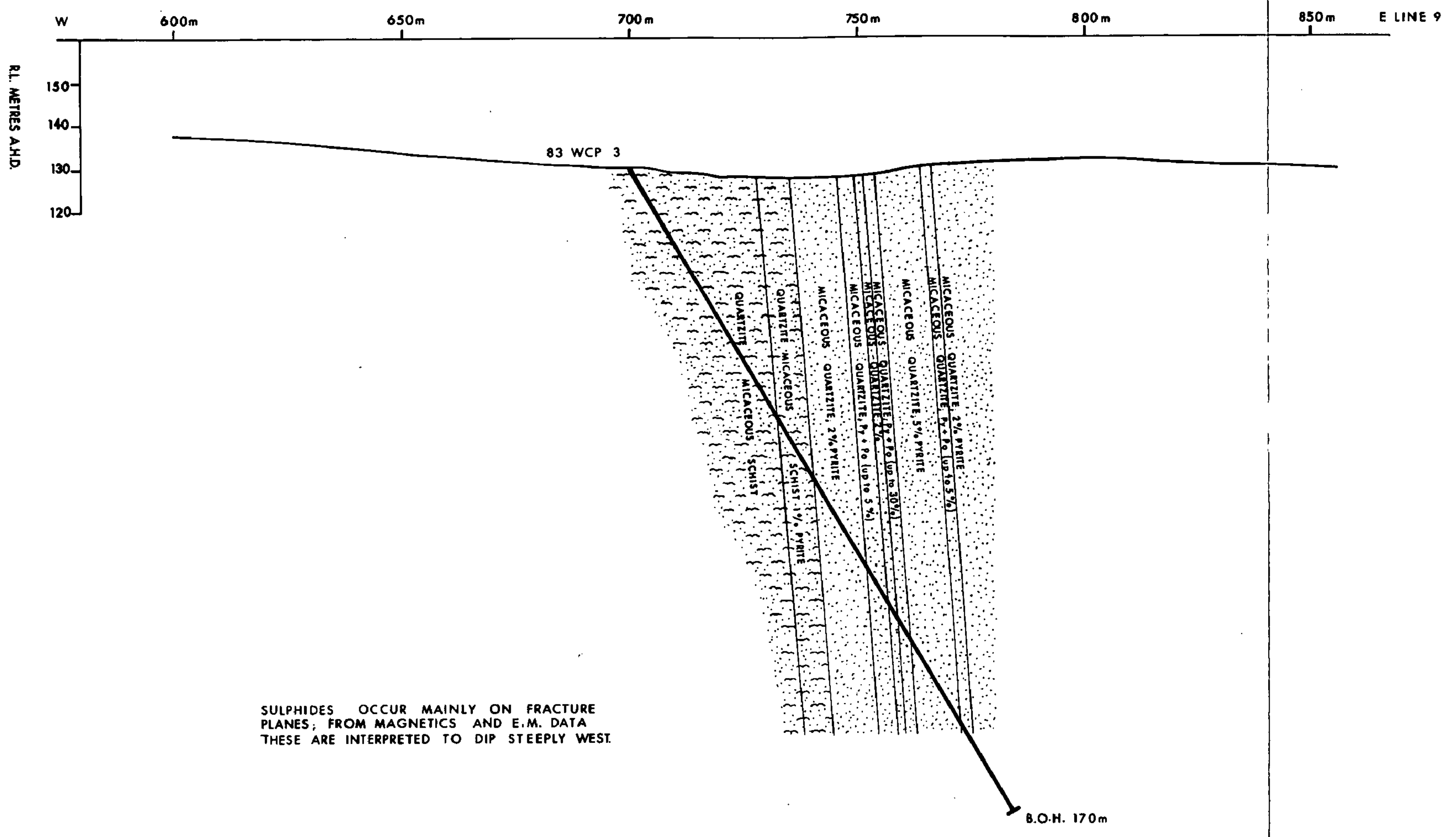
DEPTH FROM (M)	DEPTH TO (M)	CORE REC (M)	CORE SIZE	GRAPHIC LOG	CORE DESCRIPTION	SPECIAL FEATURES WEATH., ALTERATION, FRACTURING VEINING, MINERALIZATION	SAMPLE No.	FROM (M)	TO (M)	REC (M)	Pb	Zn	Cu	Ag	Au
0	2		40		Quartz-mica schist; grey; Fe staining										
2	4		25		Quartz-mica schist, grey; Fe staining.										
4	6		25		Quartz-mica schist, grey; Fe staining.										
6	8		30		Quartz-mica schist, grey; Fe staining; quartz veinlets.										
8	10		40		Quartz-mica schist, grey.										
10	12		30		Quartz-mica schist, grey; quartz veinlets.										
12	14		30		Quartz-mica schist, grey.										
14	16		30		Quartz-mica schist, grey.										
16	18		25		Quartz-mica schist, grey; trace pyrite.										
18	20		25		Quartz-mica schist, grey; quartz veining										
20	22		40		Quartz-mica schist, grey; quartz veining										
22	24		40		Quartz-mica schist, grey; quartz veining										
24	26		20		Quartz-mica schist, grey; quartz veining										
26	28		20		Quartz-mica schist, grey.										
28	30		50		Quartz-mica schist, grey.										
30	32		25		Quartz-mica schist, grey.										
32	34		30		Quartz-mica schist, grey.										
34	36		35		Quartz-mica schist, grey (80%); quartz (vein) (20%)										
36	38		30		Quartz-mica schist, grey; rare pyrite; quartz veining.										
38	40		35		Quartz-mica schist, grey; 1% pyrite.										
40	42		30		Quartz-mica schist, grey; trace pyrite		1157201	40	42		14	60	18	<1	<0.05
42	44		55		Quartz-mica schist, grey; quartz veining		• 02	42	44		38	135	34	<1	<0.05
44	46		40		Quartz-mica schist, grey; trace pyrite		• 03	44	46		18	55	14	<1	<0.05
46	48		40		Quartz-mica schist, grey		• 04	46	48		14	90	22	<1	<0.05
48	50		25		Quartz-mica schist, grey		• 05	48	50		8	44	12	<1	<0.05
50	52		30		Quartz-mica schist, grey.		• 06	50	52		8	48	16	<1	<0.05
52	54		45		Quartz-mica schist, grey		• 07	52	54		8	48	16	<1	<0.05
54	56		25		Quartz-mica schist, grey.		• 08	54	56		12	65	16	<1	<0.05
56	58		30		Quartz-mica schist, grey.		• 09	56	58		6	50	10	<1	<0.05
58	60		30		Quartz-mica schist, grey (60%); Quartz (vein) (40%)		• 10	58	60		12	100	14	<1	<0.05
60	62		20		Quartz-mica schist, grey, (80%); quartz (vein) (20%)		• 11	60	62		20	65	18	<1	<0.05
62	64		20		Quartz-mica schist, grey, (80%); quartz (vein) (20%)		• 12	62	64		48	115	10	<1	<0.05
64	66		25		Quartz-mica schist, grey, (90%); quartz (vein) (10%)		• 13	64	66		26	85	14	<1	<0.05
66	68		20		Quartz-mica schist, grey; rare pyrite on fracture planes.		• 14	66	68		34	115	22	<1	<0.05
68	70		25		Quartz-mica schist, grey; 1% pyrite.		• 15	68	70		34	100	22	<1	<0.05
70	72		20		Quartz-mica schist, grey; rare pyrite		• 16	70	72		46	115	26	<1	<0.05
72	74		20		Quartz-mica schist, grey; 1% pyrite in joints; thin quartz veins		• 17	72	74		24	65	14	<1	<0.05
74	76		20		Quartz-mica schist, grey; 1% pyrite in quartz veins and thin qtzite (?) interbeds		• 18	74	76		18	65	18	<1	<0.05
76	78		20		Quartz-mica schist, grey; 1-2% pyrite in siliceous veins and joints		• 19	76	78		18	70	16	<1	<0.05
78	80		20		Quartz-mica schist, grey; 1% pyrite; rare quartz.		• 20	78	80		65	145	30	<1	<0.05
80	82		25		Quartz-mica schist, grey; 1% pyrite in siliceous veins. Grading into Quartzite		• 21	80	82		38	75	14	<1	<0.05
82	84		25		Micaceous Quartzite, grey; 1% pyrite on joints and quartz veinlets.		• 22	82	84		18	55	10	<1	<0.05
84	86		20		Micaceous Quartzite, grey; trace pyrite		• 23	84	86		16	70	18	<1	<0.05
86	88		15		Micaceous Quartzite, grey; trace pyrite		• 24	86	88		24	85	18	<1	<0.05
88	90		20		Micaceous Quartzite, grey; no sulphides.		• 25	88	90		16	70	18	<1	<0.05
90	92		20		Micaceous Quartzite, grey; trace pyrite in clear quartz veinlets.		• 26	90	92		18	85	30	<1	<0.05
92	94		15		Micaceous Quartzite, grey; no sulphides.		• 27	92	94		18	80	24	<1	<0.05

CRAE 117
PLAN No. W414

SUMMARY AND
SPECIAL COMMENTS

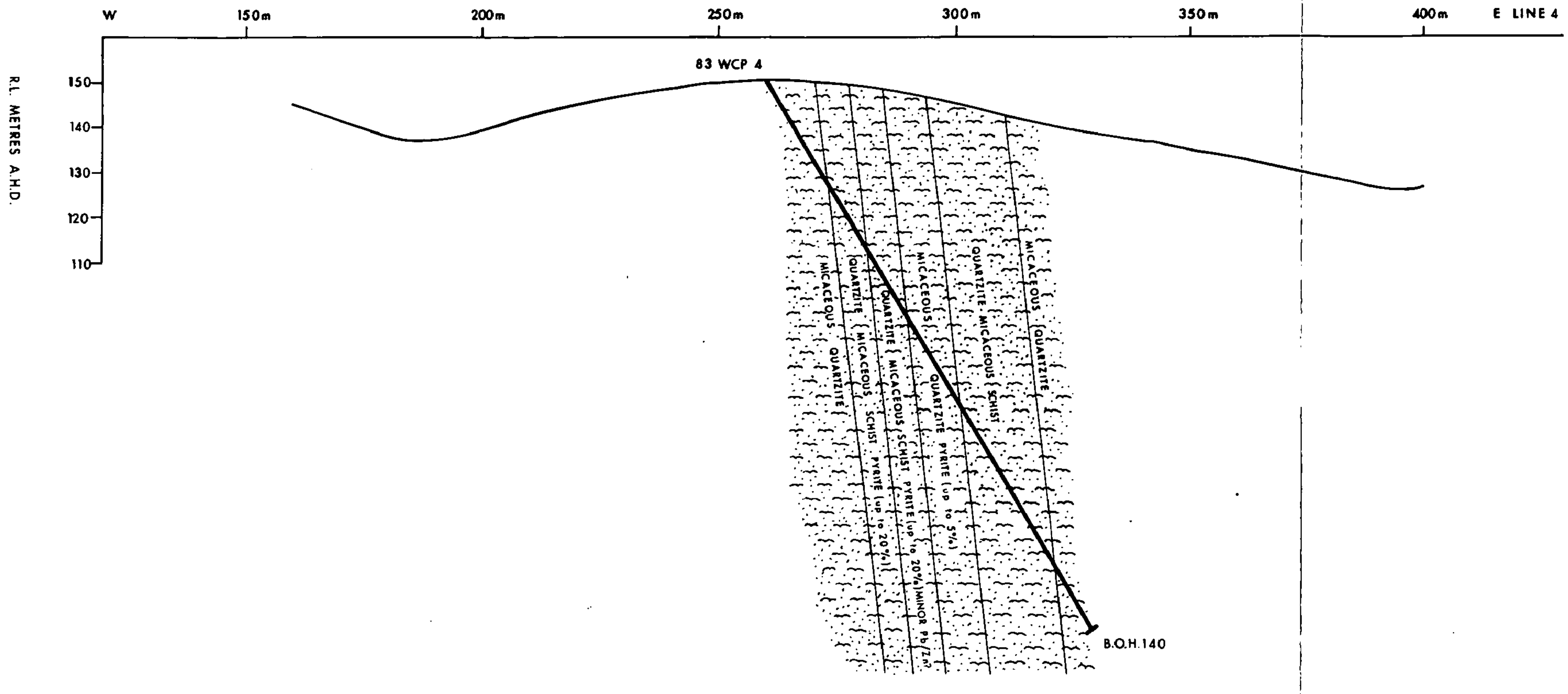
LOGGED BY G.J. BUBNER DATE 22-12-83

SHEET 1 OF 2



CRA EXPLORATION PTY LIMITED	
BULL CREEK E.L.1008 DRILL HOLE CROSS-SECTION 83 WCP 3	
REF. BARKER SI 5413	
SCALE 1:1000	
AUTHOR G.J.B.	REPORT 12583
DATE JAN.'84	PLAN No SAo 2597

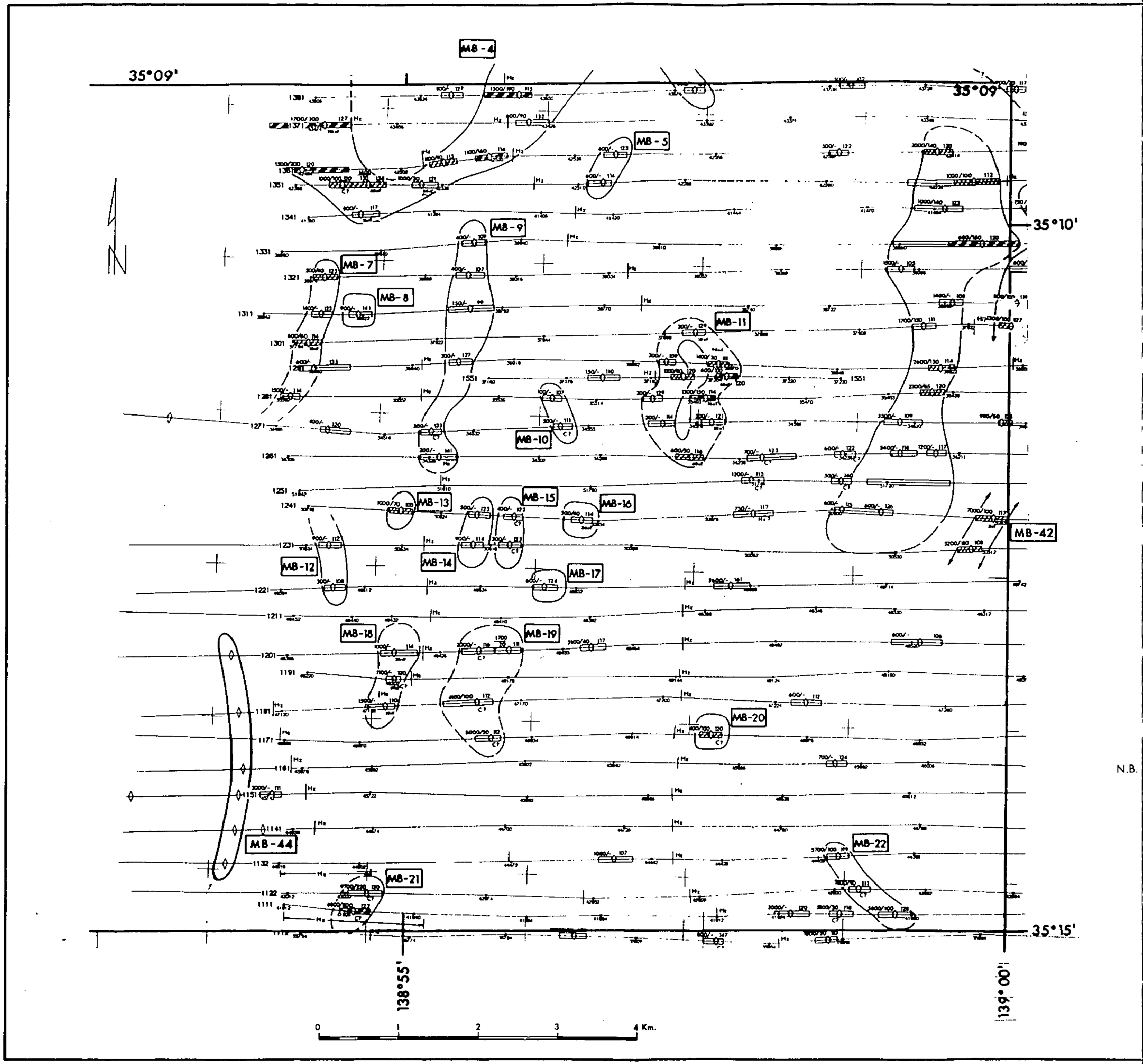
000374



SULPHIDES OCCUR MAINLY ON FRACTURE PLANES; FROM MAGNETICS AND E.M. DATA THESE ARE INTERPRETED TO DIP STEEPLY WEST.

CRA EXPLORATION PTY LIMITED	
BULL CREEK E.L.1008 DRILL HOLE CROSS-SECTION 83 WCP 4	
REF. BARKER SI 5413	
SCALE 1:1000	
AUTHOR G.J.B.	REPORT 12583
DATE JAN.'84	PLAN No SAa2598

000375



AIRBORNE SURVEY SPECIFICATIONS

EM SYSTEM :	INPUT MARK V/12 Channel centres 300, 400, 500, 600, 700, 800, 950, 1100, 1300, 1500, 1800 and 2100 microseconds after transmitter turn off
RECORDING INTERVAL :	0.2 sec (approx 13 metres at 220 kph)
MAGNETOMETER :	Geometrics G-803, sensitivity 1.0 nT
RECORDING INTERVAL :	1.0 sec (approx 60 metres at 220 kph)
DATA RECORDING :	Geoterrex MADACS acquisition system. Digital to magnetic tape.
NOMINAL TERRAIN CLEARANCE :	Magnetometer sensor in aircraft at 120 m EM transmitter in aircraft at 120 m EM receiver in towed bird at 40 m
NOMINAL LINE SPACING :	Traverse lines 400 metres No Tie lines
FLIGHT PATH RECORD :	Geocam 35mm continuous tracking camera.
FLIGHT LINE RECOVERY :	Visually to 1:25,000 black & white enlargements of high level photography

EM ANOMALY MAP

Reference Barker SI 54-13
Digitised from 1:25,000 black & white enlargements of high level photography

INTERPRETATION LEGEND

MB-5	Selected conductor zone
◊	Anomaly peak position (possible "vertical" conductor)
	Offset magnetic anomaly
2000/100	Channel 4 / channel 11 amplitudes (in ppm)
123	Terrain clearance (metres)
C?	Cultural anomaly
Hz	Powerline response
	Very low CTP - CTP < 8 Siemens (vertical model) < 3 Siemens (horizontal thin sheet)
	Low CTP - 8 < CTP < 14 Siemens (vertical) 3 < CTP < 6 Siemens (horizontal)
	Moderate CTP - 14 < CTP < 40 Siemens (vertical) 6 < CTP < 8 Siemens (horizontal)
	High CTP - CTP > 40 Siemens (vertical) CTP > 8 Siemens (horizontal)
	"Half-space" - CTP > ~30 Siemens (horizontal) (where horizontal thin sheet response enters region of very high time constant)

N.B. NO ALTITUDE CORRECTION HAS BEEN USED DURING MANUAL ESTIMATION OF THE ABOVE CTP RANGES

N.B. All INPUT Anomalies prefixed by 'In'

JOB NO : 83-551
Flown by GEOTERREX PTY LTD : OCTOBER 1983
Compiled by Geoterrex Pty Ltd., Sydney, NSW.

CRA EXPLORATION PTY LIMITED

BULL CREEK E.L. 1008 - S.A.
INPUT Anomaly Map

REF	BARKER SI 54-13		
SCALE	1 : 50000		
AUTHOR	R.L. / P.L.	REPORT	12583
DATE	March '84	PLAN No	SAa 2692

000376

IV

000377

CRA EXPLORATION PTY. LIMITED

EIGHTH QUARTERLY REPORT FOR BULL CREEK E.L. 1008, SOUTH AUSTRALIA, FOR THE PERIOD ENDING 6TH JUNE, 1984

AUTHOR: R.J.L. LANE

COPIES TO: CRAE LIBRARY
S.A.D.M.E.

DATE: 16TH MAY, 1984

SUBMITTED BY: R J L Lane

ACCEPTED BY: [signature]

12635

000378

CONTENTS

1. SUMMARY

Landowner contact commenced prior to the proposed soil geochemistry/magnetometer traverses to be carried out over INPUT anomalies INMB4, INMB7, INMB8 and INMB9. All anomalies identified as being due to cultural sources are currently being checked to confirm this interpretation.

Zonge Engineering and Research Organisation carried out two CSAMT surveys totalling 1750 m and one 700 m TEM survey over the Woodchester Prospect. These three surveys were carried out as tests of Zonge equipment. They yielded, however, valuable data about the nature of the conductors tested by previous exploration, including drilling, on the prospect.

2. INTRODUCTION

Bull Creek E.L. 1008 (formerly E.L. 612) covers an area of 469 square kilometres centred approximately 35 kilometres south south-east of Adelaide (Plan SAa 303). The licence was granted to CRA Exploration Pty. Limited as E.L. 612 on the 21st of March, 1980. A coincident area excluding the Mount Monster Mine was granted as E.L. 1008 on the 7th June, 1982. The term of the licence was extended to 24 months on the 7th June, 1983.

This report describes the work carried out during the quarter ending 7th June, 1984.

3. RECOMMENDATIONS

(1) Ground checking by a combination of geochemistry and ground magnetometer traverses continue as planned over the INPUT anomalies identified in the previous report by P. Lewis (1984).

(2) The drilling of at least one deep (500 m) percussion/diamond drill hole to test the main part of the conductor at Woodchester. Previous drilling at this prospect has tested only the uppermost expression of the conductive zone over a 500 m strike length, as well as an additional, secondary conductive zone off to one side.

Although geochemical assay results from holes 81WCP1, 81WCP2, 83WCP3 were not high, downhole SIROTEM, and the more recent CSAMT, have confirmed that the previous drilling intersected only the edge of the conductive zone, and that the major conductor remains untested.

4. SUMMARY OF PREVIOUS WORK

Previous work carried out by CRA Exploration in Bull Creek E.L. 1008 (formerly E.L. 612) is summarised below.

Geochemistry
- 215 -10#+20# stream sediment samples; analysed for Cu, Pb, Zn, most for Fe, Sn, W, U and Au.
- 217 drill core/cuttings samples; analysed for Cu, Pb, Zn, Ag, some for Co, Ni, Fe, Mn, Cr, Bi, Mo, As, Sn, W, Sb, U and Au; 6 petrographic descriptions.
- 2 rock chip samples; analysed for Cu, Pb, Zn, Ag, Fe, Au, Sn and W.

Geophysics
- aeromagnetic/radiometric survey; 300 metre line spacing, flown E-W at 80 metre mean terrain clearance.
- 35.5 line kilometres of ground magentics.
- 37.6 line kilometres of ground E.M.
- 5.5 line kilometres of ground I.P.
- 4.9 line kilometres of ground S.P.
- airborne E.M. survey over 96 km^2; 400 metre line spacing, flown E-W.

Drilling
- 5 percussion drill holes for a total of 704 metres.

Geology
- Geological mapping of the Strathalbyn and Woodchester Grid areas, at 1:5 000.

5. CURRENT EXPLORATION

5.1 CSAMT and TEM Surveys

A CSAMT survey was carried out by Zonge Engineering and Research Organisation (ZERO) at the Woodchester Prospect. Readings were taken at 25 m intervals along line 600N from 500E to 1200E and line 400N from 200E to 1250E (Plan SAa 1074). ZERO also carried out a TEM survey along line 600N from 500E to 1200E. To facilitate comparisons with the SIROTEM survey carried out along this line (Bubner, 1982), the same transmitter loop position as the SIROTEM survey was used (Plan SAa 1074).

A formal interpretation of the ZERO data, including a full presentation of the data, is being prepared for the next quarterly report, as all the data is not currently available.

See Envelope 6188.

R J L Lane

R.J.L. LANE

RJLL/dp

EXPENDITURE

Expenditure for the period ended 31st May 1984, the nearest accounting period was $10,912.00, as listed below.

Payroll	$ 4,348
Supplies	1,181
Vehicle	83
Travel	158
Property	1,318
Tenements	242
Contractors	389
Laboratory	1,186
Overheads	2,007
TOTAL	$ 10,912

REFERENCES

BUBNER, G.J. 1982 — First Quarterly Report for Bull Creek E.L. 1008, South Australia, for the Period Ending 6th September, 1982. CRAE Report No. 11670.

LEWIS, P. 1984 — Seventh Quarterly Report for Bull Creek E.L. 1008, South Australia, for the Period Ending 6th June, 1984. CRAE Report No. 12583.

LOCATION

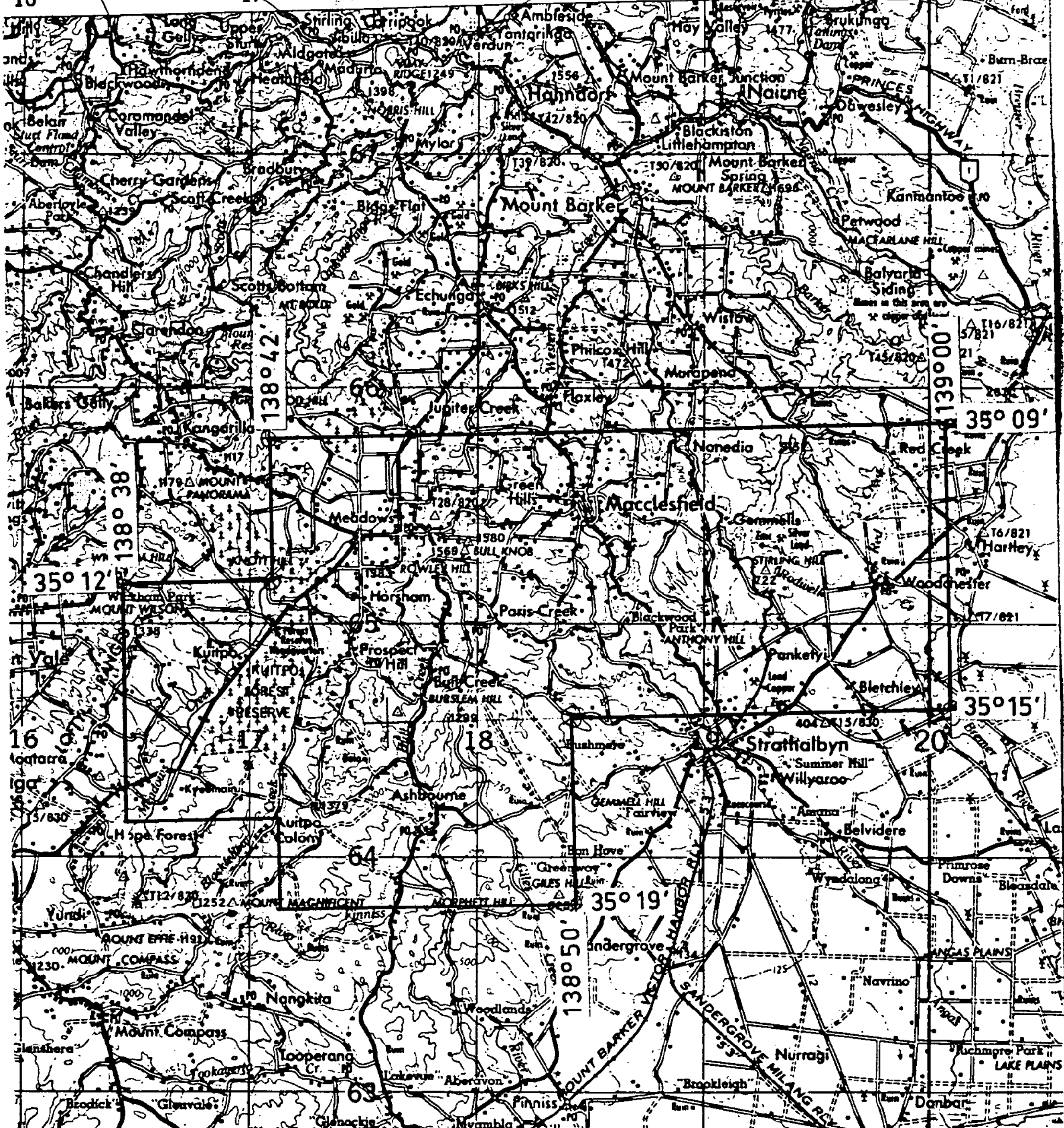
Barker SI 54-13 1:250 000 sheet

KEYWORDS

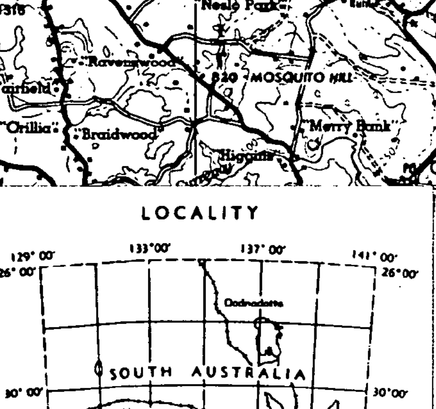
Geophys-E.M., Geophys-CSAMT.

LIST OF PLANS

Plan No.	Title	Scale
SAa 303	Bull Creek E.L. 1008 Location Plan	1:250 000
SAa 1074	Bull Creek E.L. 1008 Woodchester Grid	1: 5 000



0 5 10 15 km.



C.R.A. EXPLORATION PTY. LIMITED.

BULL CREEK, E.L.1008

LOCATION MAP

1:250,000 Sheet Ref.: BARKER SI54-13.

Geol.: K.J.W.	Date: 24-9-79	Drawn: D.R.W.
Report Nº: 12635	Scale 1:250,000	Plan Nº: SAa303

IV

000385

CRA EXPLORATION PTY. LIMITED

NINTH QUARTERLY REPORT FOR BULL CREEK E.L. 1008, SOUTH AUSTRALIA, FOR THE PERIOD ENDING 6TH SEPTEMBER, 1984

AUTHOR: P. LEWIS

COPIES TO: CIS CANBERRA
SADME

DATE: 1ST NOVEMBER, 1984

SUBMITTED BY: Paul Lewis

ACCEPTED BY: [signature]

000386

CONTENTS

1.0 SUMMARY

Ground recovery of INPUT anomalies InMB4, InMB7, InMB8 and InMB9 commenced. To date InMB7 has been sampled and ground magnetics have been read.

All data will be presented at the end of the programme.

2.0 INTRODUCTION

Bull Creek E.L. 1008 (formerly E.L. 612) covers an area of 469 square kilometres centred approximately 35 kilometres south-south-east of Adelaide (Plan SAa 303). The licence was granted to CRA Exploration Pty. Limited as E.L. 612 on the 21st March, 1980. A coincident area excluding the Mount Monster Mine was granted as E.L. 1008 on the 7th June, 1982. The term of the licence was extended to 36 months on the 7th June, 1984.

This report describes the work carried out during the quarter ending 6th September, 1984.

3.0 RECOMMENDATIONS

Ground checking by a combination of geochemistry and ground magnetometer traverses continue as planned over the INPUT anomalies identified in the previous report by R.J.L. Lane (1984).

4.0 SUMMARY OF PREVIOUS WORK

Previous work carried out by CRA Exploration Pty. Limited in Bull Creek E.L. 1008 (formerly E.L. 612) is summarised below.

Geochemistry
- 215 -10#+20# stream sediment samples; analysed for Cu, Pb, Zn, most for Fe, Sn, W, U and Au
- 217 drill core/cuttings samples; analysed for Cu, Pb, Zn, Ag, some for Co, Ni, Fe, Mn, Cr, Bi, Mo, As, Sn, W, Sb, U and Au; 6 petrographic descriptions
- 2 rock chip samples; analysed for Cu, Pb, Zn, Ag, Fe, Au, Sn and W

Geophysics
- aeromagnetic/radiometric survey; 300 metre line spacing, flown E-W at 80 metre mean terrain clearance
- 35.5 line kilometres of ground magnetics

000388

- 37.6 line kilometres of ground E.M.
- 5.5 line kilometres of ground I.P.
- 4.9 line kilometres of ground S.P.
- airborne E.M. survey over 96 square km; 400 metre line spacing, flown E-W

Drilling - 5 percussion drill holes for a total of 704 metres

Geology - Geological mapping of the Strathalbyn and Woodchester Grid areas, at 1:5000

5.0 CURRENT EXPLORATION

Ground recovery of INPUT anomalies identified in the previous report is continuing. All results will be presented at the end of the programme. The location of this work is shown on Plan SAa 2692.

P. Lewis

P. LEWIS

PL/pw

000389

EXPENDITURE

Expenditure for the period ended 30th September, 1984, the nearest accounting period was $7732.00, as listed below.

	$
Payroll	2647
Supplies	592
Vehicle	1521
Travel	16
Property	987
Tenements	798
Contractors	284
Overheads	887
Total	$7732

000390

REFERENCES

Lane, R. J. L. 1984 — Eighth Quarterly Report for Bull Creek E. L. 1008, South Australia, For The Period Ending 6th June, 1984. CRAE Report No. 12635.

LOCATION

Barker SI 54-13 1:250 000 sheet

KEYWORDS

Geochem

LIST OF PLANS

Plan No.	Title	Scale
SAa 303	Bull Creek E. L. 1008 Location Plan	1:250 000
SAa 2692	Bull Creek E. L. 1008 - S. A. INPUT Anomaly Map	1: 50 000

IV

000391

CRA EXPLORATION PTY. LIMITED

TENTH QUARTERLY REPORT FOR BULL CREEK E.L. 1008, SOUTH AUSTRALIA, FOR THE PERIOD ENDING 6TH DECEMBER, 1984.

AUTHOR:	P. LEWIS
COPIES TO:	CIS CANBERRA SADME
DATE:	16TH JANUARY, 1985
SUBMITTED BY:	R.J.L. Lane
ACCEPTED BY:	[signature]

13068

CONTENTS

1. SUMMARY

Bedrock geochemical data has been acquired over INPUT anomalies InMB7, InMB8 and InMB44. Anomalous lead (max. 880 ppm), zinc (510 ppm) and copper (840 ppm) assays were returned from iron stained quartz-sericite schist and silicified siltstone units which outcrop within the anomalies. These units are interpreted to be the source of the INPUT anomalies. No further work is warranted on anomalies InMB8 or InMB44. Further work on anomaly InMB7 is dependent on gaining access to the area.

2. INTRODUCTION

Bull Creek E.L. 1008 (formerly E.L. 612) covers an area of 469 square kilometres centred approximately 35 kilometres south-south-east of Adelaide (plan SAa 303). The licence was granted to CRA Exploration Pty. Limited as E.L. 612 on the 21st March, 1980. A coincident area excluding the Mount Monster Mine was granted as E.L. 1008 on the 7th June, 1982. The term of the licence was extended to 36 months on the 7th June, 1984.

This report describes the work carried out during the quarter ending 6th December, 1984.

3. RECOMMENDATIONS

a. The zone of anomalous copper geochemistry at the northern end of InMB7 be followed up.

b. No further work be undertaken on anomalies InMB8 and InMB44.

4. SUMMARY OF PREVIOUS WORK

Previous work carried out by CRA Exploration Pty. Limited in Bull Creek E.L. 1008 (formerly E.L. 612) is summarised below.

Geochemistry - 215 -10#+20# stream sediment samples; analysed for Cu, Pb, Zn, most for Fe, Sn, W, U and Au

- 217 drill core/cuttings samples; analysed for Cu, Pb, Zn, Ag, some for Co, Ni, Fe, Mn, Cr, Bi, Mo, As, Sn, W, Sb, U and Au; 6 petrographic descriptions

- 2 rock chip samples; analysed for Cu, Pb, Zn, Ag, Fe, Au, Sn and W

Geophysics

- aeromagnetic/radiometric survey; 300 metre line spacing, flown E-W at 80 metre mean terrain clearance

- 35.5 line kilometres of ground magnetics

- 37.6 line kilometres of ground E.M.

- 5.5 line kilometres of ground I.P.

- 4.9 line kilometres of ground S.P.

- airborne E.M. survey over 96 square km; 400 metre line spacing, flown E-W

Drilling

- 5 percussion drill holes for a total of 704 metres

Geology

- Geological mapping of the Strathalbyn and Woodchester Grid areas, at 1:5000

5. CURRENT EXPLORATION

5.1 Soil Sampling

A programme of 'C' horizon soil/rock chip traverses was completed over parts of INPUT anomalies InMB7 and InMB44. Soil traverses were orientated across strike with a line spacing of 500 metres and a sample spacing of 25 metres. Access to the northern part of InMB7 was denied and much of InMB44 is covered by alluvium.

Approximate 1 kg unsieved samples of weathered bedrock were collected using a hand auger. In areas of outcrop, composite rock chip samples were collected over an area of approximately 9 square metres. A total of 120 samples (92 soil, 28 rock chip) were collected along five traverses across the two anomalies. The location of the airborne anomalies and soil traverses are shown on plans SAa 3046 and SAa 3048.

All samples were analysed by AMDEL for copper, lead, zinc, manganese and silver by I.C.P., tin and tungsten by X.R.F. and gold by A.A.S. techniques. Sample ledgers and full assay results are presented in Appendix I. Copper, lead and zinc geochemical profiles along the traverses are shown on plans SAa 3047 and SAa 3049.

5.1.1 Previous Soil Sampling

A regional soil sampling programme (using a 500 metre line spacing and 25 metre sample interval) was completed by CRA Exploration over all mapped pyritic units within the Bull Creek licence area during 1977-78. Seven traverses were made over pyritic units in the vicinity of InMB7 and InMB8 (plan SAa 3046). Copper, lead and zinc geochemical profiles along these traverses are included on plan SAa 3047.

5.1.2 Discussion of Results

InMB7

Anomalous lead (max. 880 ppm), copper (max. 840 ppm) and elevated zinc (max. 200 ppm) assays were returned from rock samples of a silicified, iron stained siltstone (Nairne Pyrite Member) which crops out along the western side of the anomaly. Minor pyrite (to 2%) is visible in some samples. The anomalous copper assay was returned from line 3N. Overall the copper assays increase towards the northern end of the anomaly. Access to the northernmost line (4N) was denied. A stream sediment copper anomaly (220 ppm) returned in a creek off the northern end of the anomaly is probably due to the anomalous copper geochemistry associated with this pyrite horizon (plan SAa 3046). Further work on this zone would be dependent on gaining access to the area. The anomalous lead geochemistry associated with this horizon is similar to that returned from the Nairne Pyrite Member elsewhere in the Kanmantoo Trough. No further follow up on the southern part of this anomaly is warranted.

InMB44

Soil samples were only collected along two lines across this anomaly due to the presence of at least 2 m of alluvial sediments over most of the anomaly. In addition older ?Tertiary ferruginous clayey sands (inverted drainage) occur on the top of the ridge traversed by line 4N.

Weakly anomalous lead (max. 700 ppm), zinc (510 ppm) and copper (260 ppm) assays were returned from samples of bleached iron stained sericitic schist, which outcrops in the southern bank of a dam south of line 6N. The anomalous geochemistry is associated with a ground magnetic anomaly at the northern end of the anomaly. The results of drilling coincident E.M. and magnetic anomalies on the adjacent Milang E.L. 964 intersected pyrrhotitic sericite-chlorite-biotite schists.

The southern end of this anomaly remains untested but is considered to be caused by cultural features. No further work is warranted on this anomaly.

InMB8

The results of the earlier regional soil and stream sediment sampling programmes adequately tested this anomaly. Weakly anomalous lead (max. 550 ppm) and elevated zinc (210 ppm) assays were returned from a pyritic unit along strike to the south of InMB8. Elevated lead (max. 230 ppm) assays were returned from the traverse at the northern end of the anomaly (plan SAa 3047). Stream sediment assays from a creek draining the anomaly were low. No further work is warranted on the anomaly (plan SAa 3046).

5.2 Ground Magnetics

Ground magnetic data was acquired at 10 metre intervals along all traverses across InMB7 and InMB44. The data was acquired using a Scintrex MP-2 magnetometer. Diurnal variations were monitored by reference to a base station. Ground magnetic profiles are shown on plans SAa 3047 and SAa 3049.

R.J.L. Lane
for
P. LEWIS

PL/pw

EXPENDITURE

Expenditure for the period ended 30th November, 1984, the nearest accounting period was $ 87.00, as listed below.

		$
Payroll		316
Supplies		3
Vehicle		23
Travel		6
Contractors		211
Laboratory		(573)
Overheads		101
	Total	$ 87

LOCATION

Barker SI 54-13 1:250 000 sheet

KEYWORDS

Assays-surf., Copper, Lead, Zinc, Silver, Gold, Tin, Tungsten, Manganese, Geophys.-mag.

LIST OF PLANS

Plan No.	Title	Scale
SAa 303	Bull Creek E.L. 1008 Location Plan	1:250 000
SAa 3046	Bull Creek E.L. 1008, S.A., INPUT Anomalies InMB7, InMB8 Showing Position of Airborne Anomalies and Soil Traverses	1: 5 000
SAa 3047	Bull Creek E.L. 1008, S.A., InMB7, InMB8 Soil Geochemistry, Copper, Lead, Zinc Profiles with Ground Magnetic Profiles	1: 5 000
SAa 3048	Bull Creek E.L. 1008, S.A., INPUT Anomaly InMB44 Showing Position of Airborne Anomalies with Soil and Ground Magnetic Traverses	1: 5 000
SAa 3049	Bull Creek E.L. 1008, S.A., InMB44 Soil Geochemistry; Copper, Lead, Zinc Profiles with Ground Magnetic Profiles	1: 5 000

LIST OF APPENDICES

Appendix I Sample Ledgers and Assay Results InMB7 and InMB44

APPENDIX I

SAMPLE LEDGERS AND ASSAYS RESULTS InMB7 AND InMB44

000400

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GEOCHEMICAL SOIL SAMPLING LEDGER

TENEMENT: BULL CREEK EL 1008

AREA/PROSPECT: Jn MB - 7

SAMPLE Nos.: 1162060 - 080

PLAN REFERENCE: SAa 3046, SAa 3047

D.P.O. No.:

GEOLOGIST: P.L.

DATE: 15-8-84

ANALYSED BY: AMDEL

A 9006

Grid Co-ordinate LINE IN	Sample No.	Soil Composition: Rock %	Organic %	Sand %	Silt %	Clay %	Soil Horizon	Sample: Depth cm.	Colour	Bedrock: Outcrop	Con-cealed	Est. Depth to	Metal Content in ppm.: Pb	Zn	Cu	Ag			Geological observations
10000E	1162060	100	–	–	–	–	–	–	PK-GY-BN	SUB X		–	–	56	9	–			Q-F-M META SANDSTONE: F GN, MIN LIM STNG ON JOINTS & FRACTURES
9975	061	100	–	–	–	–	–	–	GY-BN	SUB X		–	–	58	7	–			Q-F-M SCHIST; F-MGN, I/B WITH ABOVE, MIN LIM STNG
9950	062	20	–	10	60	10	C	30	BN OR-RD-GY	SUB X		15	10	35	10	–			Q-M SCHIST; F-M GN, FERRUGINOUS, RARE LIM VNS, LIM STNG COMMON
9925	063	30	–	10	55	5	C	40	BN OR-RD-GY	SUB X		5	10	32	9	–			Q-M SCHIST; F. GN, LIM STNG COMMON ON FRACTURES
9900	064	70	–	–	25	5	C	20	BN Y-OR-BN	SUB X		5	–	54	10	–			AS ABOVE, MIN LIM STNG, INDURATED IN PART
9875	065	15	–	10	55	20	C	40	BN RD-OR-BN		X	15	12	41	33	–			Q-F-M SCHIST, F GN, SILTY, FERR/FELDSP CLAYS
9850	066	–	–	20	60	20	C	45	BN OR-Y-RD-BN		X	15	24	40	12	–			SILT; F GN, CLAYEY, FINE MICAS, ?FERRUGINOUS.
9825	067	100	–	–	–	–	–	–	GY-PK	X		-	6	52	13	–			Q-F-M META S/S; F-M GN, MIN LIM ON JOINTS & FRACT.
9800	068	100	–	–	–	–	–	–	RD-GY	X		–	–	70	8	–			Q-F-M META S/S; AS ABOVE
9775	069	40	–	–	55	5	C	15	BN Y-GY-BN		X	5	24	130	36	–			Q-F-M SCHIST; F GN, SILTY, MIN LIM STNG.
9750	070	–	–	–	70	30	C	60	GY OR		X	40	10	24	10	–			SILT; CLAYEY, MOTTLED, WEAKLY LAYERED ?FERRUG.
9725	071	–	–	–	60	40	C	60	GY OR-Y-BN		X	30	12	40	15	–			CLAY; SILTY, FINE MICA, MOTTLED
9700	072	–	–	20	50	30	C	45	BLK OR-Y-RD		X	20	14	38	22	–			AS ABOVE
9675	073	–	–	10	30	60	C	55	GY OR-Y-RD		X	25	16	50	20	–			AS ABOVE
9650	074	–	–	–	30	70	C	55	GY-PN RD-OR-Y-BN		X	30	24	48	28	–			AS ABOVE
9625	075	–	–	20	70	10	B/C	30	GY BN-GY		X	30	–	16	6	–			SILT; F GN, MICACEOUS, FRAGS OF INDURATED SCHIST
9600	076	–	–	10	60	30	C	50	GY RD-OR-Y-GY		X	35	10	52	23	–			SILT; CLAYEY, MICACEOUS, MOTTLED, ?FERRUG.
9575	077	–	–	10	50	40	C	50	GY OR-Y-GY		X	30	12	31	27	–			AS ABOVE
9550	078	–	–	10	55	35	C	50	GY OR-Y-GY-BN		X	30	8	33	26	–			AS ABOVE RARE Q-F-M SCHIST FRAGS
9525	079	20	–	20	50	10	C	35	GY-BN OR-RD-BN	SUB X		15	–	33	10	–			AS ABOVE
9500	080	–	–	20	50	30	C	60	GY-BN OR-RD-BN		X	30	8	32	22	–			AS ABOVE.

Page No. 1/1

GEOCHEMICAL SOIL SAMPLING LEDGER

TENEMENT BULL CREEK EL 1008

AREA/PROSPECT Jn MB - 7 SAMPLE Nos. 1162060 - 080

PLAN REFERENCE SAa 3046, SAa 3047

A 9006

D.P.O. No.

GEOLOGIST P.L. DATE 15-8-84

ANALYSED BY AMDEL

Grid Co-ordinate LINE IN	Sample No.	Soil Composition					Soil Horizon	Sample		Bedrock			Metal Content in ppm.						Geological observations
		Rock %	Organic %	Sand %	Silt %	Clay %		Depth cm.	Colour	Outcrop	Concealed	Est. Depth to	Pb	Zn	Mn	Au	Sn	W	
10000E	1162060	100	–	–	–	–	–	–	PK-GY-BN	SUB X		–			450	–	–	10	Q-F-M META SANDSTONE; F GN, MIN LIM STNG ON JOINTS & FRACTURES
9975	061	100	–	–	–	–	–	–	GY-BN	SUB X		–			510	–	–	–	Q-F-M SCHIST; F-M GN, 1/3 WITH ABOVE, MIN LIM STNG STNG COMMON
9950	062	20	–	10	60	10	C	30	BN OR-RD-GY	SUB X		15			260	–	–	–	Q-M SCHIST; F-M GN, FERRUGINOUS, RARE LIM VNS, LIM
9925	063	30	–	10	55	5	C	40	BN OR-RD-GY	SUB X		5			295	–	–	–	Q-M SCHIST; F. GN, LIM STNG COMMON ON FRACTURES
9900	064	70	–	–	25	5	C	20	BN Y-OR-BN	SUB X		5			495	–	4	10	AS ABOVE, MIN LIM STNG, INDURATED IN PART
9875	065	15	–	10	55	20	C	40	BN RD-OR-BN		X	15			200	–	–	–	Q-F-M SCHIST, F GN, SILTY, FERR/FELDSP CLAYS
9850	066	–	–	20	60	20	C	45	BN OR-Y-RD-BN		X	15			240	–	–	–	SILT; F GN, CLAYEY, FINE MICAS, ?FERRUGINOUS.
9825	067	100	–	–	–	–	–	–	GY-PK	X		–			410	–	–	–	Q-F-M META S/S; F-M GN, MIN LIM ON JOINTS & FRACT.
9800	068	100	–	–	–	–	–	–	RD-GY	X		–			455	–	–	15	Q-F-M META S/S; AS ABOVE
9775	069	40	–	–	55	5	C	15	BN Y-GY-BN		X	5			450	–	8	–	Q-F-M SCHIST; F GN, SILTY, MIN LIM STNG.
9750	070	–	–	–	70	30	C	60	GY OR		X	40			130	–	–	–	SILT; CLAYEY, MOTTLED, WEAKLY LAYERED ?FERRUG.
9725	071	–	–	–	60	40	C	60	GY OR-Y-BN		X	30			185	–	–	–	CLAY; SILTY, FINE MICA, MOTTLED
9700	072	–	–	20	50	30	C	45	BLK OR-Y-RD		X	20			205	–	10	–	AS ABOVE
9675	073	–	–	10	30	60	C	55	GY OR-Y-RD		X	25			220	–	–	–	AS ABOVE
9650	074	–	–	–	30	70	C	55	GY-PN RD-OR-Y-BN		X	30			235	–	10	–	AS ABOVE
9625	075	–	–	20	70	10	B/C	30	GY BN-GY		X	30			175	–	–	–	SILT; F GN, MICACEOUS, FRAGS OF INDURATED SCHIST
9600	076	–	–	10	60	30	C	50	GY RD-OR-Y-GY		X	35			275	–	–	–	SILT; CLAYEY, MICACEOUS, MOTTLED, ?FERRUG.
9575	077	–	–	10	50	40	C	50	GY OR-Y-GY		X	30			230	–	–	–	AS ABOVE
9550	078	–	–	10	55	35	C	50	GY OR-Y-GY-BN		X	30			235	–	8	–	AS ABOVE RARE Q-F-M SCHIST FRAGS
9525	079	20	–	20	50	10	C	35	GY-BN OR-RD-BN	SUB X		15			255	–	–	–	AS ABOVE
9500	080	–	–	20	50	30	C	60	GY-BN OR-RD-BN		X	30			190	–	–	–	AS ABOVE

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GEOCHEMICAL SOIL SAMPLING LEDGER

TENEMENT BULL CREEK E.L. 1008

AREA/PROSPECT JAMB 7 SAMPLE Nos. 1162035 - 059

PLAN REFERENCE SAa 3046, 3047

D.P.O. No.

GEOLOGIST PL DATE 14-8-84

ANALYSED BY AMDEL

A 9006

Grid Co-ordinate LINE 2N	Sample No.	Soil Composition					Soil Horizon	Sample		Bedrock			Metal Content in ppm.						Geological observations
		Rock %	Organic %	Sand %	Silt %	Clay %		Depth cm.	Colour	Outcrop	Con-cealed	Est. Depth to	Pb	Zn	Cu	Ag			
10000E	1162035	35	–	–	40	25	C	40	RD-Y-BN	SUB X		–	145	105	48	–			Q-F-M SCHIST; JAROSITIC VOIDS, LAYERED NAMNG P? HEM
9975	036	100	–	–	–	–	–	–	GY, GY-BN	X		–	14	45	9	–			Q-F-M SCHIST; F-M GN, FELDSPATHIC MIN LIM STNG
9950	037	100	–	–	–	–	–	–	GY, GY-BN	X		–	8	44	11	–			AS ABOVE I/B QTZITIC SCHIST, MIN LIM STNG
9925	038	100	–	–	–	–	–	–	GY-BN	X		–	8	46	9	–			AS ABOVE
9900	039	100	–	–	–	–	–	–	GY, GY-BN	X		–	–	56	9	–			Q-M SCHIST; I/B MICA SCHIST, THINLY BEDDED
9875	040	–	–	–	30	70	C	50	GY RD-OR-BN		X	25	30	60	21	–			CLAY; SILTY, MICACEOUS, FERRUG/FELDSPATHIC,
9850	041	–	–	–	20	80	C	65	GY DR-Y-RD-BN		X	25	28	54	23	–			CLAY; AS ABOVE MOTTLED
9825	042	10	–	20	40	30	C	40	GY Y-GY-BN		X	15	18	56	17	–			SILT; CLAYEY, MICACEOUS, SANDY, WTHD Q-F-M SCH.
9800	043	–	–	20	60	20	C	55	HUMUS Y-OR-BN		X	20	18	47	30	–			AS ABOVE, SLIGHTLY FERRUGINOUS
9775	044	–	–	–	65	35	C	60	GY DR-Y-RD-BN		X	30	26	82	33	–			AS ABOVE
9750	045	10	–	–	40	50	C	65	GY DR-RD-Y-BN		X	30	20	47	31	–			AS ABOVE, FRAGS OF MICA SCHIST
9725	046	100	–	–	–	–	–	–	GY-PK	SUB X		–	–	52	6	–			Q-F-B META S/S, F-M GN, MIN LIM STNG.
9700	047	–	–	–	40	60	C	65	HUMUS DR-Y-BN		X	30	18	44	19	–			CLAY; SILTY, F. GN, MOTTLED, FERRUG, WKLY LAYERED.
9675	048	5	10	–	45	40	C	60	HUMUS DR-RD-BN		X	30	18	41	12	–			AS ABOVE
9650	049	100	–	–	–	–	–	–	PK-GY	SUB X		–	–	52	3	–			Q-F-B SCHIST; F-M GN, SANDY, RARE LIM & HEM STNG.
9625	050	10	–	–	70	20	C	40	HUMUS GY-BN-OR	SUB X		10	12	30	4	–			Q-F SCHIST; SILTY, F. GN, CLAYEY, FERRUGINOUS
9600	051	100	–	–	–	–	–	–	PK-GY	X		–	6	50	–	–			Q-F META S/S; F-M GN, RARE LIM STNG.
9575	052	–	–	–	50	50	C	60	HUMUS DR-Y-W-RD		X	15	44	40	28	–			CLAY; SILTY, MICACEOUS, FERRUGINOUS, F GN
9550	053	10	–	–	40	50	C	65	HUMUS DR-Y-RD-BN		X	15	30	60	54	–			AS ABOVE
9525	054	15	–	10	50	25	C	50	HUMUS Y-OR-RD-BN		X	25	18	41	19	–			AS ABOVE, WTHD Q-F-M SCHIST
9500	055	100	–	–	–	–	–	–	PK-GY	SUB X		–	160	58	15	–			Q-F-M S/S; F-M GN, SILICEOUS, MIN LIM STNG.

GEOCHEMICAL SOIL SAMPLING LEDGER

Page No. 1/2

TENEMENT: BULL CREEK E.L. 1008

AREA/PROSPECT: JAMB 7

SAMPLE Nos. 1162035 - 059

PLAN REFERENCE: SAo 3046, SAo 3047

D.P.O. No.

GEOLOGIST: PL

DATE: 14-8-84

ANALYSED BY: AMDEL

A 9006

Grid Co-ordinate	Sample No.	Soil Composition					Soil Horizon	Sample		Bedrock			Metal Content in ppm.						Geological observations
LINE 2N		Rock %	Organic %	Sand %	Silt %	Clay %		Depth cm.	Colour	Outcrop	Con-cealed	Est. Depth to	Pb	Zn	Mn	Au	Sn	W	
10000E	1162035	35	–	–	40	25	C	40	RD-Y-BN	SUB X		–			255	–	–	–	Q-F-M SCHIST; JAROSITIC VOIDS, LAYERED HAMNE PY ME.
9975	036	100	–	–	–	–	–	–	GY, GY-BN	X		–			490	–	–	–	Q-F-M SCHIST; F-M GN, FELDSPATHIC MIN LIM STNG
9950	037	100	–	–	–	–	–	–	GY, GY-BN	X		–			415	–	–	–	AS ABOVE I/B QTZITIC SCHIST, MIN. LIM STNG
9925	038	100	–	–	–	–	–	–	GY-BN	X		–			465	–	–	–	AS ABOVE
9900	039	100	–	–	–	–	–	–	GY GY-BN	X		–			485	–	–	–	Q-M SCHIST; I/B MICA SCHIST, THINLY BEDDED
9875	040	–	–	–	30	70	C	50	GY RD-OR-BN		X	25			220	–	4	–	CLAY; SILTY, MICACEOUS, FERRUG/FELDSPATHIC,
9850	041	–	–	–	20	80	C	65	GY OR-Y-RD-BN		X	25			225	–	8	–	CLAY; AS ABOVE MOTTLED
9825	042	10	–	20	40	30	C	40	GY Y-GY-BN		X	15			270	–	–	–	SILT; CLAYEY, MICACEOUS, SANDY, WTHD Q-F-M SCH.
9800	043	–	–	20	60	20	C	55	HUMUS Y-OR-BN		X	20			200	–	–	–	AS ABOVE, SLIGHTLY FERRUGINOUS
9775	044	–	–	–	65	35	C	60	GY OR-Y-RD-BN		X	30			280	–	8	–	AS ABOVE
9750	045	10	–	–	40	50	C	65	GY OR-RD-Y-BN		X	30			205	–	10	10	AS ABOVE, FRAGS OF MICA SCHIST
9725	046	100	–	–	–	–	–	–	GY-PK	SUB X		–			475	–	–	10	Q-F-B META S/S, F-MGN, MIN LIM STNG.
9700	047	–	–	–	40	60	C	65	HUMUS OR-Y-BN		X	30			210	–	6	10	CLAY; SILTY, F.GN, MOTTLED, FERRUG, WKLY LAYERED.
9675	048	5	10	–	45	40	C	60	HUMUS OR-RD-BN		X	30			270	–	–	–	AS ABOVE
9650	049	100	–	–	–	–	–	–	PK-GY	SUB X		–			440	–	–	–	Q-F-B SCHIST; F-MGN, SANDY, RARE LIM & HEM STNG.
9625	050	10	–	–	70	20	C	40	HUMUS GY-BN-PK	SUB X		10			300	–	–	10	Q-F SCHIST; SILTY, F.GN, CLAYEY, FERRUGINOUS
9600	051	100	–	–	–	–	–	–	PK-GY	X		–			365	–	–	–	Q-F META S/S; F-MGN, RARE LIM STNG.
9675	052	–	–	–	50	50	C	60	HUMUS OR-Y-W-RD		X	15			250	–	–	–	CLAY; SILTY, MICACEOUS, FERRUGINOUS, F.GN
9550	053	10	–	–	40	50	C	65	HUMUS OR-Y-RD-BN		X	15			250	–	6	–	AS ABOVE
9525	054	15	–	10	50	25	C	50	HUMUS Y-OR-RD-BN		X	25			305	–	6	–	AS ABOVE, WTHD Q-F-M SCHIST
9500	055	100	–	–	–	–	–	–	PK-GY	SUB X		–			440	–	–	–	Q-F-M S/S; F-MGN, SILICEOUS, MIN LIM STNG.

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GEOCHEMICAL SOIL SAMPLING LEDGER

TENEMENT BULL CREEK EL 1008

D.P.O. No.

AREA/PROSPECT TAMB - 7 SAMPLE Nos. 1162 035 - 059

GEOLOGIST PL DATE 14-8-84

PLAN REFERENCE SAa 3046, SAa 3047

ANALYSED BY AMDEL

A 9006

Grid Co-ordinate	Sample No.	Soil Composition: Rock %	Organic %	Sand %	Silt %	Clay %	Soil Horizon	Sample: Depth cm.	Colour	Bedrock: Outcrop	Con-cealed	Est. Depth to	Metal Content in ppm.: Pb	Zn	Cu	Ag			Geological observations
LINE 2N																			
9475	1162056	50	–	–	30	20	C	45	RD-OR-BN	x		15	16	52	16	–			Q-F-M SCHIST; F GN, MIN LIM ON FRACTURES, FERRUG. SILT
9450	057	100	–	–	–	–	–	–	PK-GY	x		–	–	52	8	–			AS ABOVE
9425	058	100	–	–	–	–	–	–	PK-GY-BN	x		–	6	66	6	–			Q-F-M SCHIST · F-M GN, SANDY MIN LIM STNG, SILICEOUS SCHIST, PYRITIC, JAROSITIC [illegible] PY MEMBER
9400	059	10	–	–	20	70	C	70	HUMUS D-Y-GY-BN	SUB x		15	105	200	76	–			CLAY; MOTTLED, STICKY STIFF, FERRUGINOUS, SOME

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GEOCHEMICAL SOIL SAMPLING LEDGER

TENEMENT BULL CREEK EL 1008
AREA/PROSPECT JAMB - 7
SAMPLE Nos. 1162035 - 059
PLAN REFERENCE SAn 3046 , SAn 3047
A 9006

D.P.O. No.
GEOLOGIST PL DATE 14-8-84
ANALYSED BY AMDEL

Grid Co-ordinate	Sample No.	Soil Composition					Soil Horizon	Sample		Bedrock			Metal Content in ppm.						Geological observations
LINE 2N		Rock %	Organic %	Sand %	Silt %	Clay %		Depth cm.	Colour	Outcrop	Con-cealed	Est. Depth to	Pb	Zn	Mn	Au	Sn	W	
9475	1162056	50	–	–	30	20	C	45	RD-OR-BN	X		15			365	–	–	–	Q-F-M SCHIST; F GN, MIN LIM ON FRACTURES, FERRUG SILT
9450	057	100	–	–	–	–	–	–	PK-GY	X		–			465	–	–	–	AS ABOVE
9425	058	100	–	–	–	–	–	–	PK-GY-BN	X		–			420	–	4	–	Q-F-M SCHIST: F-M GN, SANDY, MIN LIM STNG. SILICEOUS SCHIST, PYRITIC, SARADITIC MARINE PY MEMBER
9400	059	10	–	–	20	70	C	70	HUMUS D-Y-GY-BN	SUB X		15			215	–	6	10	CLAY: MOTTLED, STICKY STIFF, FERRUGINOUS, SOME

000406

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GEOCHEMICAL SOIL SAMPLING LEDGER

TENEMENT: BULL CREEK EL 1008
AREA/PROSPECT: Ja MB-7
SAMPLE Nos. 1162014 - 034
PLAN REFERENCE: SAa 3046, SAa 3047
D.P.O. No.
GEOLOGIST: P.L.
DATE: 14.8.84
ANALYSED BY: AMDEL

A 9006

Grid Co-ordinate LINE 3N	Sample No.	Soil Composition: Rock %	Organic %	Sand %	Silt %	Clay %	Soil Horizon	Sample: Depth cm.	Colour	Bedrock: Outcrop	Con-cealed	Est. Depth to	Metal Content in ppm: Pb	Zn	Cu	Ag			Geological observations
10000 E	1162014	30	-	-	40	30	C	40	HUMUS RD-GY-BN	SUB X		5	24	56	17	-			Q-F-M SCHIST; 1/B MICA SCHIST, F-M GN, MIN LIM STNG.
9975	015	20	-	-	40	40	C	55	HUMUS Y-OR-RD		X	20	62	46	36	-			CLAY; SOME COARSE SERICITE, WTHD MICA SCHIST, FERRUG.
9950	016	80	-	-	15	5	-	-	GY-PK BN	X		-	54	50	9	-			Q-F-M SCHIST; SANDY, F-M GN, RARE LIM STNG
9925	017	20	-	-	50	30	C	60	HUMUS Y-OR-RD	SUB X		10	54	60	40	-			CLAY; MICAC, SILTY, F GN, FERRUG, WK LAYERING.
9900	018	20	-	-	20	60	C	65	HUMUS Y-GY-BN		X	20	30	70	35	-			AS ABOVE, FRAGS OF M GN MICA SCHIST
9875	019	20	-	-	20	60	C	40	HUMUS OR-Y-RD-BN		X	20	34	62	48	-			AS ABOVE
9850	020	10	-	-	20	70	C	70	HUMUS Y-W-GY-BN		X	20	22	58	27	-			AS ABOVE
9825	021	-	-	-	20	80	C	70	HUMUS Y-GY-BN		X	20	18	70	38	-			AS ABOVE; VERY STICKY
9800	022	5	-	20	60	15	C	70	HUMUS Y-OR-BN		X	20	10	23	13	-			CLAYEY, SANDY SILT; MINOR MICA, SLIGHTLY BLEACHED
9775	023	-	-	20	40	40	C	70	HUMUS Y-GY-BN		X	20	8	40	6	-			AS ABOVE, MICACEOUS, LIM STNG COMMON
9750	024	10	-	20	50	20	C	70	HUMUS Y-OR-BN		X	20	16	39	32	-			CLAY; AS ABOVE
9725	025	10	-	20	20	50	C	65	HUMUS D-Y-OR-BN	SUB X		10	88	28	115	-			CLAY; MOTTLED, LAYERED FERRUG, FRAGS OF SERICITIC SANDSTONE
9700	026	100	-	-	-	-	-	-	PK-GY	X		-	-	50	5	-			Q-F-B SCHIST, F-M GN, SANDY, SILICEOUS BANDS, RARE LIM STNG.
9675	027	20	-	20	40	20	C	40	BN Y-OR-BN	SUB X		10	12	66	27	-			Q-F-M S/S; F-M GN, LIM-HEM STNG COMMON
9650	028	20	-	30	40	10	C	35	HUMUS OR-RD-BN	SUB X		10	10	42	25	-			AS ABOVE, FERRUGINOUS
9625	029	30	-	10	30	30	C	35	HUMUS RD-Y-OR-GY	SUB X		5	10	56	49	-			Q-F-M SCHIST; F-C GN, FERRUGINOUS CLAYS
9600	030	40	-	10	40	10	C	20	BN Y-GY-BN	SUB X		5	8	48	26	-			Q-F-B SCHIST; 1/B QUARTZITIC SCHIST, SOME LIM STNG.
9575	031	100	-	-	-	-	-	-	GY-PK	X		-	26	60	6	-			AS ABOVE, RARE QTZ-HEM VNG, RARE Mn OXIDES.
9550	032	50	-	-	20	30	C	30	Y-OR PU-GY		X	30	370	195	62	-			SHALE, F GN, FERRUGINOUS, SLIGHTLY SILICEOUS, LIM STNG COMMON
9525	033	-	-	-	20	80	B/C	70	GY-BN RD-OR-Y-BN		X	?30	150	110	64	-			CLAY; STICKY, FERRUGINOUS, SOME VN QTZ, BLK MOTT SAND.
9500	034	-	-	10	30	60	B/C	70	BN RD-OR-BN		X	?30	98	76	49	-			CLAY; MOTTLED, MINOR SILT, RARE MICA.

000407

GEOCHEMICAL SOIL SAMPLING LEDGER

Page No. 1/1

TENEMENT: BULL CREEK EL 1008

D.P.O. No.

AREA/PROSPECT: TAMB-7 SAMPLE Nos. 1162014 - 034

GEOLOGIST: P.L. DATE: 14-8-84

PLAN REFERENCE: SAa 3046 / SAa 3047

ANALYSED BY: AMDEL

A 9006

Grid Co-ordinate LINE 3N	Sample No.	Soil Composition: Rock %	Organic %	Sand %	Silt %	Clay %	Soil Horizon	Sample: Depth cm.	Colour	Bedrock: Outcrop	Concealed	Est. Depth to	Metal Content in ppm.: Pb	Zn	Mn	Au	Sn	W	Geological observations
10000 E	1162014	30	–	–	40	30	C	40	HUMUS RD-GY-BN	SUB X		5			335	–	–	10	Q-F-M SCHIST; I/B MICA SCHIST, F-M GN, MIN LIM STNG.
9975	015	20	–	–	40	40	C	55	HUMUS Y-OR-RD		X	20			225	–	–	–	CLAY; SOME COARSE SERICITE, WTHD MICA SCHIST, FERRUG.
9950	016	80	–	–	15	5	–	–	GY-PK BN	X		–			475	–	–	–	Q-F-M SCHIST; SANDY, F-M GN, RARE LIM STNG
9925	017	20	–	–	50	30	C	60	HUMUS Y-OR-RD	SUB X		10			250	–	–	–	CLAY; MICAC, SILTY, F GN, FERRUG, WK LAYERING.
9900	018	20	–	–	20	60	C	65	HUMUS Y-GY-BN		X	20			220	–	–	10	AS ABOVE, FRAGS OF M GN MICA SCHIST
9875	019	20	–	–	20	60	C	40	HUMUS OR-Y-RD-BN		X	20			205	–	6	–	AS ABOVE
9850	020	10	–	–	20	70	C	70	HUMUS Y-GY-BN		X	20			240	–	4	–	AS ABOVE
9825	021	–	–	–	20	80	C	70	HUMUS Y-GY-BN		X	20			275	–	–	–	AS ABOVE; VERY STICKY
9800	022	5	–	20	60	15	C	70	HUMUS Y-OR-BN		X	20			88	–	–	–	CLAYEY, SANDY SILT; MINOR MICA, SLIGHTLY BLEACHED
9775	023	–	–	20	40	40	C	70	HUMUS Y-GY-BN		X	20			200	–	–	–	AS ABOVE, MICACEOUS, LIM STNG COMMON
9750	024	10	–	20	50	20	C	70	HUMUS Y-OR-BN		X	20			155	–	–	–	CLAY; AS ABOVE
9725	025	10	–	20	20	50	C	65	HUMUS D-Y-OR-BN	SUB X		10			120	–	4	–	CLAY; MOTTLED, LAYERED, FERRUG, FRAGS OF SERICITIC SANDSTONE
9700	026	100	–	–	–	–	–	–	GY-PK-GY	X		–			455	–	–	–	Q-F-B SCHIST, F-M GN, SANDY, SILICEOUS BANDS, RARE LIM STNG.
9675	027	20	–	20	40	20	C	40	BN Y-OR-BN	SUB X		10			300	–	–	–	Q-F-M S/S; F-M GN, LIM-HEM STNG COMMON
9650	028	20	–	30	40	10	C	35	HUMUS OR-RD-BN	SUB X		10			235	–	–	–	AS ABOVE, FERRUGINOUS
9625	029	30	–	10	30	30	C	35	HUMUS RD-Y-OR-GY	SUB X		5			250	–	–	10	Q-F-M SCHIST; F-C GN, FERRUGINOUS CLAYS
9600	030	40	–	10	40	10	C	20	BN Y-GY-BN	SUB X		5			430	–	6	–	Q-F-B SCHIST; I/B QUARTZITIC SCHIST, SOME LIM STNG.
9575	031	100	–	–	–	–	–	–	GY-PK	X		–			420	–	4	–	AS ABOVE, RARE QTZ-HEM VNG, RARE MN OXIDES.
9550	032	50	–	–	20	30	C	30	Y-OR RD-GY		X	30			58	–	4	–	SHALE, F GN, FERRUGINOUS, SLIGHTLY SILICEOUS, LIM STNG COMMON
9525	033	–	–	–	20	80	B/C	70	GY-BN RD-OR-Y-BN		X	?30			160	–	4	–	CLAY; STICKY FERRUGINOUS, SOME VN QTZ, BLK MN SAND.
9500	034	–	–	10	30	60	B/C	70	BN RD-OR-BN		X	?30			180	–	6	–	CLAY; MOTTLED, MINOR SILT, RARE MICA.

GEOCHEMICAL SOIL SAMPLING LEDGER

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TENEMENT BULL CREEK EL 1008

D.P.O. No. 937

AREA/PROSPECT JAMB 7

SAMPLE Nos. 1162081 – 083

GEOLOGIST PL DATE 15/8/84

PLAN REFERENCE SAe 3046, SAe 3047

ANALYSED BY AMDEL

A 9006

Grid Co-ordinate	Sample No.	Soil Composition						Sample		Bedrock			Metal Content in ppm.								Geological observations
		Rock %	Organic %	Sand %	Silt %	Clay %	Soil Horizon	Depth cm.	Colour	Outcrop	Con-cealed	Est. Depth to	Pb	Zn	Cu	Ag	Au	Mn	Sn	W	
LINE 3N 9650E	1162081	100	–	–	–	–	–	–	–	–	–	–	–	5	4	–	–	34	–	–	VEIN QUARTZ WITH MINOR LIMONITE VEINING & STAINING IN VOIDS.
LINE 3N 9540E	082	100	–	–	–	–	–	–	–	–	–	–	880	150	92	4	–	24	–	10	SILTSTONE; F.GN, SILICIFIED, LIM-HEM-JAROSITE STAINING
LINE 2N 9400E	083	100	–	–	–	–	–	–	–	–	–	–	570	34	840	1	–	90	–	–	SILTSTONE; AS ABOVE, MINOR FRESH PYRITE.

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GEOCHEMICAL SOIL SAMPLING LEDGER

TENEMENT: BULL CREEK EL 1008
AREA/PROSPECT: JAMB 44
SAMPLE Nos. 1157120 – 140
PLAN REFERENCE: SA1 3049, 3048
A 9006

D.P.O. No. 932
GEOLOGIST: PL
DATE: 5-6-84
ANALYSED BY: AMDEL

Grid Co-ordinate LINE 5N	Sample No.	Soil Composition: Rock %	Organic %	Sand %	Silt %	Clay %	Soil Horizon	Sample: Depth cm.	Colour	Bedrock: Outcrop	Concealed	Est. Depth to	Metal Content in ppm.: Pb	Zn	Cu	Ag			Geological observations
10000 E	1157120	–	–	15	45	40	B/C	50	RD-BN RD-BN-GY		X	?50	40	66	30	–			CLAY; SILTY, SANDY, FERRUGINOUS, RARE FRAGS OF Q-M SCHIST
9975	121	–	–	20	45	35	B	65	RD-BN Y-BN		X	>65	20	36	20	–			AS ABOVE, MGE FERRUGINOUS SANDSTONE, SHALE FRAGS.
9950	122	–	–	15	50	35	B	35	BN RD-BN		X	>35	46	70	36	–			AS ABOVE
9925	123	–	–	10	60	30	B/C	65	BN Y-BN		Y	>65	40	48	30	–			SILT; CLAYEY, MOTTLED, MICACEOUS MINOR, SOME LIMONITE STNG.
9900	124	–	–	20	60	20	B	35	BN RD-BN		Y	>35	66	66	32	–			SILT; AS ABOVE, MINOR SHALE GRIT, ALLUVIAL.
9875	125	–	–	10	50	40	B	35	BN RD-BN		Y	>35	50	76	36	–			CLAY; SILTY, FERRUGINOUS, MINOR QTZ GRAVEL.
9850	126	–	–	15	55	30	B	45	BN RD-BN		Y	>45	66	96	38	–			CLAY; SILTY, FERRUGINOUS, MINOR MICA.
9825	127	–	–	15	75	10	B	40	BN RD-BN		X	>40	26	60	28	–			AS ABOVE.
9800	128	100	–	–	–	–	–	–	GY-W	SUB X		–	10	30	14	–			CALC-SILICATE; F-M GN, WEAKLY LAYERED, LENSES & OSSANOUS VOIDS WITH GEOTHITE/LIMONITE STNG.
9775	129	35	–	–	65	–	C	35	BN GY-BN		X	25	20	86	32	–			Q-B-SCHIST; F GN, MINOR LIM STAINING.
9750	130	25	–	–	75	–	C	30	BN Y-W		X	10	30	100	38	–			Q-S SCHIST; F. GN, BLEACHED, MIN LIM STNG.
9725	131	30	–	–	55	15	C	50	BN Y-OR-W		X	20	530	510	130	–			AS ABOVE, SANDY, LIMONITIC IN PART
9700	132	35	–	–	65	–	C	30	BN Y-GY-BN		X	10	10	50	24	–			Q-F-M SCHIST, F GN, MIN LIM STNG.
9675	133	20	–	–	60	20	C	35	Y-BN OR-Y-CR		X	15	36	86	90	–			Q-F-S SCHIST; F. GN, BLEACHED, LENSES OF GEOTHITE & LIMONITE STAINING.
9650	134	10	–	–	60	30	C	70	Y-BN CR-Y		X	20	20	48	140	–			CLAY; SERICITIC, BRECCIATED IN PART.
9625	135	15	–	–	65	20	C	60	BN CR-GY-BN		X	15	36	76	80	–			SCHIST; QTZITIC, F.GN, MINOR SERICITE, MIN LIM.
9600	136	10	–	–	60	30	C	45	Y-BN CR-GY		X	15	26	96	76	1			CLAY; SERICITIC, SILTY, MIN LIM STNG IN BANDS
9575	137	15	–	–	55	30	C	35	Y-BN PK-Y-GN		X	15	36	96	70	–			AS ABOVE, BRECCIATED TEXTURE IN PART.
9550	138	20	–	–	75	5	C	45	BN Y-GY-W		X	15	16	40	22	–			Q-F-M SCHIST; F GN, SERICITIC, MIN LIM STNG.
9525	139	20	–	–	75	5	C	35	BN GY-BN		X	20	16	42	32	–			AS ABOVE, ABUNDANT LIM STNG.
9500	140	40	–	–	60	–	C	50	BN GY		X	10	10	38	38	–			AS ABOVE, MIN LIM STNG.

Page No. 1/1

GEOCHEMICAL SOIL SAMPLING LEDGER

TENEMENT: BULL CREEK EL 1008

AREA/PROSPECT: JaMB 44

SAMPLE Nos. 1157120 – 140

PLAN REFERENCE: SA 3049, 3048

D.P.O. No. 932

GEOLOGIST: PL DATE: 5-6-84

ANALYSED BY: AMDEL

A 9006

Grid Co-ordinate LINE 5N	Sample No.	Soil Composition: Rock %	Organic %	Sand %	Silt %	Clay %	Soil Horizon	Sample: Depth cm.	Colour	Bedrock: Outcrop	Con-cealed	Est. Depth to	Metal Content in ppm.: Pb	Zn	Mn	Au	Sn	W	Geological observations
10000 E	1157120	–	–	15	45	40	B/C	50	RD-BN RD-BN-GY		X	?50			220	–	–	10	CLAY; SILTY, SANDY, FERRUGINOUS, RARE FRAGS OF Q-M SCHIST
9975	121	–	–	20	45	35	B	65	RD-BN Y-BN		X	>65			150	–	4	–	AS ABOVE, MCE FERRUGINOUS SANDSTONE, SHALE FRAGS.
9950	122	–	–	15	50	35	B	35	BN RD-BN		X	>35			220	–	4	–	AS ABOVE
9925	123	–	–	10	60	30	B/C	65	BN Y-BN		Y	>66			170	–	–	10	SILT; CLAYEY, MOTTLED, MICACEOUS MINOR, SOME LIMONITE STNG.
9900	124	–	–	20	60	20	B	35	BN RD-BN		Y	>35			180	–	–	–	SILT; AS ABOVE, MINOR SHALE GRIT, ALLUVIAL.
9875	125	–	–	10	50	40	B	35	BN RD-BN		Y	>35			170	–	–	–	CLAY; SILTY, FERRUGINOUS, MINOR QTZ GRAVEL.
9850	126	–	–	15	55	30	B	45	BN RD-BN		X	>45			160	–	4	–	CLAY; SILTY, FERRUGINOUS, MINOR MICA
9825	127	–	–	15	75	10	B	40	BN RD-BN		X	>40			150	–	–	10	AS ABOVE.
9800	128	100	–	–	–	–	–	–	GY-W	SUB X		–			1100	–	6	–	CALC-SILICATE; F-M GN, WEAKLY LAYERED, LENSES & GOSSANOUS VOIDS WITH GEOTHITE/LIMONITE STNG.
9775	129	35	–	–	65	–	C	35	BN GY-BN		X	25			330	–	–	–	Q-B-SCHIST; F GN, MINOR LIM STAINING.
9750	130	25	–	–	75	–	C	30	BN Y-W		X	10			190	–	4	10	Q-S SCHIST; F. GN, BLEACHED, MIN LIM STNG.
9725	131	30	–	–	55	15	C	50	BN Y-OR-W		X	20			70	–	–	10	AS ABOVE, SANDY, LIMONITIC IN PART
9700	132	35	–	–	65	–	C	30	BN Y-GY-BN		X	10			200	–	–	10	Q-F-M SCHIST, F GN, MIN LIM STNG.
9675	133	20	–	–	60	20	C	35	Y-BN OR-Y-CR		X	15			220	–	–	10	Q-F-S SCHIST; F.GN, BLEACHED, LENSES OF GEOTHITIC & LIMONITE STAINING.
9650	134	10	–	–	60	30	C	70	Y-BN CR-Y		X	20			130	–	–	–	CLAY; SERICITIC, BRECCIATED IN PART.
9625	135	15	–	–	65	20	C	60	BN CR-GY-BN		X	15			290	–	–	–	SCHIST; QTZITIC, F.GN, MINOR SERICITE, MIN LIM.
9600	136	10	–	–	60	30	C	45	Y-BN CR-GY		X	15			290	–	–	–	CLAY; SERICITIC, SILTY, MIN LIM STNG IN BANDS
9575	137	15	–	–	55	30	C	35	Y-BN PK-Y-GN		X	15			490	–	6	–	AS ABOVE, BRECCIATED TEXTURE IN PART.
9550	138	20	–	–	75	5	C	45	BN Y-GY-W		X	15			700	–	–	–	Q-F-M SCHIST; F GN, SERICITIC, MIN LIM STNG.
9525	139	20	–	–	75	5	C	35	BN GY-BN		X	20			420	–	6	–	AS ABOVE, ABUNDANT LIM STNG.
9500	140	40	–	–	60	–	C	50	BN GY		X	10			570	–	4	–	AS ABOVE, MIN LIM STNG.

000411

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GEOCHEMICAL SOIL SAMPLING LEDGER

TENEMENT: BULL CREEK EL 1008

AREA/PROSPECT: ZAMB 44

SAMPLE Nos.: 1157099 – 119

PLAN REFERENCE: SAa 3049, SAa 3048

D.P.O. No.: 932

GEOLOGIST: P.L. DATE: 4-6-84

ANALYSED BY: AMDEL

A 9006

Grid Co-ordinate LINE 4N	Sample No.	Soil Composition: Rock %	Organic %	Sand %	Silt %	Clay %	Soil Horizon	Sample: Depth cm.	Colour	Bedrock: Outcrop	Con-cealed	Est. Depth to	Metal Content in ppm: Pb	Zn	Cu	Ag			Geological observations
10000 E	1157099	–	–	10	50	40	?C	75	RD-BN RD-GY-FN		x	?50	26	34	14	–			SILT; CLAYEY, MOTTLED, SERICITIC, BRECCIA TEXTURE IN PART
9975	100	–	–	20	60	20	?C	45	RD-BN CR		x	?45	16	26	16	–			SILT; SANDY, CLAYEY AT TOP
9950	101	–	–	20	60	20	?C	50	RD-BN CR		x	?50	20	66	28	–			AS ABOVE
9925	102	–	–	60	10	30	N/R	30	RD-BN OR-BN		x	>30	20	36	18	–			CLAY: SANDY, WELL ROUNDED, MODERATELY WELL SORTED
9900	103	–	–	25	65	10	N/R	50	GY-BN OR-GY-W		x	>50	26	36	14	–			SILT; SANDY, SUB ANGULAR, WELL SORTED
9875	104	–	–	10	75	15	N/R	40	BN CR-W		x	>50	6	20	10	–			SILT; SANDY, CLAYEY IN PART.
9850	105	–	–	45	5	50	N/R	45	GY GY-BN-RD		x	>20	6	14	8	–			CLAY; SANDY, MINOR RED FERRUGINOUS SILT AT BASE
9825	106	–	–	55	5	40	N/R	45	GY OR-Y-GY		x	>45	6	16	8	–			AS ABOVE.
9800	107	–	–	50	40	10	N/R	35	DK BN CR		x	>35	6	8	6	1			SAND; SILTY, WELL ROUNDED, POOR-MODERATE SORTING, MINOR CLAY
9775	108	–	5	60	20	15	N/R	40	GY-BN		x	>40	–	8	4	–			AS ABOVE
9750	109	–	–	30	50	20	N/R	30	GY-RD OR-Y-BN		x	>30	10	10	4	–			AS ABOVE, RARE SHELL FRAGMENTS
9725	110	–	–	80	–	20	N/R	55	GY-BN Y-OR		x	>15	6	8	2	–			SAND; MEDIUM TO COARSE GRAINED, WELL SORTED, WELL ROUNDED, MINOR IRON STAINING
9700	111	5	–	15	50	30	?C	65	RD-BN Y-W-BN		x	25	16	24	10	–			SILT; SANDY, CLAYEY, MINOR IRON STNG.
9675	112	15	–	30	40	15	?C	30	RD-BN PU-GY-BN		x	15	40	38	26	–			SANDSTONE; FERRUGINOUS, WELL ROUNDED, WELL SORTED, M.-C. GN, FERRUGINOUS.
9650	113	10	–	–	85	5	C	65	RD-BN Y		x	20	220	24	70	–			SILT; SERICITIC, F. GN, MINOR FERRUGINOUS VNS.
9625	114	10	–	–	85	5	C	70	BN Y-W-GY		x	20	16	100	50	–			AS ABOVE, MIN LIM STNG SLIGHTLY BLEACHED.
9600	115	15	–	5	45	35	C	30	BN Y-OR-BN		x	10	50	66	56	1			SERICITIC SANDSTONE; INDURATED, LENSES OF LIM GOSSAN EX SULPHIDE.
9575	116	15	–	15	70	–	C	15	BN GY-BN		x	5	16	50	26	–			SILT; SERICITIC, CLAYEY
9550	117	10	–	–	70	20	C	55	BN Y-GY-BN		x	25	16	150	70	–			SCHIST; F. GN, SILTY, SERICITIC, MINOR FERRUGINOUS LENSES.
9525	118	15	–	5	40	40	C	45	BN Y-OR-GY		x	15	30	100	66	–			AS ABOVE
9500	119.	–	–	–	30	70	B/C	70	BN RD-BN		x	?70	20	60	28	–			CLAY, FRAGS OF PORPHYROBLASTIC Q-M SCHIST.

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GEOCHEMICAL SOIL SAMPLING LEDGER

TENEMENT: BULL CREEK EL 1008
D.P.O. No.: 932
AREA/PROSPECT: InMB 44
SAMPLE Nos.: 1157099 – 119
GEOLOGIST: P.L.
DATE: 4.6.84
PLAN REFERENCE: SAa 3049, SAa 3048
ANALYSED BY: AMDEL

A 9006

Grid Co-ordinate LINE 4N	Sample No.	Soil Composition: Rock %	Organic %	Sand %	Silt %	Clay %	Soil Horizon	Sample: Depth cm.	Colour	Bedrock: Outcrop	Con-cealed	Est. Depth to	Metal Content in ppm.: Pb	Zn	Mn	Au	Sn	W	Geological observations
10000 E	1157099	–	–	10	50	40	?C	75	RD-BN / RD-GY-BN		x	?50			130	–	6	–	SILT; CLAYEY, MOTTLED, SERICITIC, BRECCIA TEXTURE IN PART
9975	100	–	–	20	60	20	?C	45	RD-BN / CR		x	?45			130	–	4	–	SILT; SANDY, CLAYEY AT TOP
9950	101	–	–	20	60	20	?C	50	RD-BN / CR		x	?50			190	–	6	–	AS ABOVE
9925	102	–	–	60	10	30	N/R	30	RD-BN / OR-BN		x	>30			80	–	4	–	CLAY; SANDY, WELL ROUNDED, MODERATELY WELL SORTED
9900	103	–	–	25	65	10	N/R	50	GY-BN / OR-GY-W		x	>50			96	–	–	15	SILT; SANDY, SUB ANGULAR, WELL SORTED
9875	104	–	–	10	75	15	N/R	40	BN / CR-W		x	>50			76	–	–	–	SILT; SANDY, CLAYEY IN PART.
9850	105	–	–	45	5	50	N/R	45	GY / GY-BN-RD		x	>20			46	–	–	–	CLAY; SANDY, MINOR RED FERRUGINOUS SILT AT BASE
9825	106	–	–	55	5	40	N/R	45	GY / OR-Y-GY		x	>45			36	–	–	–	AS ABOVE.
9800	107	–	–	50	40	10	N/R	35	DK BN / CR		x	>35			50	–	–	–	SAND; SILTY, WELL ROUNDED, POOR-MODERATE SORTING, MINOR CLAY
9775	108	–	5	60	20	15	N/R	40	GY-BN		x	>40			30	–	–	–	AS ABOVE
9750	109	–	–	30	50	20	N/R	30	GY-RD / OR-Y-BN		x	>30			36	–	–	–	AS ABOVE, RARE SHELL FRAGMENTS
9725	110	–	–	80	–	20	N/R	55	GY-BN / Y-OR		x	>15			26	–	–	–	SAND; MEDIUM TO COARSE GRAINED, WELL SORTED, WELL ROUNDED, MINOR IRON STAINING
9700	111	5	–	15	50	30	?C	65	RD-BN / Y-W-BN		x	25			80	–	4	–	SILT; SANDY, CLAYEY, MINOR IRON STNE.
9675	112	15	–	30	40	15	?C	30	RD-BN / PK-GY-BN		x	15			100	–	4	–	SANDSTONE; FERRUGINOUS, WELL ROUNDED, WELL SORTED, M.-C. GN, FERRUGINOUS.
9650	113	10	–	–	85	5	C	65	RD-BN / Y		x	20			66	–	–	–	SILT; SERICITIC, F. GN, MINOR FERRUGINOUS VNS.
9625	114	10	–	–	85	5	C	70	BN / Y-W-GY		x	20			300	–	4	–	AS ABOVE, MIN LIM STNG, SLIGHTLY BLEACHED
9600	115	15	–	5	45	35	C	30	BN / Y-OR-BN		x	10			110	–	4	–	SERICITIC SANDSTONE; INDURATED, LENSES OF LIM GOSSAN OR SULPHIDE.
9575	116	15	–	15	70	–	C	15	BN / GY-BN		x	5			180	–	–	–	SILT; SERICITIC, CLAYEY
9550	117	10	–	–	70	20	C	55	BN / Y-GY-BN		x	25			240	–	10	–	SCHIST; F. GN, SILTY, SERICITIC, MINOR FERRUGINOUS LENSES.
9525	118	15	–	5	40	40	C	45	BN / Y-OR-GY		x	15			140	–	6	–	AS ABOVE
9500	119.	–	–	–	30	70	B/C	70	BN / RD-BN		x	?70			510	–	8	10	CLAY, TRACES OF PORPHYROBLASTIC Q-M SCHIST.

Page No. 1/1

GEOCHEMICAL SOIL SAMPLING LEDGER

TENEMENT: BULL CREEK EL1008

AREA/PROSPECT: In MB-44

SAMPLE Nos.: 1157141 - 148

PLAN REFERENCE: SA₄ 3048 , SA₄ 3048

D.P.O. No.: 932

GEOLOGIST: PL DATE: 5-6-84

ANALYSED BY: AMDEL

A 9006

Grid Co-ordinate	Sample No.	Soil Composition						Sample		Bedrock			Metal Content in ppm.								Geological observations
		Rock %	Organic %	Sand %	Silt %	Clay %	Soil Horizon	Depth cm.	Colour	Outcrop	Con-cealed	Est. Depth to	Pb	Zn	Cu	Ag	Au	Mn	Sn	W	
LINE 4N - 9650E	1157141	100	–	–	–	–	–	–	–	–	–	–	130	150	90	–	–	76	–	–	FINE GRAINED HEMATITIC SANDSTONE,
																					LAYERED, MINOR LIMONITIC BLOTCHES
LINE 4N - 9650E	142	100	–	–	–	–	–	–	–	–	–	–	90	460	260	–	–	70	8	–	SCHIST; FINE GRAINED LIMONITIC,
																					GOSSANOUS VOIDS, IRREGULAR VEINS.
LINE 5N - 9625E	143	100	–	–	–	–	–	–	–	–	–	–	10	16	18	–	–	60	–	–	VEIN QUARTZ, SLIGHTLY GOSSANOUS
																					WITH LIMONITIC STNGS, RARE CLAYS
LINE 6N - 9675E	* 144	100	–	–	–	–	–	–	–	–	–	–	6	90	6	–	–	480	10	–	Q-B SCHIST; FINE GRAINED, RARE LIM.
		(FOOTWALL OF 145)																			STNG, SOME SILICEOUS BNDS.
AS ABOVE	145	100	–	–	–	–	–	–	–	–	–	–	110	240	130	1	–	150	4	–	Q-S SCHIST; SERICITIC, F. GN, THIN
		(10 m CHANNEL SAMPLE)																			GOSSANOUS & SILICIFIED BANDS.
AS ABOVE	146	100	–	–	–	–	–	–	–	–	–	–	10	200	34	–	–	630	–	–	Q-B SCHIST; F. GN, SANDY, INTERBED
		(HANGING WALL OF 145)																			BIOTITE QTE, MIN LIMONITE STNG.
AS ABOVE	147	100	–	–	–	–	–	–	–	–	–	–	700	140	120	–	–	30	–	–	GOSSANOUS BAND FROM Q-S SCHIST
																					ABOVE (1157145)
AS ABOVE.	148	100	–	–	–	–	–	–	–	–	–	–	70	56	18	–	–	200	–	–	SILICIFIED BAND FROM Q-S SCHIST
																					ABOVE (1157145).

* EXPOSED IN SOUTHERN BANK OF DAM TO SOUTH OF LINE 6N

TV

000414

CRA EXPLORATION PTY. LIMITED

ELEVENTH QUARTERLY AND FINAL REPORT FOR BULL CREEK E.L. 1008, SOUTH AUSTRALIA, FOR THE PERIOD ENDING 6TH MARCH, 1985.

AUTHOR: P. LEWIS

COPIES TO: CIS CANBERRA
SADME

DATE: 23RD APRIL, 1985

SUBMITTED BY: R.J.L. [signature]

ACCEPTED BY: [signature]

13290

000415

CONTENTS

1. SUMMARY

No field work was undertaken during the quarter. A review of the Kanmantoo Trough tenements was made and an application for one licence (Hartley E.L.A.) covering Callington E.L. 1061 and parts of Brukunga E.L. 1180, Milang E.L. 964 and Bull Creek E.L. 1008 was lodged with the SADME.

2. INTRODUCTION

Bull Creek E.L. 1008 covers an area of 469 square kilometres centred approximately 35 kilometres south-south-east of Adelaide (plan SAa 303). The licence was granted to CRA Exploration Pty. Limited on 7th June, 1982. The term of licence was extended to 36 months on 7th June, 1984. The area covered by the licence was previously held as E.L. 612.

That part of Bull Creek E.L. 1008 east of longitude 138°52' will be retained under the new Hartley licence area (plan SAa 303). This area was covered by the 1983 INPUT survey. Follow up of the remaining INPUT anomalies is planned.

3. SUMMARY OF PREVIOUS WORK

Previous work carried out by CRA Exploration Pty. Limited in Bull Creek E.L. 1008 (formerly E.L. 612) is summarised below.

Geochemistry
- 215 -10#+20# stream sediment samples; analysed for Cu, Pb, Zn, most for Fe, Sn, W, U and Au
- 92 C horizon soil samples; analysed for Cu, Pb, Zn, Mn, Ag, Sn, W and Au
- 217 drill core/cuttings samples; analysed for Cu, Pb, Zn, Ag, some for Co, Ni, Fe, Mn, Cr, Bi, Mo, As, Sn, W, Sb, U and Au; 6 petrographic descriptions
- 2 rock chip samples; analysed for Cu, Pb, Zn, Ag, Fe, Au, Sn and W

Geophysics - aeromagnetic/radiometric survey; 300 metre line spacing, flown E-W at 80 metre mean terrain clearance

- 35.5 line kilometres of ground magnetics

- 37.6 line kilometres of ground E.M.

- 5.5 line kilometres of ground I.P.

- 4.9 line kilometres of ground S.P.

- airborne E.M. survey over 96 square km; 400 metre line spacing, flown E-W

Drilling - 5 percussion drill holes for a total of 704 metres

Geology - Geological mapping of the Strathalbyn and Woodchester Grid areas, at 1:5000

R. J. L. Lane
for

P. LEWIS

PL/pw

EXPENDITURE

Expenditure for the period ended 28th February, 1985, the nearest accounting period was $ 1305.00, as listed below.

		$
Payroll		711
Supplies		16
Vehicle		40
Rent		21
Overheads		517
	Total	$ 1305

LOCATION

Barker SI 54-13 1:250 000 sheet

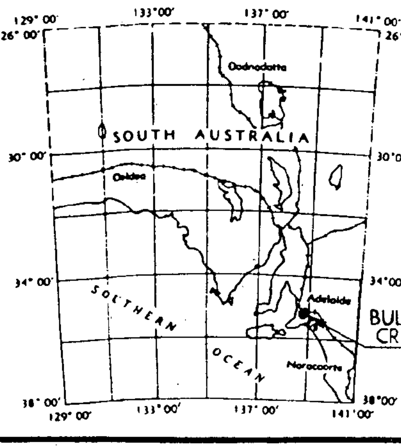
KEYWORDS

History

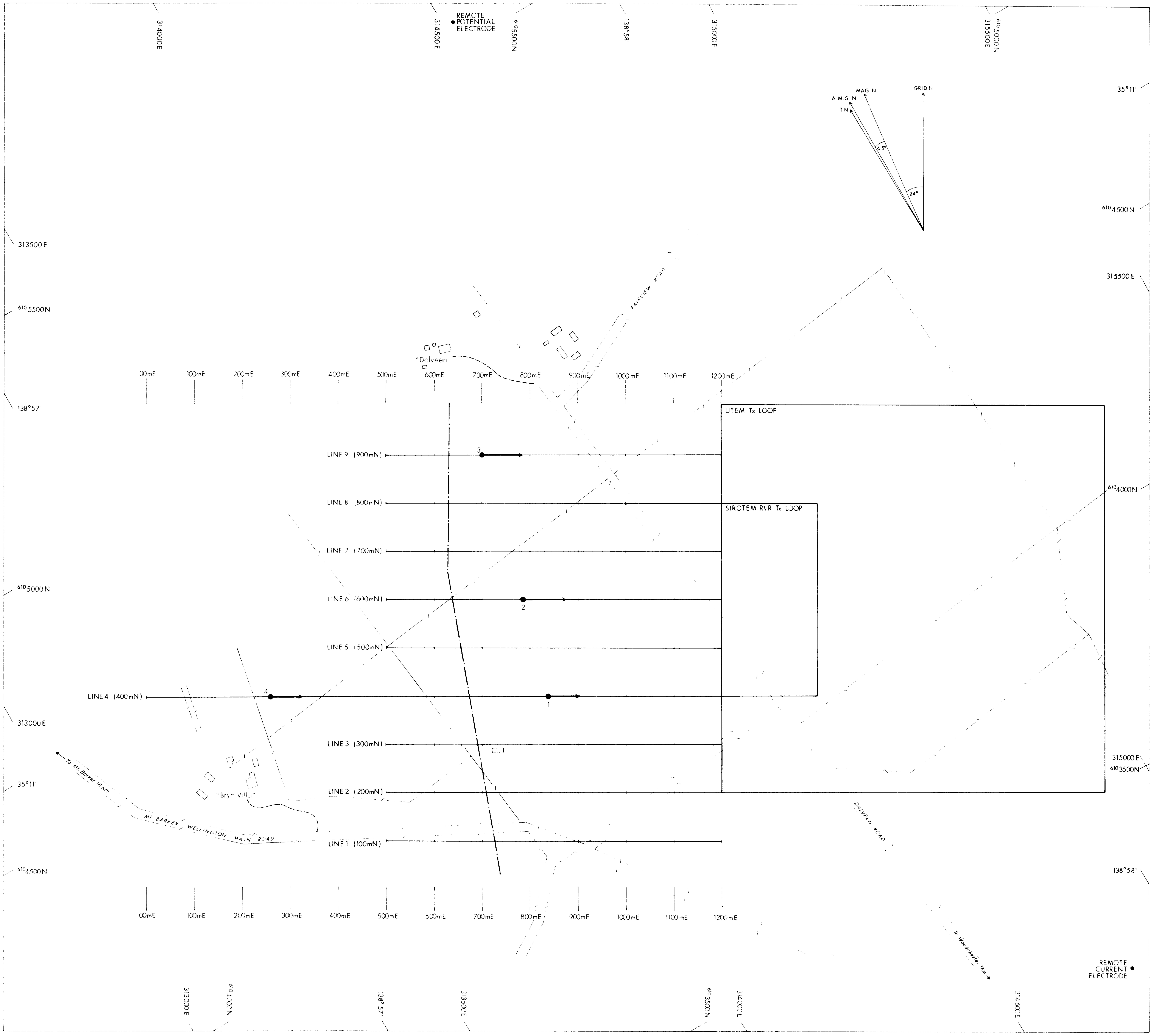
LIST OF PLANS

Plan No.	Title	Scale
SAa 303	Bull Creek E.L. 1008 Location Plan Showing Area To Be Relinquished	1:250 000

000420



C.R.A. EXPLORATION PTY. LIMITED.		
BULL CREEK, E.L. 1008 LOCATION MAP 1:250,000 Sheet Ref.: BARKER SI54-13.		
Geol.: P.L.	Date: March '85	Drawn: D.R.W.
Report Nº: 13290	Scale 1:250,000	Plan Nº: SAa 303



LEGEND

- Fence
- Geophysical Traverse
- Power Line
- Track

81 WCP 1	Depth 142m	Inc. 60°	Azimuth 90° (Grid N)
81 WCP 2	Depth 182m	Inc. 60°	Azimuth 90° (Grid N)
83 WCP 3	Depth 170m	Inc. 60°	Azimuth 114° Mag / 90° Grid N
83 WCP 4	Depth 140m	Inc. 60°	Azimuth 114° Mag / 90° Grid N

0 100 200 300 400 500
METRES

3832 (4) - 1

CRA EXPLORATION PTY. LTD

BULL CREEK E.L.1008

WOODCHESTER GRID

Ref: BARKER 5154-13	
Author: G.J.B	Date: March 1983
Drawn: J.C.R	Report No.: 12583
Scale: 1:5000	Plan No.: SAa 1074

DOWNHOLE LOG 83 WCP 3

BULL CREEK E.L.1008
"WOODCHESTER PROSPECT"
Ref.: BARKER SI 54-13
A.M.G. Co-ords. 314120 mE ; 6104750 mN.
Lat. 35° 10' 59", Long. 138° 57' 31"

Total depth :	170 m	Date.	22/12/83
Depth logged :	165 m	Logger.	SIE T450E
R.L. AHD :	130 m	Ratemeter	TC : 2
Hole diameter :	150 mm	Logging speed.	4 m/min.
PVC Casing to	6m	Operator.	G.J.B.

CRA EXPLORATION PTY. LIMITED
DOWNHOLE LOG 83 WCP3

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Report No. 12583
Plan No. SAa 2595

DOWNHOLE LOG 83 WCP 4

BULL CREEK E.L. 1008

"WOODCHESTER PROSPECT"

Ref.: BARKER SI 54-13

A.M.G. Co-ords. 313490 mE ; 6104540 mN.

Lat. 35° 11' 06", Long. 138° 57' 06"

Total depth : 140 m

Depth logged : 137·9 m

R.L. AHD : 130 m

Hole diameter : 150 mm

PVC Casing to 6 m

Date. 23/12/83

Logger. SIE T450 E

Ratemeter. TC : 2

Logging speed. 4 m/min.

Operator. G.J.B.

CRA EXPLORATION PTY LIMITED

DOWNHOLE LOG 83 WCP4

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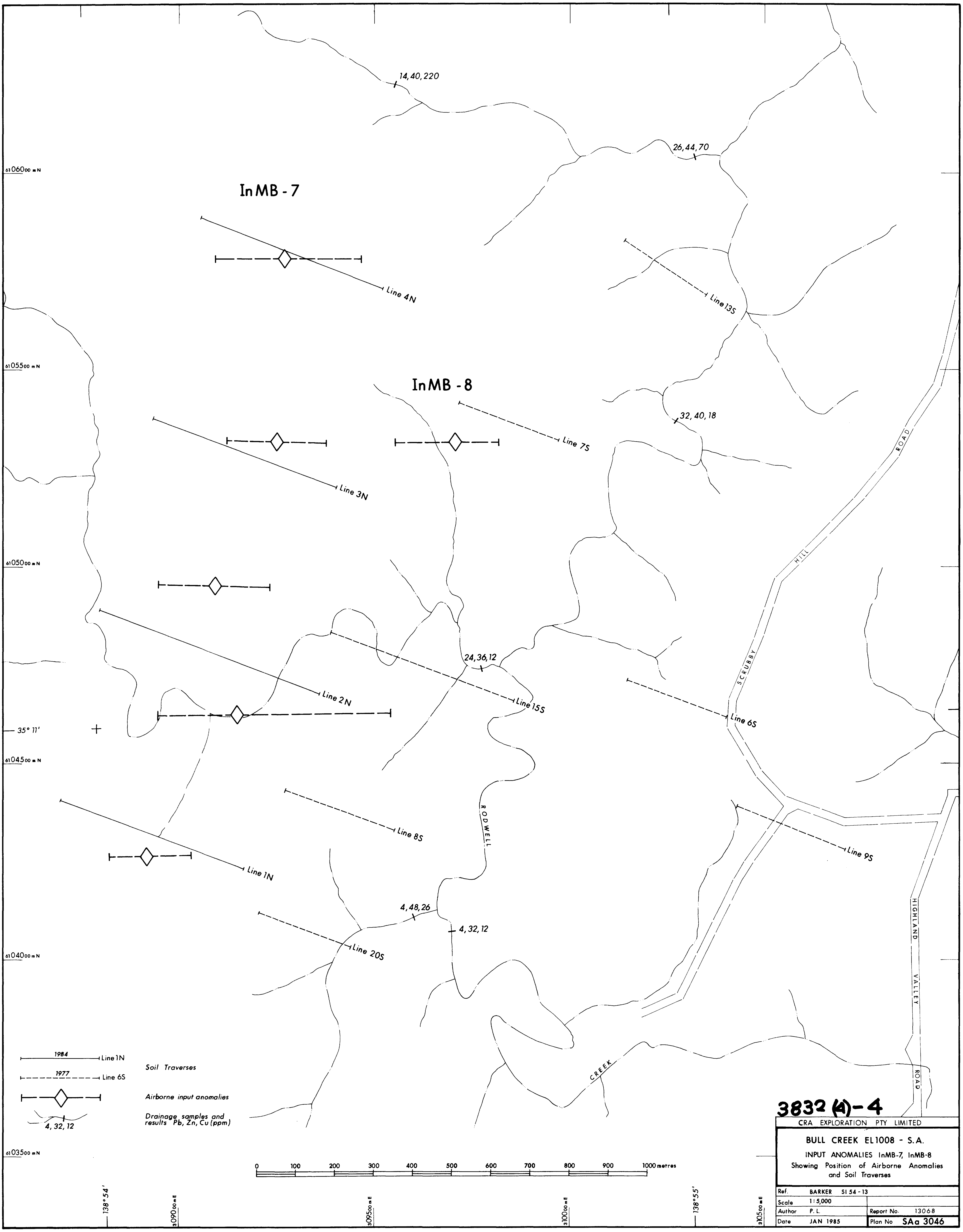
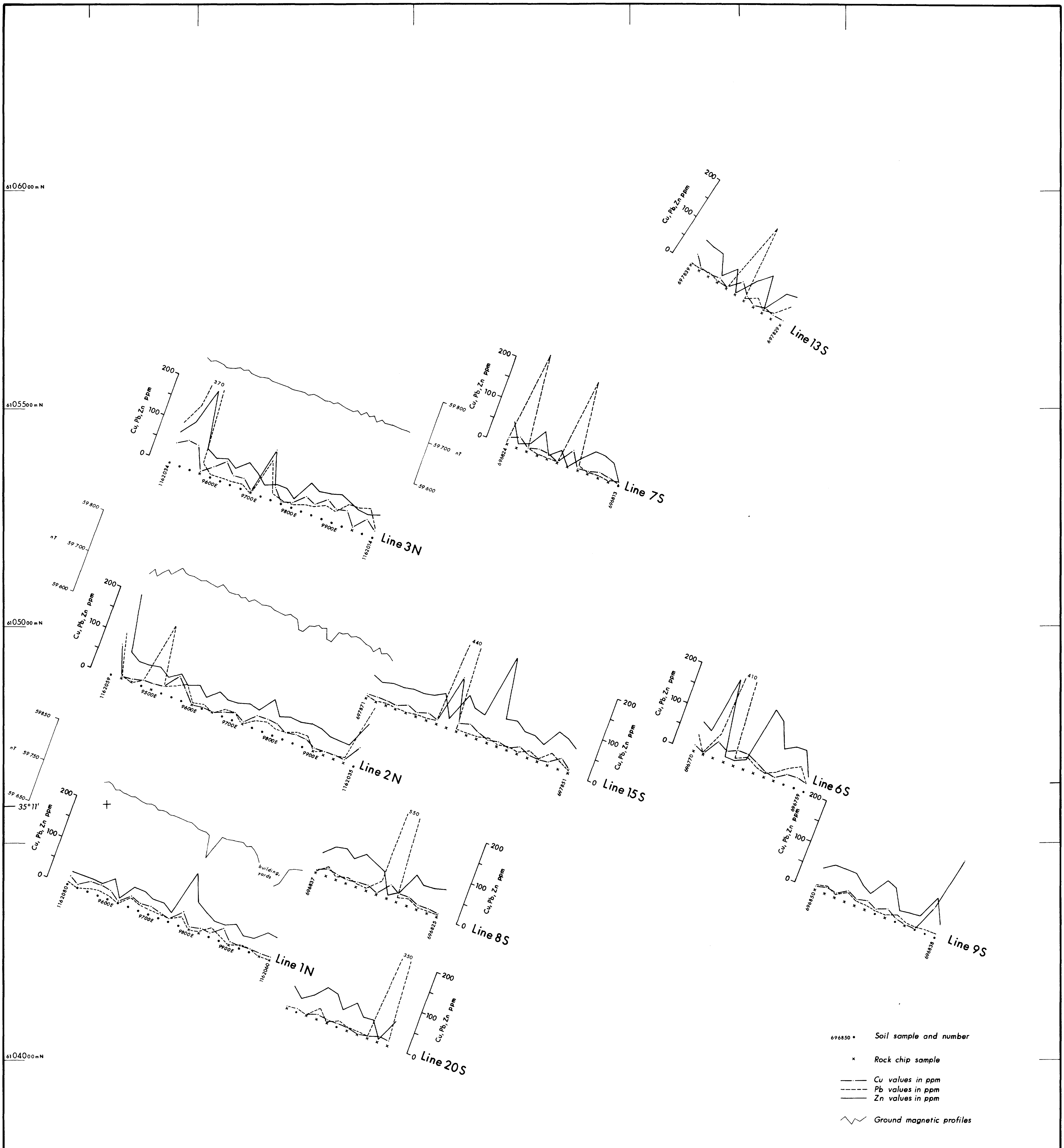
Report No. 12583

Plan No. SAa 2596


InMB - 7
InMB - 8
Line 4N
Line 3N
Line 2N
Line 1N
Line 13S
Line 7S
Line 15S
Line 6S
Line 8S
Line 9S
Line 20S
14, 40, 220
26, 44, 70
32, 40, 18
24, 36, 12
4, 48, 26
4, 32, 12
SCRUBBY HILL ROAD
HIGHLAND VALLEY ROAD
RODWELL CREEK
35° 11'
6106000 mN
6105500 mN
6105000 mN
6104500 mN
6104000 mN
6103500 mN
138° 54'
309000 mE
309500 mE
310000 mE
138° 55'
310500 mE
0 100 200 300 400 500 600 700 800 900 1000 metres
1984 Line 1N
1977 Line 6S
Soil Traverses
Airborne input anomalies
4, 32, 12
Drainage samples and results Pb, Zn, Cu (ppm)
3832 (A)-4
CRA EXPLORATION PTY LIMITED
BULL CREEK EL1008 - S.A.
INPUT ANOMALIES InMB-7, InMB-8
Showing Position of Airborne Anomalies and Soil Traverses
Ref. BARKER SI 54 - 13
Scale 1:5,000
Author P. L.
Report No. 13068
Date JAN 1985
Plan No SAa 3046



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CRA EXPLORATION PTY LIMITED

BULL CREEK EL1008 - S.A.
InMB 7,8 SOIL GEOCHEMISTRY
COPPER, LEAD, ZINC PROFILES WITH
GROUND MAGNETIC PROFILES

Ref.	BARKER SI54-13		
Scale	1:5,000		
Author	P.L.	Report No.	13068
Date	JAN 1985	Plan No.	SAa 3047

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CRA EXPLORATION PTY LIMITED

BULL CREEK EL1008 - S.A.

INPUT ANOMALY In MB-44

Showing Position of Airborne Anomalies with Soil and Ground Magnetic Traverses

Ref.	BARKER SI 54-13		
Scale	1: 5,000		
Author	P.L.	Report No.	13068
Date	JAN 1985	Plan No.	SAa 3048

61010 00 mN
35°13'
61005 00 mN
61000 00 mN
60995 00 mN
35°14'
60990 00 mN
60985 00 mN
60980 00 mN
60000
59900
59800
59700
nT
9400E 9500E 9600E 9700E 9800E 9900E 10000E
Line 6N
530 ppm Pb
510 ppm Zn
Cu, Pb, Zn ppm
200
100
0
1157140
9600E 9700E 9800E 9900E
1157120
Line 5N
O/H power lines
fence O/H power lines
1157119
1157099
Line 4N
9350E 9400E 9500E 9600E 9700E 9800E 9900E
Line 3N
old car
shed
9200E 9300E 9400E 9500E 9600E 9700E 9800E 9900E 10000E
Line 2N
Line 1N
1157099 • Soil sample and number
× Rock chip sample
Cu values in ppm
Pb values in ppm
Zn values in ppm
Ground magnetic profiles
3832(4)-7
0 100 200 300 400 500 600 700 800 900 1000 metres
3080 00 mE
3085 00 mE
138°54'
3090 00 mE
CRA EXPLORATION PTY LIMITED
BULL CREEK EL1008 - S.A.
InMB-44 SOIL GEOCHEMISTRY
COPPER, LEAD, ZINC PROFILES WITH
GROUND MAGNETIC PROFILES
Ref. BARKER S154-13
Scale 1:5,000
Author P.L.
Report No. 13068
Date JAN 1985
Plan No. SAa 3049