

**GEOPHYSICAL INVESTIGATIONS,  
FORARI BAY,  
EFATE, VANUATU**

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## SUMMARY

Manganese was mined from Forari Bay on the east coast of Efate from between about 1962 and 1979. The ore was processed and shipped from facilities in Forari Bay. The manganese was generally concentrated in one or two layers at a depth of 1-6 m below the ground surface, but dips at angles of up to 20° under overburden eastwards of the previous mining limit. As the base of the overburden may be an undulating surface rather than one of constant dip, a geophysical survey was undertaken to ascertain the depth to this interface and perhaps the thickness of the mineralised layer down dip from outcrop.

Bathymetric profiling and sampling of the seabed was also undertaken in Forari Bay to supplement investigations by Portman Mining Ltd into whether marine action had winnowed fine manganese ore and tailings lost in the bay during mining operations into an easily worked ore body now that manganese processing techniques have improved.

This work was carried out from 25 August to 10th September 1992 as part of the 1992 SOPAC Work Plan Task 92.Va.14a: Study of Forari Bay manganese. The acquisition of the data was successful and this should allow interpretation to meet the objectives of the survey. The data collected are archived at SOPAC Secretariat, Suva, Fiji. Digital files on 3.5 HD diskette are included in copies of this report submitted to Portman Mining and to the Vanuatu Department of Geology Mines and Water Resources.

## ACKNOWLEDGEMENTS

The work was carried out at the request of the Department of Geology Mines and Water Resources of the Vanuatu Government which assisted with all in-country logistics and transportation. The generous support of equipment and personnel from the Mineral Resources Department, Republic of Fiji for this work is gratefully acknowledged. Funding for SOPAC assistance was contributed by the Government of Australia with supplementing support from the New Zealand Government and the EC.

## OBJECTIVES

1. To pursue a geophysical exercise involving seismic refraction and resistivity to test if these methods are able to ascertain depth of overburden and perhaps the thickness of the mineralised layer down dip from the old mining limit.
2. To conduct a bathymetric and sampling exercise in Forari Bay to supplement investigations by Portman Mining Ltd

This work was carried out from 25 August to 10th September 1992 as part of the 1992 SOPAC Work Plan Task 92.Va.14a: Study of Forari Bay manganese.

## INTRODUCTION

Manganese was first discovered in 1953 by geologists of the Compagnie Francoise des Phosphates de l'Océanien in Forari near Metensa Bay (referred to as Forari Bay this report) on the east coast of Efate (Figure 1). Open cast mining commenced around 1962 with the ore then washed, upgraded by sintering at a processing plant by Forari Bay and then shipped from facilities in the bay, mainly to Japan. Production in subsequent years from a peak of 74406 tones in 1965 gradually decreased with only 27,553 tones export in 1977. Mining then ceased around 1978/1979 (Ash et al 1978).

The manganese was generally concentrated in one or two layers which ran roughly parallel to and at a depth of 1-6 m below the ground surface, usually showing a conformable relationship to the tuffs below and the red clays and soils above. However, the ore bearing horizon dips at angles of up to 20° under an overburden of chocolate brown soils, buff brown tuffaceous clays and coral limestone eastwards of the previous mining limit (Figure 2), (Warden 1971). As the base of the overburden may be an undulating surface rather than one of constant dip, a geophysical exercise was undertaken to ascertain the depth to this interface and perhaps the thickness of the mineralised layer down dip from outcrop. The results could have significant economic implications.

Bathymetric profiling and sampling of the seabed was also undertaken in Forari Bay to supplement investigations by Portman Mining Ltd (current prospector) into whether marine action had winnowed fine manganese ore and tailings lost in the bay during mining operations into an easily worked ore body now that manganese processing techniques have improved.

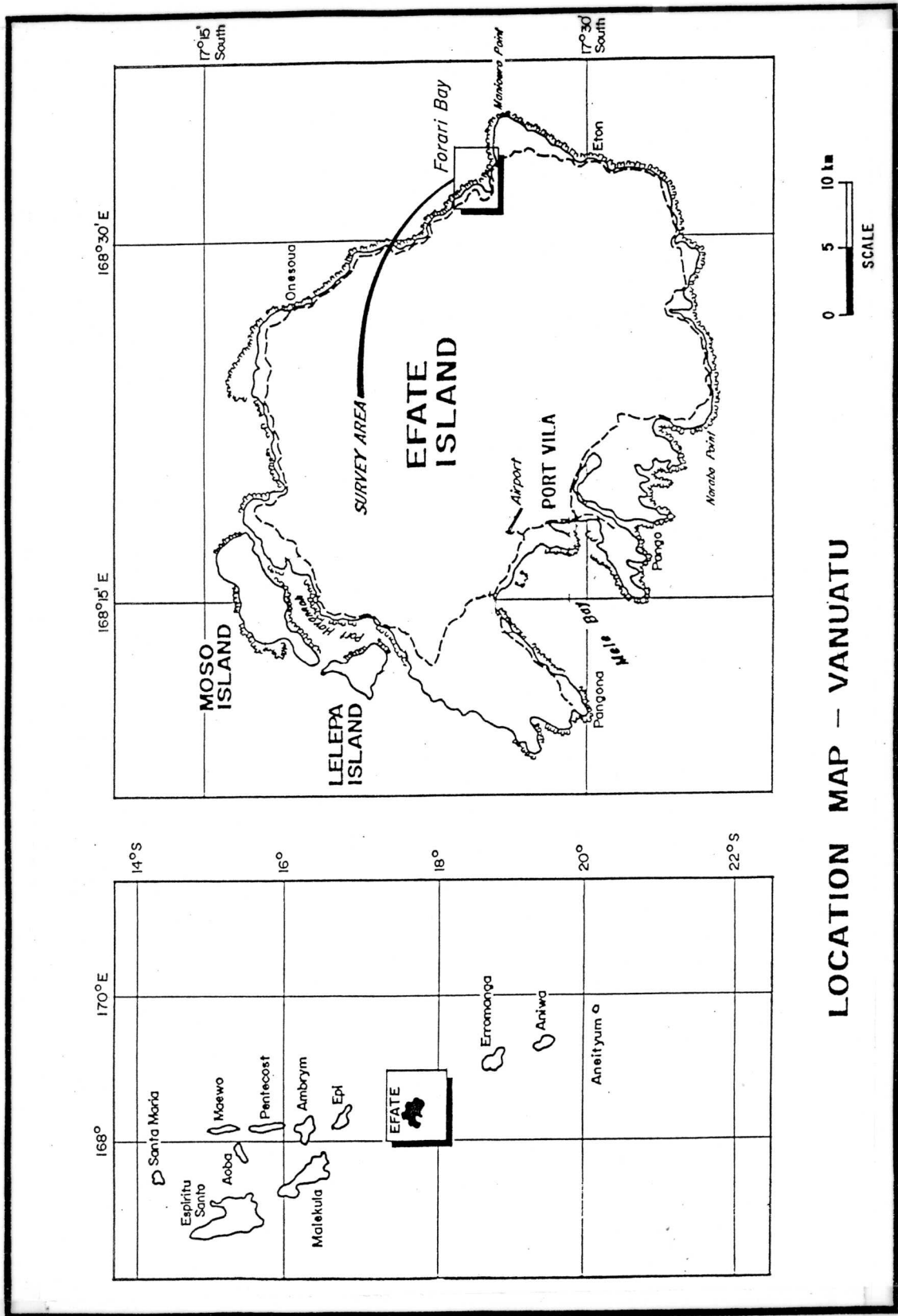


Figure 1. Location map

## SURVEY OPERATIONS

### Onshore

#### *Seismic refraction*

Figure 2 is a location map of the seismic refraction and resistivity lines surveyed at the Forari mine. Five refraction lines and two resistivity lines were completed during a nine day period. The location of the lines were selected by the Portman Mining (Vanuatu) Ltd representative in Vanuatu. Data collected are available both hard copy seismogram (Appendix 1) and digital files on 3.5 HD diskette (included in copies of this report submitted to Portman Mining and to the Vanuatu Department of Geology Mines and Water Resources). Line configuration, geophone location and shot positions for the five lines are in Appendix 2. Technical specifications for the 12 channel OYO McSeis 170 seismic refraction system used on the survey are given in Appendix 7.

Energy source was a hammer. A total of 95 seismograms were collected for the 5 lines. The order in which lines were surveyed were 2, 1, 5, 3, and 4. Figure 3 is the spread configuration used. Where a geophone and shot location occur together the respective phone was displaced 2.5 m from the shot then moved back to its original position for the reciprocal shot. No surveying for elevation control of geophone stations was done. Phone spacing was 5 metres with a total spread length of 55 metres.

Line 1. Traverse direction was west to east. A 5 metre geophone interval was used with a 4 phone overlap. There are 18 seismograms for line 1. Figure 4 shows shooting on line 1.

Line 2. This line started at 100 west and was shot eastward to end at 200 East. A 5 metre interval phone spacing was used. A fifteen metre, 4 geophone overlap between each profile was used. Line 2 at 005E intersects with line 5 at point 000. There are 18 seismograms for line 2. Note that shot 2 is a "20 m extension" to check the deeper layer velocity only, which may not be very useful on its own.

Line 3. Traverse direction was west to east with a total line length of 492.5 metres. Although there was no overlap for each spread, there was a common receiving phone position. In many places along this line it was difficult to plant the phones due to the hard limestone surface.

To achieve phone coupling with the ground, especially in areas where there was nothing but limestone with only a very thin top soil (2 cm - 3 cm), holes for the phone stem were chiseled into the ground using a steel spike. There are 24 seismograms for line 3.

Line 4. Traverse direction was west to east. Five spreads, with no overlap but with one common phone between each spread for a total line traverse of 275 metres. There are ten seismograms for line 5.

Line 5. Traverse direction was south to north with a total line length of 477.5 metres. For seismograms shots 37 to 40 a 2.5 metre interval for the geophones was used. From shots 44 to 59 a 5 metre phone spacing was used. In both the 2.5 metre spreads and 5 metre spreads no phone overlap were used but there is a common receiving point. At 000 South line 5 intersects with line 2 at 005 East. Again there were areas in this line where it was difficult to plant the geophone due to a hard limestone surface with little or no top soil. There are 25 seismograms for line 5

Phone spacing 5 metres  
Line spread arrangement

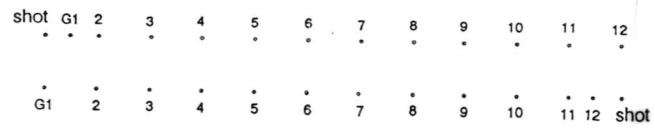


Figure 3. Spread configuration used during survey



Figure 4. Shooting line 1

### *Resistivity Measurements*

Resistivity measurements were made using the offset Wenner array.

The offset Wenner sounding uses a five electrode array. One electrode remains fixed at the centre of the spread and a switching device is used to change from one adjacent set of 4 electrodes to the others. Two resistances are obtained which are averaged to provide the offset Wenner resistance at the centre of the array. The spacing used was according to the series  $a=0.5, 1, 2, 4, 8, 16, 32$  and 64 metres. Equipment used was an ABEM Terrameter SAS system and a BGS 128 offset sounding cable. Technical specifications are in Appendix 7.

Resistivity soundings were completed on lines 1, 2, and 4. Soundings were not attempted on lines 3 and 5 because of the lack of top soil and an extensive limestone surface which is not conducive to resistivity measurements. Sounding results for lines 1 and 2 are tabulated in Appendix 2. Line 4 results have not been included as a 0.5 metre error in the offset cable affected the results of near-electrode values recorded. Figure 5 illustrates laying of the line.



**Figure 5. Resistivity sounding, line 2**

## CONCLUSIONS

1. The acquisition of the data was successful and this should allow interpretation to meet the objectives of the survey.
2. The data collected are archived at SOPAC Secretariat, Suva, Fiji.

## REFERENCES

Warden A.J. 1971. Manganese Mineralization in the New Hebrides. Rep. Geol. Surv. New Hebrides.

Ash R.P; Carney J.N; MacFarlane A, 1971. Geology of Efate and offshore Islands. Rep Geol. Surv. New Hebrides.

**APPENDIX 1**  
**SEISMOGRAMS**

<b>LINE #</b>	<b>SEISMOGRAM ID NOS</b>
1	Record ID 19 - 36
2	Record ID 1 - 18
3	Record ID 62 - 85
4	Record ID 86 - 95
5	Record ID 37 - 61

**Typical Record Header**

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ID No 019 :(record identification no.)  
Date :  
Filter :  
Stack :  
Sampling :  
Delay :  
Time Scale :  
Size :

## **Offshore**

### *Navigation*

Navigation control was accomplished with a Del Norte 520 digital distance measuring unit. Calibration was done over a known range and the calibration factors recorded prior to the start of the survey and checked daily. The remote shore stations were located on selected bench marks established by the Vanuatu Lands and Survey Department (Appendix 3). No station descriptions were available. All navigation data were logged and processed on PC laptops.

A position fix period of 10 seconds for lines 1 and 2 and 15 seconds for lines 3 to 21 was used for the profiles in Forari Bay. Figure 6 is a track plot of these lines. Final coordinates for the bathymetric data are listed in Appendix 5.

### *Bathymetry*

A DE719e Raytheon precision echo sounder was used for profiling the seabed. Calibration of the sounder was by the bar check method. Correction for tidal effects was from tidal data supplied by the Vanuatu Hydrographic Department. Datum selected is LAT (Lowest Astronomical Tide).

Data from the original French hydrographic survey of 1960 was also acquired as hard copy on fair sheets. These data were collected prior to mining activities and dumping of tailings in the bay. Interpretation of the recently corrected bathymetric data using the same datum may reflect a change in the bay bathymetry thereby allowing some estimate as to volume of tailings (sediment) increase in the bay. Figure 7 shows the survey vessel.

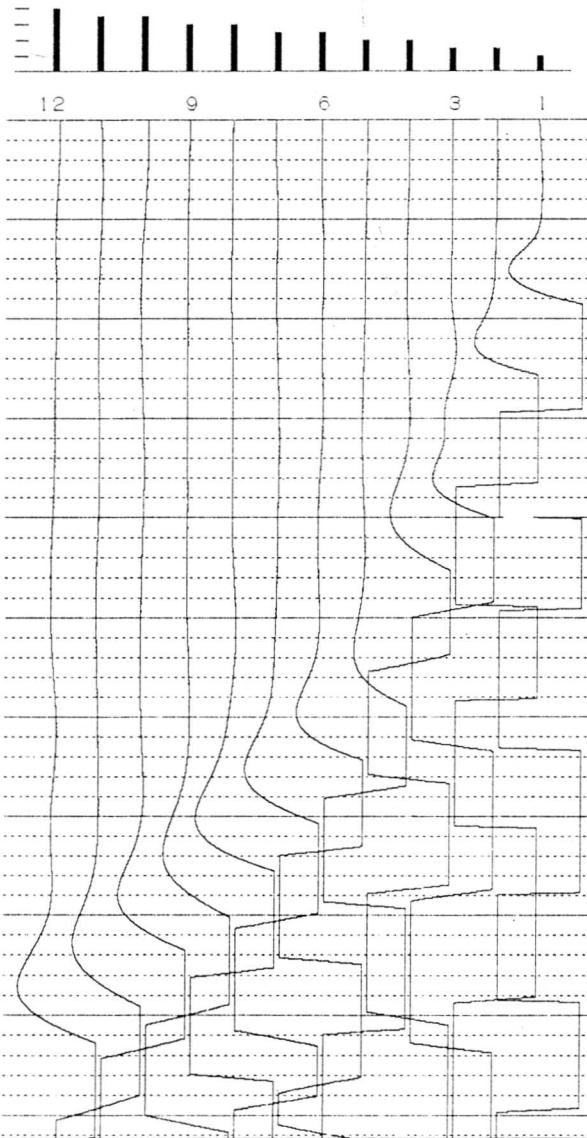
### *Seabed Sampling*

A Vanveen grab was used to collect samples from the bay (Figure 8) at thirty seven stations. Figure 9 is the sample location map. Appendix 5 gives a listing of the sample stations with coordinates in VMG and sample description. The samples were split with the bulk of the samples left with Portman's representative in Port Vila, Doug Hutchinson of Pacific Prospecting Services.

# OYO

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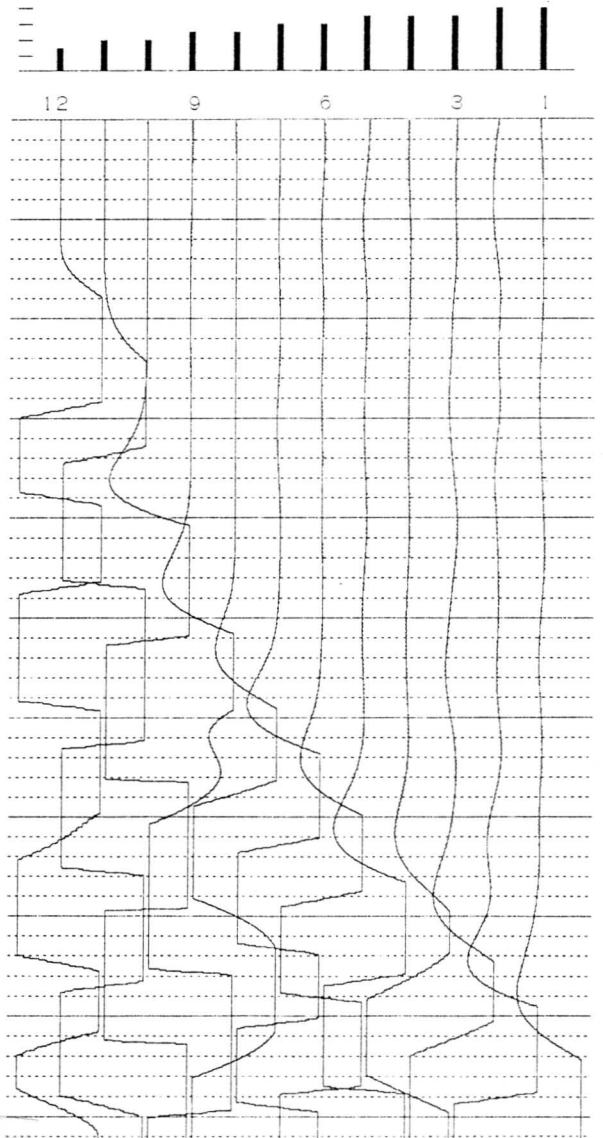
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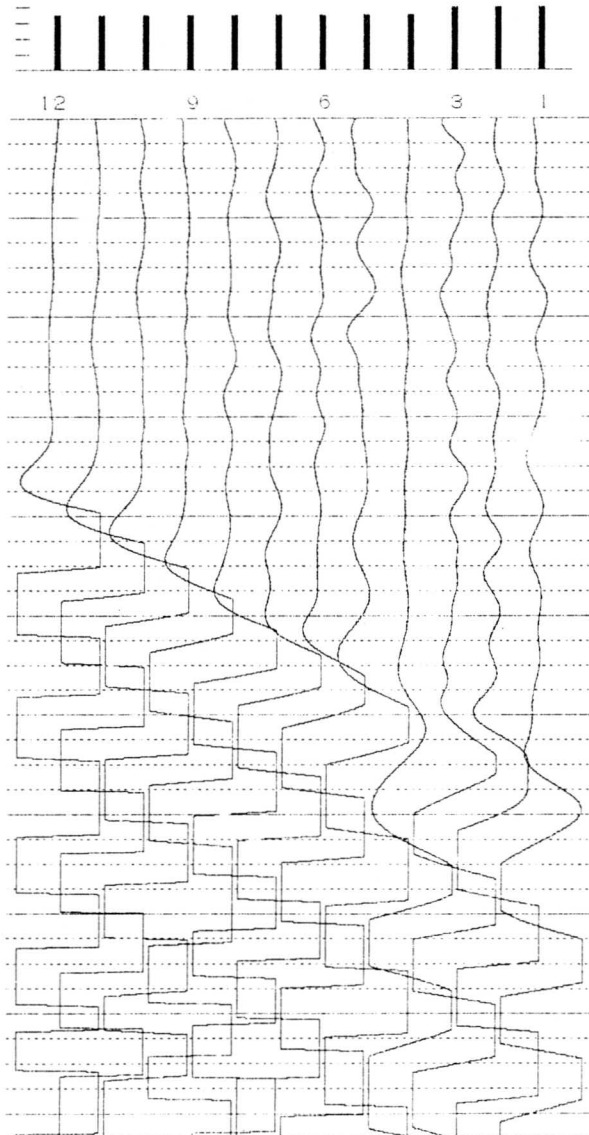
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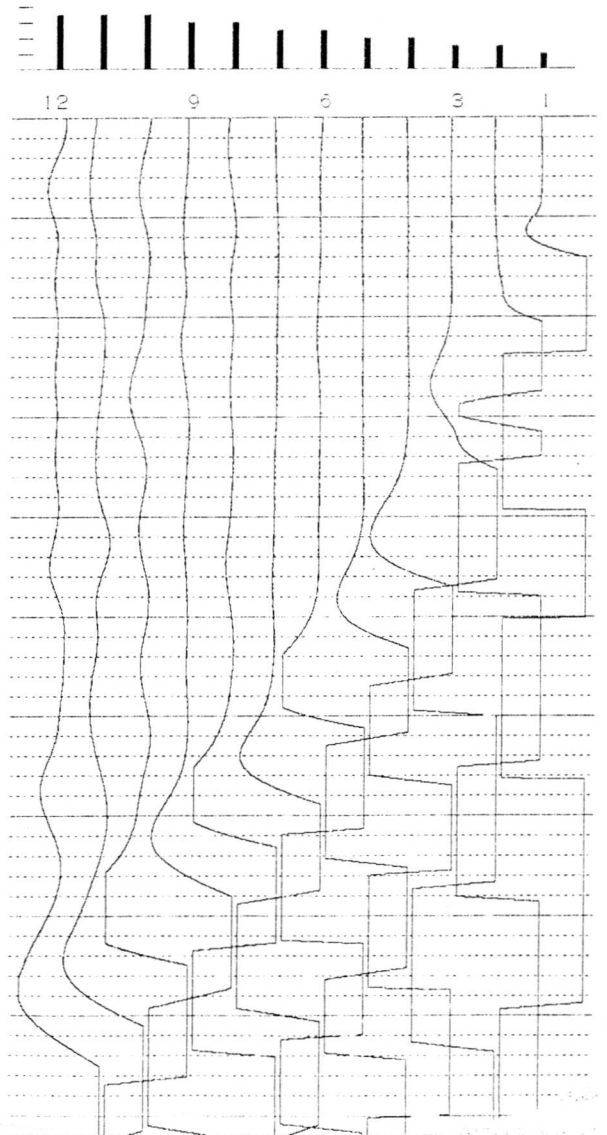
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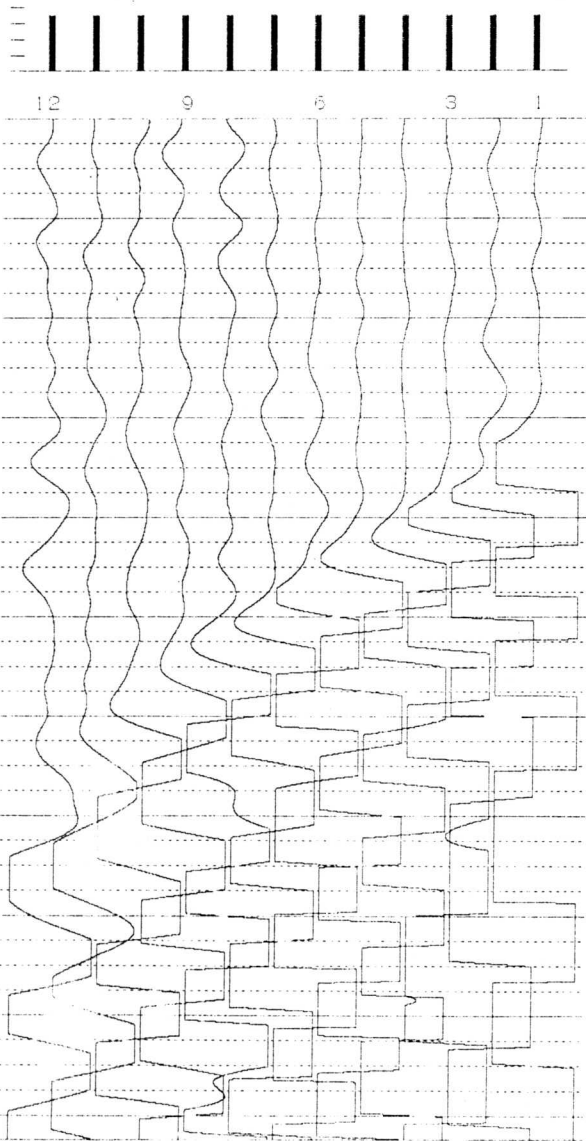
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OYO

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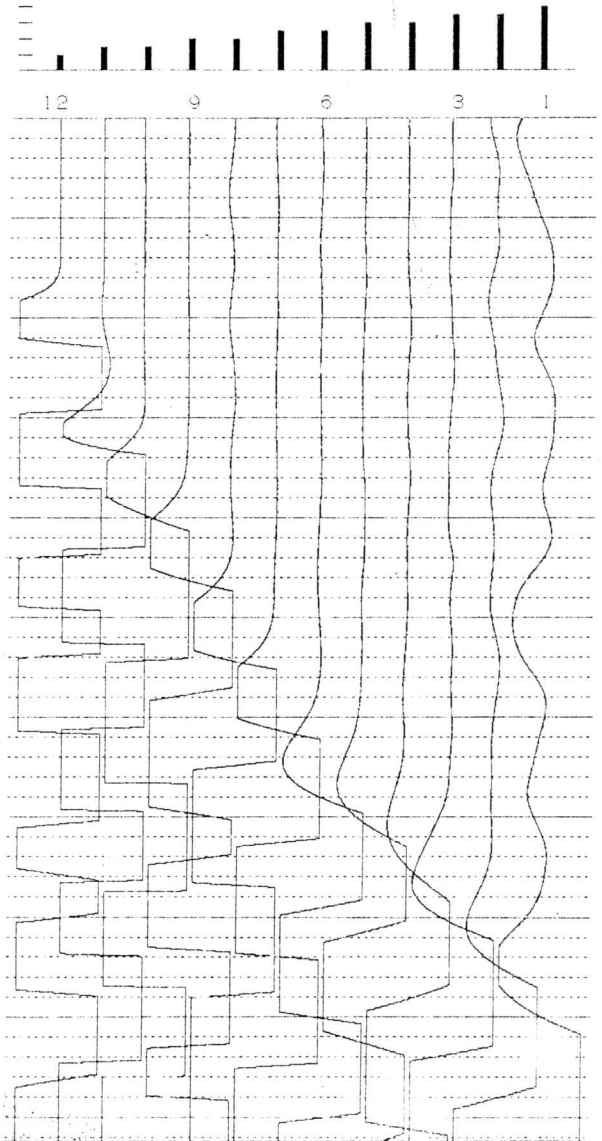
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OYO

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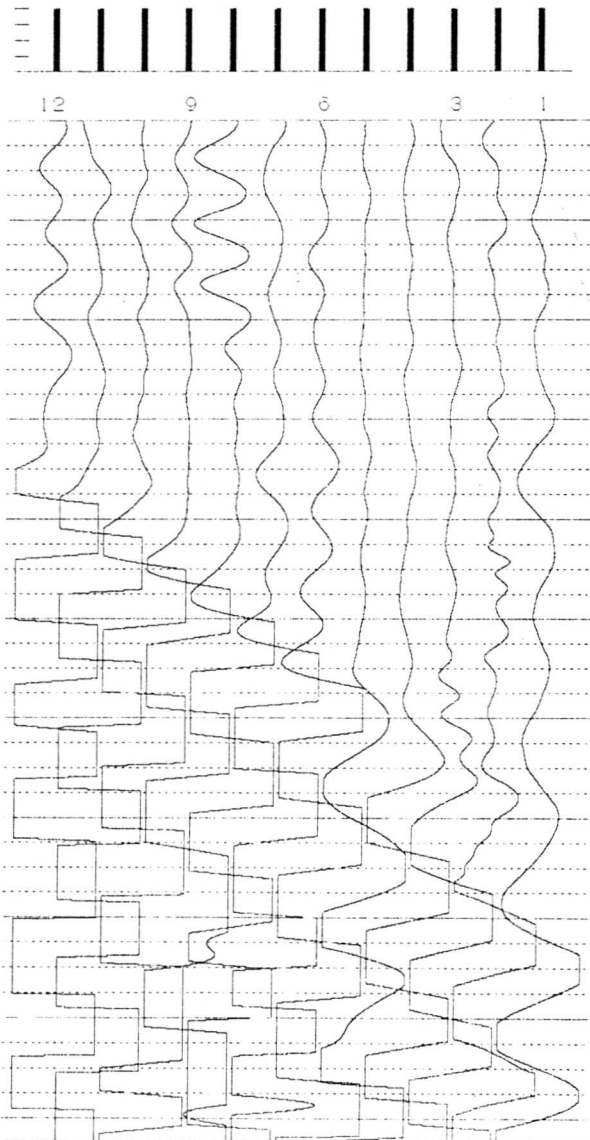
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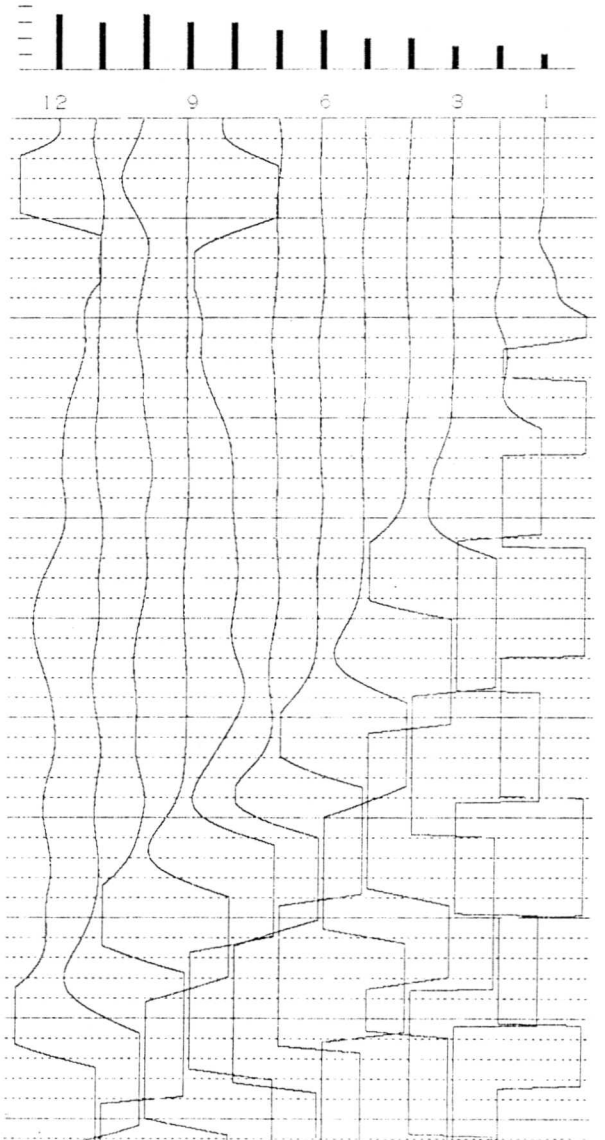
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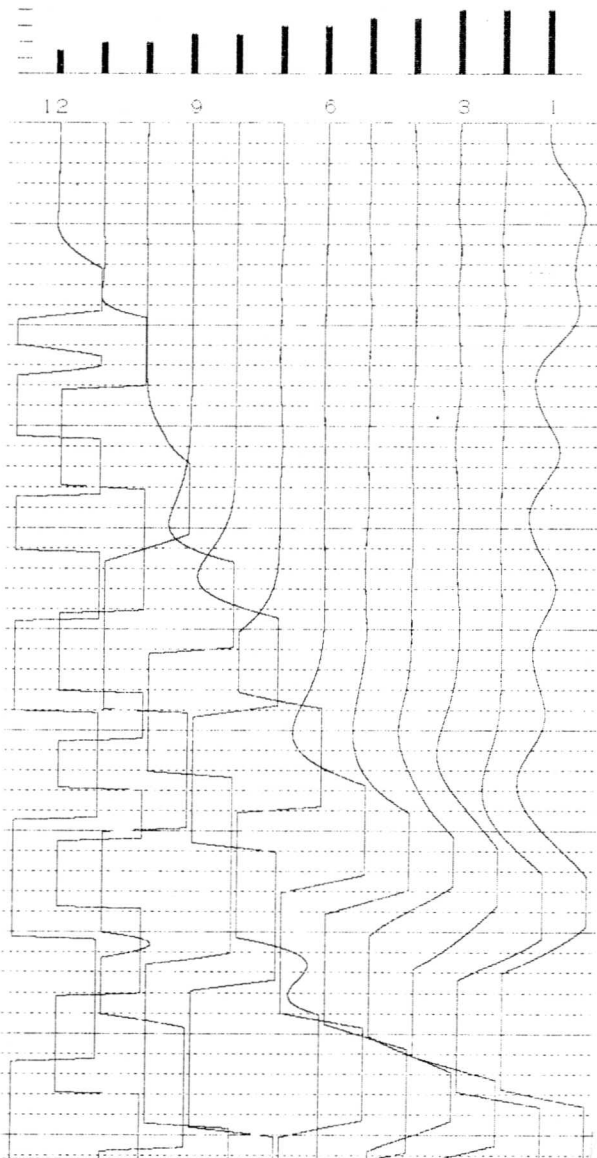
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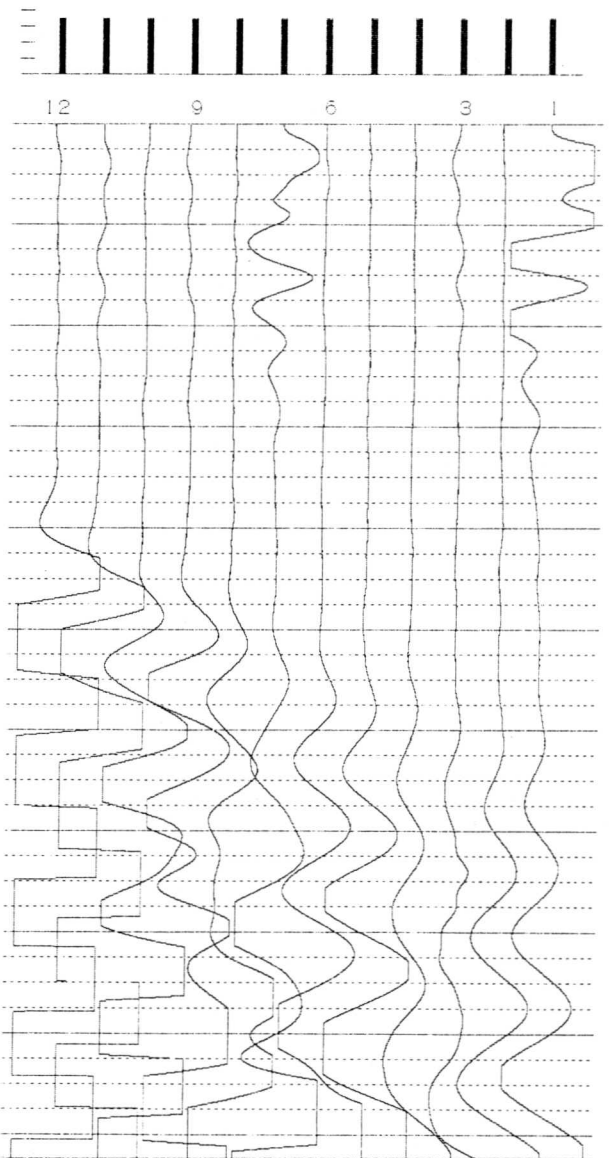
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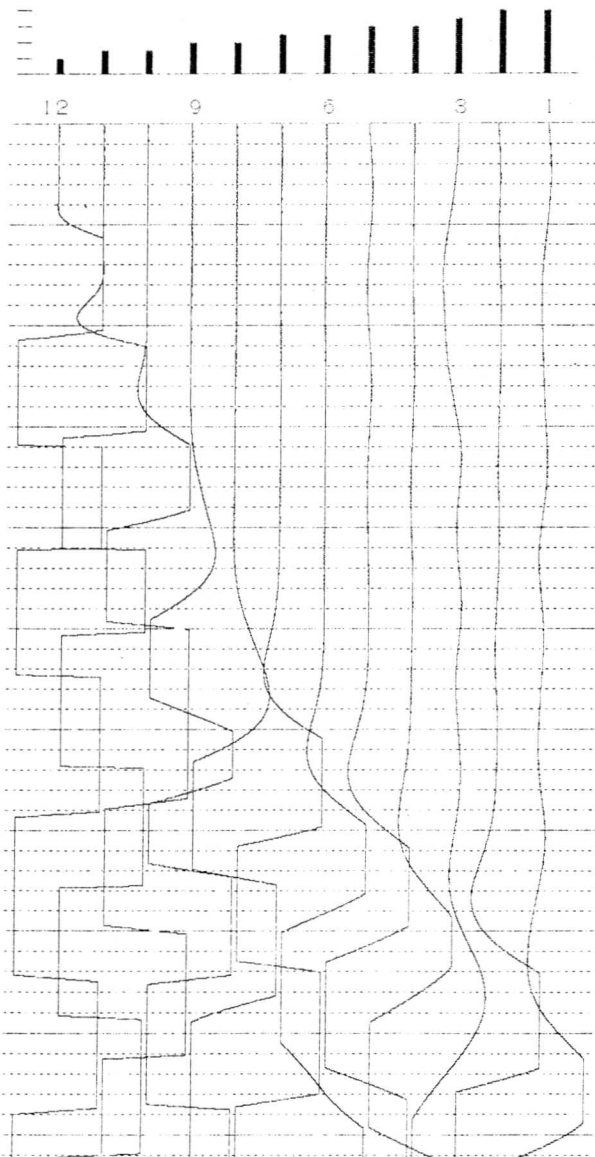
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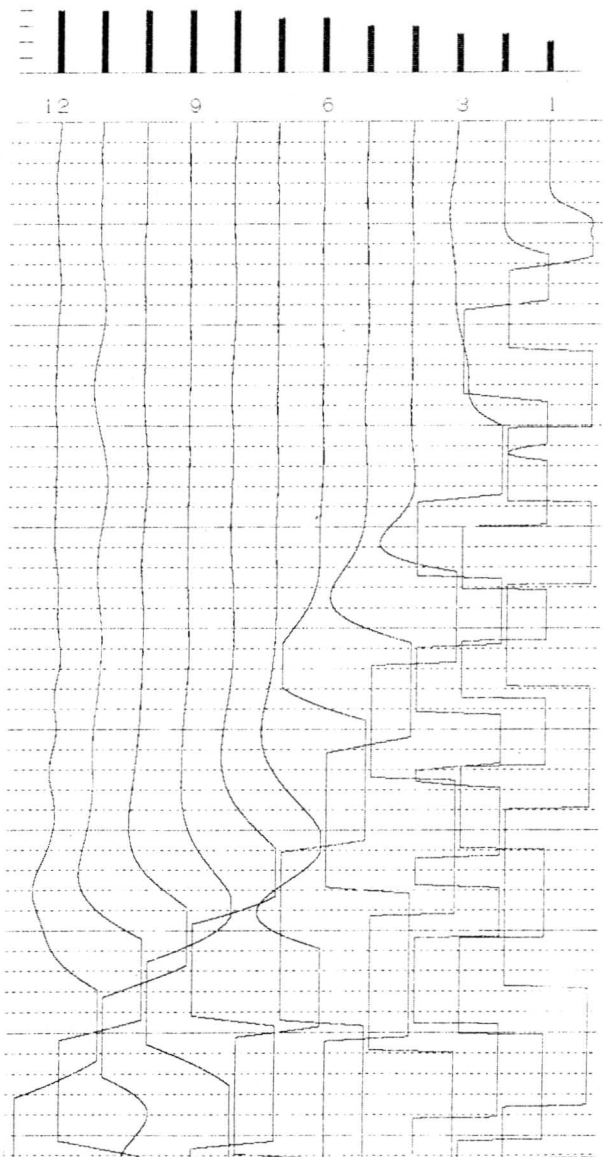
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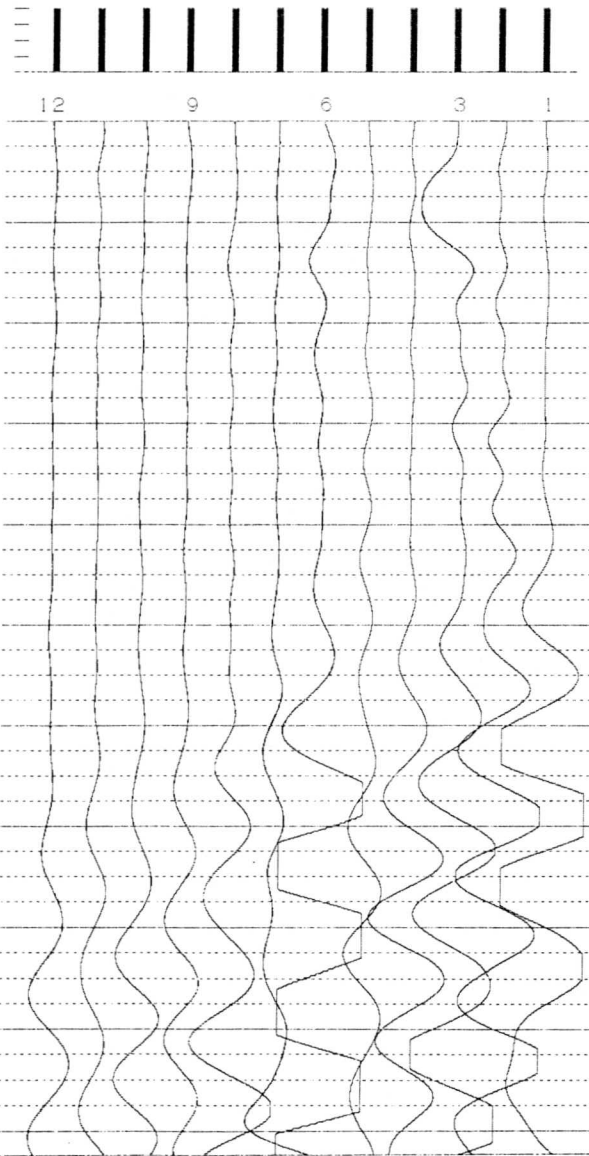
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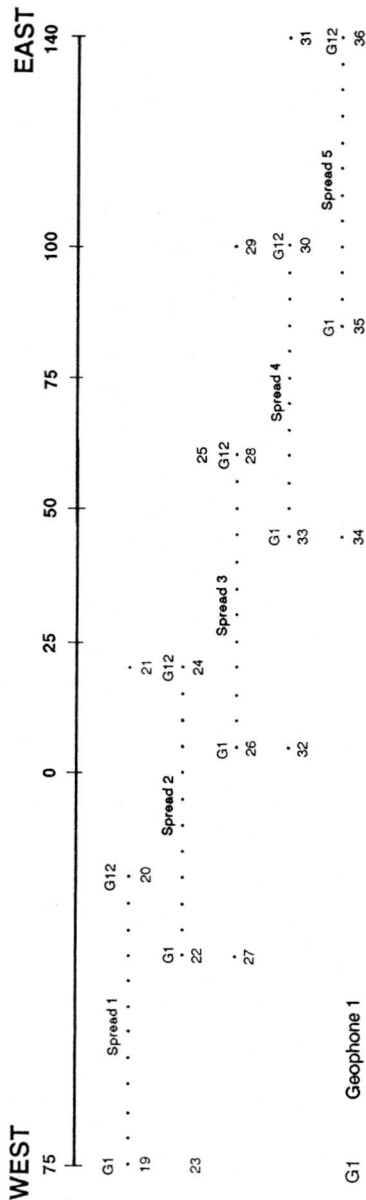
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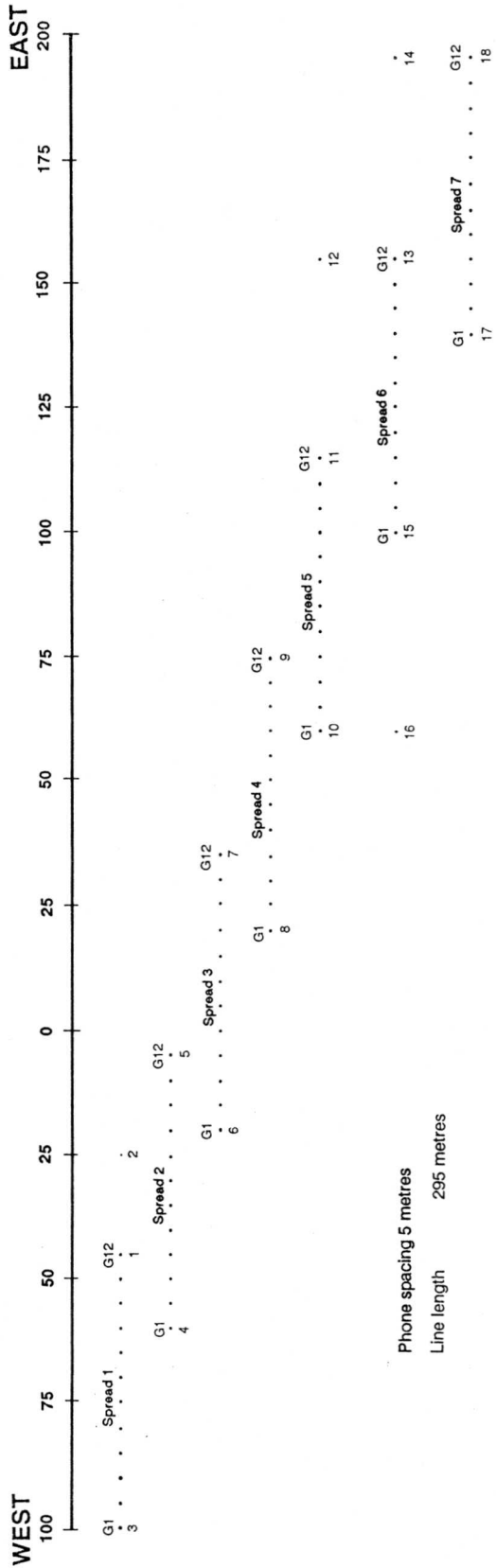
27-8-92.



G1 Geophone 1  
 G12 Geophone 12  
 Line Length 215m  
 Phone spacing 5 metres  
 19 etc Shot location

# LINE 2 TRAVERSE DIRECTION WEST TO EAST

26-8-92.

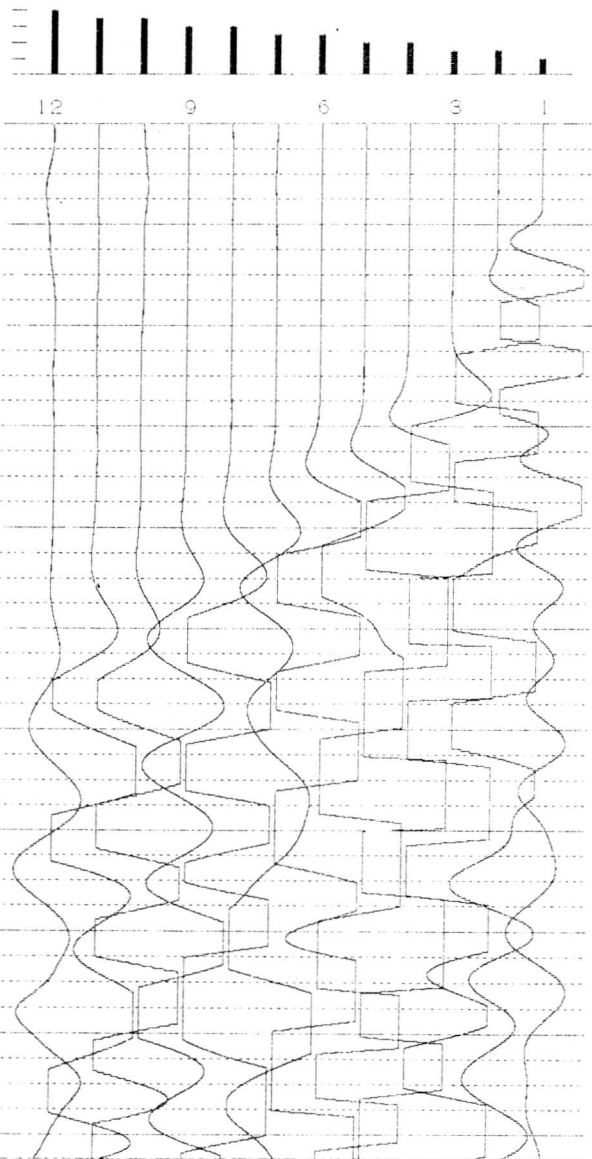


Phone spacing 5 metres  
 Line length 295 metres

# OYO

McSEIS-170 V1.41

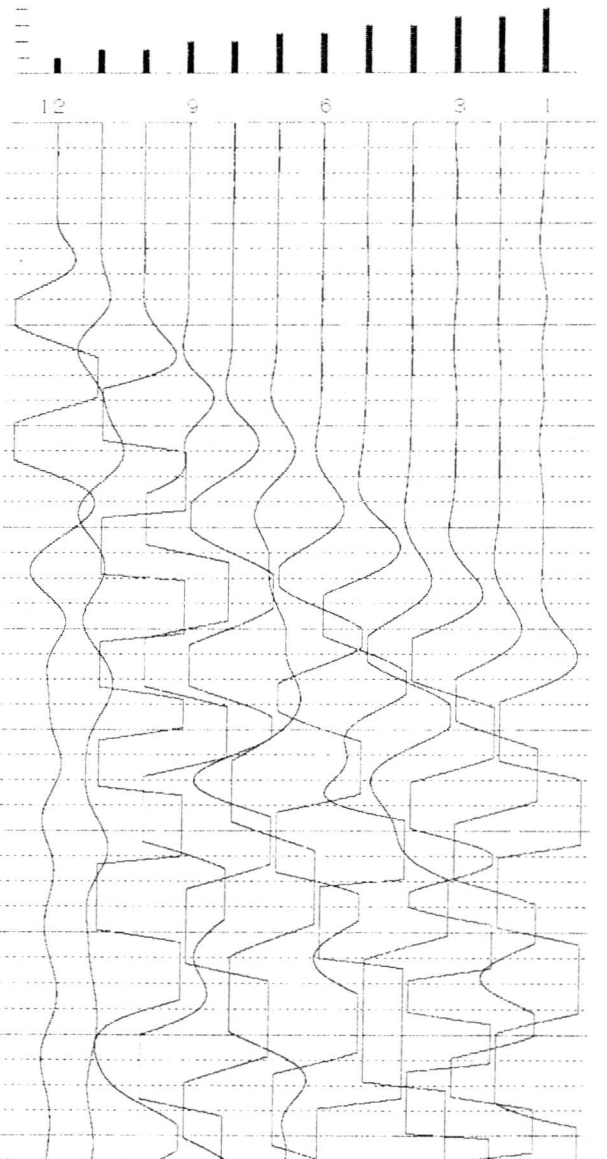
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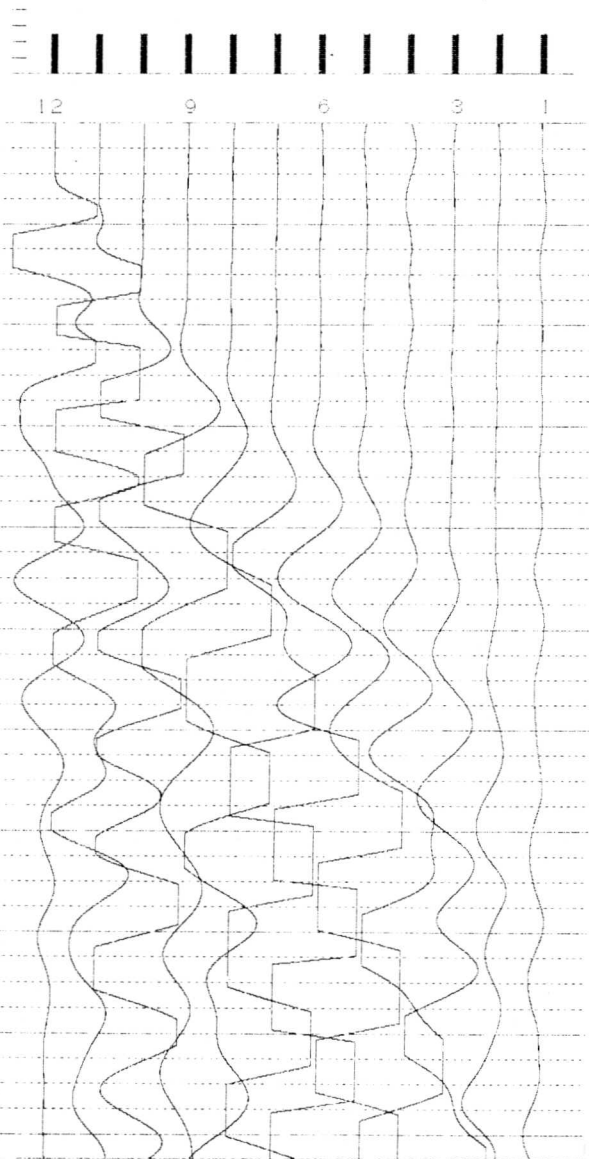
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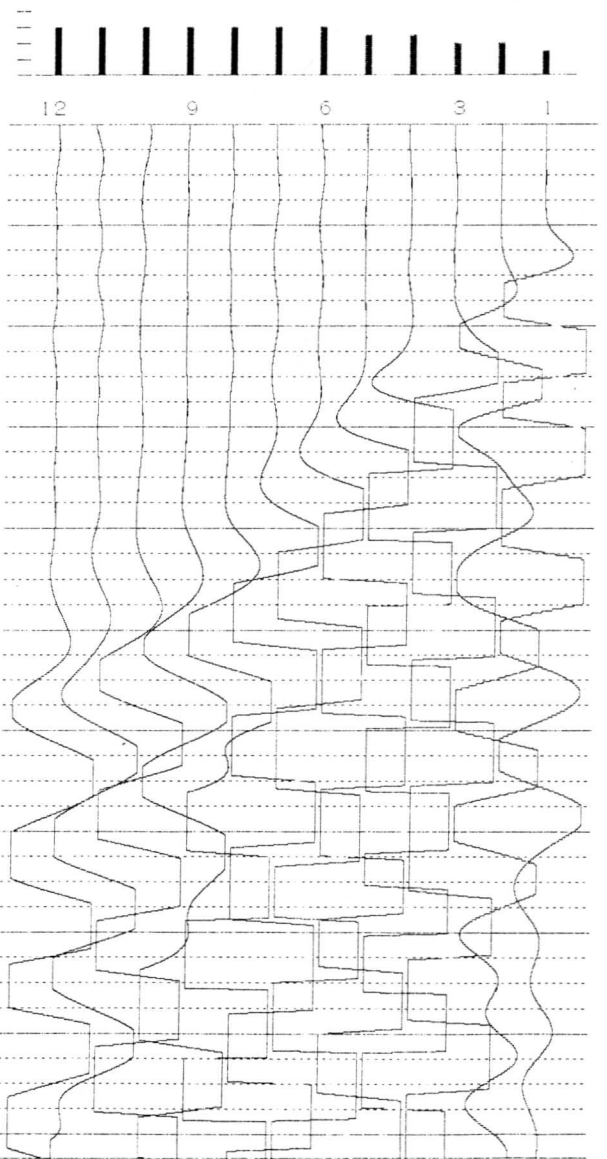
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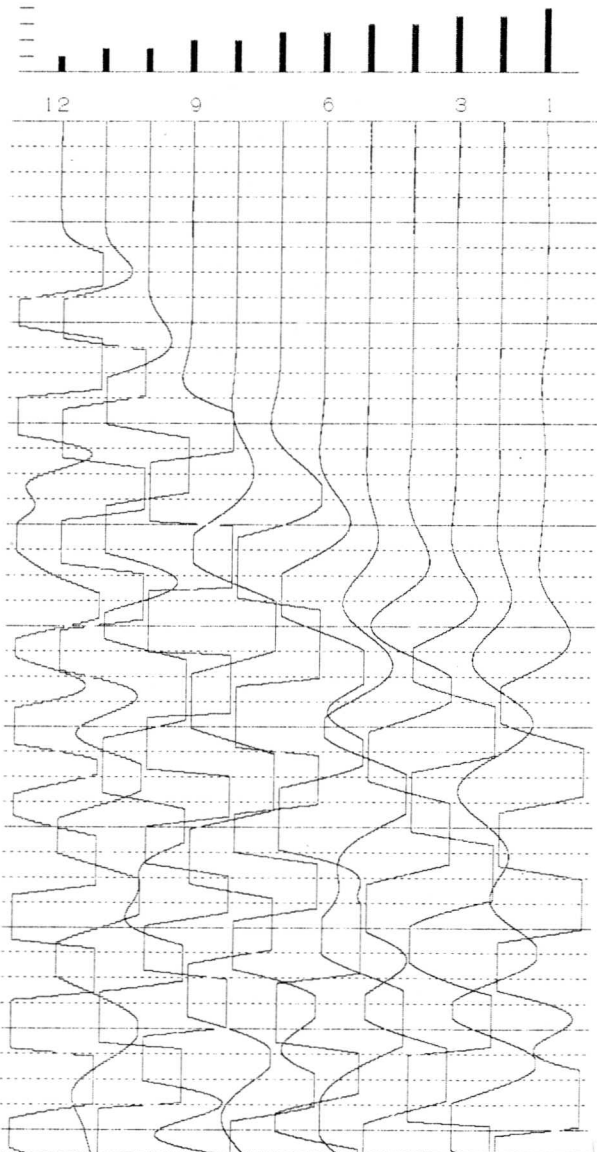
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# OYO

McSEIS-170 VI. 41

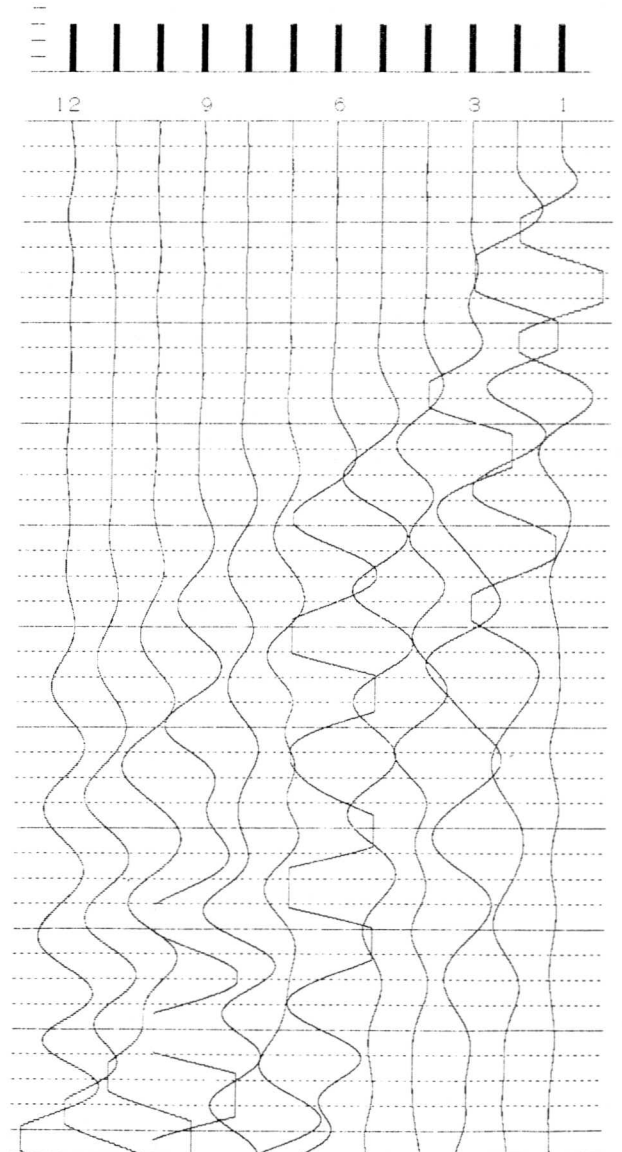
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McSEIS-170 VI. 41

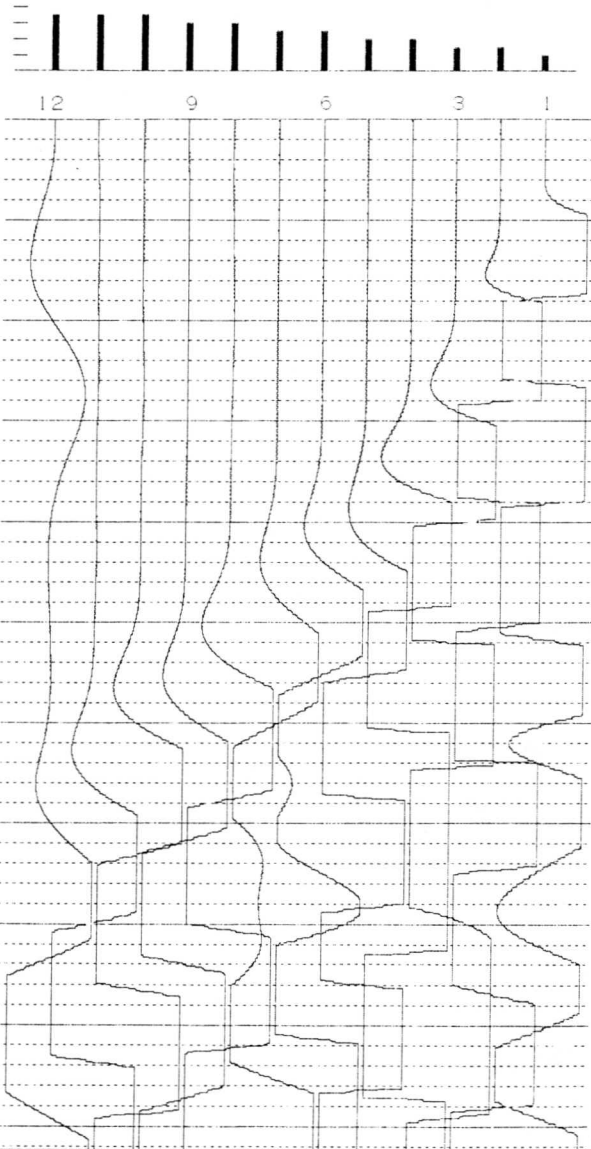
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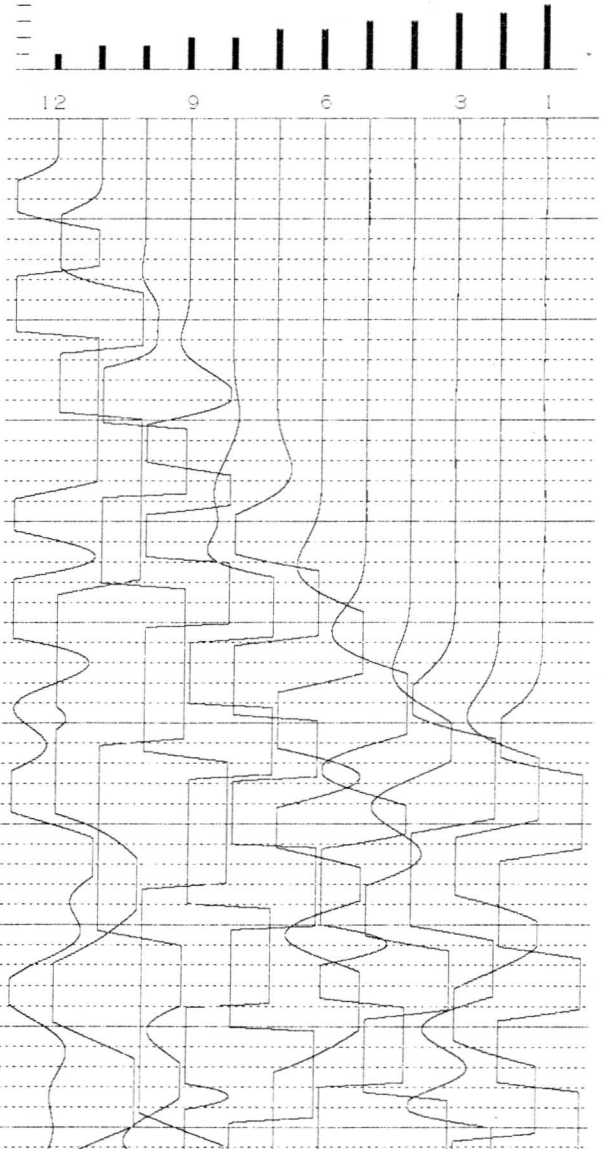
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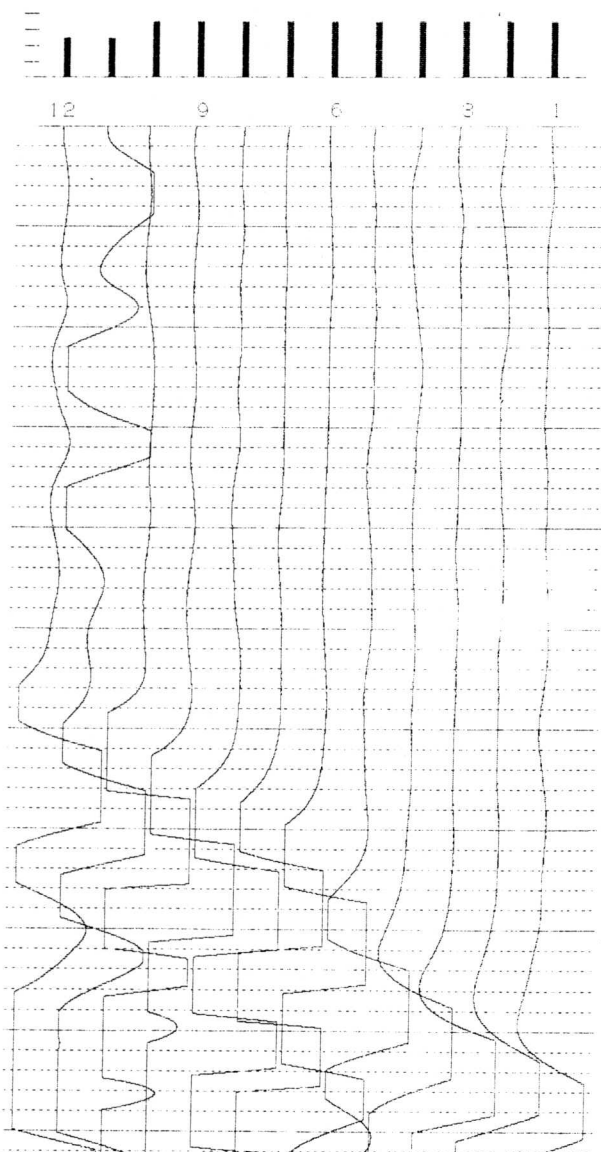
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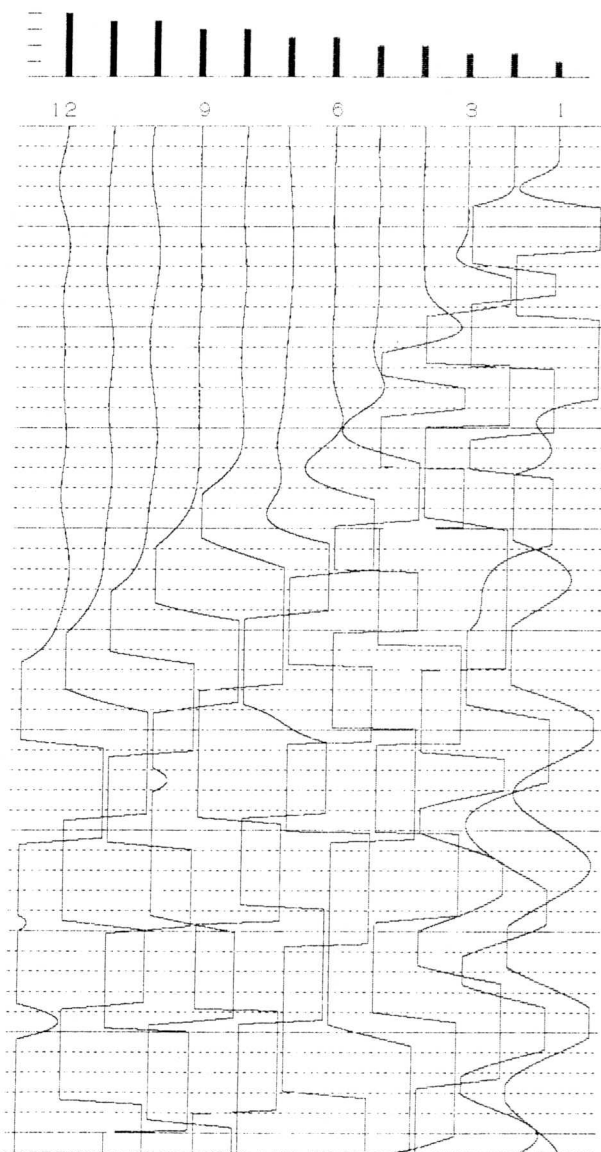
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# OYO

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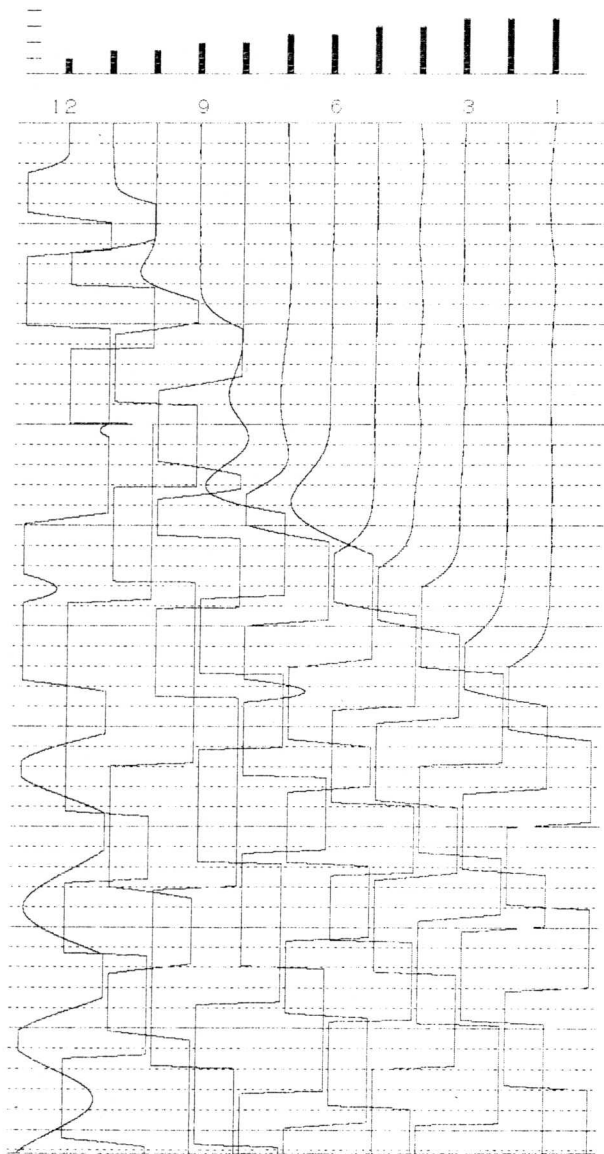
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SIZE : 9



# OYO

McSEIS-170 V1.41

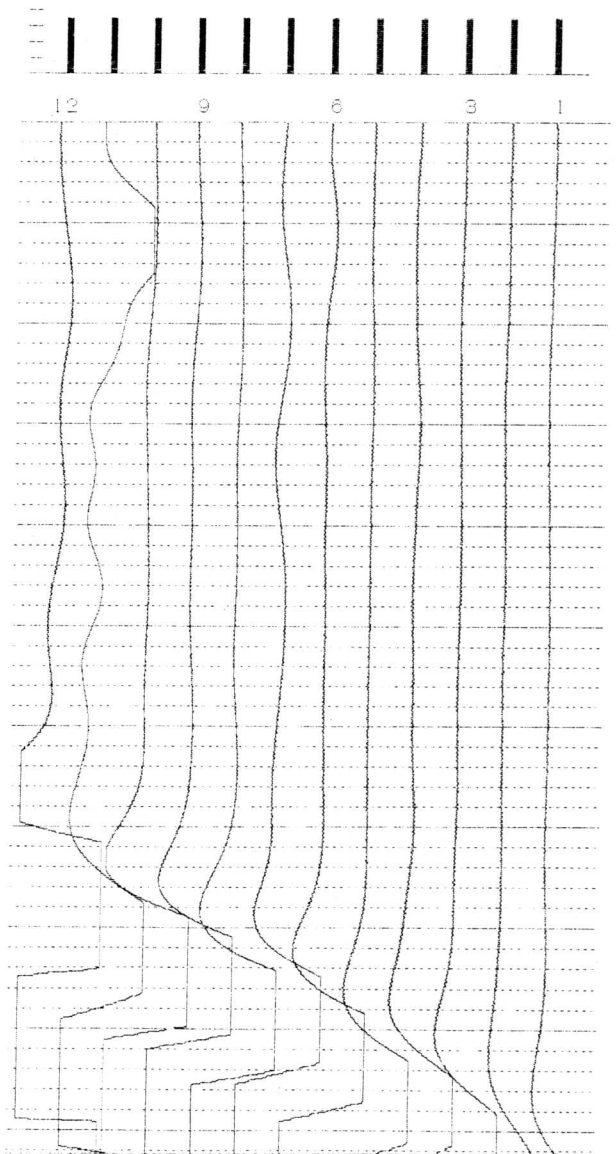
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ID. NO : 041  
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FILTER : 96 [Hz]  
STACK : 4  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 9



# OYO

McSEIS-170 V1.41

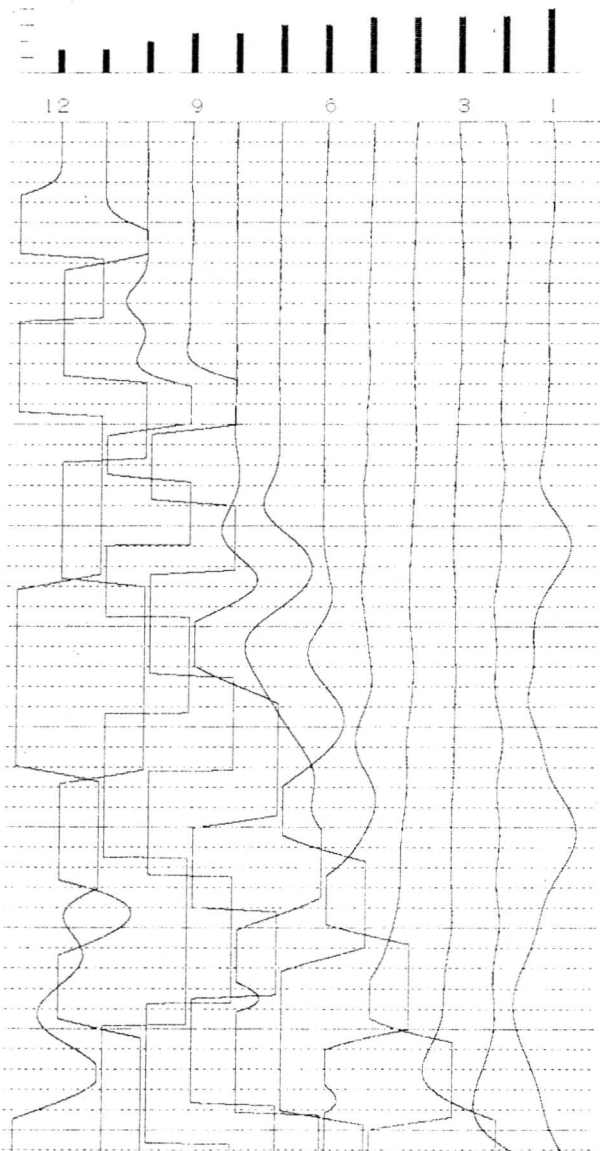
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SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 9



# OYO

MsSEIS-170 V1.41

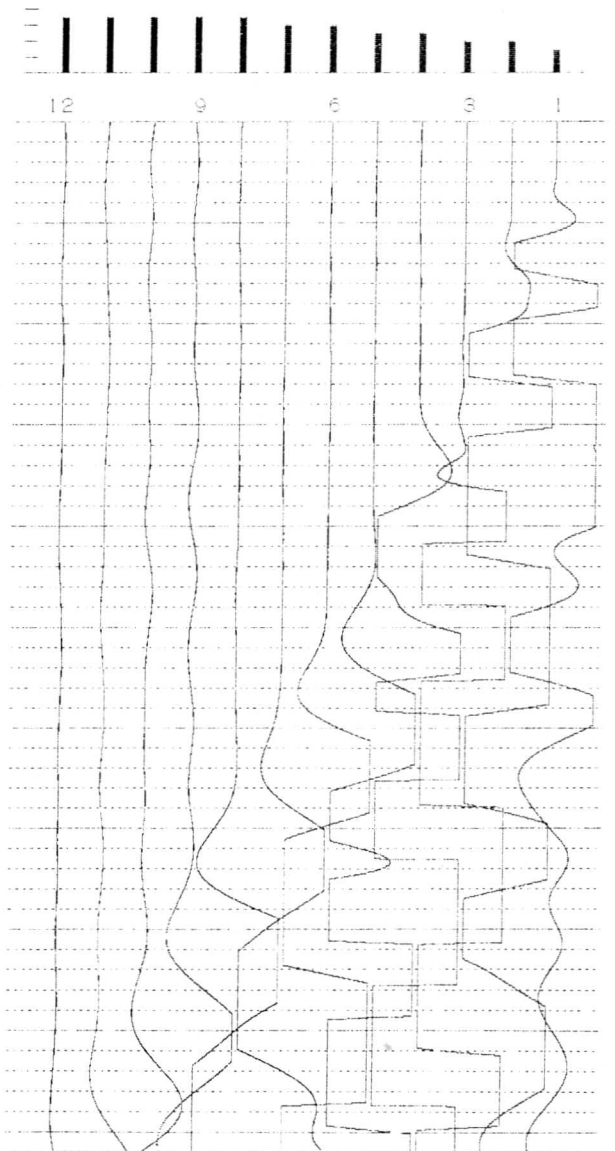
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DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 9



# OYO

MsSEIS-170 V1.41

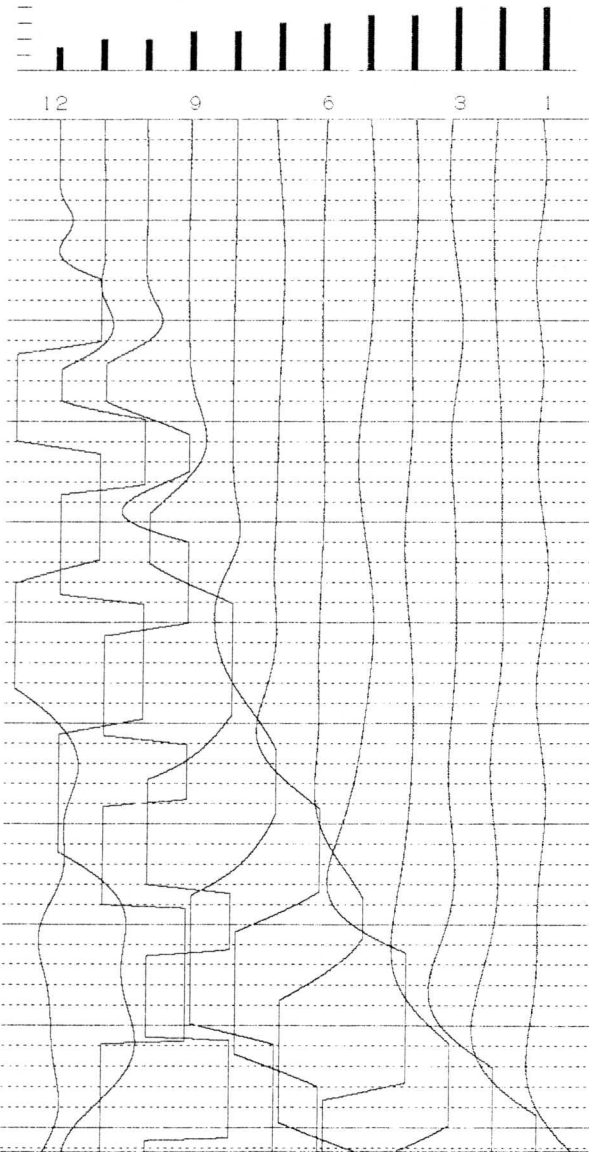
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SIZE : 8



# OYO

McSEIS-170 V1.41

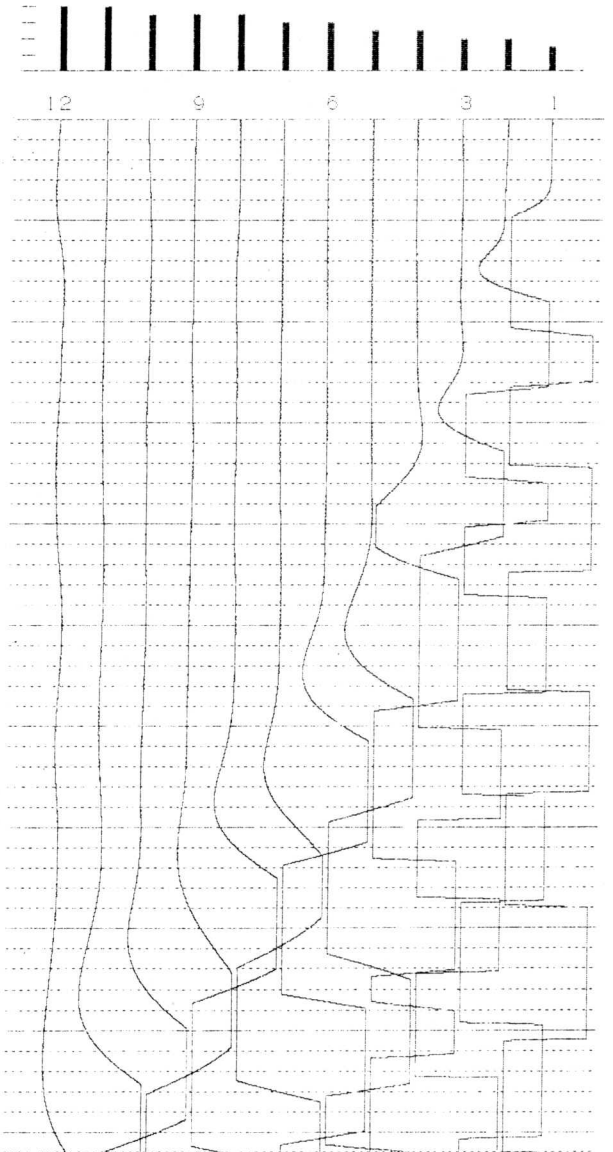
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ID. NO : 045  
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SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

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FIELD : -----  
ID. NO : 046  
DATE : 16/00/04 , 11:53:25 PM  
FILTER : 48 [Hz]  
STACK : 14  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



OYO

McSEIS-170 VI.41

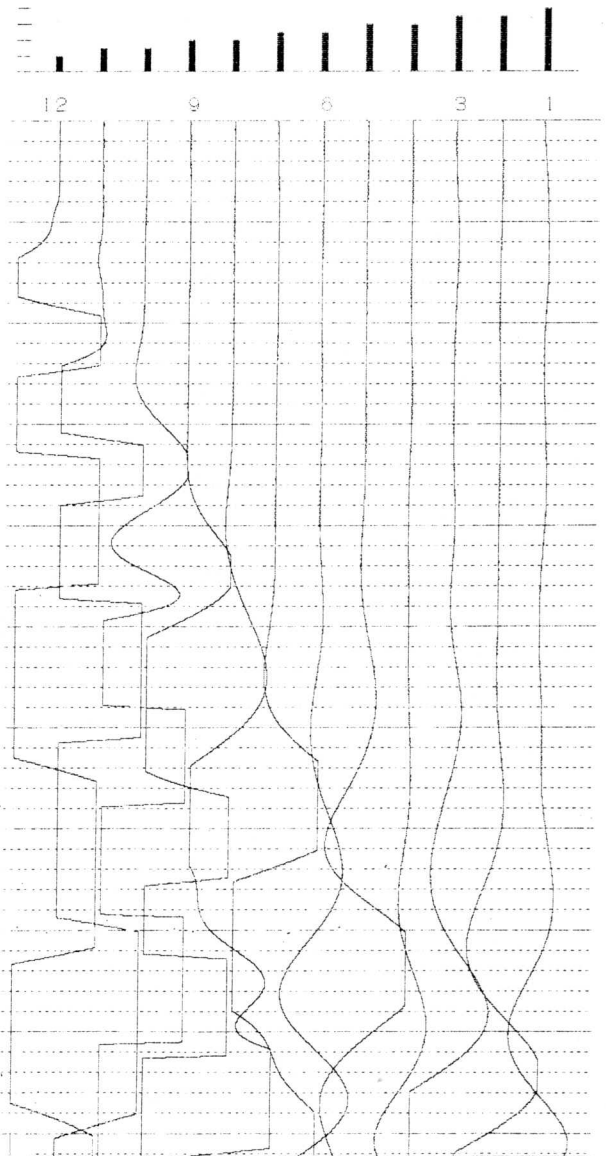
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DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



OYO

McSEIS-170 VI.41

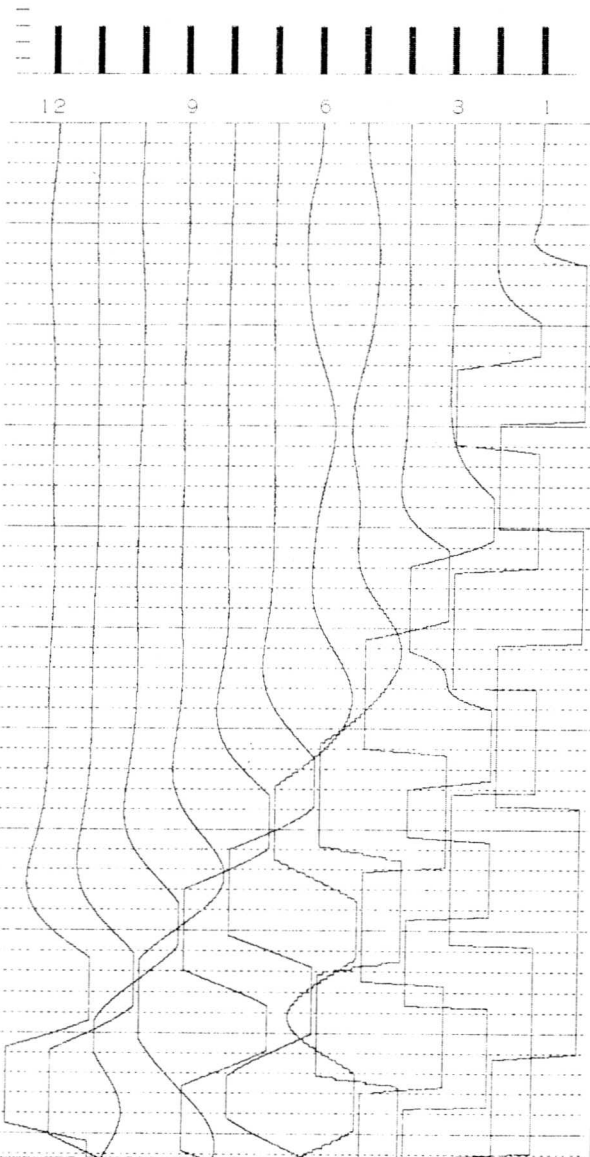
FIELD : -----  
ID,NO : 048  
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SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

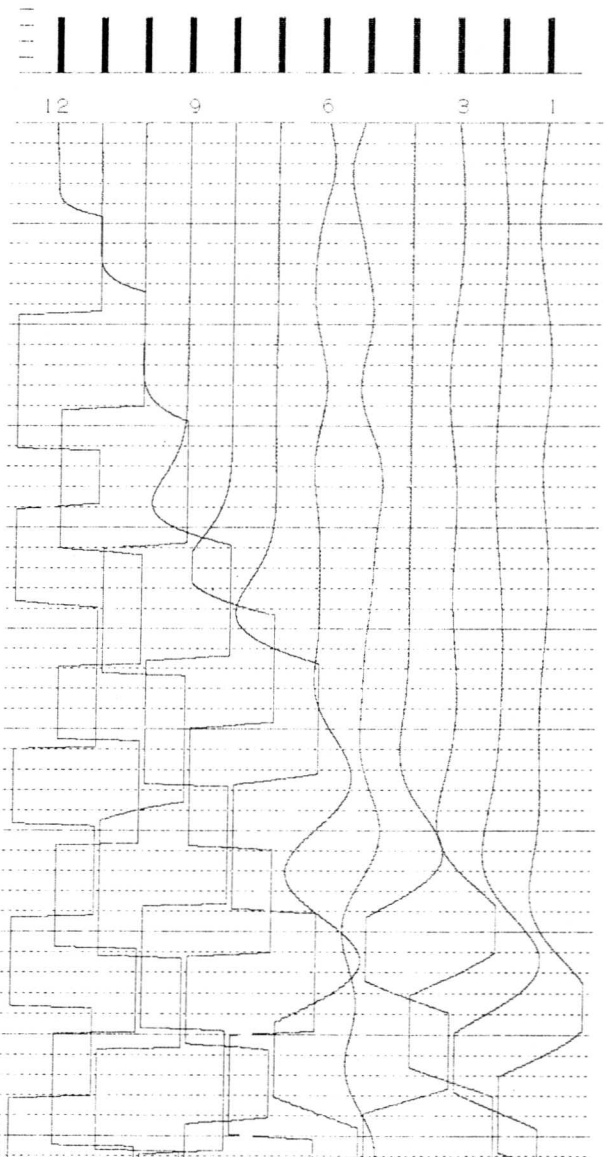
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ID. NO : 049  
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STACK : 2  
SAMPLING : 100 [uSec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

FIELD : -----  
ID. NO : 050  
DATE : 17/00/04 , 01:25:15 AM  
FILTER : 48 [Hz]  
STACK : 5  
SAMPLING : 100 [uSec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



The 217E and 218E transponders increase the accuracy and stability of the Trisponder system. To achieve this improvement it was necessary to dedicate the master and remote units. The transponders are not interchangeable as master and remotes. Additional features of the transponders are listed below:

1. Automatic anti-drift control.
2. Better pulse discrimination for high ambient noise environments.
3. Improved minimum signal control (reduces or eliminates range move-out).
4. Power Saver now a standard feature.
5. True time of transmission (mainbang) detection.
6. Remote data transfer from remote to master when used with data assembler.
7. Expanded code capabilities.

### 1.3 CHARACTERISTICS

The physical and electrical characteristics of the transponders are shown in table 1.3-1.

Table 1.3-1. Transponder Specifications

CHARACTERISTIC	DESCRIPTION
Range (Maximum)	80 km (50 mi), line of sight
Transmitter	Magnetron, tunable
Pulse Power	1000W (+60 dBm)
Pulse Width	0.6 $\pm$ 0.1 microseconds
Receiver	Superheterodyne, solid state
Intermediate Frequency	60 $\pm$ 5 MHz
Bandwidth	12 MHz
Pulse Sensitivity	-78 dBm
Voltage	22 to 30 Vdc (24.5 Vdc recommended)
Current	450 Milliamps receive mode 60 Milliamps power down
Warm-up	30 to 90 sec, after power application
Size, Overall (Less Antenna)	35.6 cm (14 in)H x 15.2 cm (6 in)W x 26.7 cm (10.5 in)D
Weight	7 kg (15 lb)

## APPENDIX 8

### Trip Log

August	25th	Depart AM for Vila arrive 1200 non. Visit Geology meet Portman representative Doug Hutchinson.
	26th	Commence survey shoot line 2.
	27th	Refraction survey line 1 completed.
	28th	Refraction survey line 5 and line 3 completed.
	29th	Complete line 3 and line 4 refraction.
	30th	Sunday Process data.
	31st	Survey line 4 resistivity (offset Wenner)
September	1st	Resistivity survey lines 1 & 2 completed
	2nd	Move seafreight for offshore survey to Forari. Prepare airfreight send to Suva. Visit Lands/Survey. Pick up maps coordinates.
	3rd	Mobilize equipment sample in Bay No. 1-11.
	4th	Bathymetry survey lines 1 - 9 sample stations 12 to 22.
	5th	Process data
	6th	Sunday
	7th	Bathymetry profiles 10 to 20 sample stations 23 to 37.
	8th	Demobilize equipment at Forari Bay, prepare for transportation to Port Villia.
	9th	Pack containers for seafreight. Visit Lands to check on Bench Mark used.
	10th	Depart Vanuatu for Fiji, arrive Nadi 1430. Drive to Suva, drop Sekove at Qauia Village, vale jeldi.

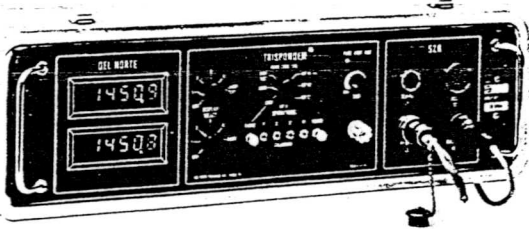
## SPECIFICATIONS

Depth Range	0-55, 50-105, 100-155, 150-205 Feet 0-16.5, 15-31.5, 30-41.5, 45-61.5 Meters
Sounding Rate	534 Soundings per minute
Voltage Input	12 VDC
Current Input	2.5 Amperes
Accuracy	$\pm 0.5\% \pm 1"$ of indicated depth
Operating Frequency	208 kHz
Tranducer	Barium titanate - Model 200T5HAD Optional Model 7245A
Transducer Beamwidth	8° at the half power points
Chart Paper Speed	1, 2, 3, 4, inches per minute
Chart Paper	7 inches x 60 feet
Recorder Dimensions	Height (including handle) - 18" Width 15-3/8" Depth 9-1/16"
Net Weight	Recorder w/transducer and rigging 47 lbs. Recorder only - 38 lbs.

The heart of the Rho/Theta System is Del Norte's Model 520 Digital Distance Measuring Unit (DDMU). It provides range and azimuth read-out at the mobile station with superior performance and accuracy.



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Technology, Inc. DEL  
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DEL NORTE Technol  
c. DEL NORTE Ter  
Inc. DEL NORTE  
ology, Inc.



### Model 520 DDMU

The 520 DDMU is fully automatic, both portable and waterproof, and can also operate in a *range-range* mode. The DDMU decodes all signals from the shore station and provides both the operator and the peripheral equipment with range, angle and data communication.

- Range: line-of-sight to 80 Km (50 miles)
- Accuracy:  $\pm 1$  meter
- Resolution: 0.1 meter
- Temperature:  $-18^{\circ}\text{C}$  to  $+55^{\circ}\text{C}$  ( $0^{\circ}\text{F}$  to  $+130^{\circ}\text{F}$ )
- Size: 19.69 H x 53.98 W x 45.72 D cm  
(7.75 x 21.25 x 18.00 in)
- Weight: 13.15 Kg (29 lbs)
- Voltage: 22-27 VDC
- Current: 1.6 Amps

#### Options Available

- Parallel data output
- Data transmission
- Anti-null
- Power conditioner for 24-40 VDC input

## Transponder

A TRANSPONDER Model 217E or 218E Remote, which is standard, is fully capable of super imposing angular and status upon the ranging function, eliminating the need for a separate RF data link. The remote still retains its capability to operate in the *range-range* mode.

Rho/Theta also employs a standard TRANSPONDER Master at the mobile location.

### Model 217E/218E



- Frequency: 217E/218E: 9320-9500/8800-9000 MHz
- Voltage: 23 to 30 VDC
- Current: 0.07 Amps power down  
0.77 Amps standby  
1.00 Amps transmit
- Temperature:  $-30^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$  ( $-20^{\circ}\text{F}$  to  $+158^{\circ}\text{F}$ )
- Weight: 7 Kg (15 lbs)



## Azimuth Tracker

A high quality Azimuth Tracker provides the angle measurement for the Rho/Theta System. This self-contained unit is adaptable to all field applications and to standard optical equipment.

The Azimuth Tracker has an instrumental accuracy of  $\pm 0.01$  degree arc.

Weight: 4.5 Kg (10 lbs)

## Data Switch Box

The Data Switch Box provides the operator with a visual display of reference or tracking angle. It also contains mode switches to signal the boat or track and set reference angles.

- Weight: 0.7 Kg (1.6 lbs)
- Size: 5.7 H x 8.4 W x 15.2 D cm  
(2.25 H x 3.13 W x 6.00 D in)
- Power: From Data Transfer Unit

## Data Transfer Unit

Provides the interface between all pieces of equipment at the remote station.

- MODEL 282
- Weight: 2.9 Kg (6.5 lbs)
- Size: 8.9 H x 26.0 W x 15.9 D  
(3.50 H x 10.25 W x 6.25 D in)
- Voltage: 23 to 28 VDC
- Current: 1.2 Amps (With Remote T/R, Data Transfer Units and Azimuth Tracker operating)



**DEL NORTE Technology, Inc.**

PRINTED IN U.S.A.

WCG 5M-5/84 HP

Table 1.3-1. Transponder Specifications (Cont)

CHARACTERISTIC	DESCRIPTION
Construction	Waterproof for marine use
Temperature	-20°C to +70°C (-4°F to +158°F)
Serial Number	Stamped on lid of TR

1.4 RELATED PUBLICATIONS

Publications required and/or suggested for use with this manual to aid in understanding and maintaining the transponder are listed in table 1.4-1.

Table 1.4-1. Related Publications

PUBLICATION NUMBER	TITLE
21810008 (DNTI)	Model 217E/218E Microwave Transponder Field Service Manual
21810009 (DNTI)	Model 217E/218E Microwave Transponder Depot Service Manual
54000016 (DNTI)	Microwave Transponder System Manual

1.5 TRANSPONDER IDENTIFICATION

The 217E and the 218E transponders operate at different frequencies, as shown in table 1.5-1. Model number and transmitter configuration are based on FCC assigned operating frequencies. To identify the configuration of the transponders, an information plate is attached to the handle (refer to figure 1.5-1).

Table 1.5-1. Transponder Identification

<u>Model Number</u>	<u>Transmitter Configuration</u>	<u>TX Frequency</u>	<u>RX Frequency</u>
217E	Master	9480 MHz	9325 MHz
217E	Remote	9325 MHz	9480 MHz
218E	Master	8960 MHz	8860 MHz
218E	Remote	8860 MHz	8960 MHz

**【Remarks】** Note that no guaranty is given to the result from stacking exceeding 11 times (inclusive) if done.

Conditions	<ol style="list-style-type: none"><li>1. Input.....600 <math>\Omega</math> Termination</li><li>2. Gain..... Maximum</li><li>3. Sampling range.....500 msec</li><li>4. Frequency..... 48~1536 Hz</li><li>5. Trace size..... 8 X</li></ol>
------------	--

## 8 SPECIFICATIONS

This section presents specifications for the Terrameter SAS 300B, Terrameter SAS 2000 Booster, Terrameter SAS LOG 200 and UBC Universal Battery Charger.

## 8.1 TERRAMETER SAS 300B - SPECIFICATIONS

Transmitter:	Selectable currents	0.2, 0.5, 1, 2, 5, 10, 20 mA
	Voltage, max	160 V (320 V p-p)
Receiver, voltage measurement:	Input impedance	10 Mohm, min
	Input range	0-500 V
	Precision	$\pm 1 \mu\text{V}$
	Noise rejection	95 dB at 50-60 Hz 85 dB at 16-20 Hz
Receiver, resistivity measurement:	$\frac{\Delta V}{I}$ range	0-1.9 Mohm
	$\frac{\Delta V}{I}$ precision	0.05 Mohm (20 mA, one reading)
System data:	Selectable cycle times	3.6, 7.2, 14.4 seconds
	Selectable total averaging period (1-64 readings)	3.6 - 920 seconds
Accuracy:		$\pm 2\% \pm$ precision
Temperature range:	Within specification Operating	0..... +6°C -10°... +70°C
Power supply:		Rechargeable 12 V battery
Fuse:		3.15 A Fast blow 5x20 mm
Battery capacity:		3500-5000 single cycle measurements per charge
Weight:		5.6 kg incl battery
Dimensions:		WxLxH 105x325x300 mm

## 8.2 TERRAMETER SAS 2000 BOOSTER - SPECIFICATIONS

Transmitter:	Selectable currents	0.2, 0.5, 1, 2, 5, 10, 20, 50, 100, 200, 500 mA
	Voltage, max	400 V (800 V p-p)
System data:	$\frac{\Delta V}{I}$ precision	2 $\mu$ Ohm (500 mA, one reading)
	$\frac{\Delta V}{I}$ accuracy	$\pm 2\% \pm$ precision
Temperature range:	Within specification	0° ..... +60°C
	Operating	-10°..... +70°C
Power supply:		Rechargeble 12 V
Fuses:		10 A slow blow 5x20 mm and 1 A fast blow 5x20 mm
Battery capacity:		800-3500 single cycle measurements per charge
Weight:		6.3 kg incl. battery
Dimensions:		WxLxH 105x325x300 mm

**8.4 UBC UNIVERSAL BATTERY CHARGER - SPECIFICATIONS**

**Input:** 10-30 V DC, from any battery or other DC supply  
or  
100-240 V AC, 47-63 Hz, from mains

**Output:** Two separate charging circuits  
(outputs A and B), each of which provides  
400 mA  $\pm$  5 % at a maximum output voltage  
of 15 V  
or  
Single charging circuit (output A)  
which provides 400 mA  $\pm$  5 % at a maximum  
output voltage of 36 V

**Cell temperature:** 0 to +65°C

**Overheating protection:** Internal protector cuts off input current

**Fuses:** 315 mA slow blow 5x20 mm fuse for AC input  
250 mA fuse for DC input

**Two indicator lamps:** One LED for each output lights up when  
charging current exceeds 280 mA

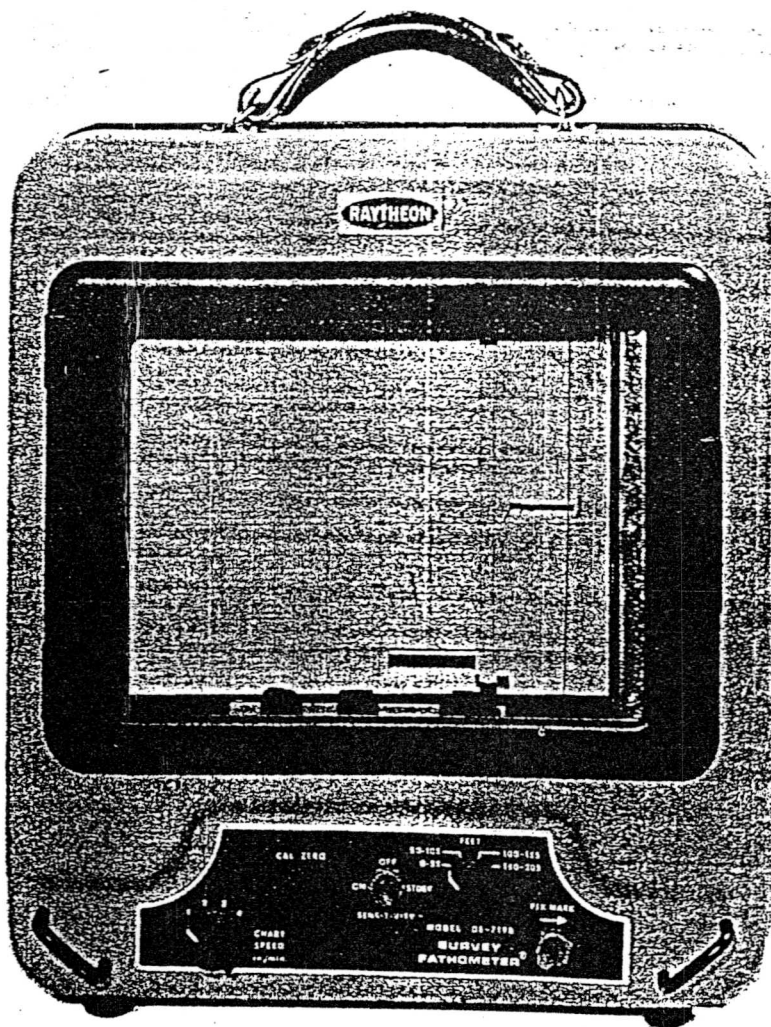
**Weight:** 2.4 kg

**Dimensions:** WxHxD 125x80x210 mm

# DE-719

## FATHOMETER<sup>®</sup>

### PRECISION SURVEY DEPTH RECORDER



Sample No.	Easting	Northing	Water Depth (metres)	Sediment Description
34	557849	8045080	7.7	Fine to medium grey brown sand with abundant coral & shell detritus
35	557790	8045080	6.2	Coral detritus
36	557732	8045040	4.2	Fine to medium grey brown sand with abundant coral and shell detritus
37	557628	8045110	2.1	Fine to medium grey brown sand

## **APPENDIX 7**

### **Equipment Specifications**

OYO McSeis - 170 12 channel seismic refraction system

ABEM Terrameter SAS System with Booster and

BGS 128 offset sounding cable

Raytheon De 719e with ODOM digitizer

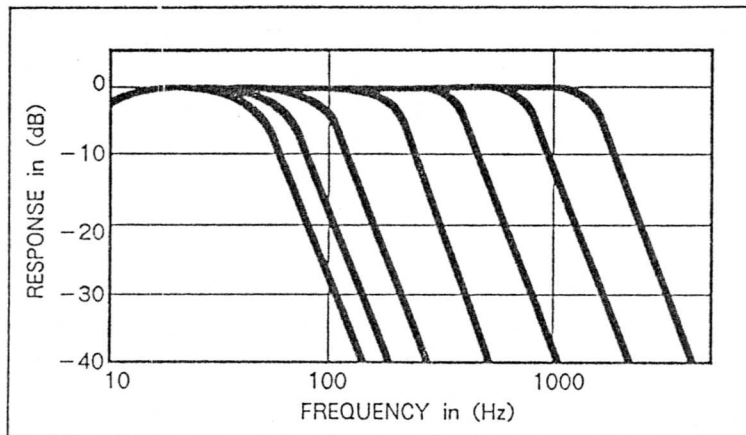
Del Norte 520 Digital Distance Measuring Unit

### 1.3 Specifications

Table 1-1 Standard Specifications for McSEIS-170

#### Standard Specifications for McSEIS-170

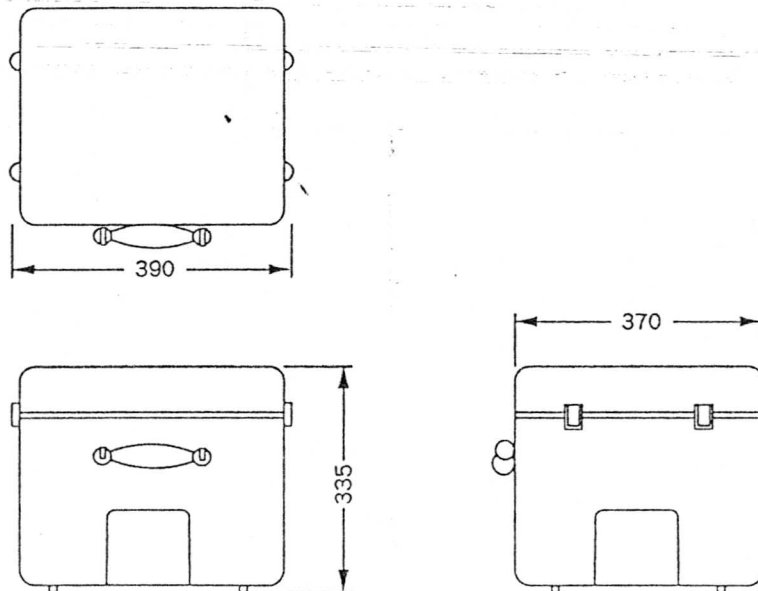
No. of channels .....24 or 12  
 Input impedance .....600 ohms  
 Gain .....40 dB~ 86 dB  
 (8 steps : 100, 200, 400, 1k, 2K, 4K, 10K, 20K)  
 Frequency response .....5 Hz~1536 Hz (Refer to the diagram below.)



Typical frequency response

High-cut filter .....48, 64, 96, 192, 384, 768, 1536 Hz  
 A/D resolution .....12 bit  
 Memory capacity .....1024 words  
 Pretrigger .....0, 128, 256, 512 words  
 Trigger delay .....10 msec ~ 990 msec (10 msec steps)  
 Sampling rate .....25 micro second for 12 channels (In case of the  
 structure being 24 channels, 12 channels out of the  
 same, do work.) 50, 100, 200, 500, 1000, 2000  
 micro second  
 Waveform storage memory ....48 Kbytes  
 Printer Method .....Thermal dotted line  
 Resolution .....7 dots/mm, 1 line 640 dots  
 Paper .....112 mm, thermal sensitive paper (TF50KS-E2)  
 CRT .....5.5 inch (orange colored)

Operating voltage.....10.5V ~ 13.5V  
Current .....4.0 A (during measurement)  
.....7.0 A (during printout)  
Dimensions.....390 (W) × 335 (H) × 370 (D) mm  
Weight.....18 Kg (Including T-type case)



【 Remarks 】

Note that since the Software mounted on this Instrument has always been updated, there may be the case where the difference might arise between the Version No. displayed in the Message Menu/Output Data referred to in the Operation Manual and the Version No. actually displayed on the Menu.

Table 1-2 Standard Specifications for McSEIS-170 (Other Features)

Other Features

CRT Display .....	Selection and setting are feasible with various message contents, while outputting waveform data. Data may be displayed in variable or wiggle mode. Vertical size function is equipped. Slow and fast waveform scrolling functions. Time interval from trigger signal displayed on CRT. Stacking times are displayed. Error message contents are displayed.
GP-IB Interface .....	Receiving/transmission of data from & to McSEIS 1600 NPU Unit (MODEL-5749A) is feasible as controller. Receiving/transmission of data is feasible even in remote control.
RS-232C Interface .....	Receiving/transmission of data is feasible by external command signal.
Data Transmission Format.....	SEG-1 format
Floppy Disk .....	3.5-inch microfloppy diskette (2DD) MS-DOS formatted
Printer .....	Print out header containing measurement information in addition to waveform data. Trace size (=Recording amplitude) can be selected out of 1 time, 2 times and 4 times, while as for Trace length, selection is feasible with either LONG or SHORT. Clipping mode function and Vertical size function, effective for first arrival picking, are equipped.
Noise amplitude .....	less than 1mm (inclusive) / 1 time stack (including noise and drift) less than 2.5mm (inclusive) / 5 times stack (including noise and drift) less than 4mm (inclusive) / 10 times stack (including noise and drift)

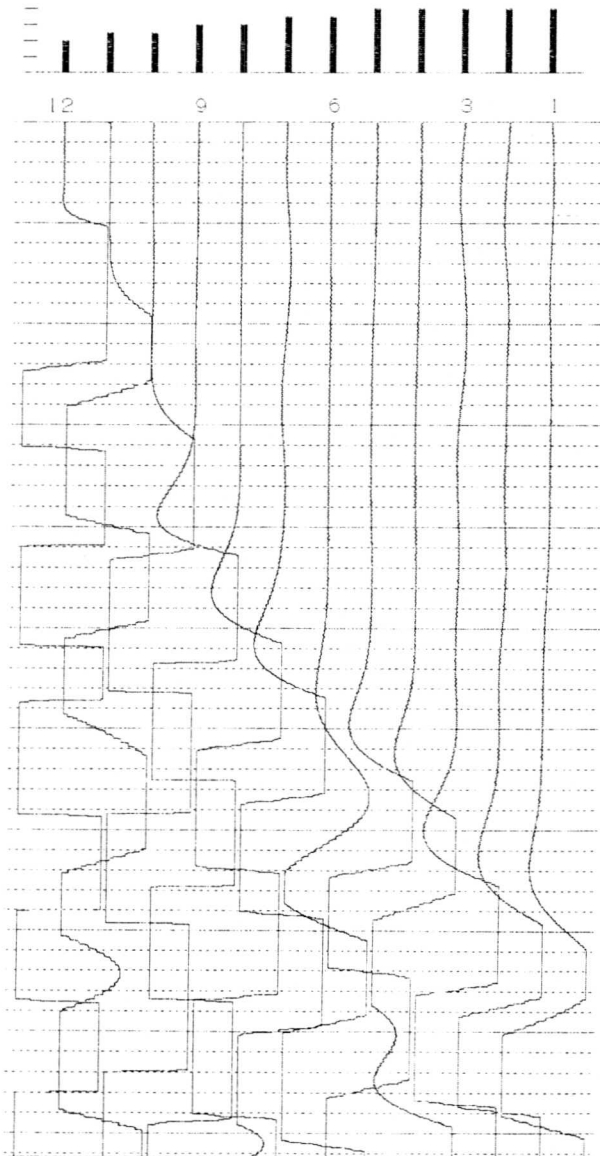
26	557734	8044870	4.9	Fine to medium black sand with some brown clay
27	557793	8044840	5.8	Fine to medium black sand with some brown clay
28	557839	8044850	6.5	Fine to medium black sand with some brown clay
29	557885	8044830	6.7	Fine to medium black-brown sand with a clayey content
30	557942	8044850	6.9	Fine to medium black sand with minor brown and white material
31	557996	8044870	7.2	Fine to medium black sand with minor brown and white material
32	557886	8044930	7.2	Fine to medium grey to brown sand
33	557862	8045010	8.2	Fine to medium grey to brown sand

<b>Sample No.</b>	<b>Easting</b>	<b>Northing</b>	<b>Water Depth (metres)</b>	<b>Visual Sediment Description</b>
17	557610	8045050	2.3	Fine to medium sand slightly clayey, grey-black with some carbonaceous material
18	557672	8045040	3.3	A/A
19	557663	8044970	4.0	Clayey sand mixture grey brown black
20	557715	8044990	5.3	Clayey sand mixture brown to grey black
21	557799	8045010	7.4	Very clayey sticky brown mud
22	557802	8044950	7.3	Clayey brown mud
23	557548	8044940	1.6	Fine to medium black sand
24	557622	8044920	2.9	Fine to medium black sand with a slight clayey content
25	557684	8044880	3.6	Fine to medium black sand

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McSEIS-170 VI.41

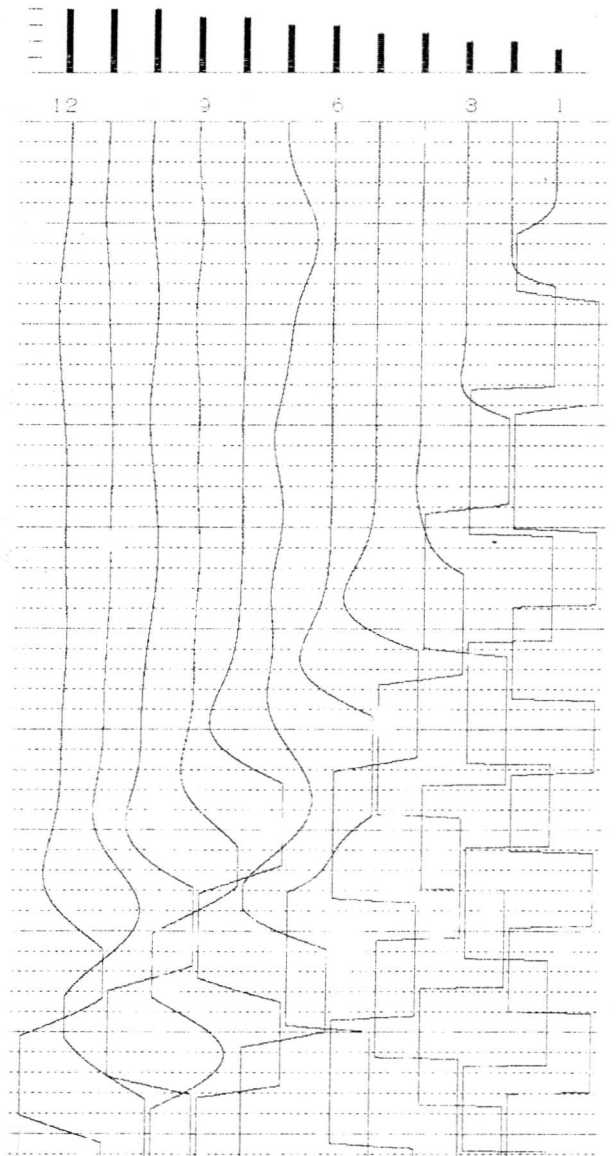
FIELD : -----  
ID. NO : 051  
DATE : 17/00/04 , 01:38:41 AM  
FILTER : 48 [Hz]  
STACK : 1  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



OYO

McSEIS-170 VI.41

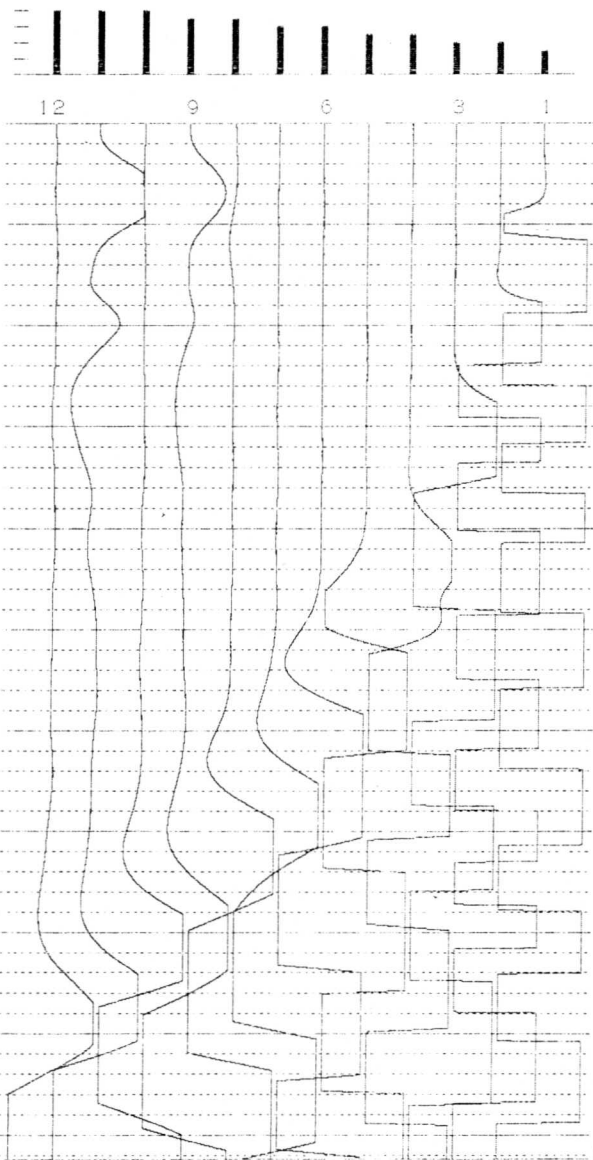
FIELD : -----  
ID. NO : 052  
DATE : 17/00/04 , 01:43:09 AM  
FILTER : 48 [Hz]  
STACK : 12  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

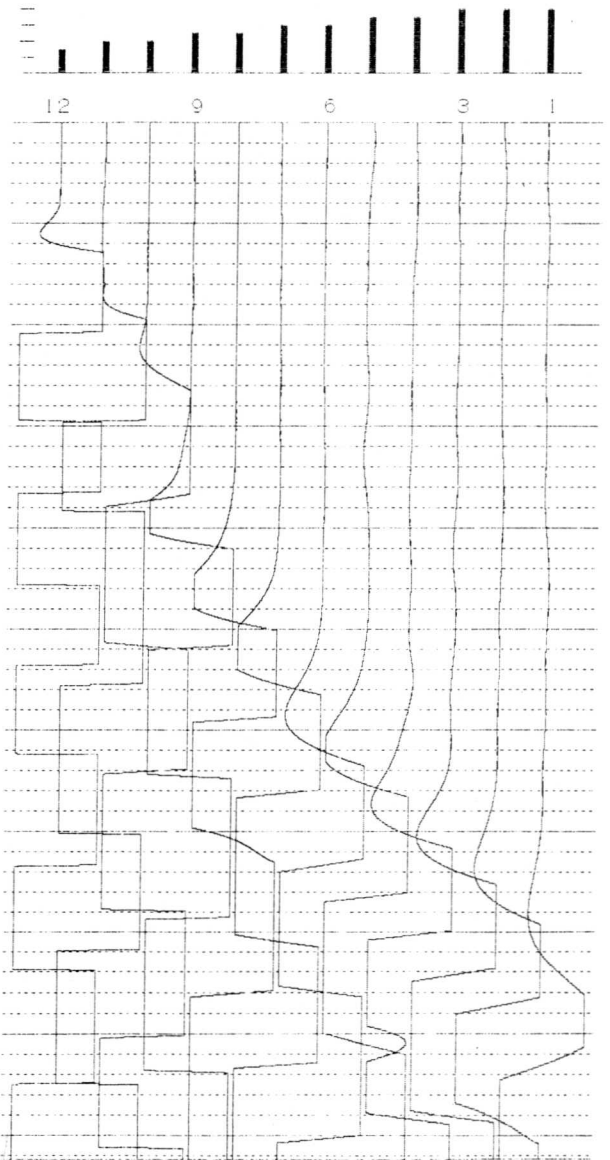
FIELD : -----  
ID. NO : 053  
DATE : 17/00/04 , 01:57:57 AM  
FILTER : 96 [Hz]  
STACK : 8  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

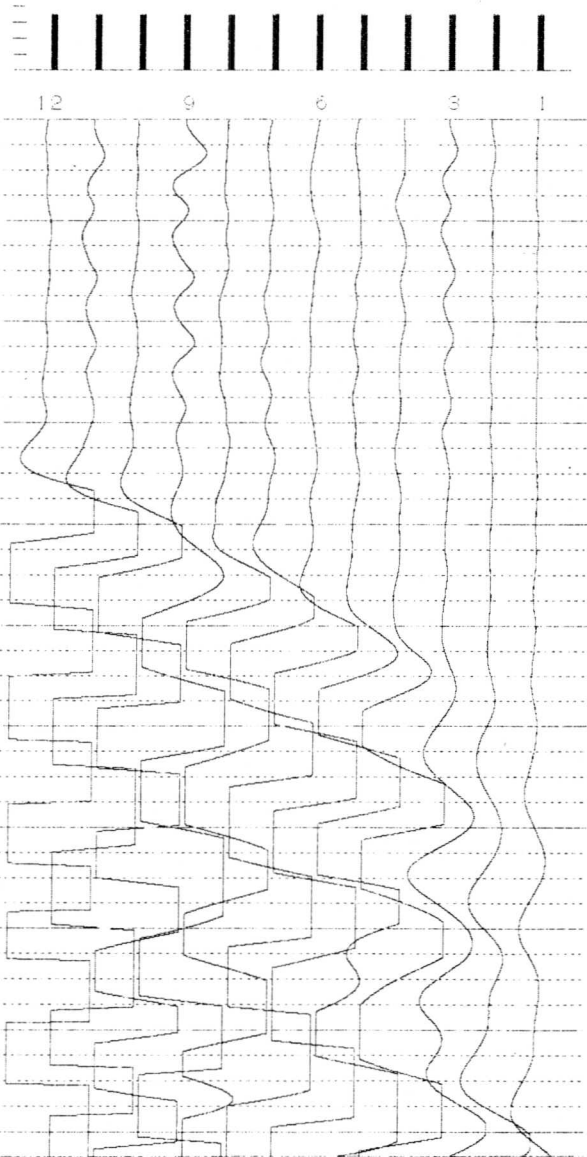
FIELD : -----  
ID. NO : 054  
DATE : 17/00/04 , 02:01:18 AM  
FILTER : 96 [Hz]  
STACK : 10  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

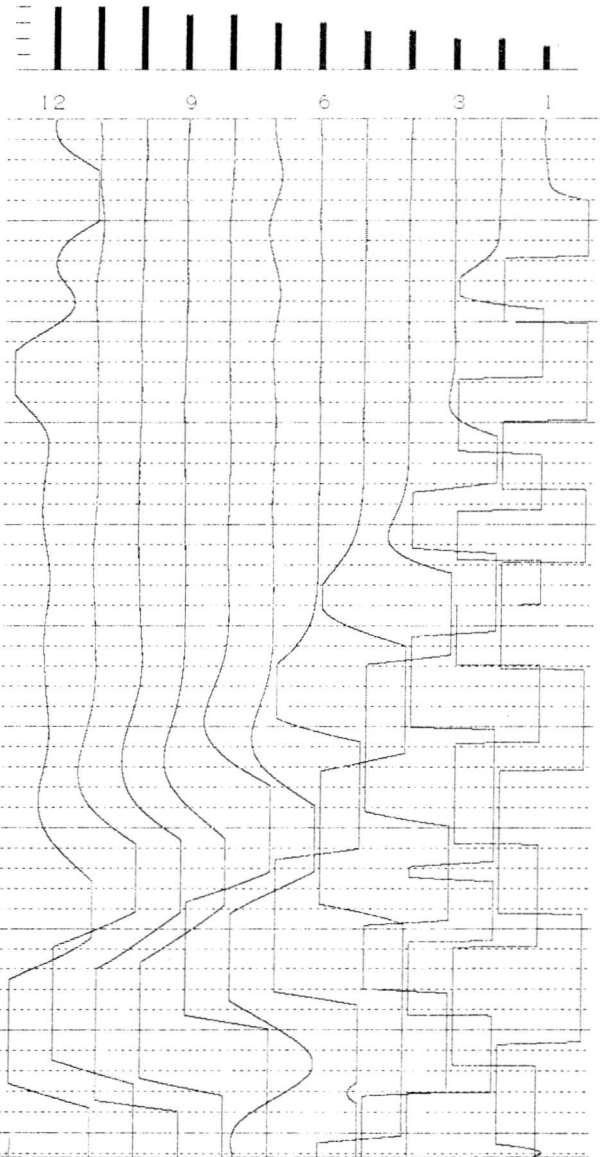
FIELD : \_\_\_\_\_  
ID. NO : 055  
DATE : 17/00/04 , 02:11:20 AM  
FILTER : 96 [Hz]  
STACK : 16  
SAMPLING : 200 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 5 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

FIELD : \_\_\_\_\_  
ID. NO : 056  
DATE : 17/00/04 , 02:24:07 AM  
FILTER : 96 [Hz]  
STACK : 9  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 VI.41

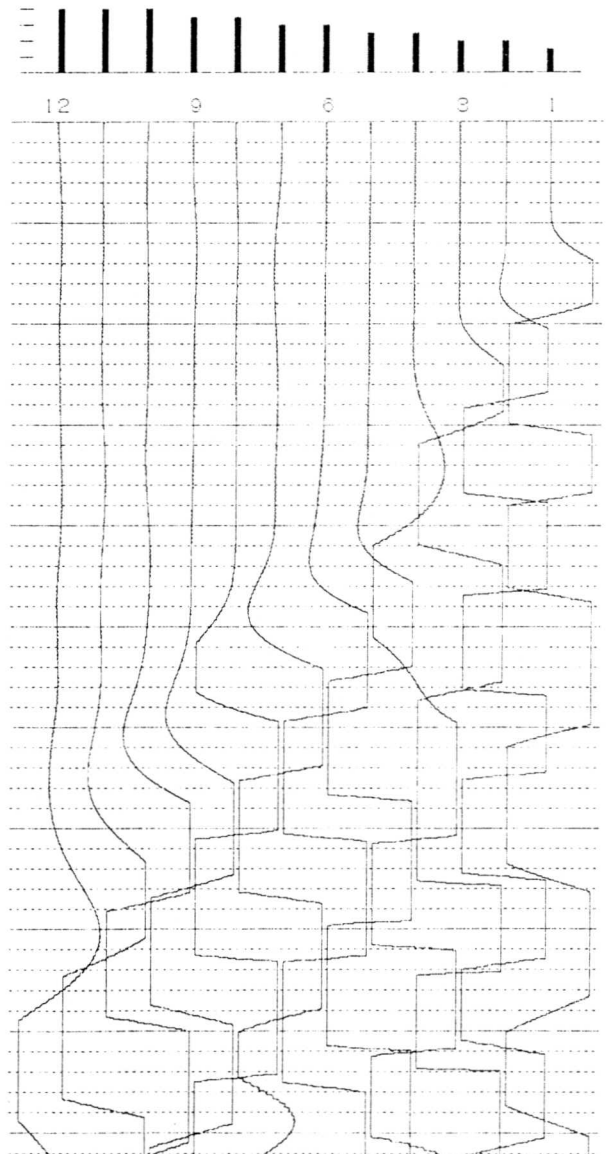
FIELD : -----  
ID. NO : 074  
DATE : 17/00/04 , 10:54:15 PM  
FILTER : 48 [Hz]  
STACK : 2  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 VI.41

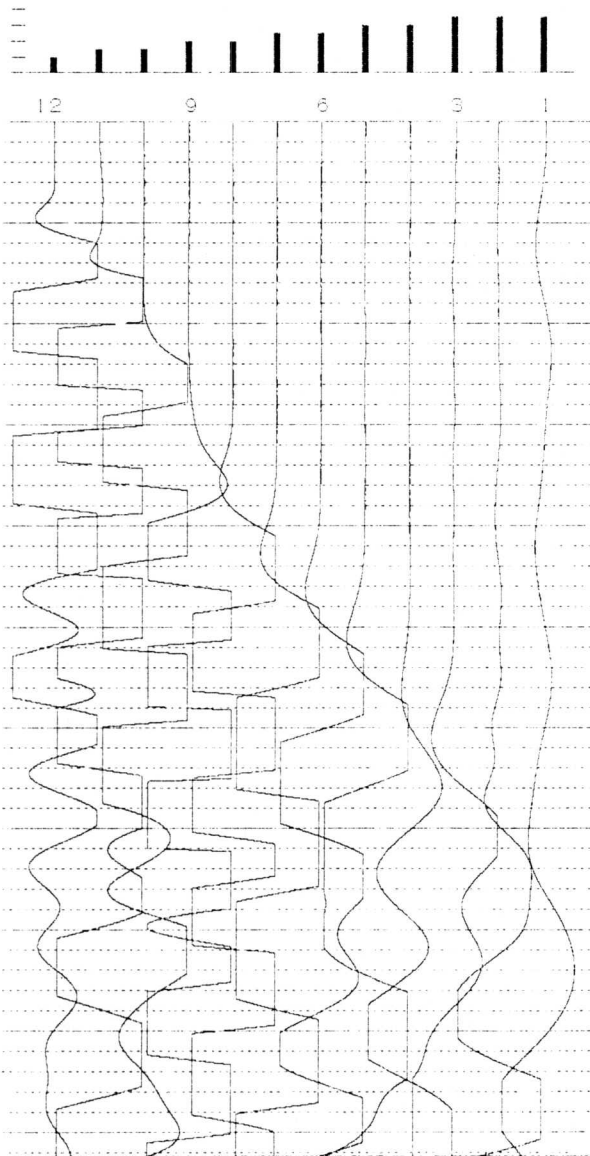
FIELD : -----  
ID. NO : 075  
DATE : 17/00/04 , 10:58:47 PM  
FILTER : 48 [Hz]  
STACK : 11  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 VI.41

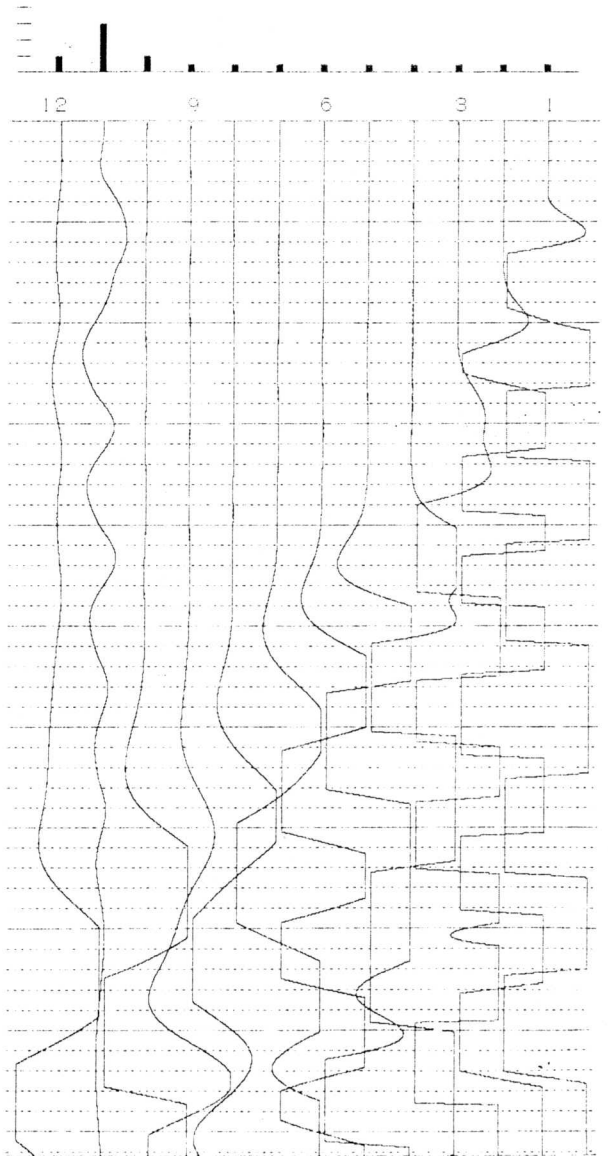
FIELD : -----  
ID. NO : 076  
DATE : 17/00/04 , 11:18:02 PM  
FILTER : 96 [Hz]  
STACK : 9  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 VI.41

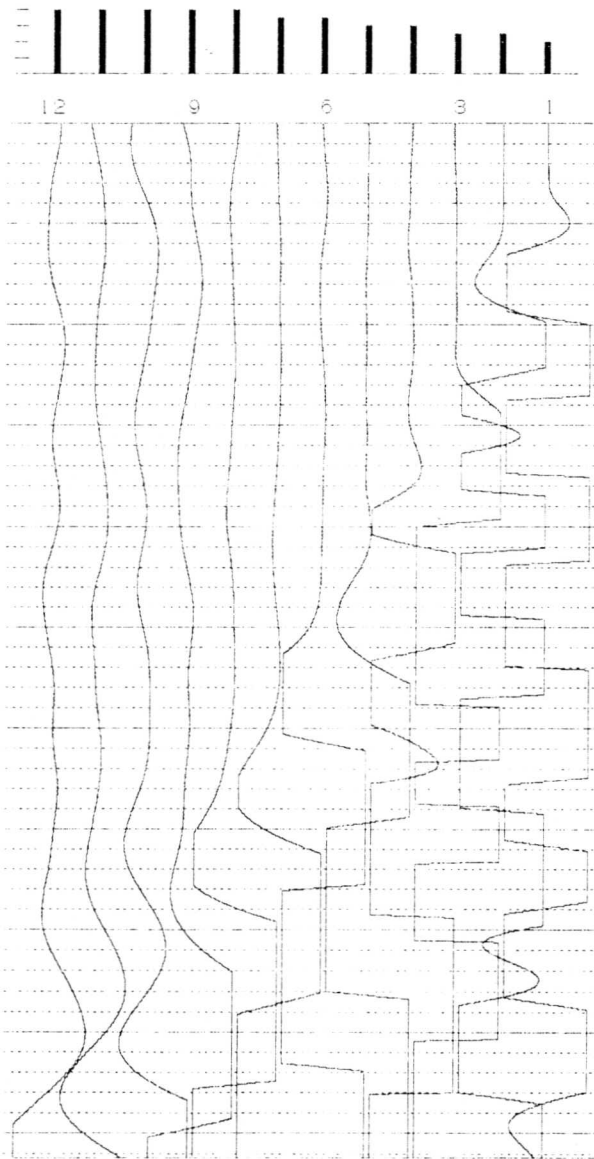
FIELD : -----  
ID. NO : 077  
DATE : 17/00/04 , 11:28:30 PM  
FILTER : 96 [Hz]  
STACK : 2  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



OYO

MeSEIS-170 VI.41

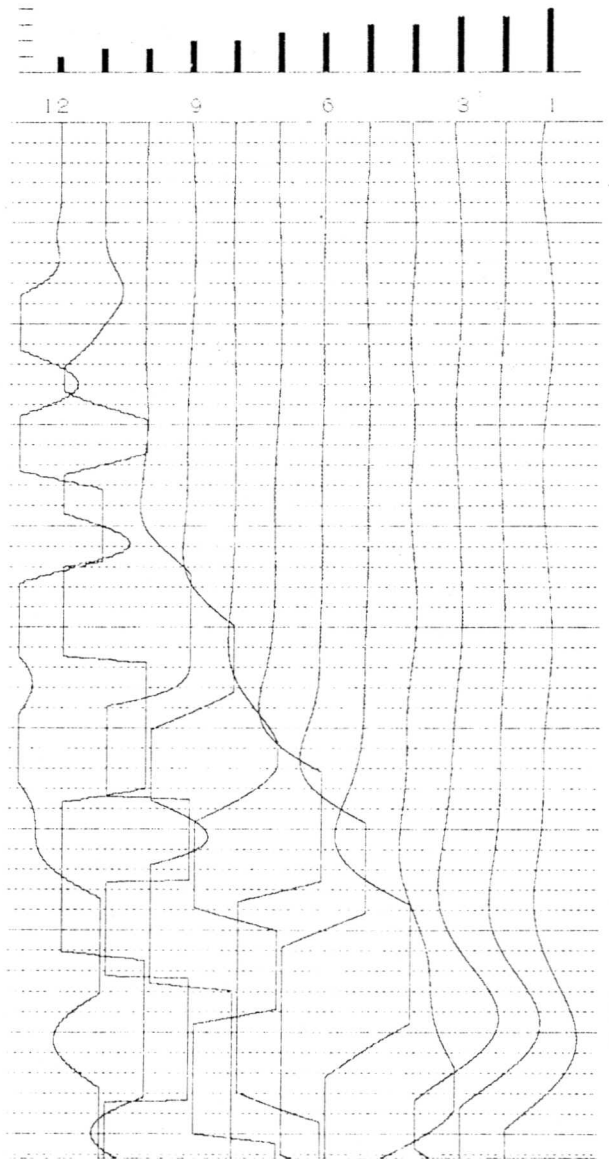
FIELD : .....  
ID. NO : 078  
DATE : 17 00 04 , 11:44:56 PM  
FILTER : 48 [Hz]  
STACK : 17  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



OYO

MeSEIS-170 VI.41

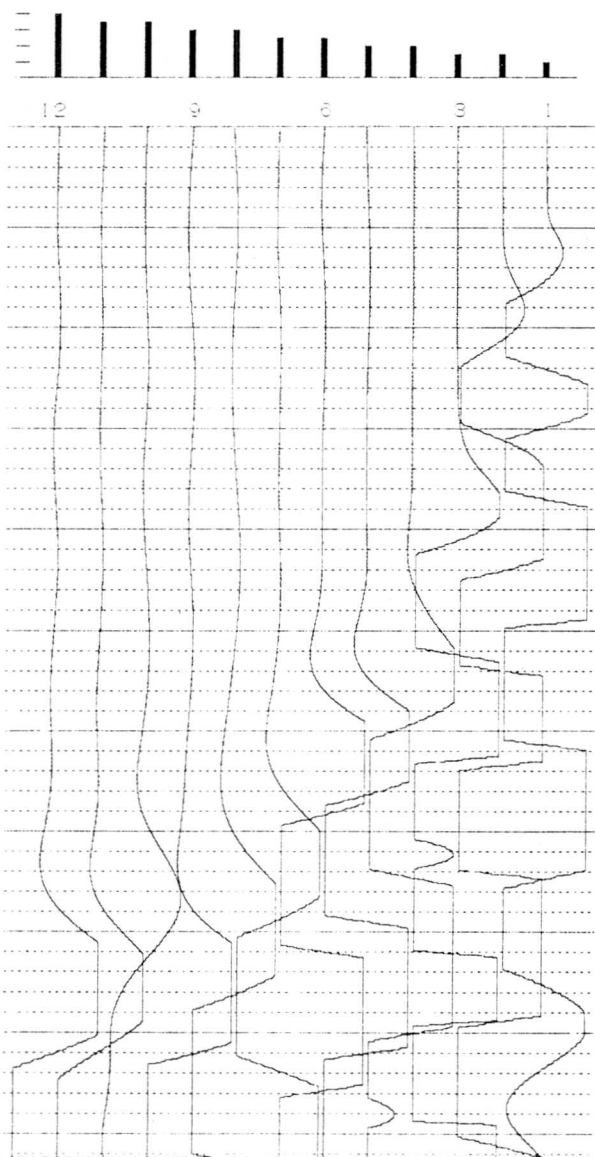
FIELD : .....  
ID. NO : 079  
DATE : 17 00 04 , 11:51:17 PM  
FILTER : 48 [Hz]  
STACK : 15  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 VI.41

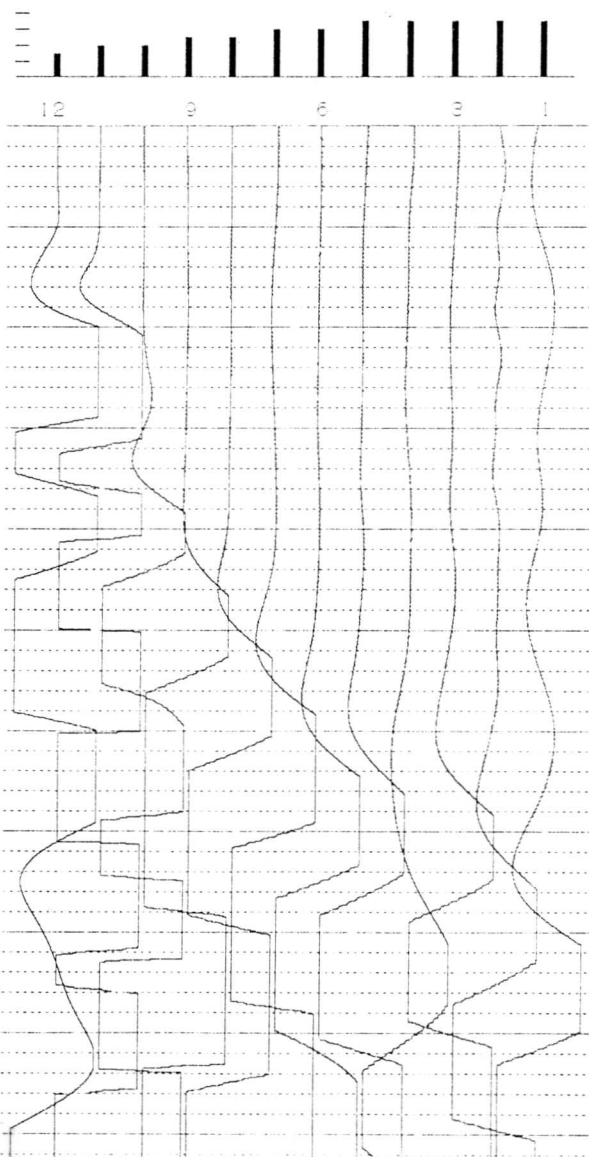
FIELD : -----  
ID,NO : 080  
DATE : 18-00-04, 00:18:40 AM  
FILTER : 48 [Hz]  
STACK : 2  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 VI.41

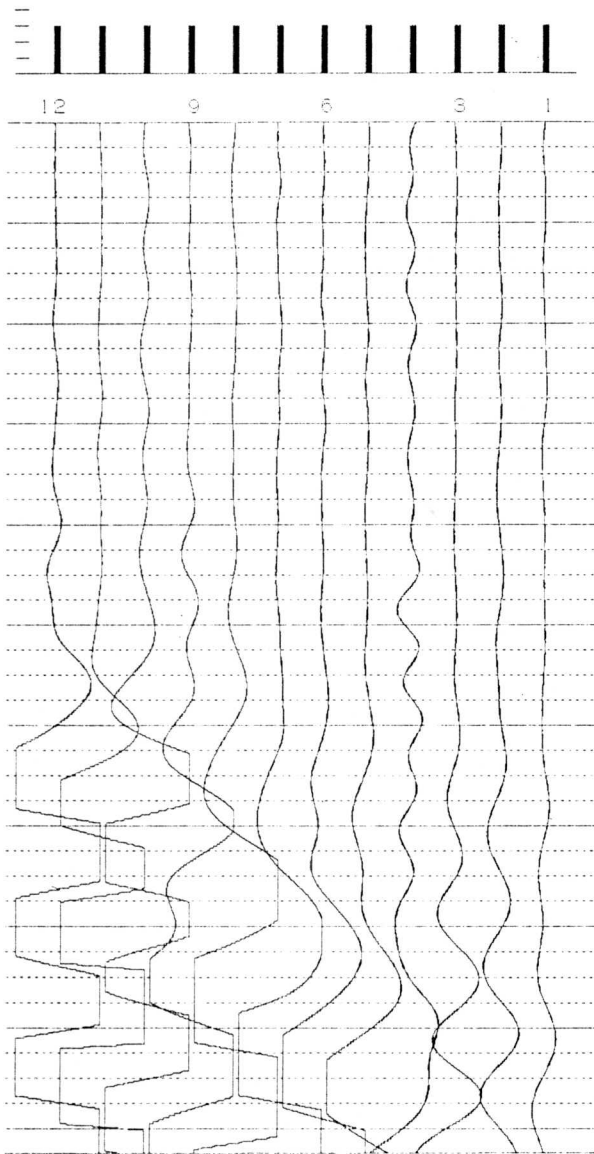
FIELD : -----  
ID,NO : 081  
DATE : 18-00-04, 00:23:18 AM  
FILTER : 48 [Hz]  
STACK : 10  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

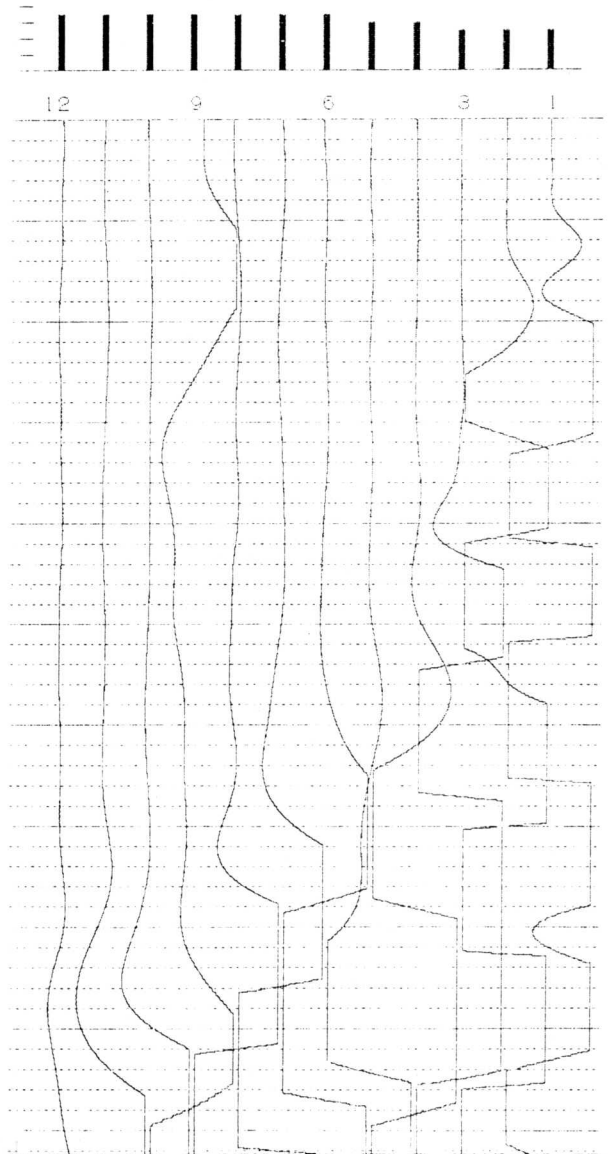
FIELD : -----  
ID.NO : 082  
DATE : 18/00/04, 01:08:48 AM  
FILTER : 48 [Hz]  
STACK : 17  
SAMPLING : 200 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 5 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

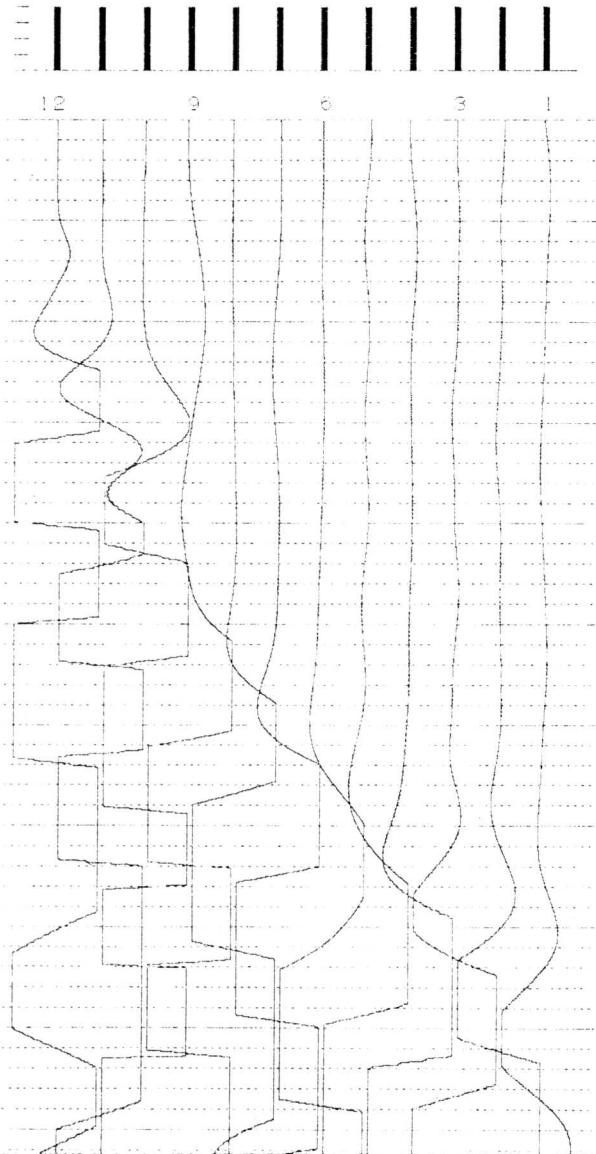
FIELD : -----  
ID.NO : 083  
DATE : 18/00/04, 01:25:48 AM  
FILTER : 48 [Hz]  
STACK : 3  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



OYO

McSEIS-170 V1.41

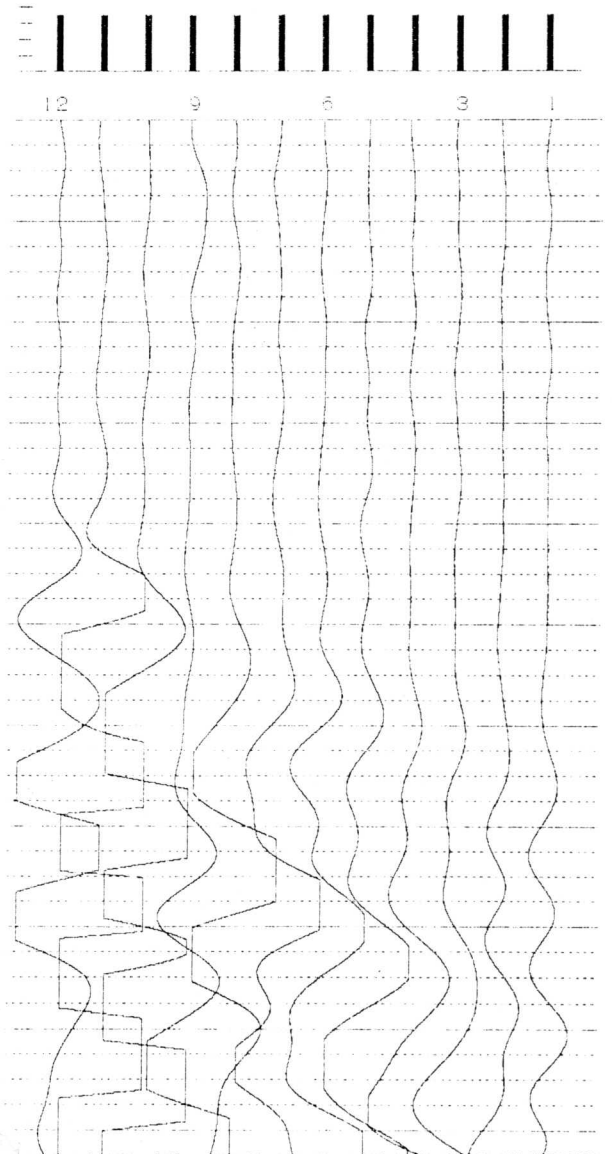
FIELD : -----  
ID. NO : 084  
DATE : 18/00/04 , 01:31:42 AM  
FILTER : 48 [Hz]  
STACK : 6  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



OYO

McSEIS-170 V1.41

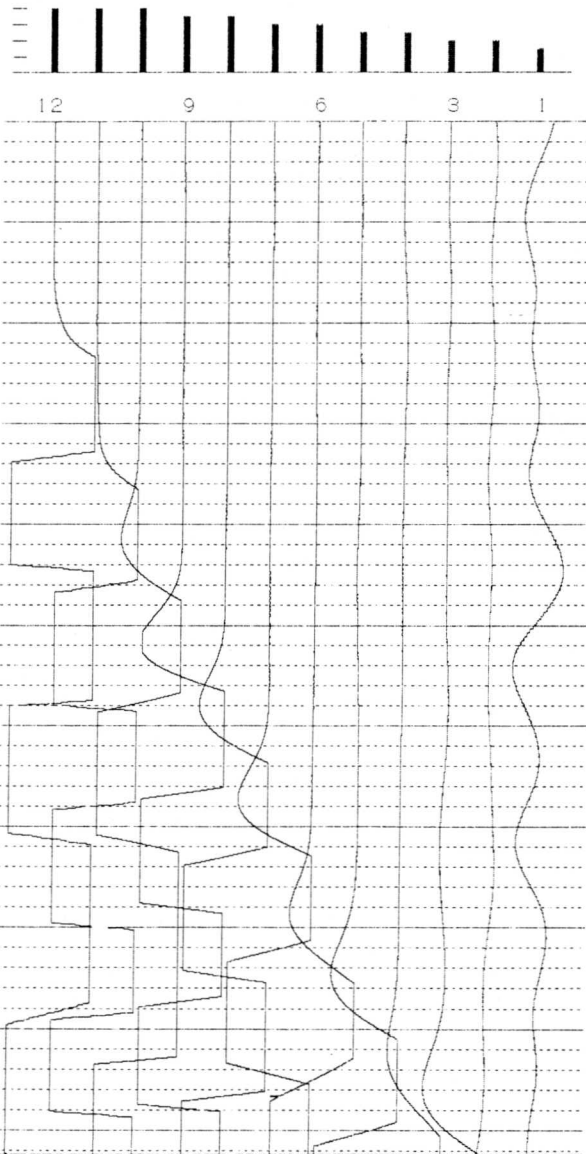
FIELD : -----  
ID. NO : 085  
DATE : 18/00/04 , 01:36:27 AM  
FILTER : 48 [Hz]  
STACK : 4  
SAMPLING : 200 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 5 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

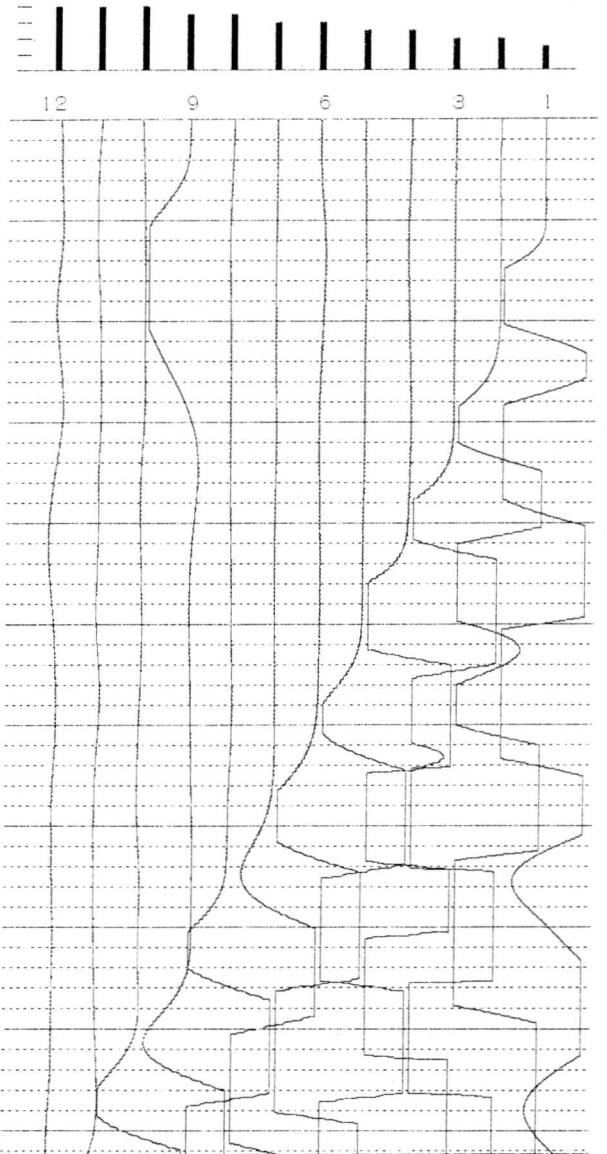
FIELD : -----  
ID,NO : 086  
DATE : 18/00/04 , 02:06:38 AM  
FILTER : 48 [Hz]  
STACK : 10  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

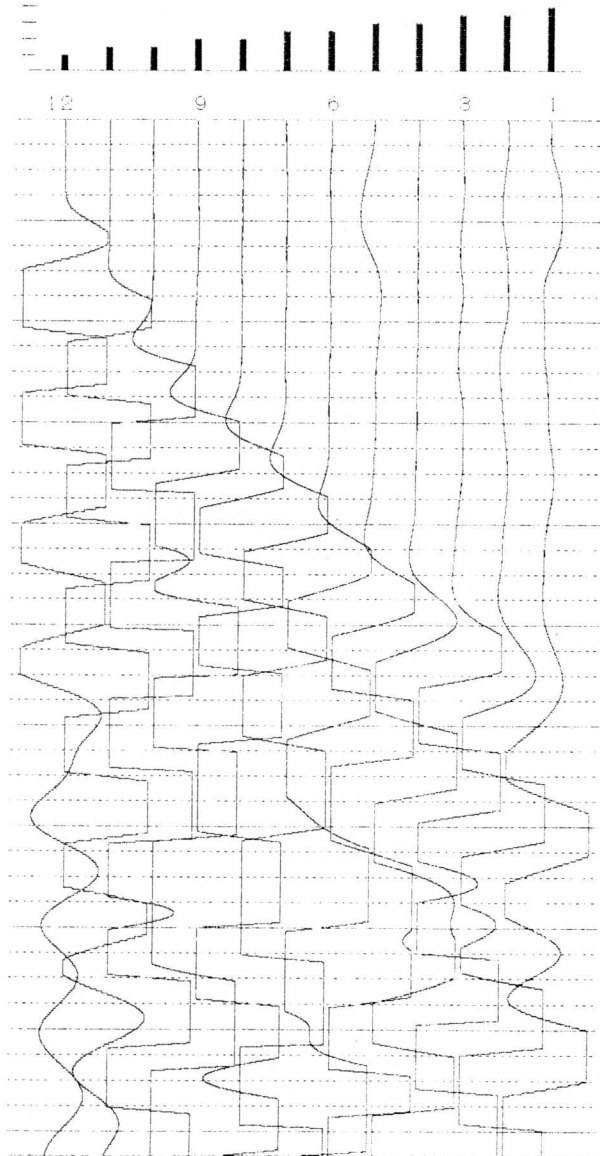
FIELD : -----  
ID,NO : 087  
DATE : 18/00/04 , 02:11:20 AM  
FILTER : 48 [Hz]  
STACK : 2  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

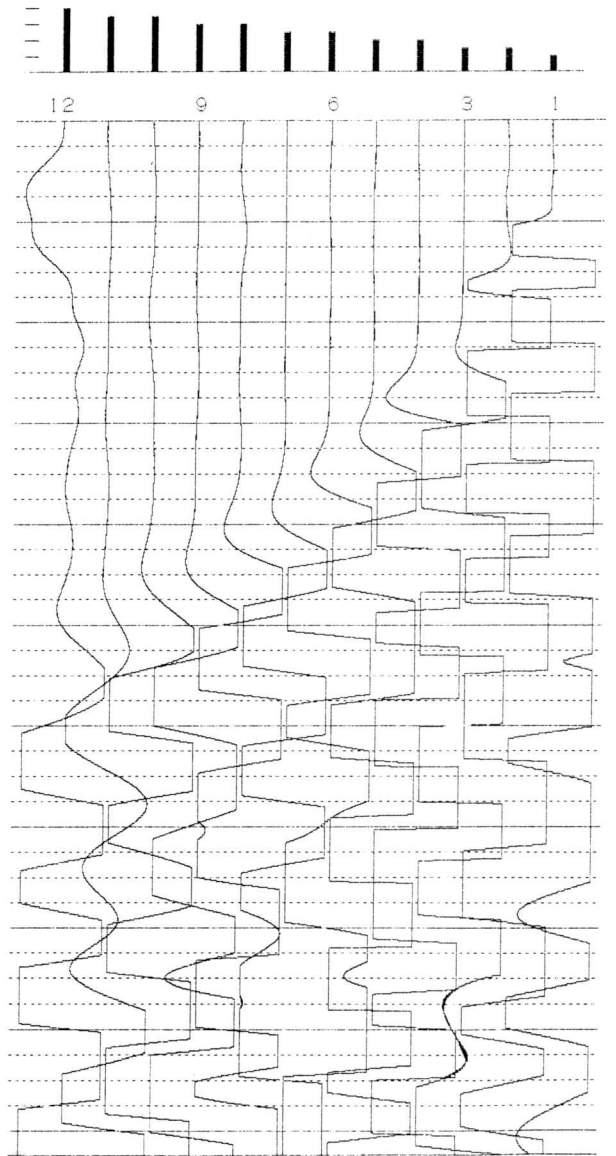
FIELD : -----  
ID.NO : 088  
DATE : 18/00/04 , 02:28:45 AM  
FILTER : 48 [Hz]  
STACK : 2  
SAMPLING : 200. [uSec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 5 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

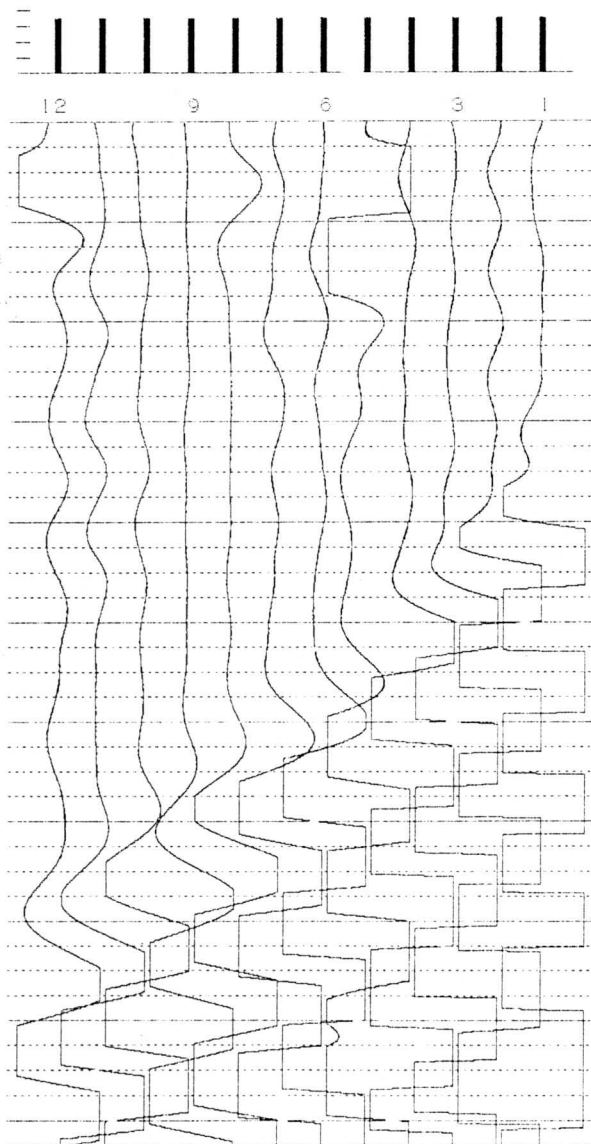
FIELD : -----  
ID.NO : 089  
DATE : 18/00/04 , 02:53:38 AM  
FILTER : 48 [Hz]  
STACK : 8  
SAMPLING : 200 [uSec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 5 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 VI. 41

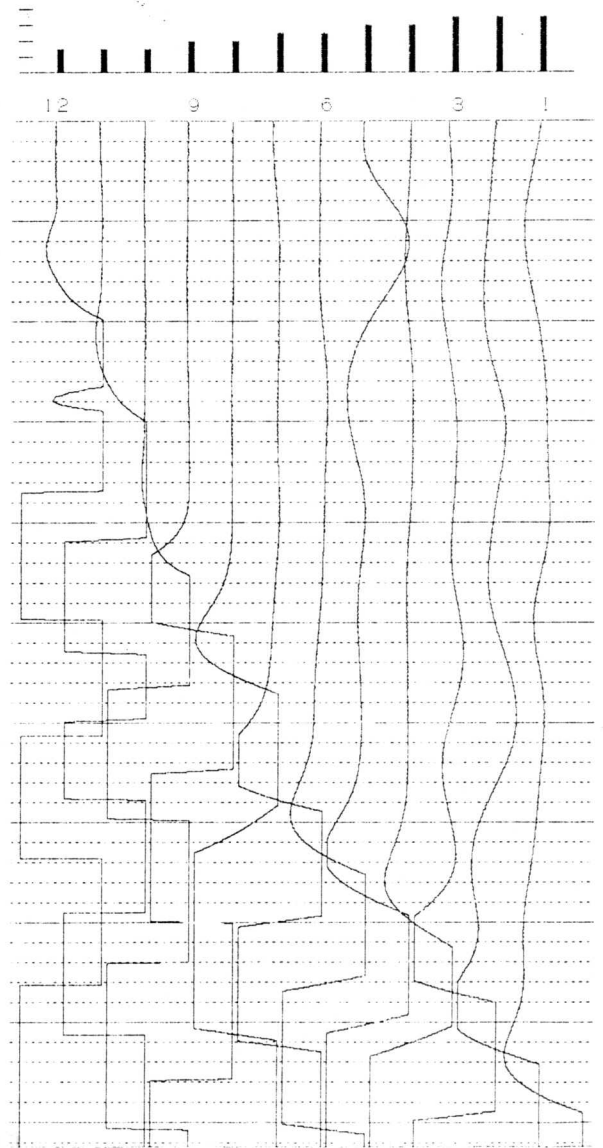
FIELD : -----  
ID. NO : 027  
DATE : 16/00/04 , 00:16:48 AM  
FILTER : 48 [Hz]  
STACK : 17  
SAMPLING : 200 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 5 [mSec/LINE]  
SIZE : 9



# OYO

McSEIS-170 VI. 41

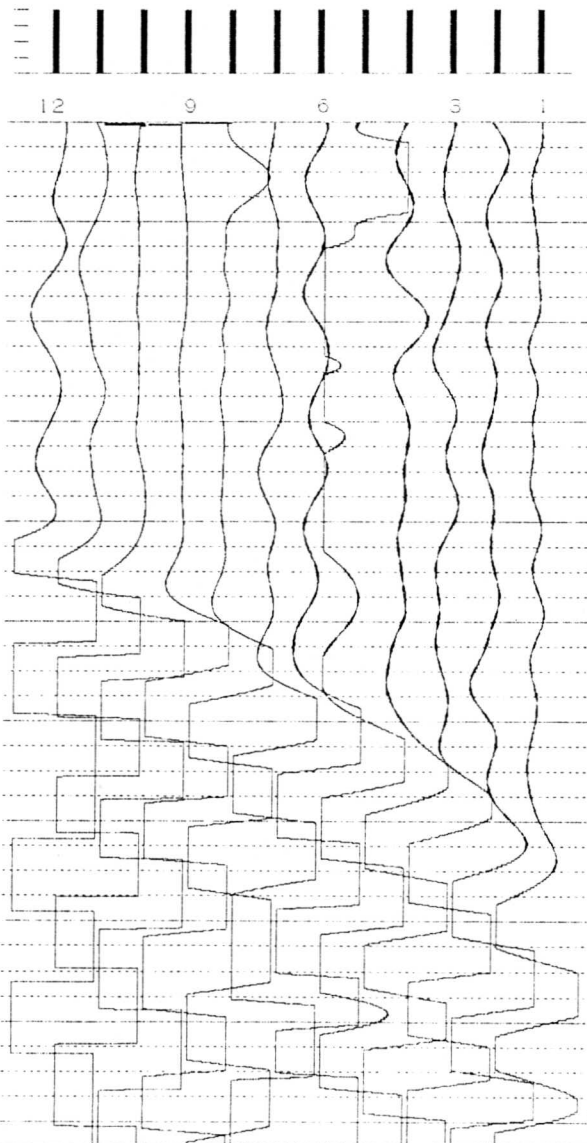
FIELD : -----  
ID. NO : 028  
DATE : 16/00/04 , 00:25:06 AM  
FILTER : 48 [Hz]  
STACK : 12  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 9



OYO

McSEIS-170 VI. 41

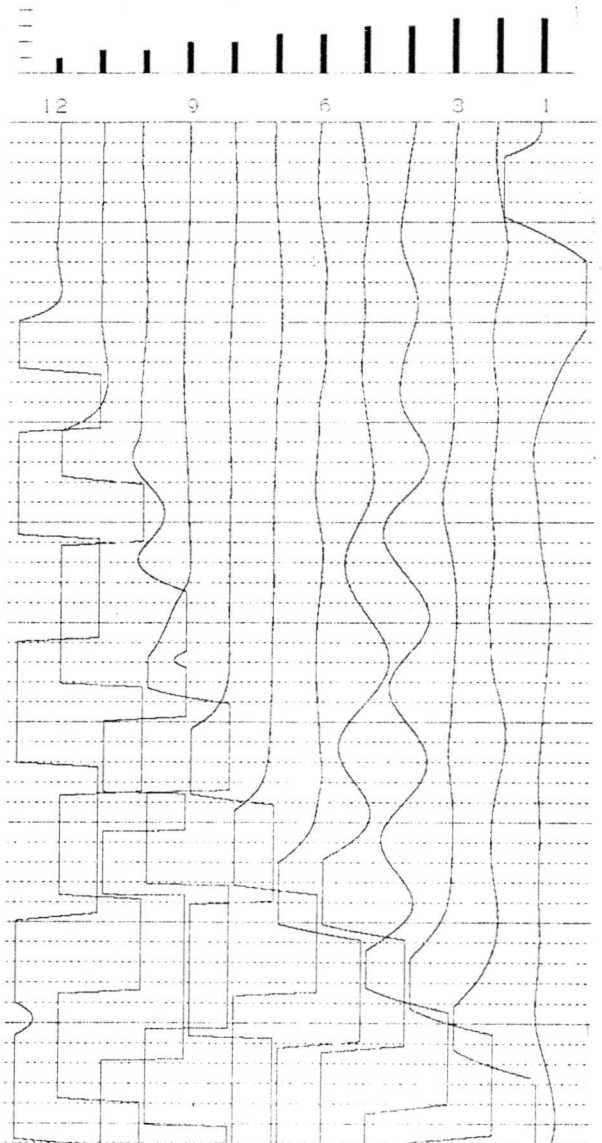
FIELD : -----  
ID. NO : 029  
DATE : 16/00/04 , 00:32:08 AM  
FILTER : 48 [Hz]  
STACK : 17  
SAMPLING : 200 [uSec]  
DELAY : +0000,000 [mSec]  
TIME SCALE: 5 [mSec/LINE]  
SIZE : 9



OYO

McSEIS-170 VI. 41

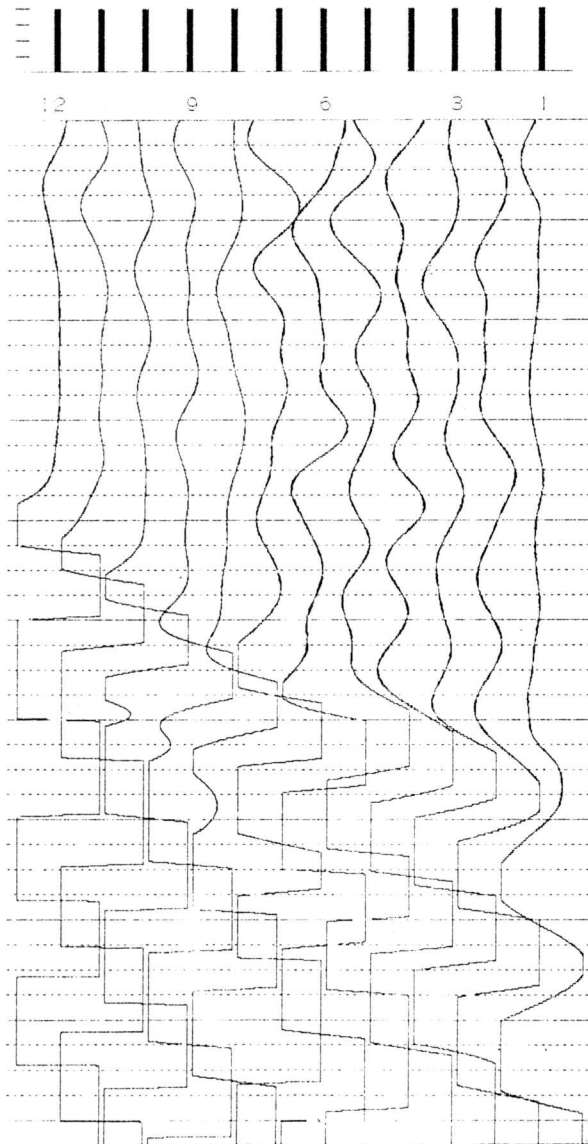
FIELD : -----  
ID. NO : 030  
DATE : 16/00/04 , 01:32:22 AM  
FILTER : 96 [Hz]  
STACK : 2  
SAMPLING : 100 [uSec]  
DELAY : +0000,000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 9



# OYO

McSEIS-170 V1.41

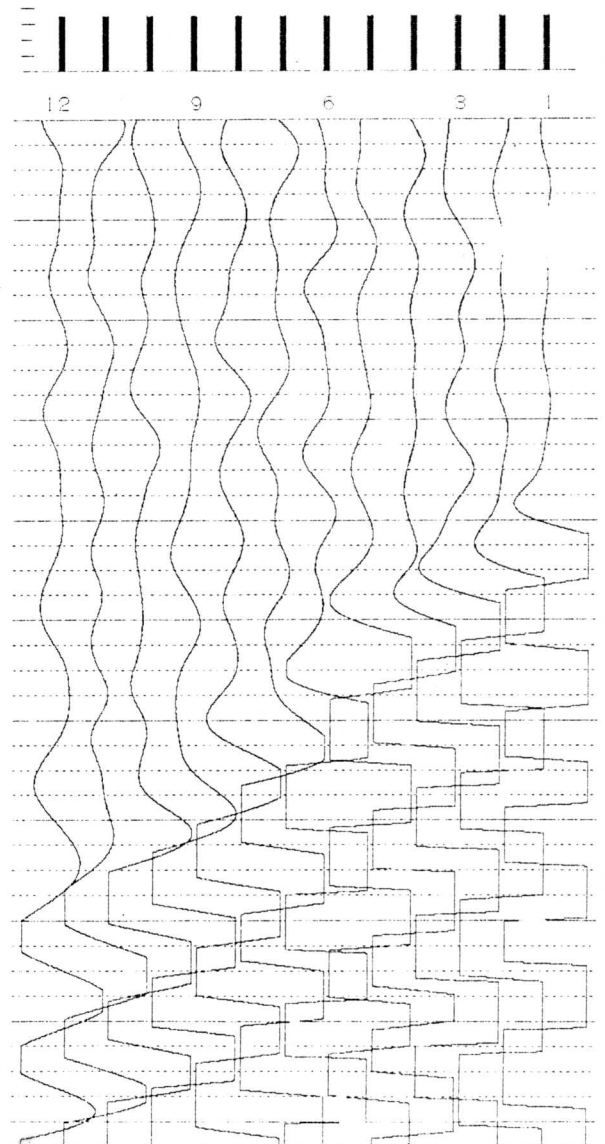
FIELD : \_\_\_\_\_  
ID, NO : 031  
DATE : 16/00/04 , 01:44:33 AM  
FILTER : 48 [Hz]  
STACK : 22  
SAMPLING : 200 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 5 [mSec/LINE]  
SIZE : 9



# OYO

McSEIS-170 V1.41

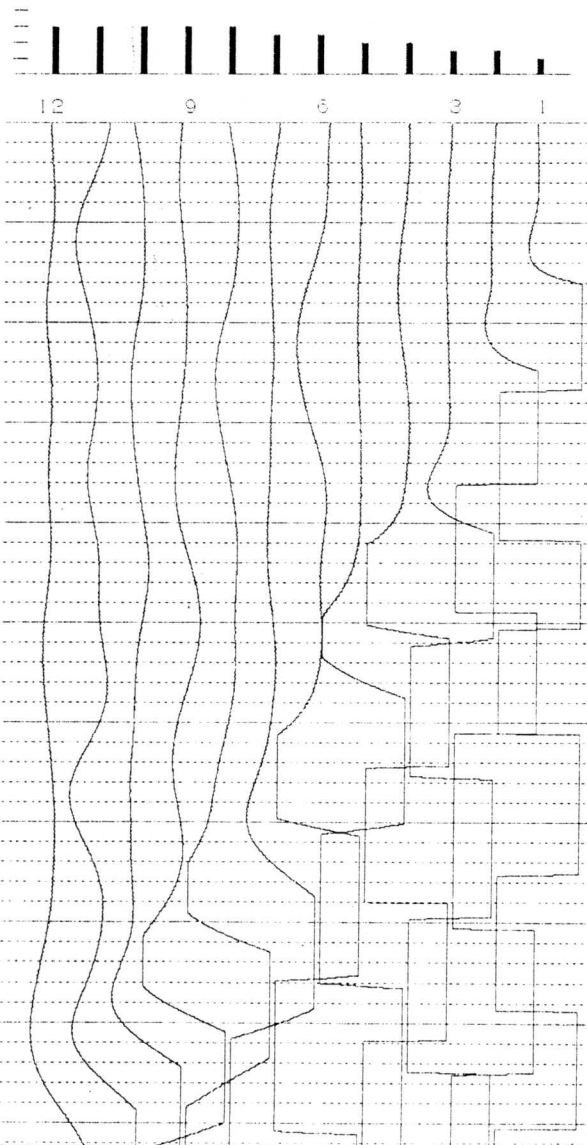
FIELD : \_\_\_\_\_  
ID, NO : 032  
DATE : 16/00/04 , 01:57:38 AM  
FILTER : 48 [Hz]  
STACK : 20  
SAMPLING : 200 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 5 [mSec/LINE]  
SIZE : 9



# OYO

McSEIS-170 V1.41

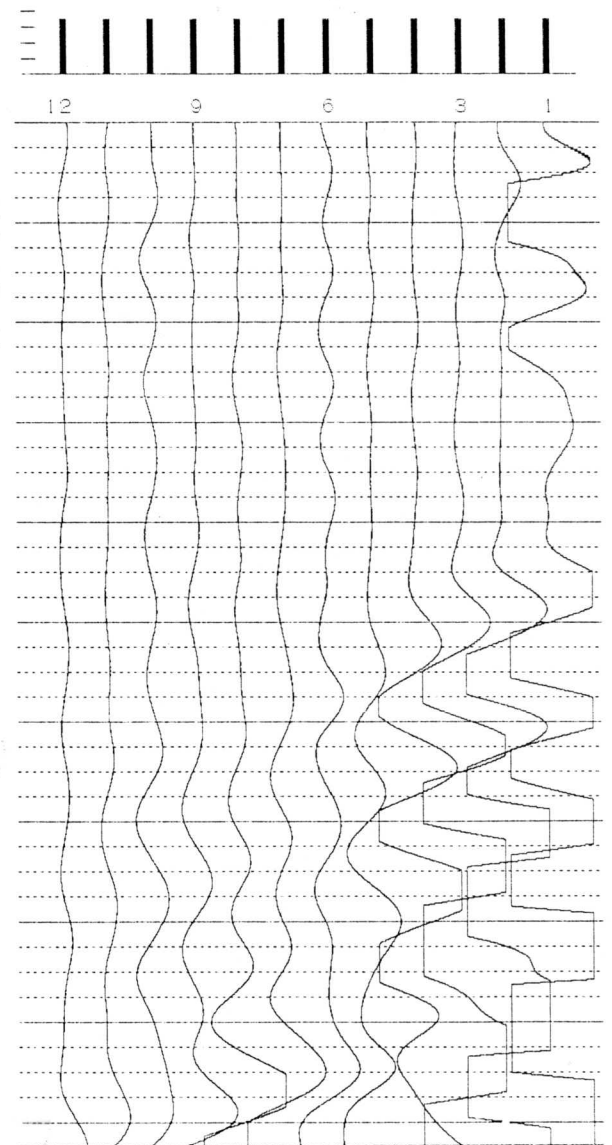
FIELD : -----  
ID. NO : 033  
DATE : 16/00/04 , 02:02:35 AM  
FILTER : 48 [Hz]  
STACK : 15  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 9



# OYO

McSEIS-170 V1.41

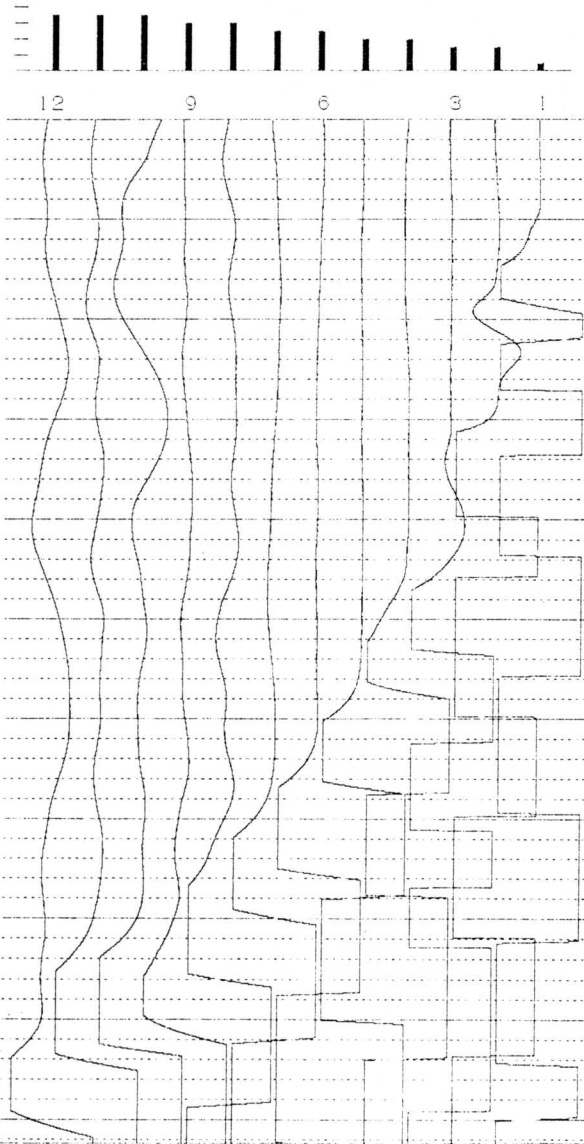
FIELD : -----  
ID. NO : 034  
DATE : 16/00/04 , 02:24:10 AM  
FILTER : 48 [Hz]  
STACK : 20  
SAMPLING : 200 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 5 [mSec/LINE]  
SIZE : 8



OYO

McSEIS-170 VI, 41

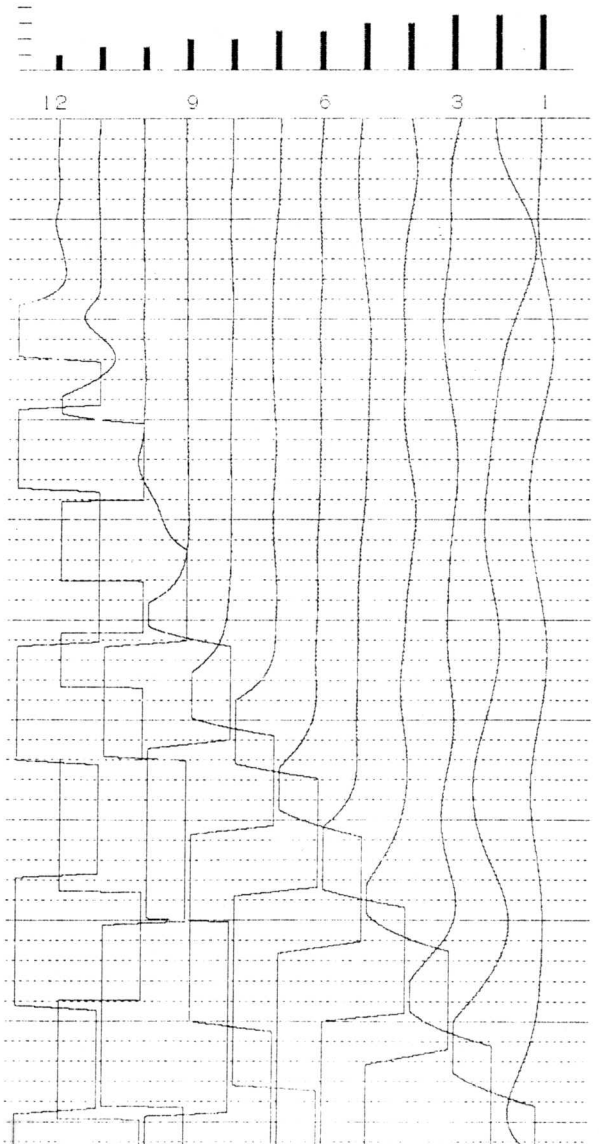
FIELD : -----  
ID, NO : 035  
DATE : 16/00/04 , 02:30:17 AM  
FILTER : 96 [Hz]  
STACK : 8  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 9



OYO

McSEIS-170 VI, 41

FIELD : -----  
ID, NO : 036  
DATE : 16/00/04 , 02:42:05 AM  
FILTER : 48 [Hz]  
STACK : 7  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 9



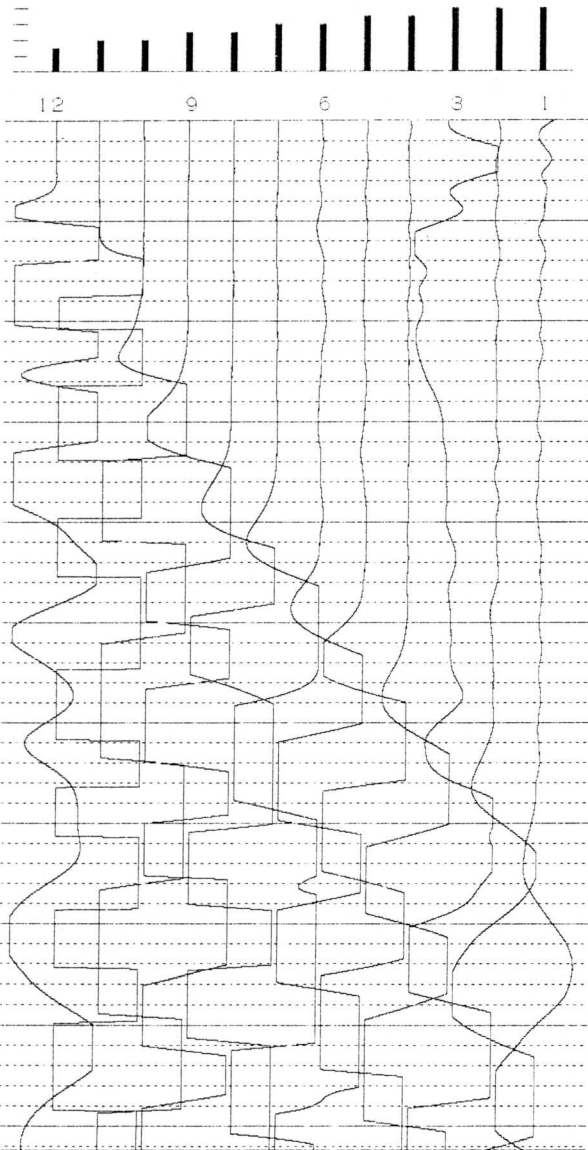
## **APPENDIX 2**

### **SPREAD LAYOUT LINES 1 TO 5**

# OYO

McSEIS-170 V1.41

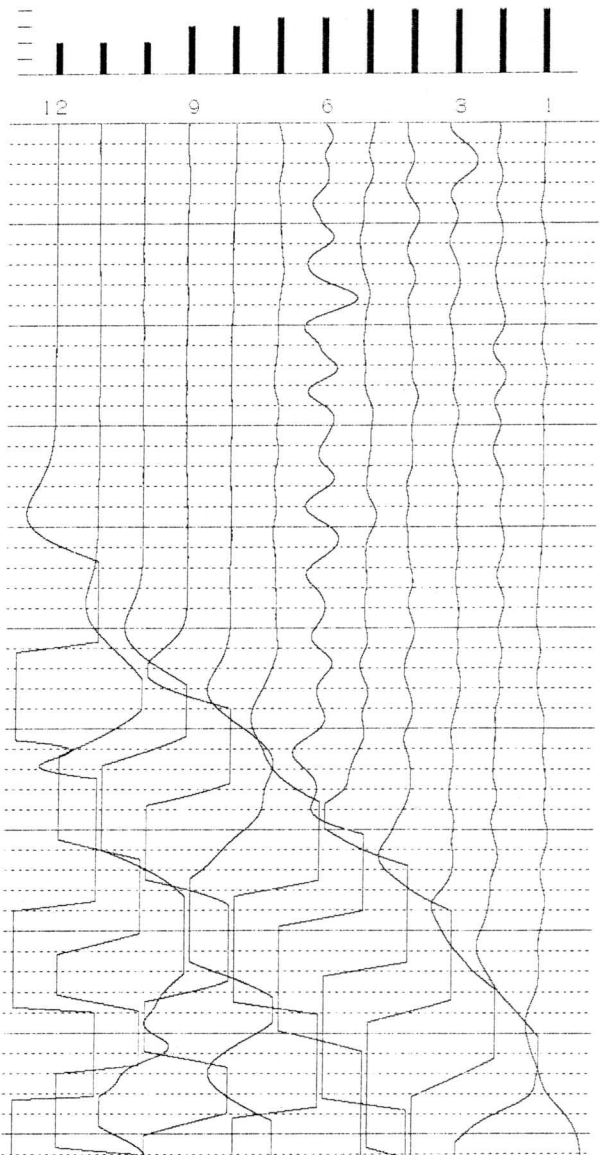
FIELD : -----  
ID,NO : 001  
DATE : 14/00/04 , 10:55:20 PM  
FILTER : 192 [Hz]  
STACK : 10  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

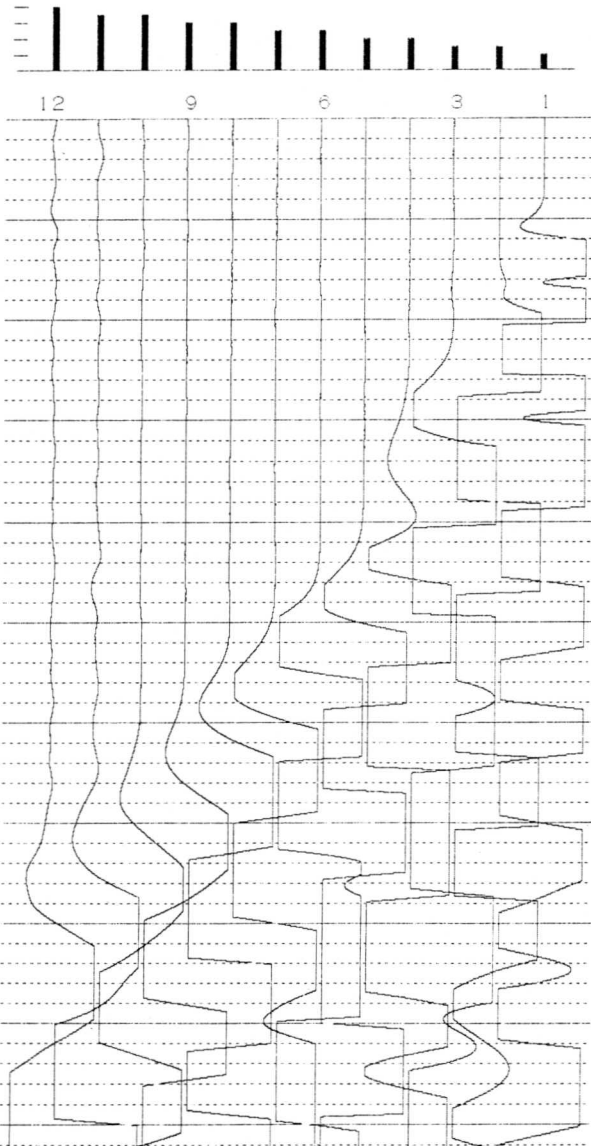
FIELD : -----  
ID,NO : 002  
DATE : 14/00/04 , 11:08:49 PM  
FILTER : 192 [Hz]  
STACK : 16  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

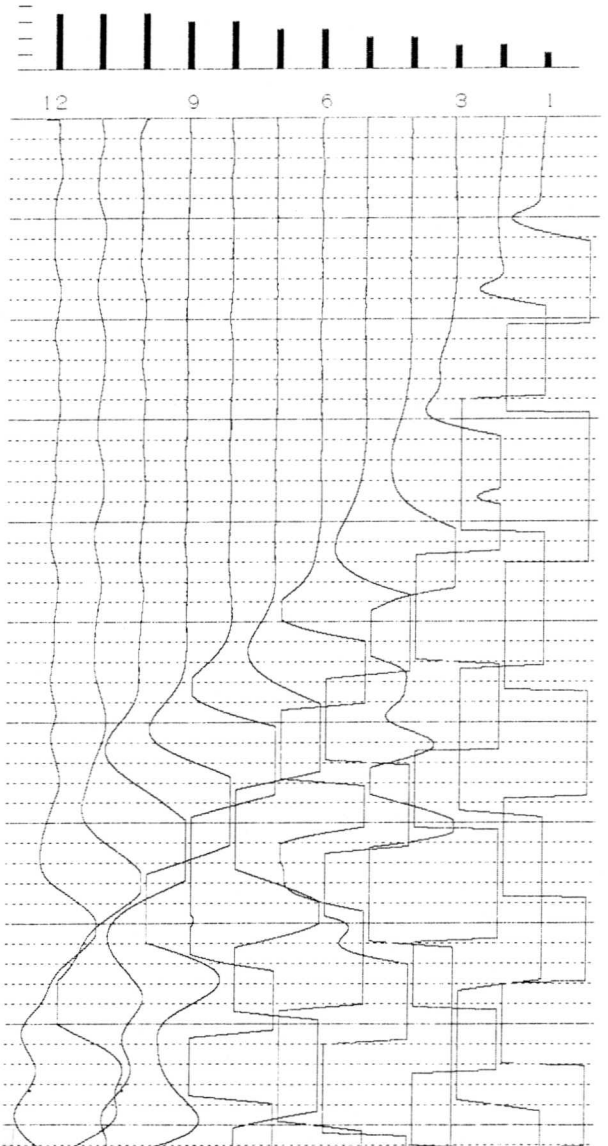
FIELD : -----  
ID. NO : 003  
DATE : 14/00/04 , 11:16:33 PM  
FILTER : 192 [Hz]  
STACK : 4  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

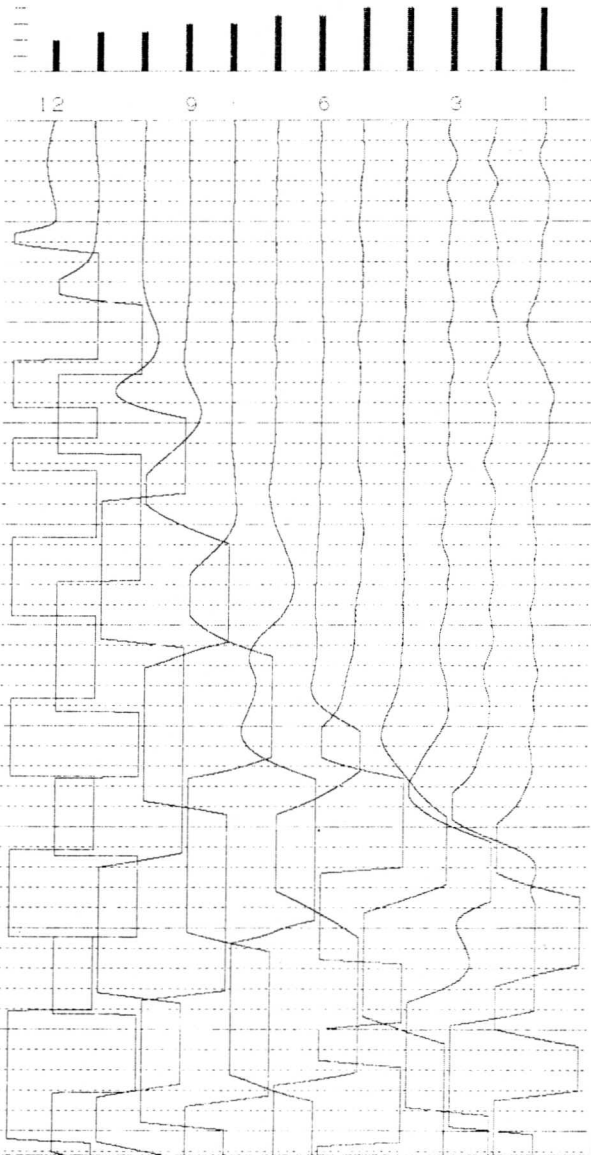
FIELD : -----  
ID. NO : 004  
DATE : 14/00/04 , 11:57:55 PM  
FILTER : 192 [Hz]  
STACK : 14  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

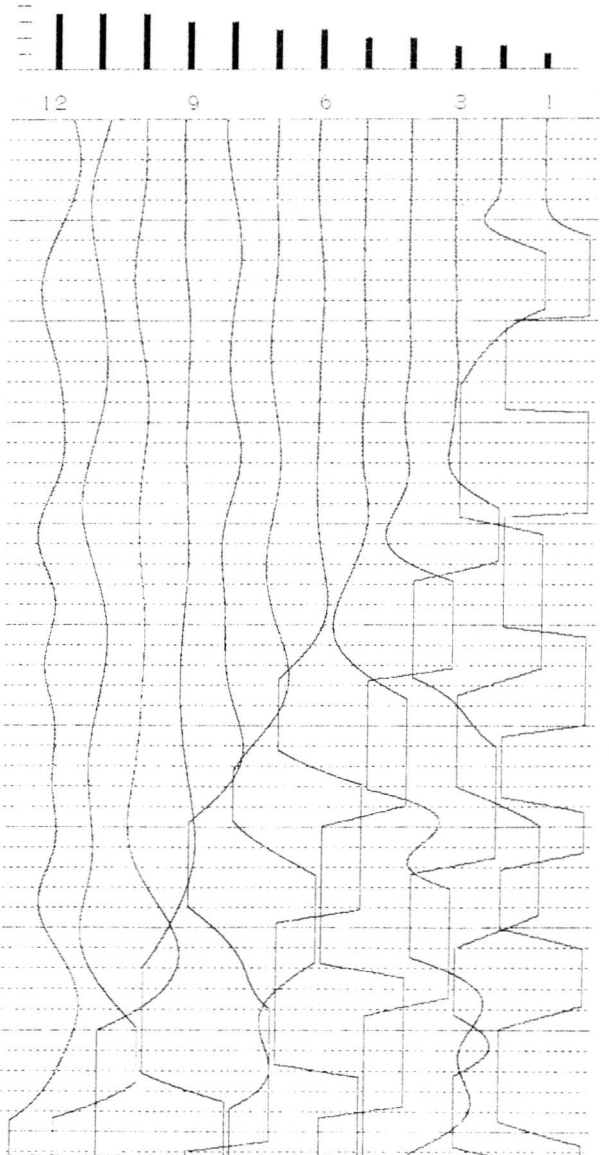
FIELD : -----  
ID,NO : 005  
DATE : 15/00/04 , 00:16:41 AM  
FILTER : 192 [Hz]  
STACK : 3  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000,000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 9



# OYO

McSEIS-170 V1.41

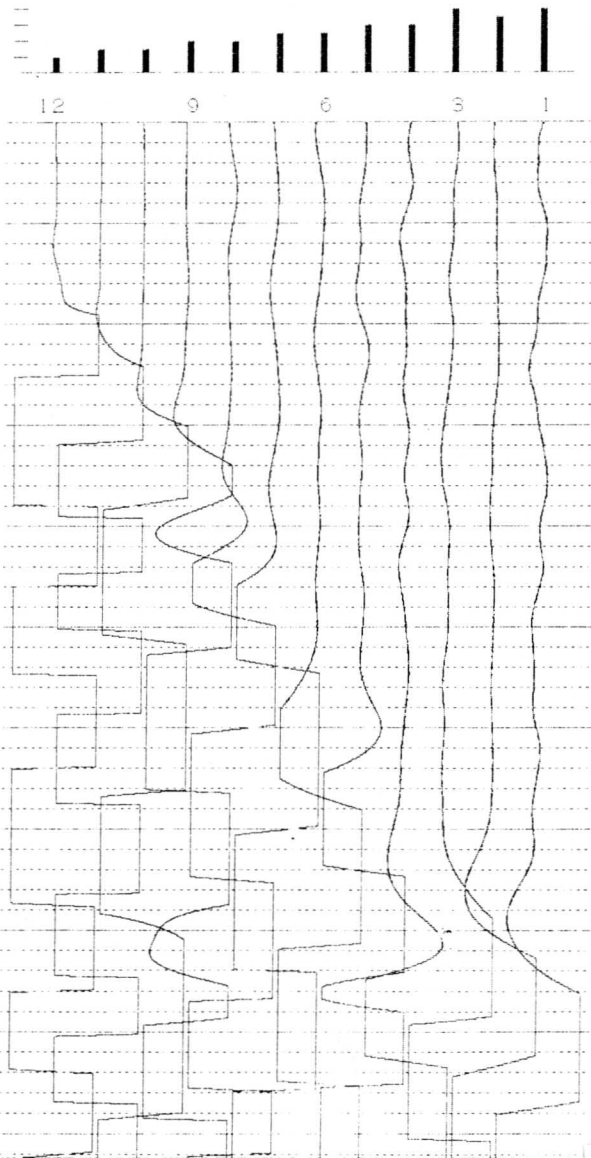
FIELD : -----  
ID,NO : 006  
DATE : 15/00/04 , 02:03:39 AM  
FILTER : 48 [Hz]  
STACK : 9  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000,000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 9



# OYO

McSEIS-170 VI, 41

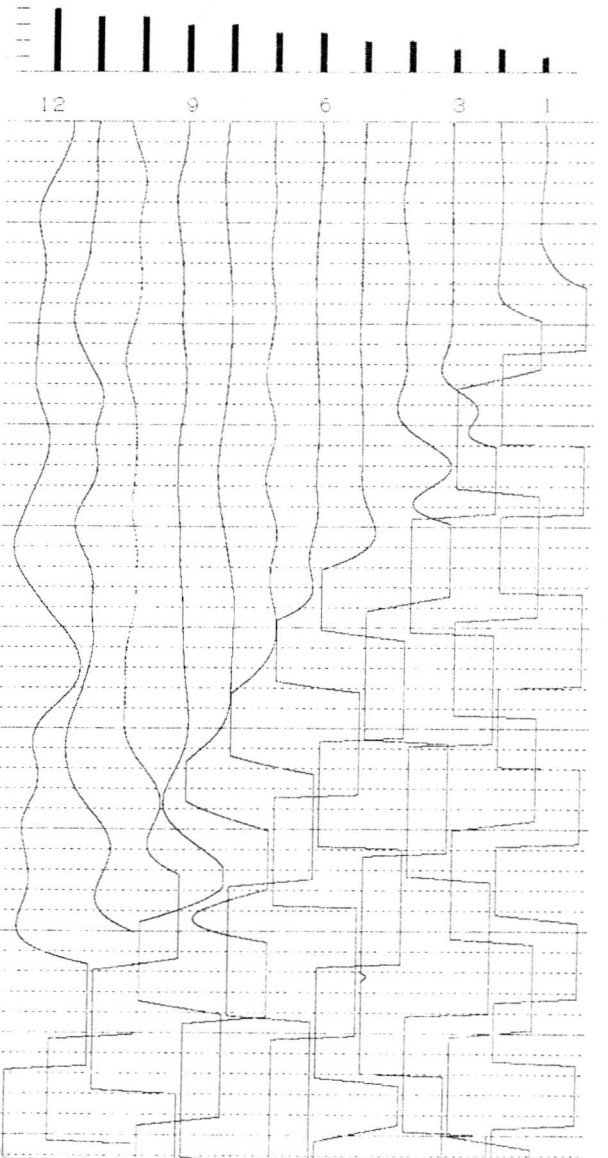
FIELD : -----  
ID, NO : 007  
DATE : 15/00/04 , 02:16:03 AM  
FILTER : 96 [Hz]  
STACK : 15  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000,000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 9



# OYO

McSEIS-170 VI, 41

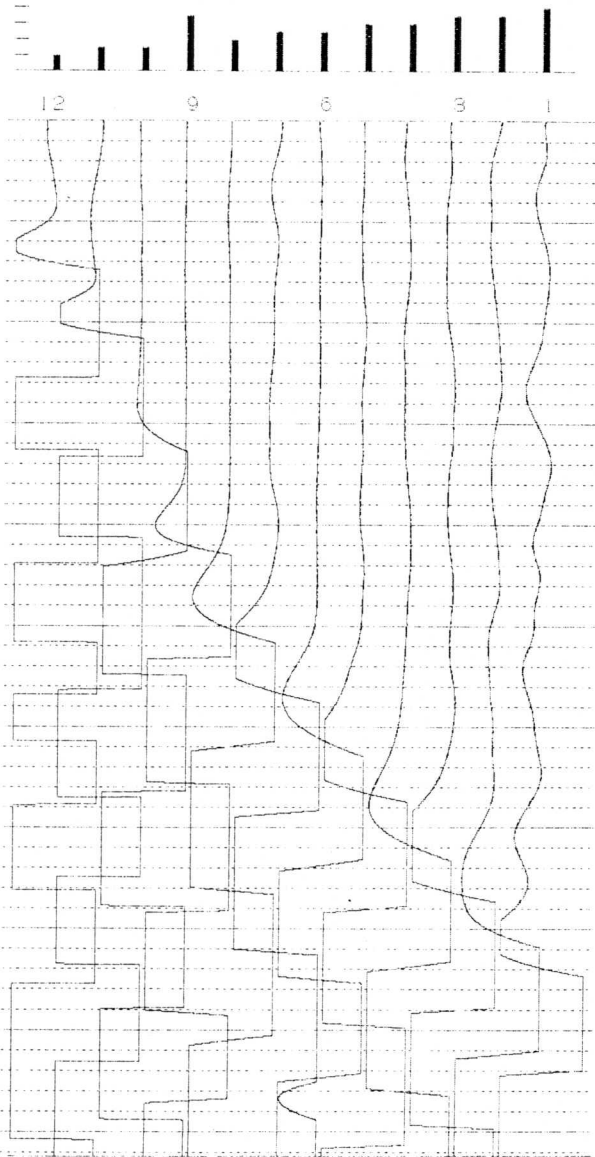
FIELD : -----  
ID, NO : 008  
DATE : 15/00/04 , 02:48:21 AM  
FILTER : 96 [Hz]  
STACK : 12  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000,000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 9



# OYO

McSEIS-170 V1.41

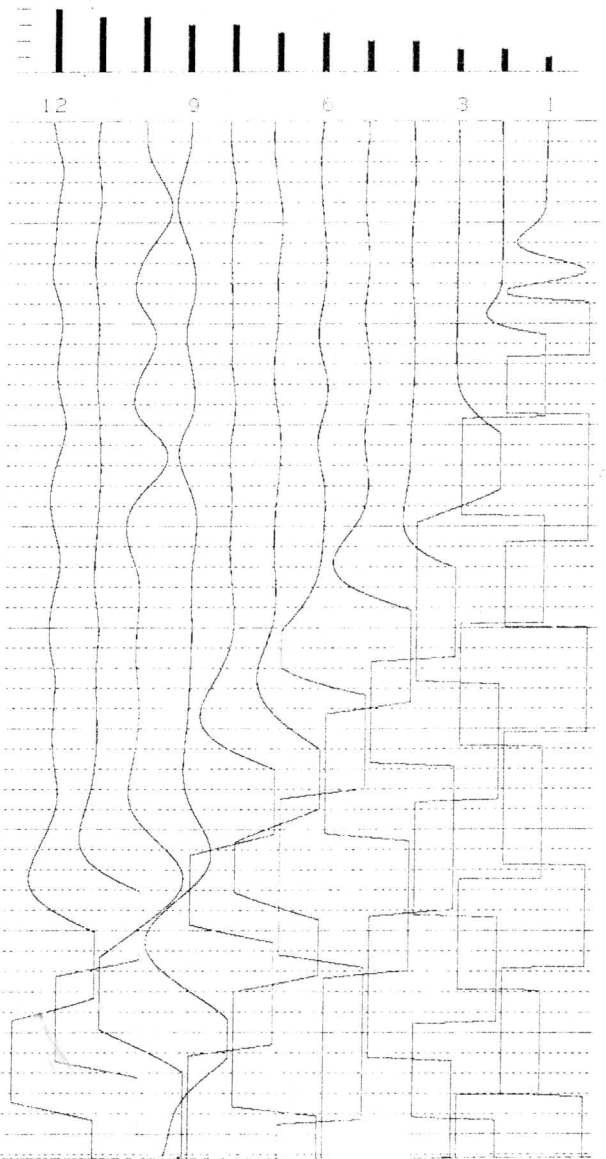
FIELD : -----  
ID. NO : 009  
DATE : 15/00/04 , 02:59:08 AM  
FILTER : 96 [Hz]  
STACK : 15  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 9



# OYO

McSEIS-170 V1.41

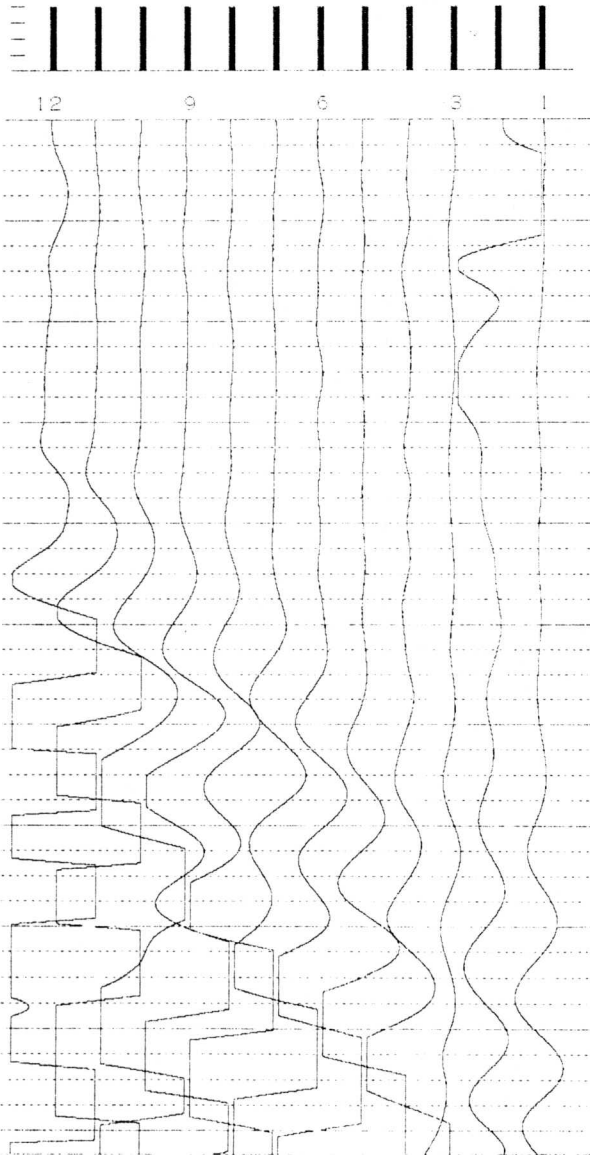
FIELD : -----  
ID. NO : 010  
DATE : 15/00/04 , 03:31:52 AM  
FILTER : 96 [Hz]  
STACK : 2  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 9



# OYO

McSEIS-170 VI.41

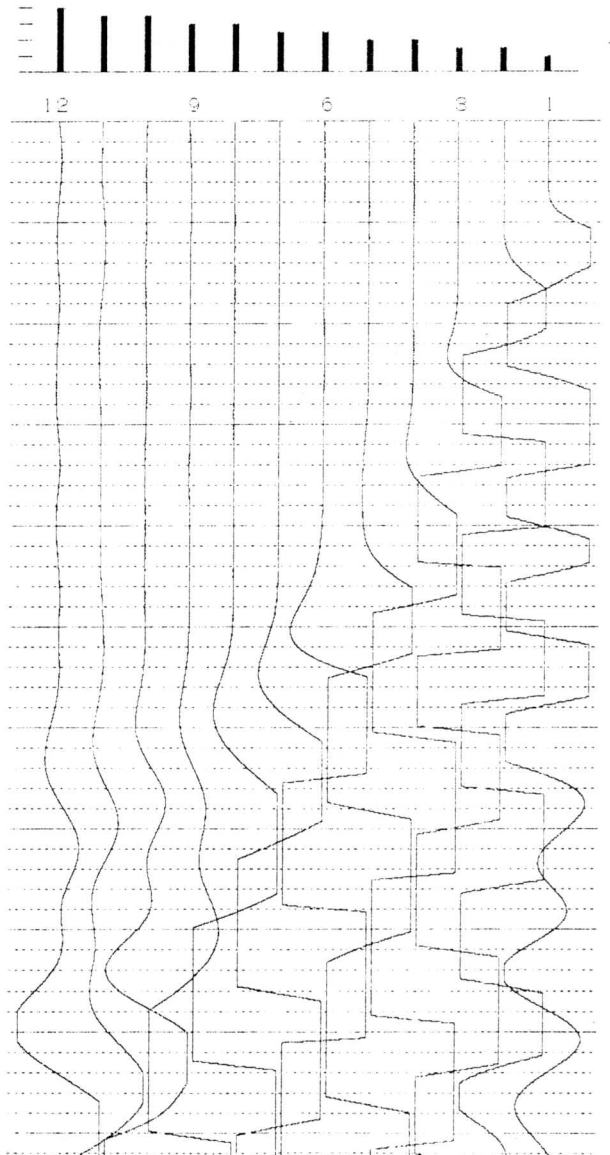
FIELD : -----  
ID,NO : 084  
DATE : 17/00/04 , 03:54:48 AM  
FILTER : 48 [Hz]  
STACK : 17  
SAMPLING : 200 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 5 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 VI.41

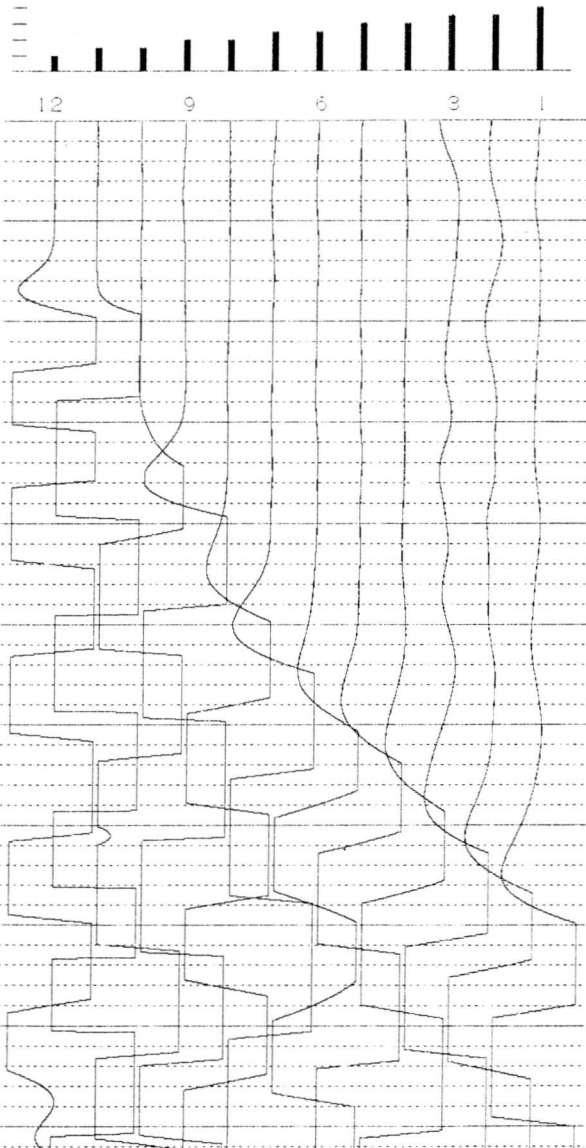
FIELD : -----  
ID,NO : 085  
DATE : 17/00/04 , 04:06:36 AM  
FILTER : 64 [Hz]  
STACK : 14  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

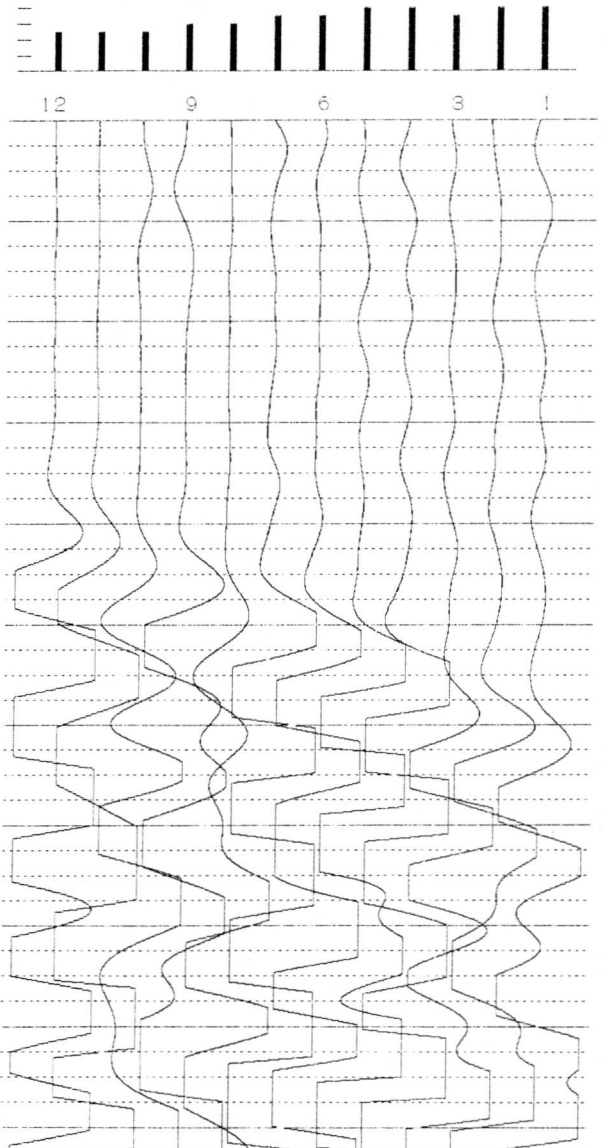
FIELD : -----  
ID.NO : 011  
DATE : 15/00/04 , 03:38:40 AM  
FILTER : 96 [Hz]  
STACK : 12  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

FIELD : -----  
ID.NO : 012  
DATE : 15/00/04 , 03:53:44 AM  
FILTER : 48 [Hz]  
STACK : 15  
SAMPLING : 200 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 5 [mSec/LINE]  
SIZE : 8



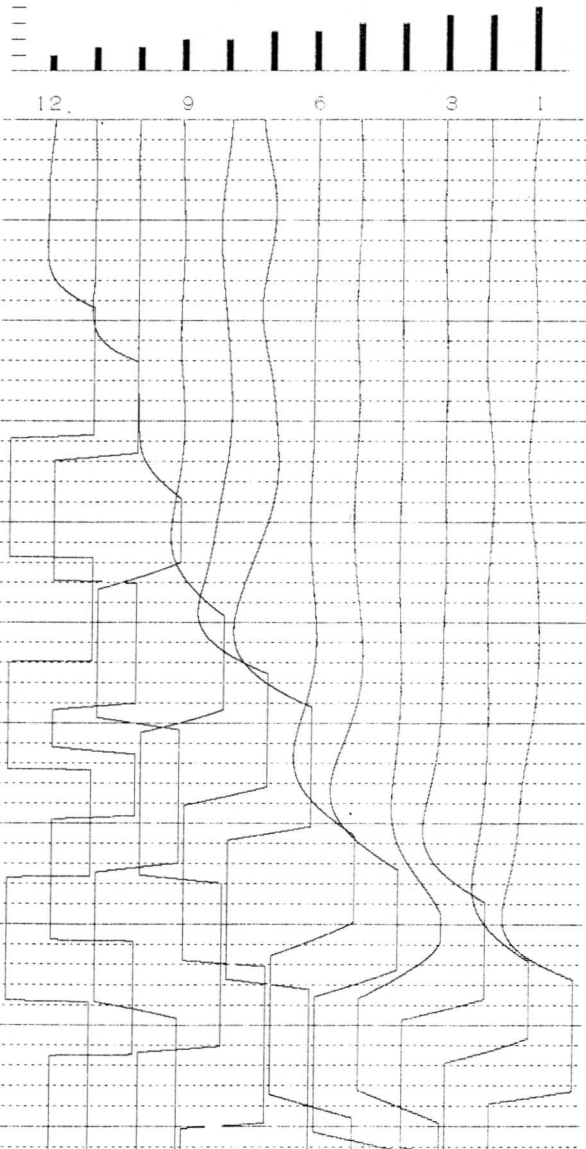
## **APPENDIX 3**

### **RESISTIVITY SOUNDINGS LINES 1 AND 2**

# OYO

McSEIS-170 V1.41

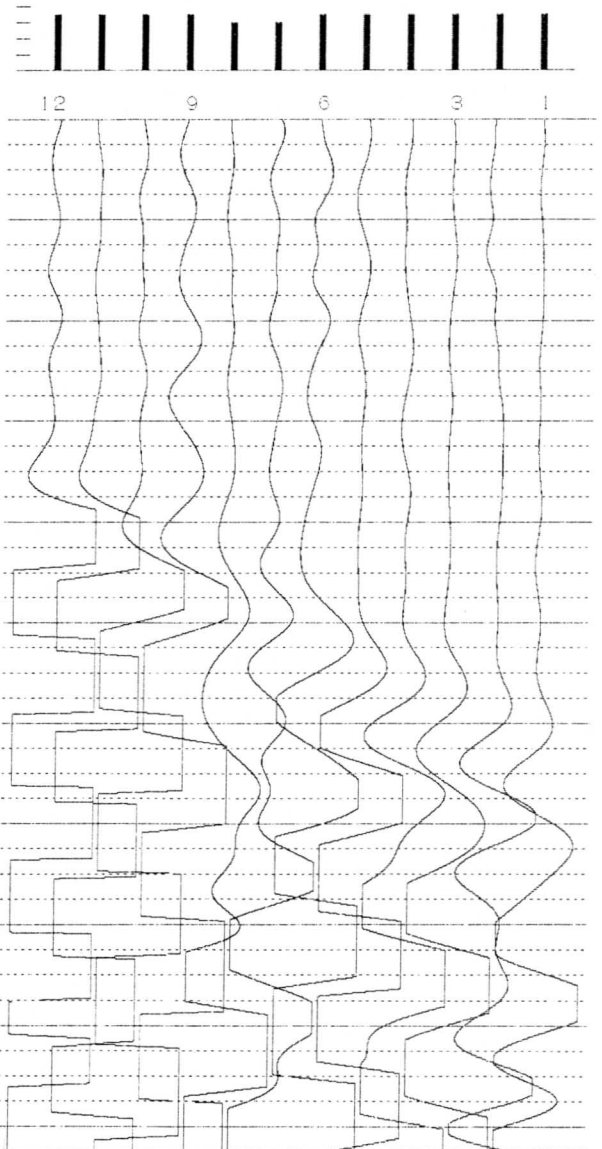
FIELD : -----  
ID.NO : 013  
DATE : 15/00/04 , 04:24:10 AM  
FILTER : 48 [Hz]  
STACK : 14  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

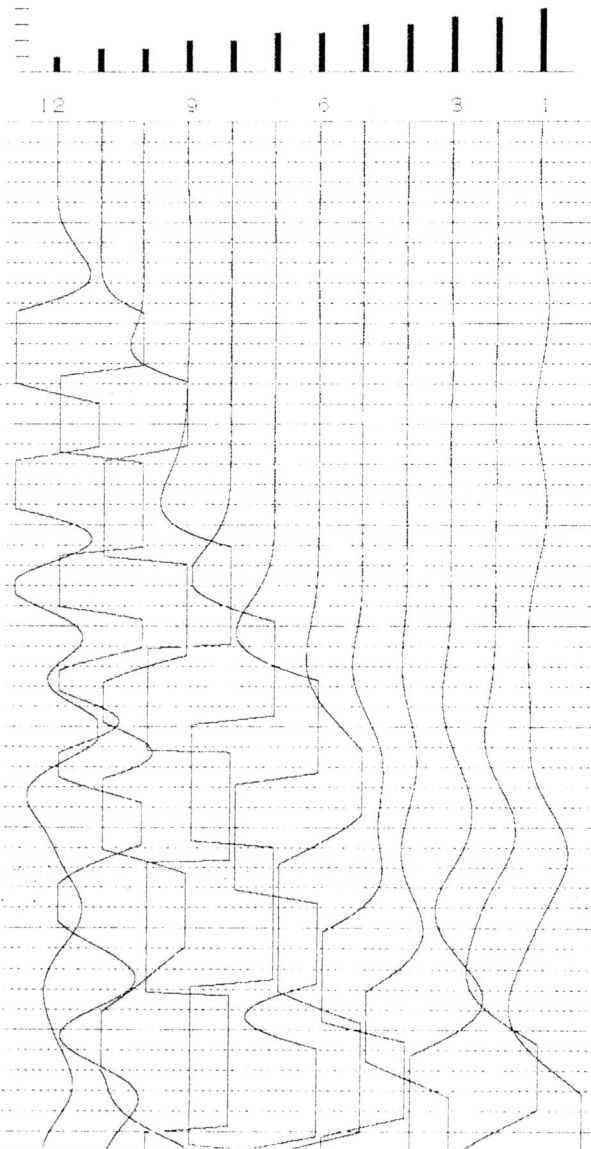
FIELD : -----  
ID.NO : 014  
DATE : 15/00/04 , 04:34:07 AM  
FILTER : 48 [Hz]  
STACK : 11  
SAMPLING : 200 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 5 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 VI.41

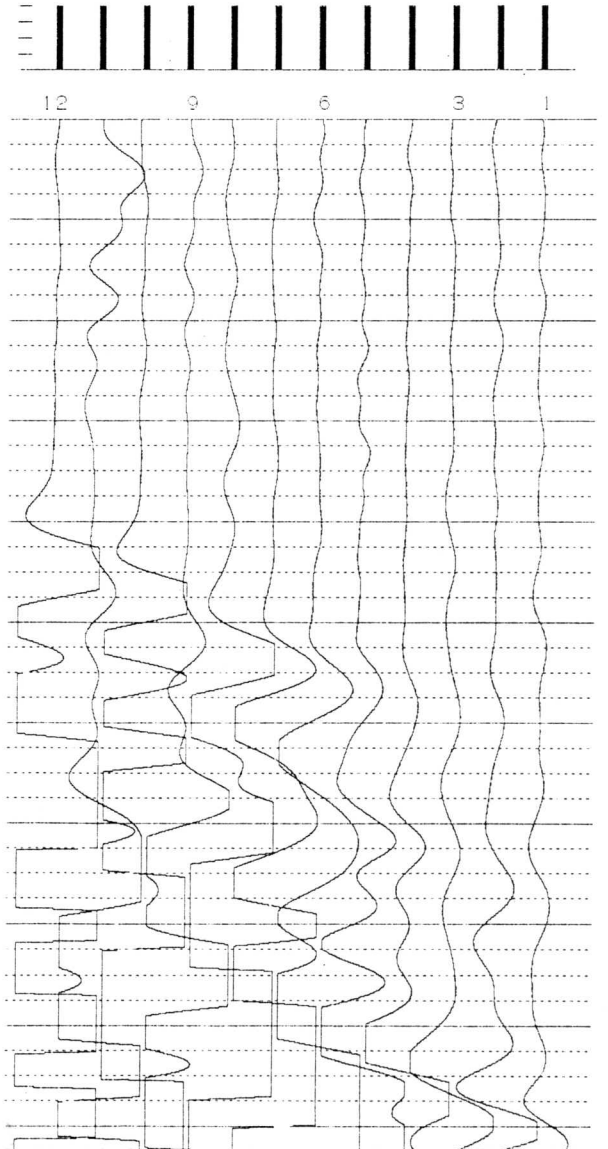
FIELD : -----  
ID. NO : 066  
DATE : 17/00/04 , 04:12:57 AM  
FILTER : 64 [Hz]  
STACK : 16  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 VI.41

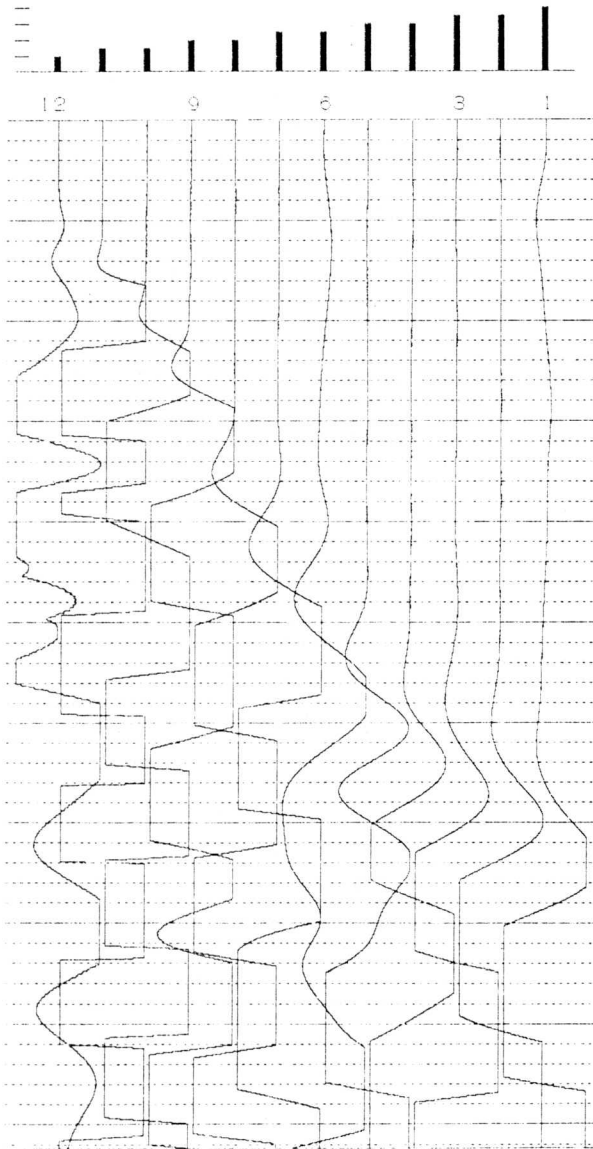
FIELD : -----  
ID. NO : 067  
DATE : 17/00/04 , 04:18:06 AM  
FILTER : 64 [Hz]  
STACK : 20  
SAMPLING : 200 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 5 [mSec/LINE]  
SIZE : 8



OYO

McSEIS-170 V1.41

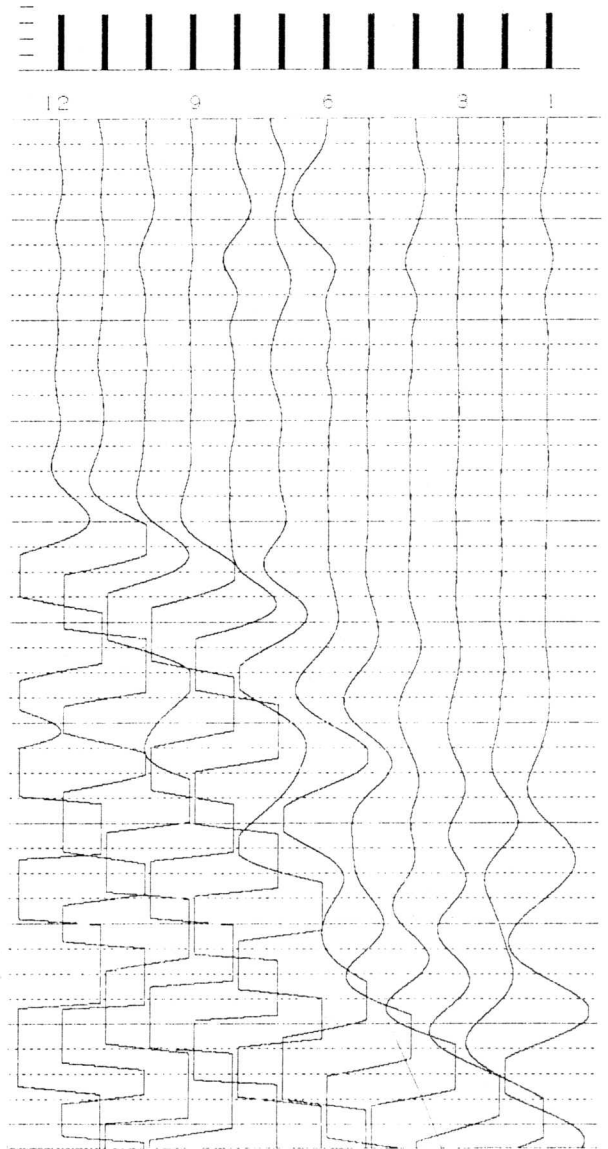
FIELD : -----  
ID,NO : 068  
DATE : 17/00/04 , 09:52:04 PM  
FILTER : 96 [Hz]  
STACK : 12  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



OYO

McSEIS-170 V1.41

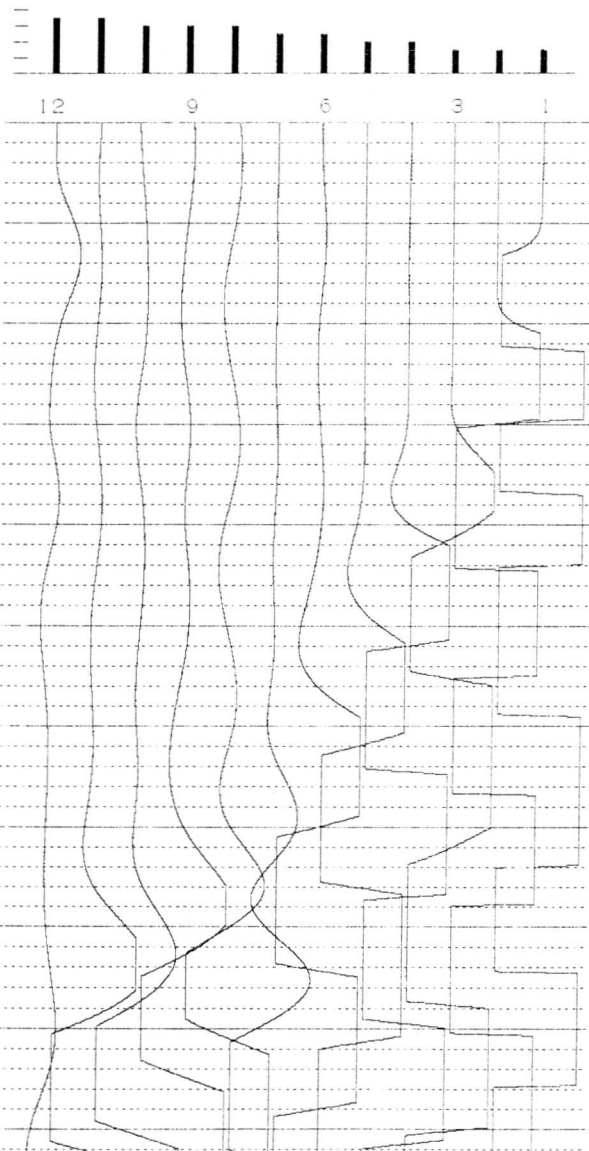
FIELD : -----  
ID,NO : 069  
DATE : 17/00/04 , 09:59:03 PM  
FILTER : 48 [Hz]  
STACK : 21  
SAMPLING : 200 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 5 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

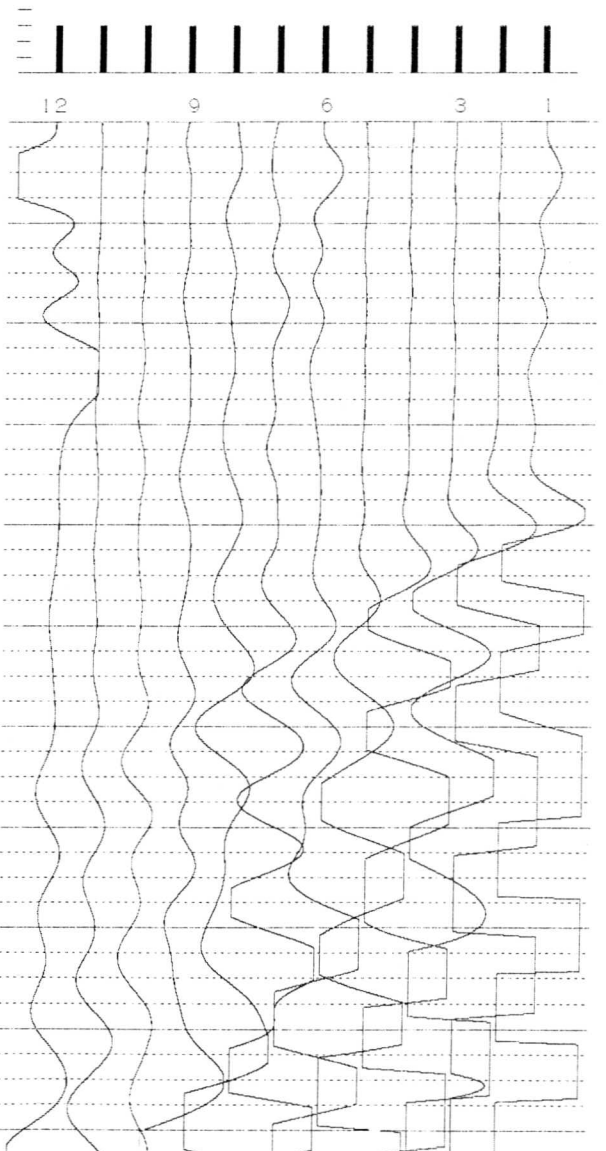
FIELD : -----  
ID.NO : 015  
DATE : 15/00/04 , 04:44:35 AM  
FILTER : 48 [Hz]  
STACK : 8  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

FIELD : -----  
ID.NO : 016  
DATE : 15/00/04 , 04:52:23 AM  
FILTER : 48 [Hz]  
STACK : 16  
SAMPLING : 200 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 5 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

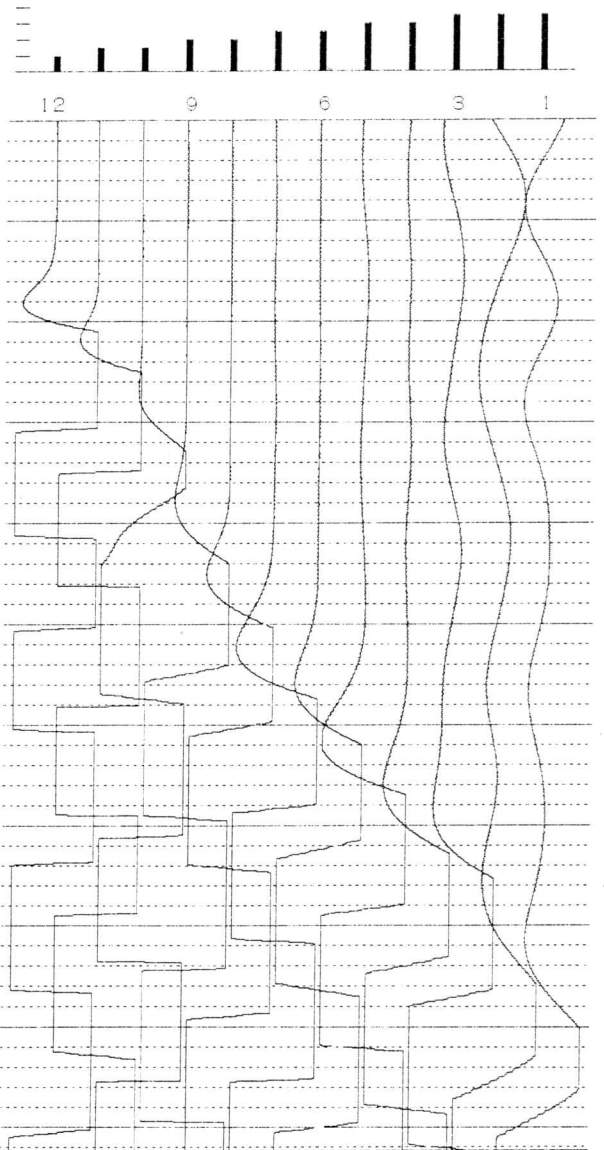
FIELD : -----  
ID.NO : 017  
DATE : 15/00/04 , 05:21:44 AM  
FILTER : 48 [Hz]  
STACK : 10  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

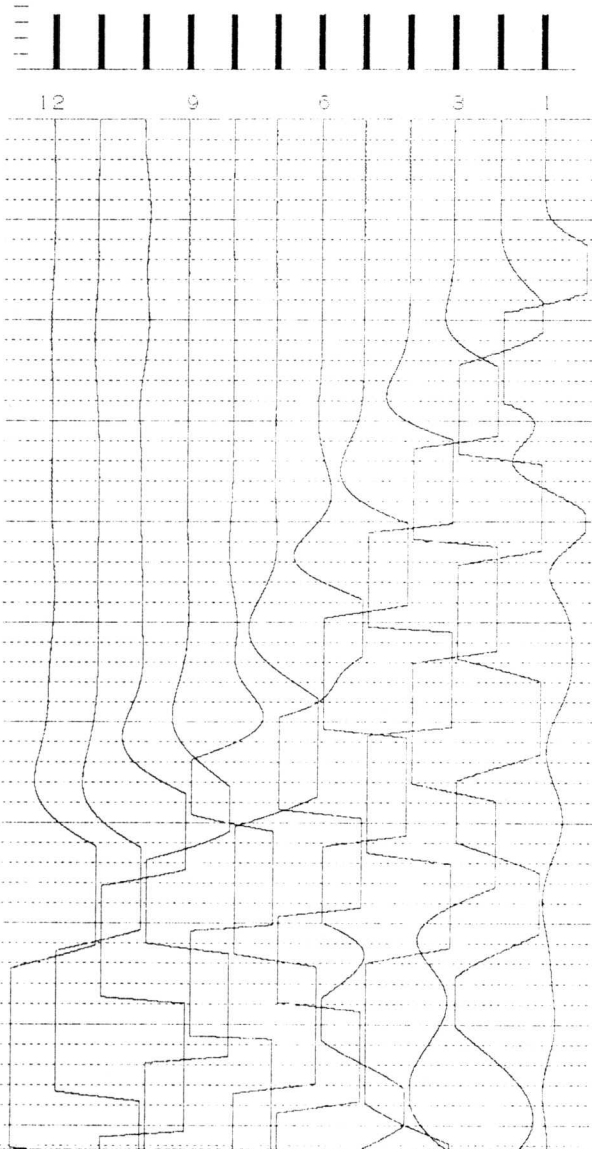
FIELD : -----  
ID.NO : 018  
DATE : 15/00/04 , 05:27:33 AM  
FILTER : 48 [Hz]  
STACK : 13  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 VI. 41

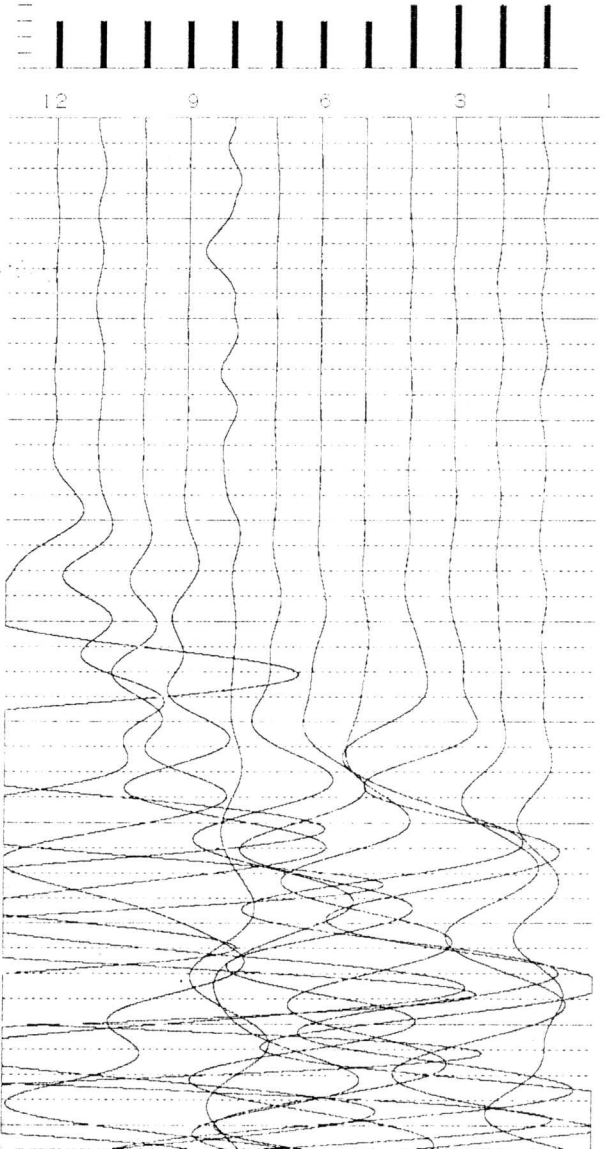
FIELD : \_\_\_\_\_  
ID. NO : 070  
DATE : 17/00/04 , 10:07:46 PM  
FILTER : 96 [Hz]  
STACK : 3  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE : 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 VI. 41

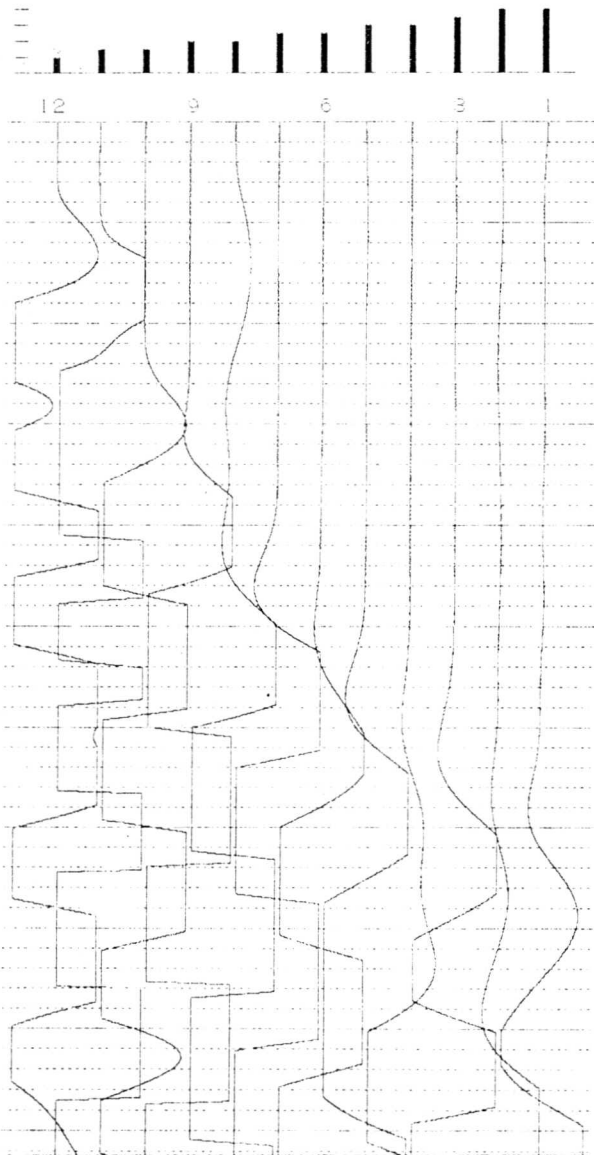
FIELD : \_\_\_\_\_  
ID. NO : 071  
DATE : 17/00/04 , 10:22:45 PM  
FILTER : 48 [Hz]  
STACK : 2  
SAMPLING : 200 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE : 5 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

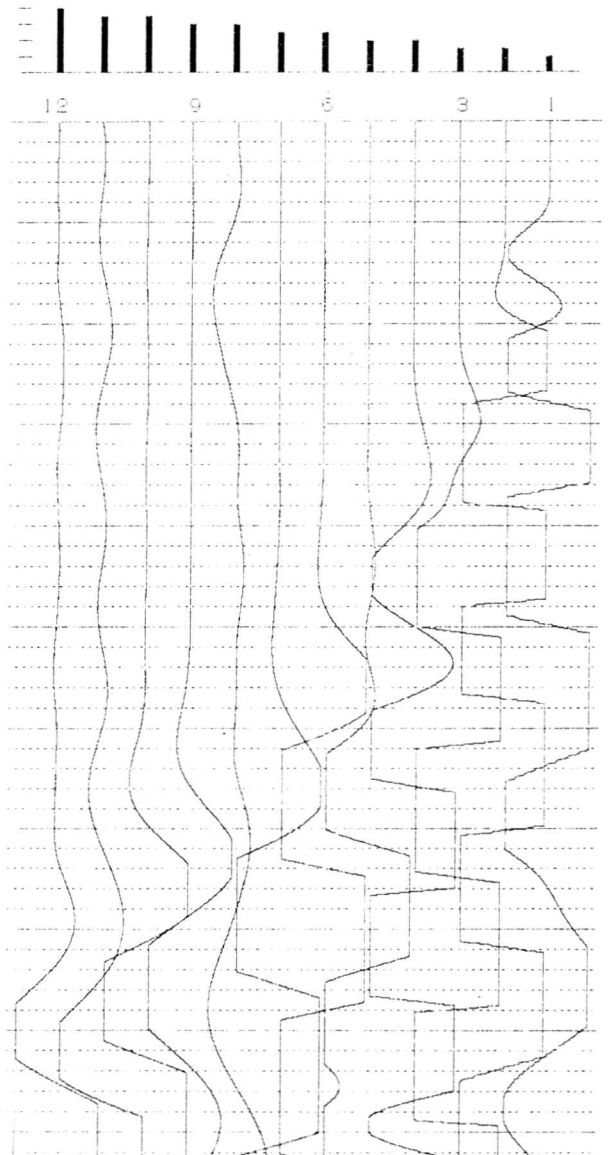
FIELD : \_\_\_\_\_  
ID, NO : 072  
DATE : 17 00 04 . 10:27:00 PM  
FILTER : 48 [Hz]  
STACK : 11  
SAMPLING : 100 [uSec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 V1.41

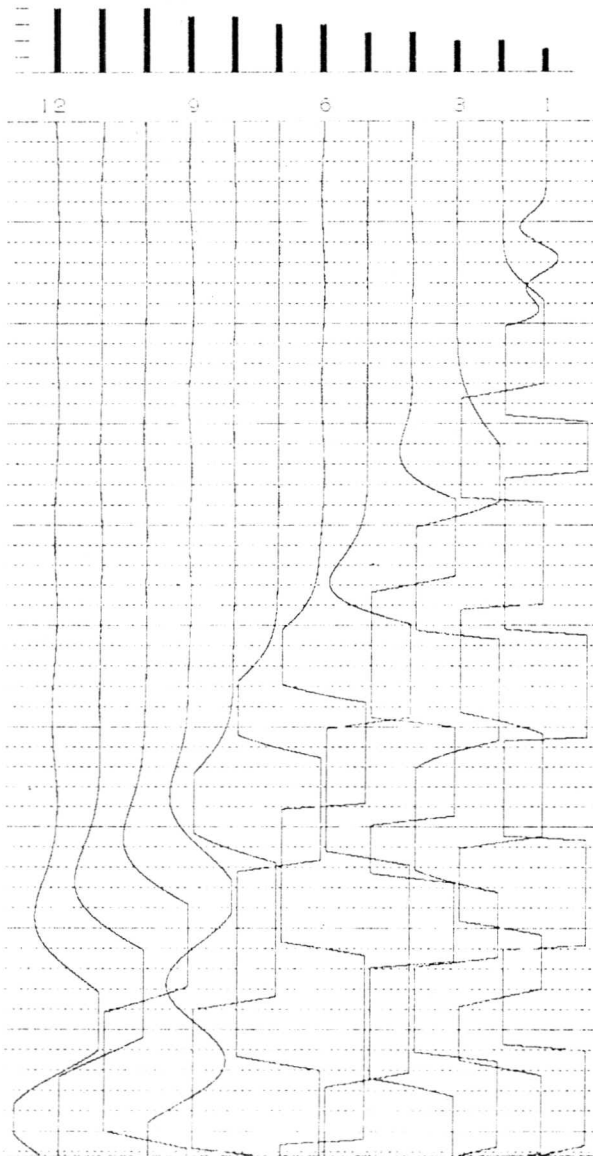
FIELD : \_\_\_\_\_  
ID, NO : 073  
DATE : 17 00 04 . 10:32:42 PM  
FILTER : 48 [Hz]  
STACK : 1  
SAMPLING : 100 [uSec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 VI.41

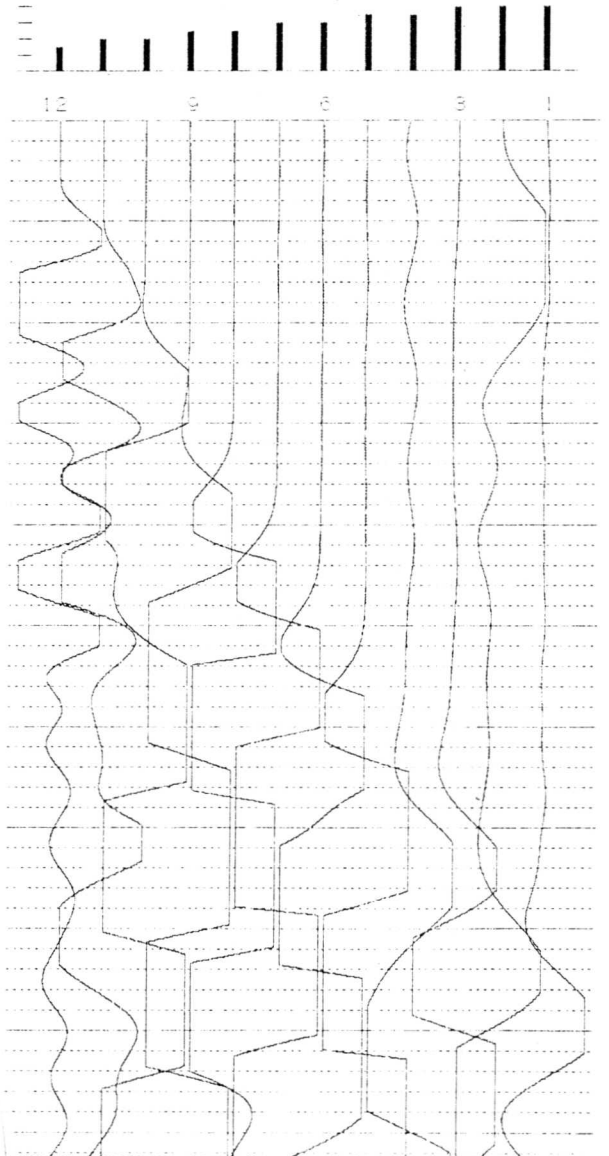
FIELD : -----  
ID, NO : 082  
DATE : 17/00/04 . 03:40:37 AM  
FILTER : 64 [Hz]  
STACK : 10  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



# OYO

McSEIS-170 VI.41

FIELD : -----  
ID, NO : 083  
DATE : 17/00/04 . 03:47:06 AM  
FILTER : 64 [Hz]  
STACK : 11  
SAMPLING : 100 [ $\mu$ Sec]  
DELAY : +0000.000 [mSec]  
TIME SCALE: 2 [mSec/LINE]  
SIZE : 8



**Line 1 Resistivity Soundings  
(Centre Electrode @ 000E)**

<b>Metres</b>	<b>A</b>	<b>C</b>	<b>D1</b>	<b>D2</b>	<b>B</b>
0.5	45.2	43.6	30.3	31.6	1.641
1.0	16.16	14.42	10.78	17.64	1.749
2.0	15.05	14.67	9.76	9.76	0.421
4.0	5.13	4.83	4.39	3.84	0.342
8.0	1.628	1.54	11.395	1.030	0.0664
16.0	0.685	0.657	0.479	0.508	0.029
32.0	0.454	0.424	0.348	0.397	0.0297

**Centre @ 025E**

<b>Metres</b>	<b>A</b>	<b>C</b>	<b>D1</b>	<b>D2</b>	<b>B</b>
0.5	14.3	13.62	9.71	10.54	0.687
1.0	7.49	7.04	4.85	5.88	0.449
2.0	5.61	5.3	3.77	3.72	0.426
4.0	3.78	3.49	2.67	2.85	0.296
8.0	2.29	2.18	1.727	1.636	0.115
16.0	0.962	0.907	0.858	0.545	0.0579
32.0	0.510	0.484	0.372	0.357	0.0264

**Line 1 Centre @ 050 E**

<b>Meters</b>	<b>A</b>	<b>C</b>	<b>D1</b>	<b>D2</b>	<b>B</b>
0.5	23.9	22.8	15.69	17.73	1.092
1.0	14.79	13.37	8.61	10.97	0.809
2.0	10.49	9.74	6.52	7.80	0.773
4.0	7.43	6.89	5.27	5.27	0.538
8.0	2.96	2.63	2.45	2.92	0.396
16.0	1.211	1.148	1.246	0.955	0.0505
32.0	0.630	0.589	0.474	0.350	0.0247

**Line 1 Centre @ 75E**

<b>Metres</b>	<b>A</b>	<b>C</b>	<b>D1</b>	<b>D2</b>	<b>B</b>
0.5	27.7	25.3	22.6	23.1	2.54
1.0	16.65	15.8	11.44	13.09	0.850
2.0	6.73	6.32	5.22	5.17	0.522
4.0	4.43	4.21	2.64	3.3	0.227
8.0	2.70	2.49	1.816	2.09	0.267
16.0	1.618	1.537	1.102	1.271	0.0966
32.0	0.893	0.869	0.696	0.492	0.0316

**Line 1      Centre @ 100E**

<b>Metres</b>	<b>A</b>	<b>C</b>	<b>D1</b>	<b>D2</b>	<b>B</b>
0.5	27.0	25.9	17.69	21.5	1.114
1.0	12.48	11.92	9.14	8.71	0.75
2.0	6.06	5.72	4.32	4.23	0.339
4.0	4.02	3.79	2.75	2.74	0.233
8.0	2.95	2.75	2.06	2.06	0.265
16.0	2.29	2.2	1.778	1.414	0.1019
32.0	1.762	1.722	1.596	0.626	0.0379

**Resistivity Sounding Line 2  
Centre @ 025W**

<b>Metres</b>	<b>A</b>	<b>C</b>	<b>D1</b>	<b>D2</b>	<b>B</b>
0.5	29.0	26.9	21.0	18.33	2.10
1.0	19.26	17.92	15.43	13.11	1.766
2.0	13.41	12.78	11.31	7.65	0.632
4.0	5.44	5.13	6.12	3.31	0.309
8.0	1.755	1.701	1.430	1.404	0.0851
16.0	0.787	0.742	0.638	0.475	0.0374
32.0	0.602	0.571	0.324	0.368	0.0323

**Line 2      Centre @ 000E**

<b>Metres</b>	<b>A</b>	<b>C</b>	<b>D1</b>	<b>D2</b>	<b>B</b>
0.5	56.0	54.6	40.3	42.2	0.411
1.0	19.82	18.79	15.07	12.44	1.064
2.0	10.62	10.08	6.65	7.67	0.701
4.0	7.58	7.25	4.98	5.32	0.315
8.0	2.44	2.22	2.33	2.12	0.226
16.0	1.268	1.220	1.061	0.711	0.0419
32.0	0.968	0.940	0.805	0.320	0.0310

**Line 2      Centre @ 025E**

<b>Metres</b>	<b>A</b>	<b>C</b>	<b>D1</b>	<b>D2</b>	<b>B</b>
0.5	34.4	32.7	25.3	21.9	1.779
1.0	23.0	22.2	12.05	16.83	1.107
2.0	17.52	16.76	11.11	11.16	0.778
4.0	9.89	8.66	6.71	9.58	1.518
8.0	6.82	6.44	5.25	4.89	0.358
16.0	3.09	3.12	2.52	2.28	0.066
32.0	0.745	0.708	0.585	0.751	0.0326

Line 2 Centre @ 050E

Metres	A	C	D1	D2	B
0.5	22.4	21.3	16.48	13.54	1.17
1.0	21.5	20.5	15.61	11.59	1.001
2.0	14.5	13.32	9.04	11.3	1.17
4.0	13.01	12.16	9.62	8.01	0.890
8.0	8.33	7.48	6.39	6.36	0.875
16.0	3.29	2.92	4.18	2.38	0.371
32.0	0.641	0.588	0.680	0.624	0.0378

Line 2 Centre @ 075E

Metres	A	C	D1	D2	B
0.5	64.5	60.6	42.1	55.1	4.19
1.0	39.2	37.2	22.4	35.8	2.15
2.0	24.3	22.8	14.03	21.9	1.431
4.0	17.84	17.01	10.97	13.17	0.837
8.0	8.59	7.68	7.85	6.38	0.915
16.0	3.72	3.52	2.60	3.81	0.203
32.0	0.839	0.799	0.957	0.570	0.040

Line 2 Centre @ 100E

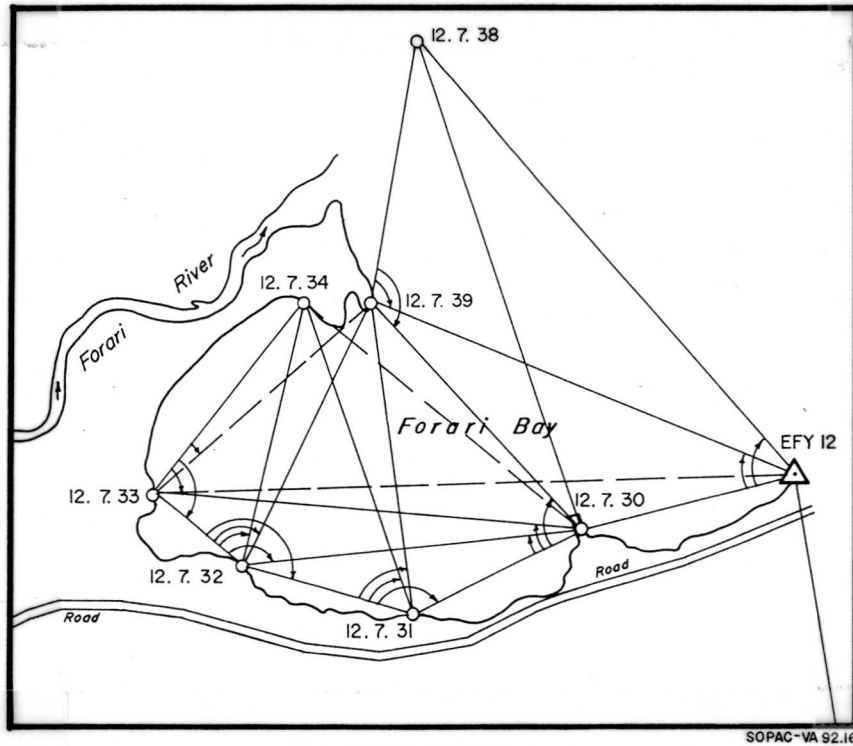
Metres	A	C	D1	D2	B
0.5	48.6	35.0	44.0	37.2	13.86
1.0	43.8	41.5	28.5	33.3	2.42
2.0	33.4	32.1	24.0	20.4	1.289
4.0	15.28	14.13	12.37	11.64	1.44
8.0	7.66	7.29	5.91	6.12	0.513
16.0	3.63	3.54	2.38	2.80	0.089
32.0	1.244	1.193	0.858	0.890	0.0605

Line 2 Centre @ 125E

Metres	A	C	D1	D2	B
0.5	39.1	37.5	29.5	26.2	1.61
1.0	13.51	12.65	10.66	11.55	0.928
2.0	9.00	8.55	5.93	6.14	0.451
4.0	7.50	7.01	4.44	5.35	0.663
8.0	5.49	5.16	4.28	3.46	0.326
16.0	2.26	2.10	1.812	1.991	0.203
32.0	1.267	1.215	0.858	0.860	0.053

## APPENDIX 4

### Navigation Control, Forari Bay

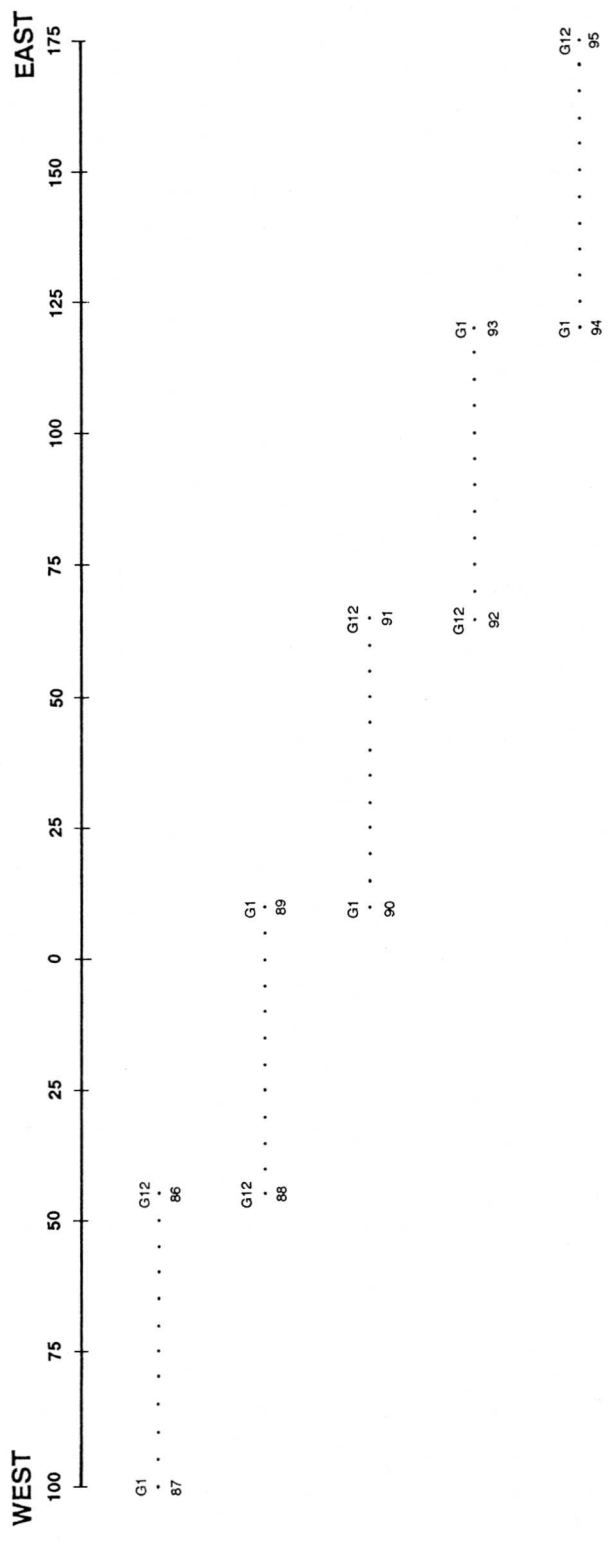


SOPAC-VA 92.16

**Figure of triangulation**

STATION	EASTING	NORTHING	COMMENTS
12.7.30	558188.016	8044867.557	On wharf, used
12.7.31	557899.807	8044733.826	Not used
12.7.32	557598.277	8044844.525	Used (ground-mark not labeled).
12.7.33	557448.286	8045006.313	On reef outcrop on beach, not used
12.7.34	557731.154	8045328.106	Marked, not used
12.7.EFY 12	558570.415	8044920.021	Large marker 0.5 m high, not used
12.7.38	557977.903	8045763.732	Access through village, not used
12.7.39	557844.627	8045328.508	Used, refer to photo for correct mark.

**LINE 4 TRAVERSE DIRECTION WEST TO EAST**      29-8-92.





**Illustration of bench mark 12.7.39 at centre top of photo. At this particular site there are five bench marks within a radius of about 5 metres.**

## APPENDIX 5

### Data file for Bathymetry (Meters, Vanuatu Map Grid)

<b>Easting</b>	<b>Northing</b>	<b>Fix#</b>	<b>Z (LAT)</b>	<b>Easting</b>	<b>Northing</b>	<b>Fix#</b>	<b>Z (LAT)</b>
557520	8045160	1	-0.91	557849	8045130	26	-2.91
557526	8045160	2	-0.91	557862	8045130	27	-0.91
557536	8045160	3	-1.16	557875	8045130	28	-1.31
557546	8045160	4	-1.41	557889	8045140	29	-3.21
557558	8045150	5	-1.51	557902	8045140	30	-3.51
557569	8045150	6	-1.51	557916	8045140	31	-4.91
557582	8045140	7	-1.71	557931	8045140	32	-4.41
557596	8045140	8	-1.91	557944	8045140	33	-3.41
557610	8045130	9	-2.01	557959	8045140	34	-3.51
557624	8045130	10	-2.21	557973	8045150	35	-5.21
557637	8045130	11	-2.31	557990	8045150	36	-6.41
557651	8045130	12	-2.51	558003	8045160	37	-10.61
557665	8045130	13	-2.51	558019	8045160	38	-11.01
557678	8045130	14	-3.31	558033	8045160	39	-11.21
557691	8045130	15	-2.41	558048	8045160	40	-11.61
557703	8045130	16	-3.21	558060	8045170	41	-11.61
557718	8045130	17	-3.01	558073	8045180	42	-11.81
557734	8045140	18	-2.01	558085	8045180	43	-12.21
557749	8045140	19	-2.51	558096	8045190	44	-12.71
557763	8045140	20	-1.91	558108	8045200	45	-12.31
557778	8045130	21	-2.81	558118	8045210	46	-12.71
557793	8045130	22	-2.91	558131	8045210	47	-12.61
557807	8045130	23	-3.61	558142	8045220	48	-12.91
557821	8045130	24	-4.41	558154	8045230	49	-13.01
557835	8045130	25	-4.51	558167	8045230	50	-14.01
				558178	8045240	51	-13.71

**Easting Northing Fix # Z (LAT)**

558204 8045230 52 -6.7  
558199 8045220 53 -7.3  
558186 8045220 54 -7.5  
558174 8045220 55 -12.7  
558159 8045220 56 -12.4  
558145 8045220 57 -12.6  
558132 8045220 58 -12.6  
558118 8045210 59 -12.4  
558101 8045210 60 -12.2  
558084 8045210 61 -12  
558065 8045210 62 -11.8  
558048 8045200 63 -13.9  
558031 8045200 64 -1.2  
558015 8045200 65 -1.1  
558000 8045190 66 -3  
557983 8045190 67 -0.5  
557968 8045180 68 -3.9  
557953 8045180 69 -3.8  
557938 8045170 70 -0.9  
557921 8045160 71 -0.7  
557904 8045150 72 -0.8  
557884 8045140 73 -0.5  
557866 8045140 74 -5  
557847 8045130 75 -3.8  
557831 8045120 76 -3.8  
557812 8045120 77 -3.9  
557794 8045120 78 -3.8  
557776 8045110 79 -4.1

**Easting Northing Fix # Z (LAT)**

557759 8045110 80 -4.2  
557740 8045100 81 -4.3  
557721 8045100 82 -3.5  
557703 8045100 83 -3.5  
557685 8045100 84 -2.9  
557668 8045090 85 -2.6  
557650 8045090 86 -2.3  
557632 8045090 87 -2.2  
557614 8045090 88 -1.6  
557596 8045090 89 -2  
557579 8045090 90 -1.8  
557562 8045090 91 -1.6  
557544 8045090 92 -1.5  
557526 8045090 93 -1.4  
557509 8045080 94 -1.2  
557484 8045030 94 -1.09  
557503 8045030 95 -1.09  
557524 8045040 96 -1.39  
557548 8045040 97 -1.69  
557572 8045040 98 -1.89  
557597 8045050 99 -2.19  
557620 8045050 100 -2.49  
557648 8045050 101 -2.69  
557673 8045060 102 -3.19  
557700 8045060 103 -3.99  
557724 8045060 104 -5.09  
557751 8045070 105 -5.49

**Easting Northing Fix # Z (LAT)**

557777 8045070 106 -6.29  
557806 8045070 107 -6.39  
557836 8045080 108 -7.49  
557860 8045080 109 -7.99  
557883 8045080 110 -8.69  
557906 8045090 111 -8.29  
557926 8045090 112 -5.99  
557952 8045100 113 -8.69  
557974 8045100 114 -9.09  
557998 8045110 115 -10.09  
558022 8045110 116 -10.59  
558044 8045120 117 -10.99  
558069 8045120 118 -11.29  
558092 8045130 119 -11.59  
558115 8045130 120 -11.79  
558137 8045130 121 -11.99  
558158 8045140 122 -12.09  
558180 8045140 123 -12.99  
558202 8045150 124 -13.69  
558224 8045150 125 -13.99  
558265 8045130 126 -13.88  
558248 8045120 127 -13.98  
558223 8045120 128 -13.78  
558199 8045110 129 -12.78  
558174 8045100 130 -11.78  
558148 8045090 131 -11.38

**Easting Northing Fix # Z (LAT)**

558123 8045090 132 -11.08  
558098 8045080 133 -10.78  
558074 8045080 134 -10.68  
558044 8045070 135 -10.58  
558015 8045070 136 -10.08  
557988 8045060 137 -9.58  
557960 8045060 138 -9.28  
557931 8045050 139 -9.08  
557905 8045050 140 -8.78  
557877 8045050 141 -6.48  
557850 8045040 142 -7.98  
557822 8045030 143 -6.78  
557794 8045030 144 -7.28  
557768 8045020 145 -6.58  
557739 8045020 146 -5.68  
557708 8045010 147 -4.78  
557679 8045000 148 -3.98  
557650 8045000 149 -3.28  
557620 8045000 150 -2.98  
557591 8044990 151 -2.28  
557561 8044990 152 -1.88  
557531 8044990 153 -1.48  
557504 8044950 154 -1.17  
557512 8044940 155 -1.37  
557533 8044960 156 -1.47  
557556 8044960 157 -1.67  
557580 8044960 158 -2.17

**Easting Northing Fix # Z (LAT)**

557604	8044970	159	-2.57
557629	8044970	160	-3.17
557655	8044980	161	-3.57
557681	8044990	162	-4.17
557707	8044990	163	-5.27
557735	8045000	164	-5.97
557762	8045000	165	-6.57
557790	8045010	166	-6.97
557818	8045020	167	-7.57
557847	8045020	168	-8.07
557875	8045030	169	-8.17
557903	8045040	170	-8.77
557930	8045040	171	-8.87
557958	8045050	172	-9.37
557986	8045050	173	-9.47
558016	8045060	174	-9.87
558045	8045060	175	-10.37
558074	8045060	176	-10.57
558104	8045070	177	-10.77
558132	8045070	178	-11.17
558162	8045070	179	-12.37
558189	8045080	180	-12.37
558217	8045090	181	-12.97
558243	8045090	182	-13.77
558269	8045100	183	-14.07
558307	8045060	184	-13.46
558286	8045060	185	-13.56

**Easting Northing Fix # Z (LAT)**

558258	8045050	186	-13.56
558232	8045040	187	-13.06
558206	8045030	188	-12.36
558179	8045020	189	-11.76
558151	8045010	190	-10.76
558124	8045010	191	-9.96
558098	8045000	192	-9.56
558068	8044990	193	-9.56
558039	8044990	194	-9.16
558008	8044980	195	-9.96
557978	8044980	196	-8.66
557949	8044970	197	-8.26
557921	8044970	198	-7.86
557893	8044960	199	-7.76
557864	8044960	200	-7.76
557836	8044960	201	-7.56
557809	8044950	202	-7.26
557781	8044950	203	-6.86
557754	8044940	204	-6.46
557727	8044940	205	-5.76
557699	8044930	206	-4.66
557669	8044930	207	-3.96
557642	8044920	208	-3.26
557662	8044860	211	-3.04
557690	8044870	212	-3.74
557716	8044890	213	-4.94
557745	8044890	214	-5.54

**Easting Northing Fix # Z (LAT)**

557773	8044900	215	-6.34
557801	8044910	216	-7.04
557828	8044920	217	-7.14
557856	8044930	218	-7.24
557882	8044940	219	-7.14
557907	8044950	220	-7.44
557933	8044950	221	-7.64
557961	8044960	222	-8.34
557988	8044960	223	-8.44
558018	8044970	224	-8.64
558046	8044970	225	-8.94
558076	8044980	226	-9.04
558106	8044980	227	-9.34
558135	8044990	228	-10.04
558164	8044990	229	-11.44
558192	8044990	230	-11.84
558219	8045000	231	-12.34
558246	8045000	232	-12.34
558274	8045010	233	-12.54
558301	8045020	234	-13.14
558332	8044980	235	-8.63
558319	8044980	236	-9.13
558289	8044960	237	-10.33
558260	8044960	238	-10.63
558229	8044950	239	-11.43
558200	8044940	240	-11.23
558171	8044930	241	-9.33

**Easting Northing Fix # Z (LAT)**

558144	8044920	242	-9.73
558118	8044910	243	-9.13
558089	8044900	244	-8.33
558063	8044880	245	-7.53
558033	8044880	246	-7.63
557895	8044870	251	-6.93
557778	8044880	256	-6.53
557772	8044900	257	-6.43
557768	8044930	258	-6.53
557762	8044960	259	-6.43
557756	8044990	260	-6.03
557748	8045020	261	-5.93
557740	8045050	262	-4.93
557735	8045080	263	-4.33
557731	8045110	264	-2.93
557726	8045140	265	-1.03
557577	8044940	266	-1.79
557574	8044940	267	-1.79
557574	8044960	268	-1.99
557576	8044980	269	-1.99
557579	8045010	270	-1.99
557581	8045030	271	-2.09
557583	8045050	272	-1.99
557583	8045080	273	-1.89
557587	8045100	274	-1.89
557590	8045120	275	-1.99
557593	8045140	276	-1.79

**Easting Northing Fix # Z (LAT)**

557598 8045160 277 -1.69  
557536 8045160 278 -1.48  
557528 8045160 279 -0.98  
557522 8045140 280 -1.18  
557515 8045130 281 -1.08  
557511 8045110 282 -1.18  
557508 8045090 283 -1.38  
557503 8045070 284 -1.08  
557500 8045050 285 -1.18  
557499 8045030 286 -1.18  
557496 8045020 287 -1.18  
557496 8045000 288 -1.18  
557495 8044980 289 -1.18  
557498 8044960 290 -1.08  
557501 8044950 291 -1.18  
557618 8044890 292 -2.38  
557633 8044890 293 -2.78  
557639 8044920 294 -3.08  
557641 8044940 295 -3.38  
557643 8044970 296 -3.38  
557645 8044990 297 -3.38  
557646 8045020 298 -3.08  
557650 8045040 299 -3.08  
557653 8045060 300 -2.78  
557655 8045090 301 -2.78  
557658 8045110 302 -2.58  
557663 8045140 303 -2.48

**Easting Northing Fix # Z (LAT)**

557754 8045130 304 -2.07  
557752 8045130 305 -3.57  
557748 8045120 306 -3.97  
557748 8045100 307 -4.57  
557750 8045080 308 -5.37  
557752 8045060 309 -5.97  
557753 8045040 310 -6.37  
557758 8045020 311 -6.67  
557761 8045000 312 -6.57  
557764 8044980 313 -6.57  
557767 8044960 314 -7.07  
557770 8044950 315 -6.87  
557773 8044930 316 -6.67  
557776 8044910 317 -6.77  
557778 8044890 318 -6.27  
557781 8044870 319 -5.87  
557860 8044840 320 -6.67  
557861 8044850 321 -6.87  
557856 8044870 322 -6.97  
557851 8044890 323 -7.17  
557847 8044920 324 -7.57  
557843 8044940 325 -6.17  
557843 8044970 326 -7.57  
557845 8044990 327 -7.67  
557839 8045010 328 -7.87  
557834 8045030 329 -5.37  
557827 8045060 330 -7.27

**APPENDIX 6****Sample location and general description**

<b>Sample No.</b>	<b>Easting</b>	<b>Northing</b>	<b>Water Depth (metres) (LAT)</b>	<b>Sediment Description</b>
1	55782	8045197	1.4	Fine black sand with some coral detritus/acropora branch
2	55739	8045160	1.2	Fine black sand
3	557491	8045080	1.1	Fine back sand
4	557535	8045030	1.53	Fine back sand
5	557704	8045010	4.1	Dark brown sticky clayey mud
6	557815	8045040	6.8	Dark brown sticky clayey mud
7	557930	8044960	7.8	Medium grained black to grey brown sand with some carbonate
8	558073	8045000	9.6	A/A
9	558166	8045000	11.3	Fine to medium grey-black sand slightly clayey
10	558246	8045020	12.9	Fine to medium grey black sand with carbonate detritus

11	550239	8045140	14.1	Coral rubble detrites
12	557544	8043130	1.4	Fine to medium black grey sand slightly clayey
13	557571	8045120	1.7	Clayey dark brown mud
14	557602	8045110	2.0	Brown clayey mixture with fine to medium grey black sand
15	557645	8045080	2.4	Fine to medium sand grey black with carbonate material
16	557670	8045120	2.8	Fine medium grey black sand slightly clayey

**Easting Northing Fix # Z (LAT)**

557819 8045080 331 -6.97  
557813 8045100 332 -5.27  
557827 8045140 333 -4.35  
557833 8045130 334 -4.75  
557847 8045110 335 -5.65  
557860 8045090 336 -8.05  
557874 8045070 337 -6.95  
557888 8045040 338 -8.55  
557904 8045020 339 -8.25  
557920 8045000 340 -8.05  
557934 8044980 341 -8.05  
557949 8044960 342 -7.95  
557963 8044940 343 -7.45  
557980 8044910 344 -7.25  
557996 8044890 345 -7.25  
558009 8044870 346 -7.25  
558024 8044850 347 -7.55  
558038 8044830 348 -7.85  
558260 8044950 349 -8.94  
558253 8044950 350 -10.44  
558246 8044980 351 -11.84  
558238 8045000 352 -12.44  
558231 8045030 353 -12.94  
558224 8045050 354 -13.14  
558221 8045080 355 -12.84  
558216 8045100 356 -13.54  
558206 8045130 357 -13.54

**Easting Northing Fix # Z (LAT)**

558195 8045160 358 -13.34  
558183 8045180 359 -13.44  
558169 8045200 360 -13.14  
558155 8045230 361 -13.04  
558141 8045250 362 -13.44  
558125 8045270 363 -13.84  
558109 8045300 364 -13.74  
558095 8045320 365 -13.44  
558080 8045340 366 -13.44  
558066 8045360 367 -13.34  
558055 8045380 368 -13.34  
558042 8045400 369 -11.94  
558031 8045420 370 -9.74  
558020 8045450 371 -8.14  
558099 8045500 372 -12.33  
558103 8045500 373 -12.43  
558122 8045490 374 -15.13  
558135 8045460 375 -15.13  
558149 8045430 376 -15.23  
558161 8045410 377 -15.13  
558175 8045380 378 -14.83  
558189 8045350 379 -14.73  
558201 8045320 380 -14.53  
558213 8045300 381 -14.13  
558228 8045270 382 -13.23  
558242 8045240 383 -12.43  
558257 8045220 384 -14.23

**Easting Northing Fix # Z (LAT)**

558272	8045190	385	-14.03
558284	8045170	386	-13.93
558298	8045140	387	-13.83
558313	8045120	388	-14.23
558326	8045090	389	-13.43
558340	8045060	390	-13.73
558355	8045040	391	-13.23
558370	8045010	392	-8.03
558438	8045060	393	-6.43
558445	8045080	394	-10.43
558435	8045110	395	-13.43
558429	8045140	396	-13.93
558422	8045170	397	-13.93
558414	8045190	398	-14.23
558405	8045220	399	-13.93
558392	8045250	400	-13.73
558380	8045270	401	-8.03
558367	8045300	402	-6.93
558355	8045320	403	-7.73
558342	8045350	404	-9.33
558331	8045370	405	-9.73
558320	8045400	406	-14.93
558308	8045420	407	-16.03
558299	8045450	408	-16.03
558286	8045480	409	-15.73
558272	8045500	410	-16.13
558258	8045520	411	-16.43

**Easting Northing Fix # Z (LAT)**

558245	8045550	412	-16.43
558230	8045570	413	-16.43
558216	8045600	414	-16.93
558201	8045620	415	-16.33
558187	8045650	416	-15.03
558172	8045670	417	-6.93
558252	8045730	418	-13.12
558260	8045730	419	-16.22
558268	8045700	420	-17.92
558276	8045680	421	-17.52
558288	8045650	422	-17.62
558300	8045630	423	-17.72
558311	8045610	424	-17.83
558321	8045580	425	-17.72
558329	8045550	426	-17.62
558339	8045530	427	-17.42
558349	8045500	428	-17.42
558361	8045480	429	-17.42
558373	8045450	430	-13.72
558383	8045430	431	-8.72
558394	8045400	432	-8.52
558404	8045370	433	-8.12
558413	8045350	434	-8.32
558424	8045320	435	-14.22
558436	8045300	436	-15.22
558447	8045270	437	-16.72
558458	8045250	438	-16.42

**Easting Northing Fix # Z (LAT)**

558469 8045220 439 -16.62  
 558480 8045200 440 -16.72  
 558491 8045170 441 -16.32  
 558504 8045150 442 -7.62  
 558503 8045120 443 -5.21  
 558487 8045120 444 -11.91  
 558459 8045110 445 -13.31  
 558430 8045110 446 -13.21  
 558402 8045110 447 -13.41  
 558374 8045110 448 -13.71  
 558345 8045100 449 -14.41  
 558317 8045100 450 -14.11  
 558289 8045100 451 -14.21  
 558260 8045100 452 -13.41  
 558232 8045090 453 -12.11  
 558204 8045090 454 -12.01  
 557923 8045060 455 -9.21  
 557921 8045060 456 -8.81  
 557893 8045060 457 -7.21  
 557866 8045050 458 -7.81  
 557837 8045050 459 -6.51  
 557808 8045040 460 -6.91  
 557781 8045030 461 -6.31  
 557754 8045030 462 -5.71  
 557727 8045020 463 -4.81  
 557700 8045010 464 -4.01  
 557672 8045000 465 -3.41

**Easting Northing Fix # Z (LAT)**

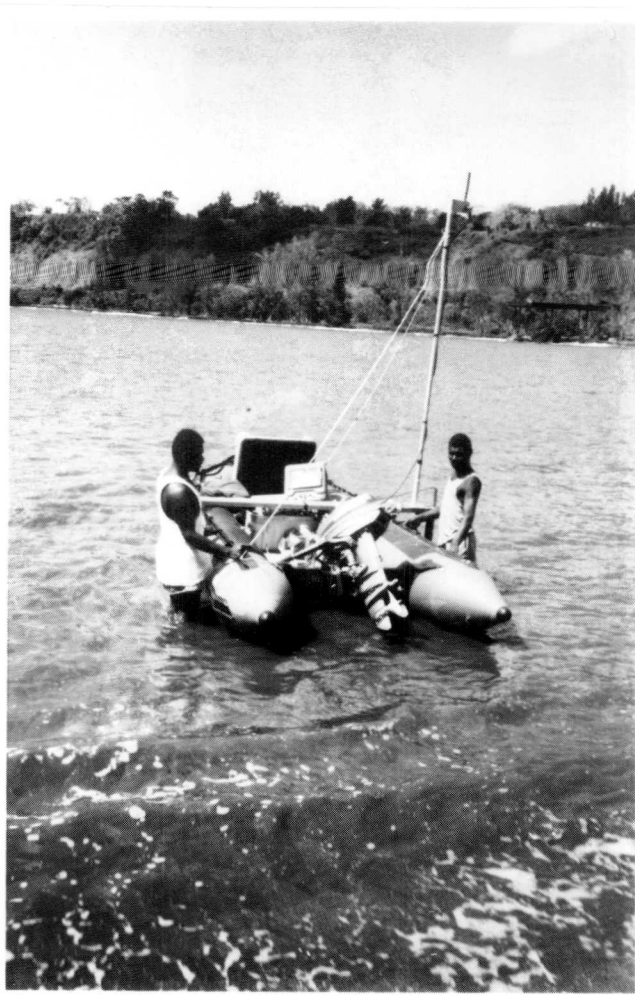
557645 8045000 466 -2.81  
 557618 8044990 467 -1.91  
 557591 8044980 468 -1.91  
 557564 8044970 469 -1.51  
 557538 8044950 470 -1.51

**V.M.G:**

**Spheroid**  
**Scale factor on**  
**Central Meridian**  
**False Easting**  
**False Northing**  
**Origin of grid**

**WGS 72**

0.9996  
 500,000  
 10,000,000  
 168° E



**Figure 7. Survey boat setup**

**Figure 8. Vanveen grab used to sample Forari Bay seabed.**

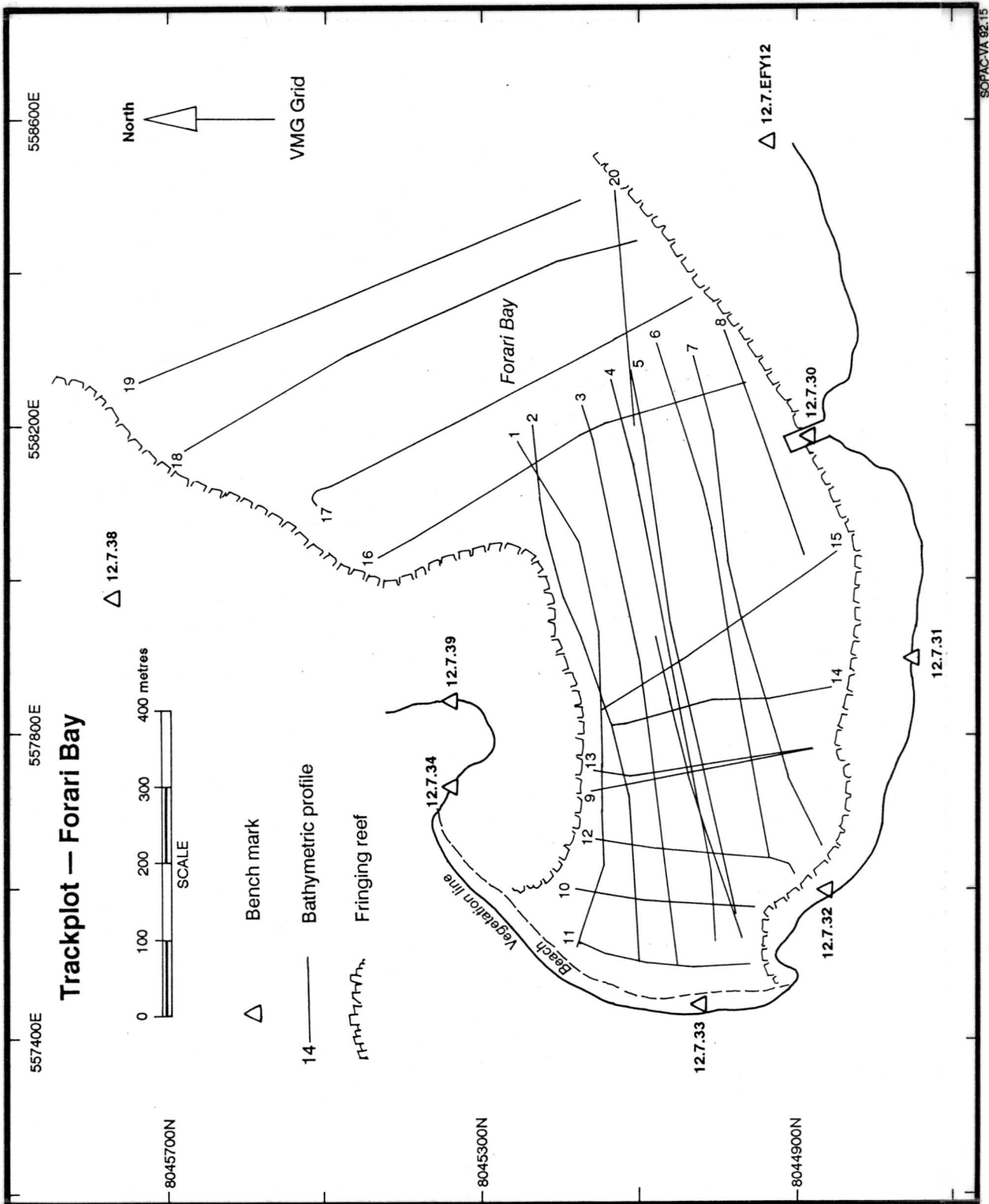


Figure 6. Track plot of survey lines, Forari Bay

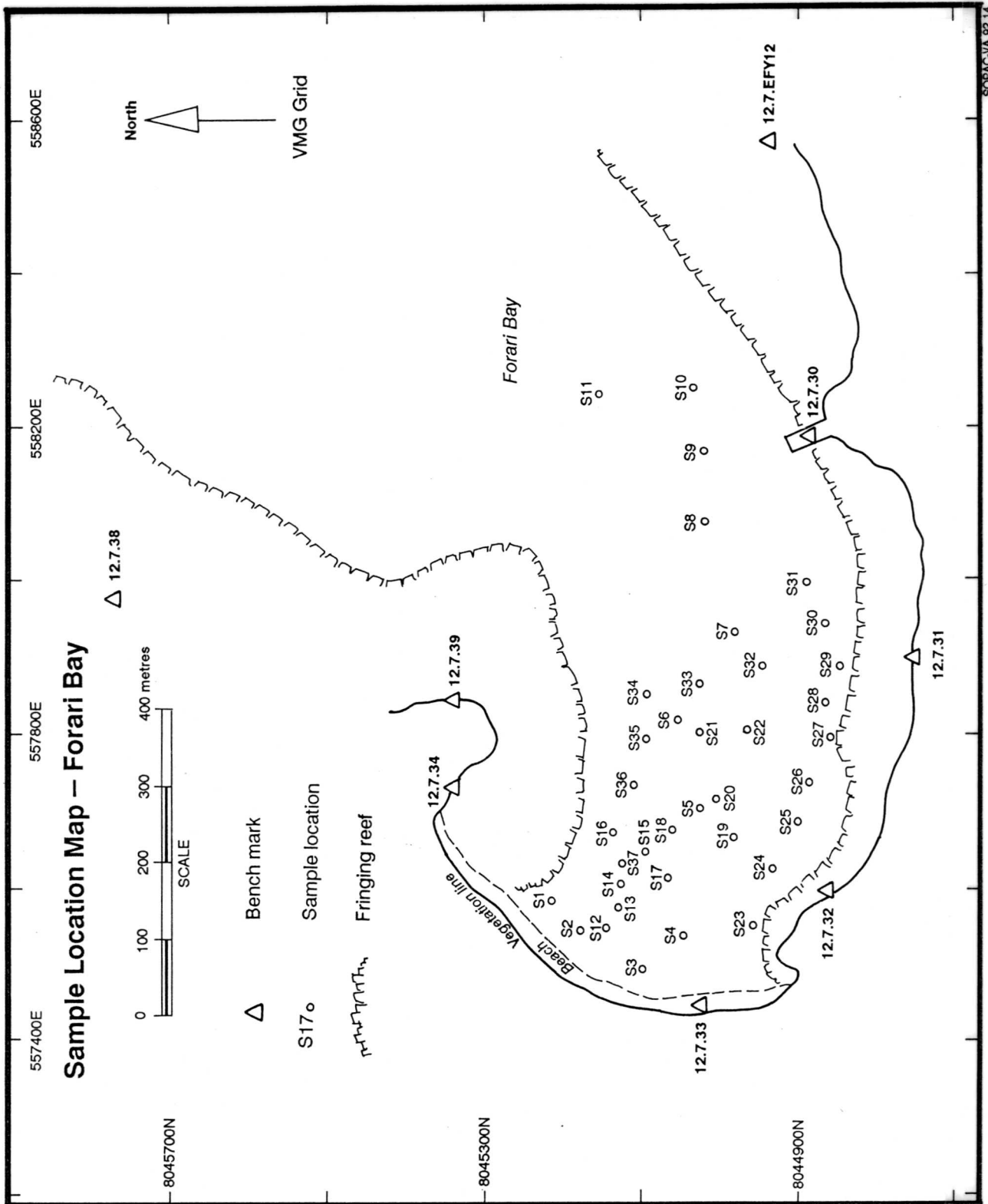


Figure 9. Sample location map, Forari Bay