



# MITRE GEOPHYSICS PTY LTD

MINERAL EXPLORATION AND ENGINEERING CONSULTANTS

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## INTERPRETATION OF THE MURCHISON RIVER MAXMIN SURVEY

for

Getty Oil Development Company Ltd  
(Minerals Division)

by

Dr. J.R. Bishop

OF

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Interpretation of the Murchison River - Maxmin  
Survey - EL1/62  
Getty Oil Development Company Limited\*, Mitre Geop  
Bishop, J.R. EL1/1962

GTY/MG84/02  
Feb., 1984.

EL 1162



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## INTRODUCTION

A Maxmin (horizontal loop EM) survey has been carried out to verify a Dighem anomaly recorded near the old Murchison River bridge (now flooded) within E.L. 1/62. The Dighem survey was flown in December, 1983 for Getty Oil (the Rosebery East survey). At the time of the survey (and the writing of this report), Dighem's interpretation report had not been received.

The Dighem anomaly occurred on two lines and was located, from the film strip, between the Murchison Highway and Lake Rosebery with the northernmost anomaly over the water. Lines of the Murchison River Grid north of the Highway were re-established and pegged at 20m intervals.

The Maxmin survey recorded strong anomalies (with amplitudes to 40%) near the expected position. The responses were open to the north and continued to the south of the road with reduced amplitude and conductances. A drill target is given below. Survey details are listed in the table.

## GEOLOGIC SETTING AND EXPLORATION TARGET

The conductor lies within the Farrell Slates which are a sequence of steeply dipping greywackes, siltstones and black slates within the Cambrian Mt Read Volcanics. The Slates are 600m-800m wide and are in faulted contact with the Mt Black Volcanics to the west. To the east, they grade into the massive lavas and pyroclastics of the Eastern Volcanics. Much of the area is covered by glacial moraine. In the area of interest, the cover is patchy and probably thin.

The Farrell Slates are host to several mineral occurrences including the abandoned Farrell and Sterling River Pb-Ag mines. These sulphides and those of the lesser deposits, occurred in structurally controlled fissure lodes.

In the past, the area has been explored for base metals but more recently the EZ company has looked for tin. Drilling along the Mt Black Volcanics - Farrell Slates contact has revealed sub-economic quantities of cassiterite and geochemically significant amounts of Sn occur within the Slates.

Thus the target may be for base metals, presumably of vein-type, or for pyrite-hosted cassiterite (the lack of an associated magnetic anomaly suggests that pyrrhotite is not present in significant quantities). Both of these types of deposits might give EM responses, although both are likely to have low conductivities.

Previous EM surveys in the Sterling Valley (by RTAE in 1959 and by McPhar for Asarco in 1974) defined conductors over long strike distances: these have all been attributed to black slates. Although no such rocks have been mapped along the Maxmin anomaly, it would be instructive to integrate the results of the new and old surveys. (The Dighem survey was not effective south of the



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Murchison Highway because of a power line down the centre of the Valley.)

#### INTERPRETATION

Figure 1 shows the 1777Hz responses over all of the lines surveyed. A conductor has been defined with a strike length of 275m; it is open and strong to the north, below the waters of Lake Rosebery and is open but weakening to the south, in the Sterling Valley. Such responses might be expected over a significant sulphide deposit, but they are also typical of graphitic shales (ie, the conductances and depths to source along strike of a black shale horizon may vary considerably). Nevertheless, in this environment, the most conductive sections of black shale horizons should be investigated since the shales themselves may be host to the mineralisation.

The low background levels recorded by the Maxmin indicate that the host rock is resistive and that there is little (conductive) overburden. Thus the standard interpretation procedures using tabular conductors in free-space should be applicable. Using the 1777Hz results on line 5375150mN for a 100m coil spacing, a conductive zone of approximately 10m width, centred beneath 385010mE, was interpreted with a depth (to the top of the conductor) of less than 10m. The dip was calculated to be  $80^{\circ}$  to the west and the conductance (conductivity x width) as 5.6 mhos. Similar values were obtained for line 5375100mN (position, 385000mE; width,  $\sim 10$ m; depth, less than 10m; dip,  $65^{\circ}$ W; conductance, 3.8).

Since surficial conductors may give similar shaped responses to bedrock conductors, further surveys <sup>we</sup> are made over the most interesting anomalies using a variety of frequencies and coil spacings. The results for lines 5375150mN and 5375100mN using a 50m spacing and four different frequencies are shown in Figures 2 and 3 respectively. Figure 4 shows the results for line 5375150mN using 1777Hz with 25m, 50m and 100m coil spacings. Interpretation of the 1777Hz/50m coil spacing data for line 5375150mN gave shallower depth and dip (6m and  $\sim 50^{\circ}$ W) but a comparable conductance (4.2mhos). The decreasing ratio of in-phase to out-of-phase with decreasing frequency in Figures 2 and 3 suggests that the conductor may have limited depth extent. Therefore a relatively shallow intersection is recommended.

Drill Target: 50m below 5375150mN/385000mE, drilled from the west.

Should this target prove to be prospective, the area beneath the lake could be investigated with EM methods using small boats.

  
J.R. Bishop  
Feb., 1984.



TABLE 1  
Murchison River Maxmin Survey  
Coverage (frequency)

LINE	COIL SPACING		
	100M	50M	25M
5375175mN	384870mE-385070mE (1777Hz)		
5375150mN	384870mE-385290mE (1777Hz) " (888Hz) " (444Hz) " (222Hz)	384835mE-385255mE (1777Hz) " (888Hz) " (444Hz) " (222Hz)	384814.5mE-385332.5mE (1777Hz) " (888Hz) " (444Hz) " (222Hz)
5375100mN	384370mE-385210mE (1777Hz)	384825mE-385205mE (1777Hz) " (888Hz) " (444Hz) " (222Hz)	
5375000mN	384930mE-385210mE (1777Hz)		
5374900mN	384870mE-385130mE (1777Hz)		

Notes:

The topography in the surveyed area was fairly flat, no corrections were made for topographic variations. The coil separations were determined from taped distances on the reference cable.

The Maxmin system, which was borrowed from Shell Minerals, was not working correctly at the 100m coil spacing for frequencies below 1777Hz. At the 50m spacing, frequencies below 888Hz were not functioning. At the 25m spacing, all frequencies were working. (And at 150m spacing, no frequencies were working correctly). This malfunction was manifested by large background offsets. (The background values should decrease with decrease in frequency). If there are unsuspected errors in the 1777Hz/100m data used for the interpretation, these would not alter the position or dip of the conductor. If the depth were to change, it would probably be shallower.

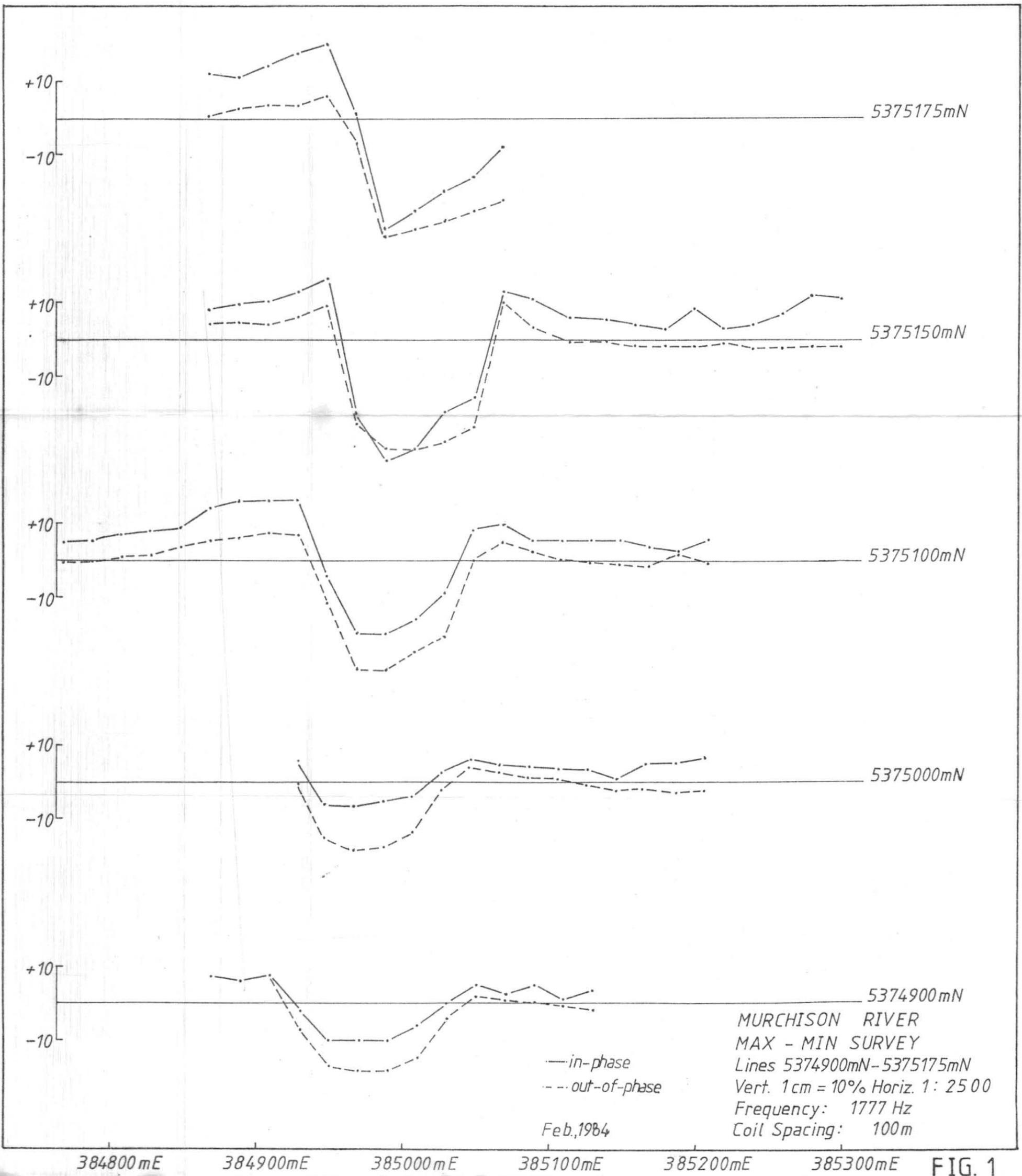


## Addendum: VLF Survey

It was decided to take advantage of a temporary lowering of Lake Rosebery's water level by surveying the northern extension of the Murchison River Dighem anomaly.

A VLF survey was carried out over lines 5375150mN and 5375200mN in Feb., 1984. A Phoenix VLF-2 receiver was used with NDT, Japan as the transmitting station. Sharp, well defined anomalies of comparable amplitude were recorded on both lines (see Figure 5). The survey confirmed the shallow source of the EM responses and shows that it is still open to the north. The high resolution of the method placed the conductor on line 5375150mN below 385010mE and on line 5375200mN, below 38525mE (ie, the drill target from the Maxmin survey has not been changed).

5 cm



699008

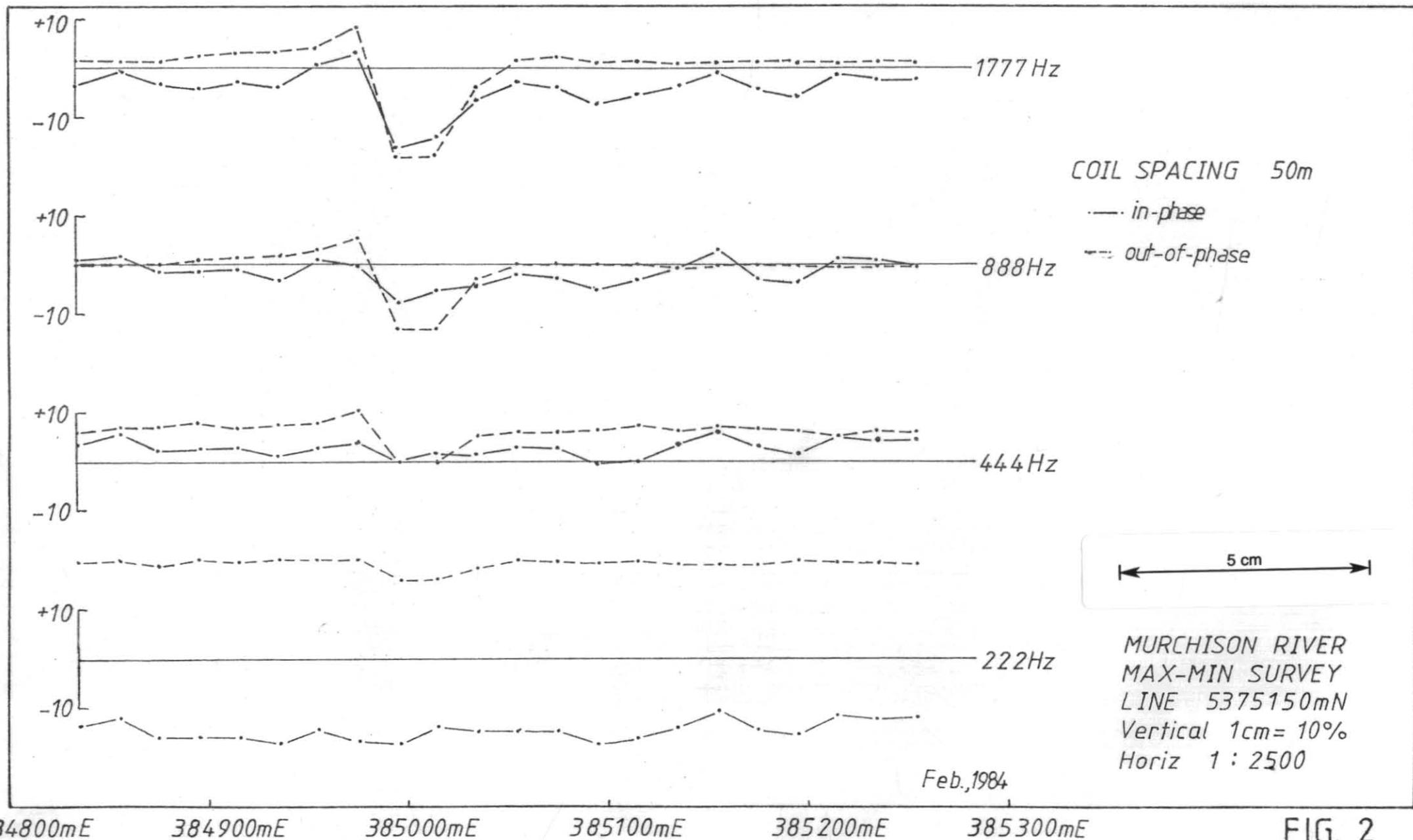


FIG. 2

699009

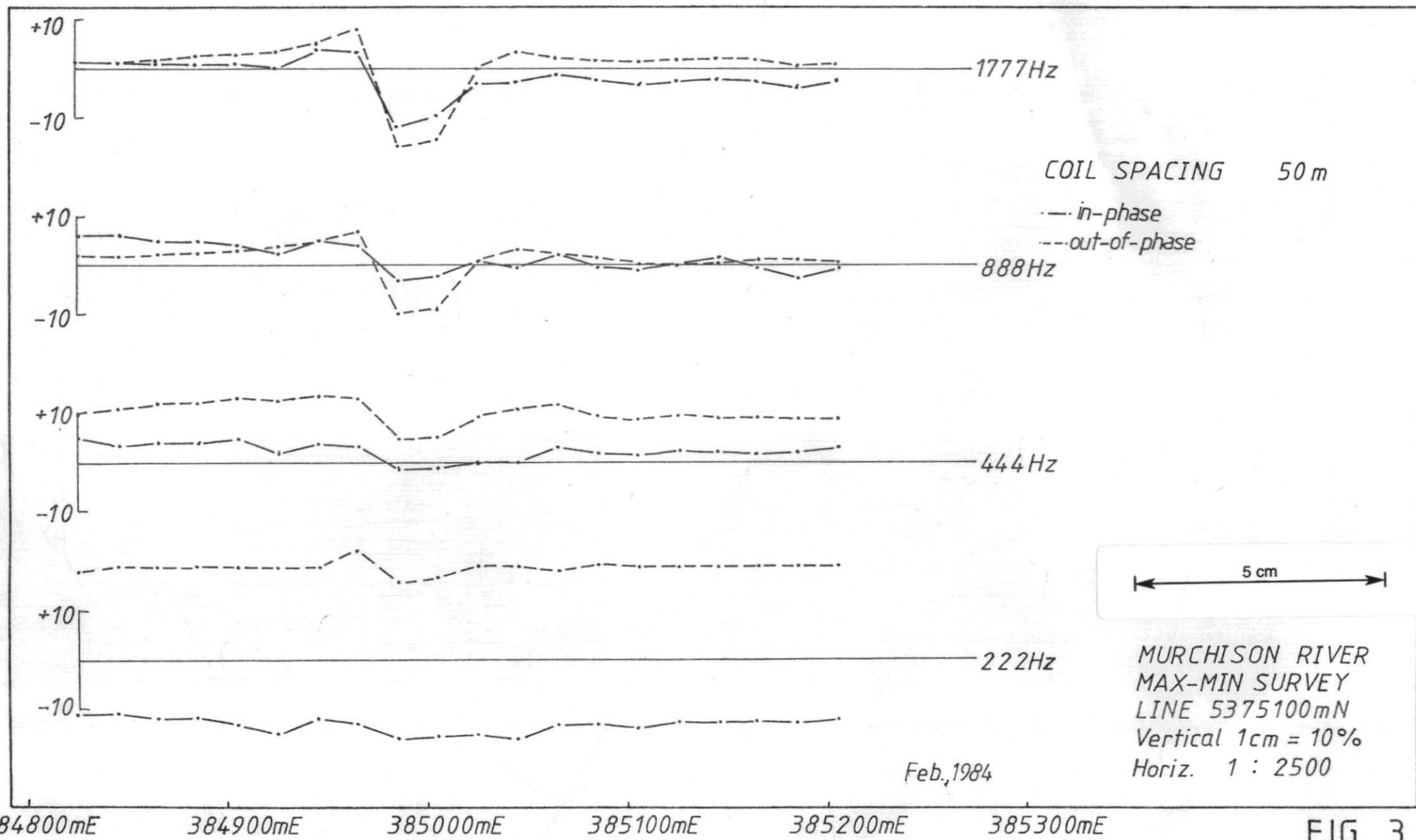
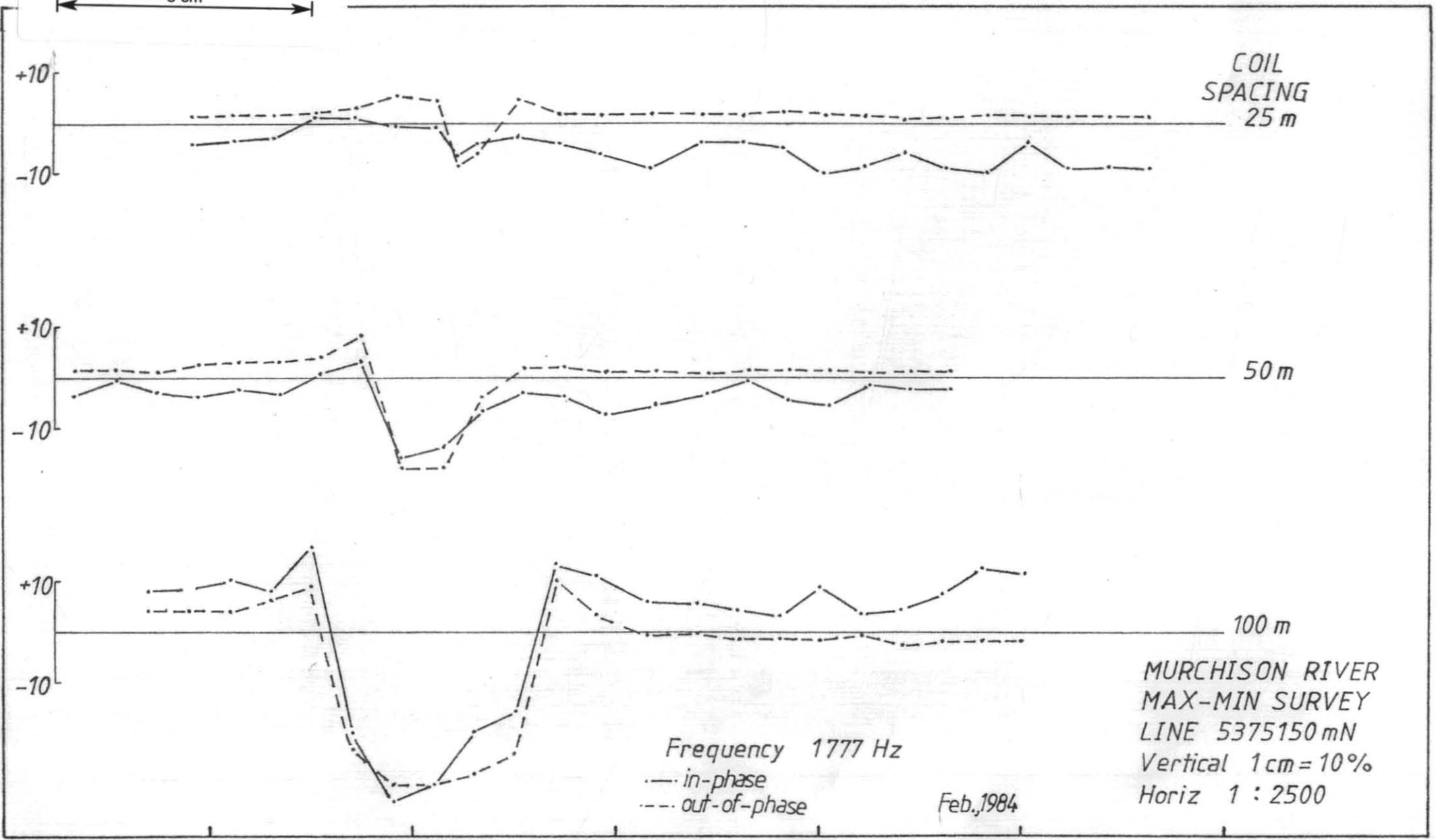


FIG. 3

699010

5 cm



MURCHISON RIVER  
MAX-MIN SURVEY  
LINE 5375150 mN  
Vertical 1cm = 10%  
Horiz 1 : 2500

384800mE 384900mE 385000mE 385100mE 385200mE 385300mE 385400mE FIG. 4

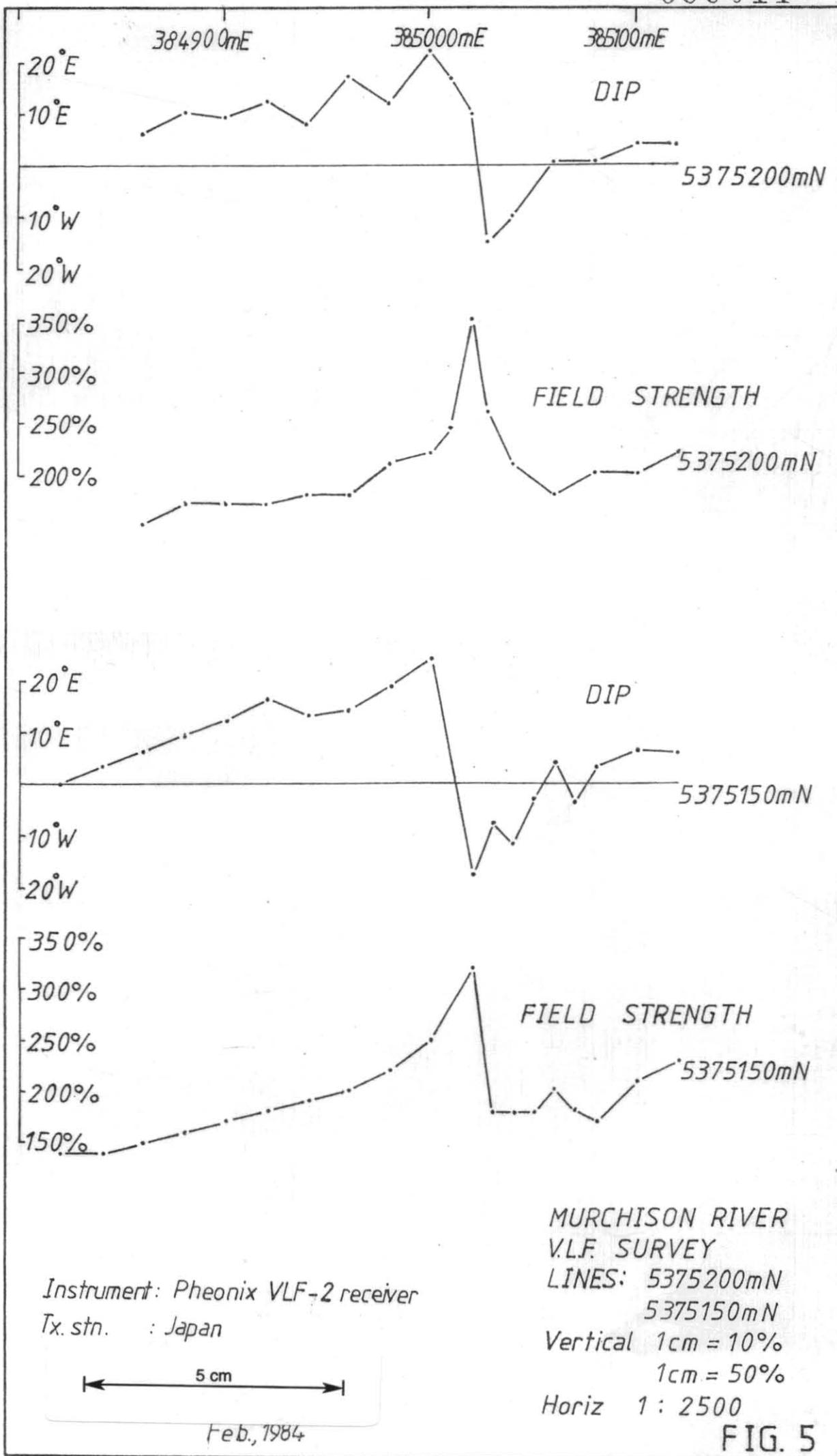


FIG. 5



DATE : JAN '84  
 Tx OPERATOR : R.O'H.  
 Rx OPERATOR : J.R.B.

# MAX - MIN E.M. FIELD SHEET

ANOMALY : STIRLING VALLEY  
 LINE NO. : 5375150  
 COIL SEP'N : 50m

AREA :

PEG

STATION NO. (MID-POINT Rx-Tx)	INCLINOMETER		222 HZ		444 HZ		888 HZ		1777 HZ		REMARKS
	%	AVERAGE %	IP	OP	IP	OP	IP	OP	IP	OP	
55.0 5242.5mE			-12.0	+19.0	+4.5	+6.0	-0.5	0	-2.5	+1	
5235.0mE			-12.5	+19.0	+4.5	+6.0	+0.5	0	-2.5	+1	
5215.0mE			-11.5	+19.0	+5.0	+5.5	+1.0	-0.5	-1.5	+0.5	
5195.0mE			-15.5	+19.5	+1.5	+6.0	-4.0	0	-6.0	+1.0	
5175.0mE			-14.5	+19.0	+3.0	+6.5	-3.0	0	-4.5	+1.0	
5155.0mE			-11.0	+19.0	+6.0	+7.0	+2.5	0	-0.5	+1.0	
5135.0mE			-14.0	+19.0	+3.5	+6.0	-1.0	-0.5	-3.5	+0.5	
5115.0mE			-16.5	+19.5	0	+7.0	-3.0	0	-5.5	+1.0	
5095.0mE			-17.5	+19.0	-0.5	+6.0	-5.0	0	-7.5	+1.0	
5075.0mE			-15.0	+19.5	+2.5	+6.0	-2.5	0	-4.0	+2.0	
5055.0mE			-15.0	+20.0	+3.0	+6.0	-2.0	0	-3.0	+1.5	5060 - 5080 is 25m
5035.0mE			-15.0	+18.0	+1.5	+5.0	-4.0	-3.0	-6.5	-4.0	5040 - 5060 is 25m
5015.0mE			-14.0	+16.0	+1.5	0	-5.0	-13.0	-14.0	-18.0	
4995.0mE			-17.5	+16.0	0	0	-7.5	-13.0	-16.0	-18.0	
4975.0mE			-17.0	+20.0	+4.0	+10.5	0	+5.5	+3.0	+8.0	
4955.0mE			-14.5	+20.0	+3.0	+8.0	+1.0	+3.0	+0.5	+4.0	
4935.0mE			-17.0	+20.0	+1.0	+7.5	-2.5	+2.0	-3.5	+3.0	
4915.0mE			-16.0	+19.5	+3.0	+7.0	-0.5	+1.5	-2.5	+3.0	
4895.0mE			-16.0	+20.0	+2.5	+8.0	-1.0	+1.0	-4.0	+2.5	

699013



DATE: 19-JAN-1984

Tx OPERATOR: R.O.H.

Rx OPERATOR: J.R.B.

## MAX - MIN E.M. FIELD SHEET

AREA:

ANOMALY: STIRLING VALLEY.

LINE NO.: 5375150mN

COIL SEP'N: 100m

STATION NO. (MID-POINT Rx-Tx)	INCLINOMETER		222 HZ		444 HZ		888 HZ		1777 HZ		REMARKS
	%	AVERAGE %	IP	OP	IP	OP	IP	OP	IP	OP	
4870.0mE					+40.0	+100.0	+35.0	+8.0	+8.0	+4.0	
4890 mE					+40.0	+100.0	+35.0	+9.0	+40.0	+4.5	
4910 mE					+45.0	+100.0	+35.0	+11.0	+10.0	+4.0	
4930 mE					+45.0	+100.0	+40.0	+20.0	+13.0	+6.0	
4950 mE					+50.0	+100.0	+40.0	+20.0	+16.5	+9.0	
4970 mE					+35.0	+75.0	+20.0	-16.0	-20.0	-23.0	
4990 mE					+35.0	+75.0	+14.0	-25.0	-33.0	-30.0	
5010 mE					+35.0	+80.0	+17.0	-20.0	-30.0	-30.0	
5030 mE					+42.0	+92.0	+25.0	-13.0	-20.0	-28.0	
5050 mE					+50.0	+85.0	+22.0	-13.0	-16.0	-24.0	
5070 mE					+52.0	+100.0	+40.0	+20.0	+13.0	+10.0	
5090 mE					+40.0	+100.0	+40.0	+11.0	+11.0	+3.0	
5110 mE					+40.0	+100.0	+35.0	+10.0	+6.0	-0.5	
5130 mE					+45.0	+100.0	+35.0	+14.0	+5.0	-0.5	
5150 mE					+40.0	+100.0	+35.0	+9.0	+4.0	-1.5	
5170 mE					+45.0	+100.0	+35.0	+13.0	+2.5	-2.0	
5190 mE					+40.0	+100.0	+35.0	+10.0	+8.0	-2.0	
5210 mE					+40.0	+100.0	+35.0	+14.0	+3.0	-1.0	
5230 mE					+35.0	+95.0	+35.0	+14.0	+4.0	-3.0	

699015



DATE : 19. JAN. 1984

# MAX - MIN E.M. FIELD SHEET

ANOMALY : STIRLING VALLEY

T<sub>x</sub> OPERATOR : R.O'H.

LINE NO. : 5375150mN

R<sub>x</sub> OPERATOR : JRB.

AREA :

COIL SEP'N : 25m

PEG

STATION-NO. (MID-POINT R <sub>x</sub> -T <sub>x</sub> )	INCLINOMETER		222 HZ		444 HZ		888 HZ		1777 HZ		REMARKS
	%	AVERAGE %	IP	OP	IP	OP	IP	OP	IP	OP	
897.5mE					<i>Other frequencies</i>				-4.	+1.1	
917.5mE					<i>also repeated</i>				-3.5	+1.3	
937.5mE									-3.	+1.2	
957.5mE									+1.	+1.3	
977.5mE									+1.	+2.4	
997.5mE									-0.5	+5.0	
5007.5mE									-1.	+4.	
5017.5mE									-6.5	-8.5	
5027.5mE									-4.5	-6.	
5037.5mE									-3.	+4.5	
5057.5mE									-4.	+1.3	
5077.5mE									-6.	+1.3	
5097.5mE									-9.	+1.2	
5117.5mE									-4.	+1.1	
5137.5mE									-4.	+1.3	
5157.5mE									-5.	+1.1	
5177.5mE									-10.	+1.	
5197.5mE									-8.5	+0.9	
5217.5mE									-6.	+0.8	

699017



DATE: 23-JAN-'84

## MAX - MIN E.M. FIELD SHEET

ANOMALY: STIRLING VALLEY

Tx OPERATOR: R.O'H.

LINE NO.: 5375100

Rx OPERATOR: S.R.B.

AREA:

COIL SEP'N: 50m

STATION NO. (MID-POINT Rx-Tx)	INCLINOMETER		222 HZ		444 HZ		888 HZ		1777 HZ		REMARKS
	%	AVERAGE %	IP	OP	IP	OP	IP	OP	IP	OP	
4825.0 <sub>miE</sub>			-18.0	+18.0	+5.0	+10.0	+6.0	+2.0	+2.0	+1.5	
845.0			<del>14.0</del> -11.0	+19.0	+3.5	+11.0	+6.0	+2.0	+1.0	+1.0	
865.0			-12.0	+19.0	+4.0	+12.0	+5.0	+2.5	+1.0	+1.5	
885.0			-11.5	+19.0	+4.0	+12.0	+5.0	+2.5	+1.0	+2.5	
905.0			-13.0	+19.0	+4.5	+13.0	+4.0	+3.5	+1.0	+3.0	
925.0			-15.0	+19.0	+2.0	+12.5	+2.5	+4.0	0	+3.5	
945.0			-12.0	+19.0	+4.0	+13.5	+5.0	+5.0	+4.0	+5.0	
965.0			-13.0	+22.0	+3.5	+13.0	+4.0	+7.0	+3.5	+8.0	
985.0			-16.0	+16.0	-1.0	+5.0	-3.0	-10.0	-12.0	-16.0	
5005.0			-15.5	+16.5	-1.0	+5.0	-2.0	-9.0	-9.5	-14.5	
025.0			-15.0	+19.0	0	+9.5	+0.5	+1.0	-3.0	0	
045.0			-16.0	+19.0	0	+11.0	-0.5	+3.0	-3.0	+3.0	
065.0			-13.0	+18.0	+3.0	+11.5	+2.0	+2.0	-1.0	+2.0	
085.0			-13.0	+19.0	+2.0	+9.5	0	+1.5	-2.5	+1.5	
105.0			-14.0	+19.0	+1.5	+8.5	-1.0	0	-3.5	+1.0	
125.0			-12.5	+19.0	+2.5	+9.5	0	0	-2.5	+1.5	
145.0			-12.5	+19.0	+2.0	+9.0	+1.0	+0.5	-2.5	+1.5	
165.0			-12.5	+19.0	+1.5	+9.0	-0.5	+1.0	-2.5	+1.5	
185.0.			-13.0	+19.0	+2.0	+9.0	-2.5	+1.0	-4.0	+0.5	

699019



DATE :

# MAX - MIN E.M. FIELD SHEET

ANOMALY : STIRLING VALLEY

T<sub>x</sub> OPERATOR : R.O'H.

LINE NO. : 5375100

R<sub>x</sub> OPERATOR : S.R.B.

AREA :

COIL SEP'N : 100m

STATION NO. (MID-POINT R <sub>x</sub> -T <sub>x</sub> )	INCLINOMETER		222 HZ		444 HZ		888 HZ		1777 HZ		REMARKS
	%	AVERAGE %	IP	OP	IP	OP	IP	OP	IP	OP	
4770.0mE									+5.0	-0.5	
790.0									+5.5	0	
810.0									+7.0	+1.0	
830.0									+8.0	+1.3	
850.0									+8.5	+3.5	
870.0									+14.0	+5.0	
890.0									+16.0	+6.0	
910.0									+16.0	+7.2	
930.0									+16.0	+6.7	
950.0									-4.5	-12.0	
970.0									-20.0	-30.0	
990.0									-20.0	-30.0	
5000.0									-16.0	-25.0	
030.0									-9.0	-21.0	
050.0									+8.0	0	
070.0									+9.0	+4.0	
090.0									+5.0	+2.0	
110.0									+5.0	+0	
130.0									+5.0	-1.0	

699021



DATE : 19- JAN -1984

# MAX - MIN E.M. FIELD SHEET

ANOMALY : STERLING VALLEY  
 FREQUENCY : 1777 Hz.  
~~LINE NO.~~

T<sub>x</sub> OPERATOR : R.O'H.

R<sub>x</sub> OPERATOR : J.R.B.

AREA:

COIL SEP'N : 100m

PEA.

5374900mN

5375000mN

5375175mN

STATION NO. (MID-POINT R <sub>x</sub> -T <sub>x</sub> )	INCLINOMETER		222 HZ		444 HZ		888 HZ		1777 HZ		REMARKS
	%	AVERAGE %	IP	OP	IP	OP	IP	OP	IP	OP	
4870.0mE			+7.5	+7.5			+12.	+0.5			
890.0			+7.	+7.5			+11.	+2.1			
910.0			+8.	+9.			+14.	+3.3			
930.0			-2.	-7.	+6.	0	+17.	+3.3			
950.0			-10.	-16.5	-6.	-15.	+20.	+6.			
970.0			-10.	-18.	-6.5	-18.5	+1.	-7.			
990.0			-10.	-18.	-5.5	-18.	-30.	-32.			
50100			-6.	-15.	-4.	-13.5	-25.	-30.			
030.0			0	-4.	+2.5	-2.	-20.	-28.			
050.0			+5.	+2.	+6.	+4.	-16.	-25.			
070.0			+2.5	+1.	+4.5	+2.5	-8.	-22.			
090.0			+5.	0	+4.	+1.					
110.0			+1.	-0.5	+3.5	+0.5					
130.0			+3.	-2.	+3.5	-1.					
150.0					+1.	-2.5					
170.0					+5.	-7.					
190.0					+5.	-3.					
210.0					+6.5	-2.5					

T<sub>x</sub> → WEST.

R<sub>x</sub> → EAST.

699023