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NOAA TECHNICAL REPORT ERL 261-POL 18

RP-1-OC-70 Southeast Pacific Geophysical Survey

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BOULDER, COLO.
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TABLE OF CONTENTS

LIST OF FIGURES

RP-1-OC-70 SOUTHEAST PACIFIC GEOPHYSICAL SURVEY

H. R. Stevens, Jr.

This report summarizes work undertaken aboard the USC&GSS OCEANOGRAPHER during the early part of 1970. Bathymetric, magnetic, and gravity data were collected between Seattle - Tahiti - Valparaiso - Guayaquil along a trackline that extended over 15,000 nautical miles. Coring operations, heat flow measurements, and continuous seismic profiling were carried out at several locations. Special scientific projects related to chart verification, meteorology, oceanography, and terrestrial geophysics were also undertaken on each of the three Legs.

1. INTRODUCTION

During the months of January through March, 1970, the Pacific Oceanographic Laboratories conducted a geological/geophysical investigation aboard the USC&GSS OCEANOGRAPHER in the southeastern Pacific Ocean. Visiting investigators from other institutions participated with Environmental Science Services Administration* (ESSA) personnel in carrying out the scientific work (see APPENDIX A). The ship's track is shown in figure 1. The purpose of this report is to summarize the objectives, methods, and results of cruise RP-1-OC-70.

2. CHRONOLOGY

The cruise was divided into three Legs (see figs. 2, 3, and 4):

I. Seattle to Papeete, Tahiti - 16 January to 26 January.

II. Papeete to Valparaiso, Chile - 31 January to 27 February.

III. Valparaiso to Guayaquil, Ecuador - 10 March to 30 March.

* National Oceanic and Atmospheric Administration was established October 3, 1970.

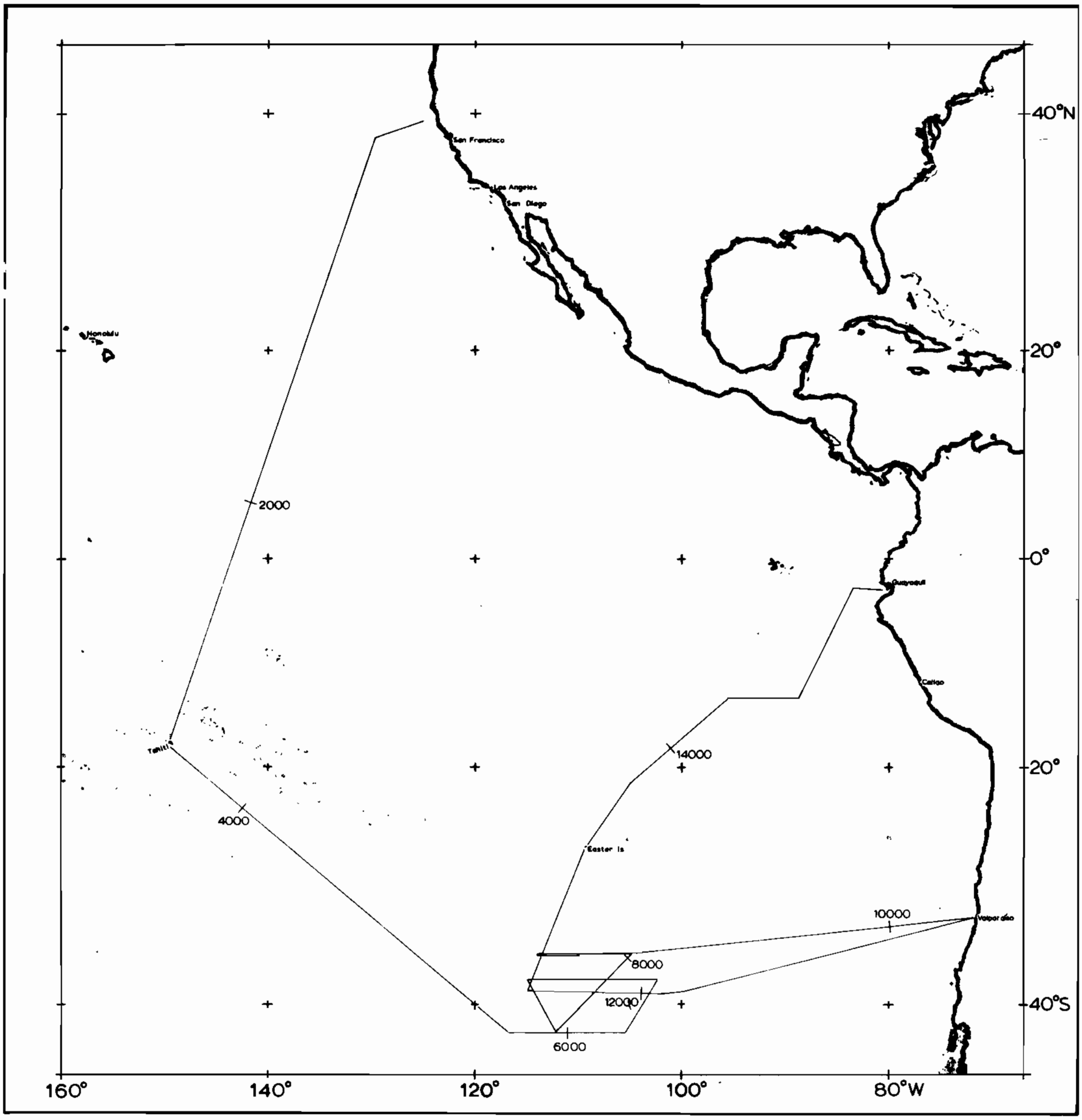


Figure 1. POL Geophysical Survey Track RP-1-OC-70
16 January - 30 March 1970

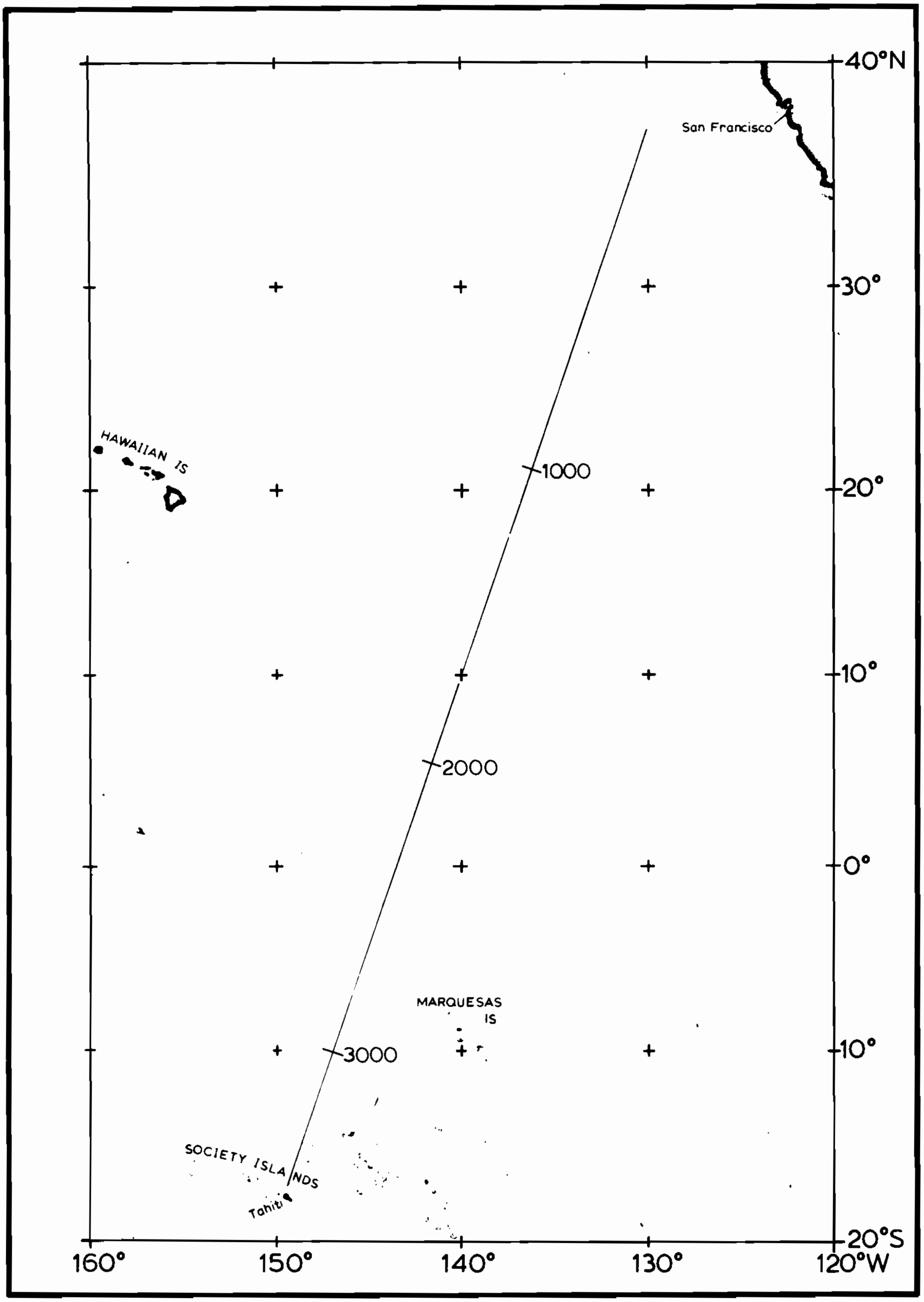


Figure 2. Leg I Seattle - Tahiti
Trackline distance (n. mi.) 0-3429.5

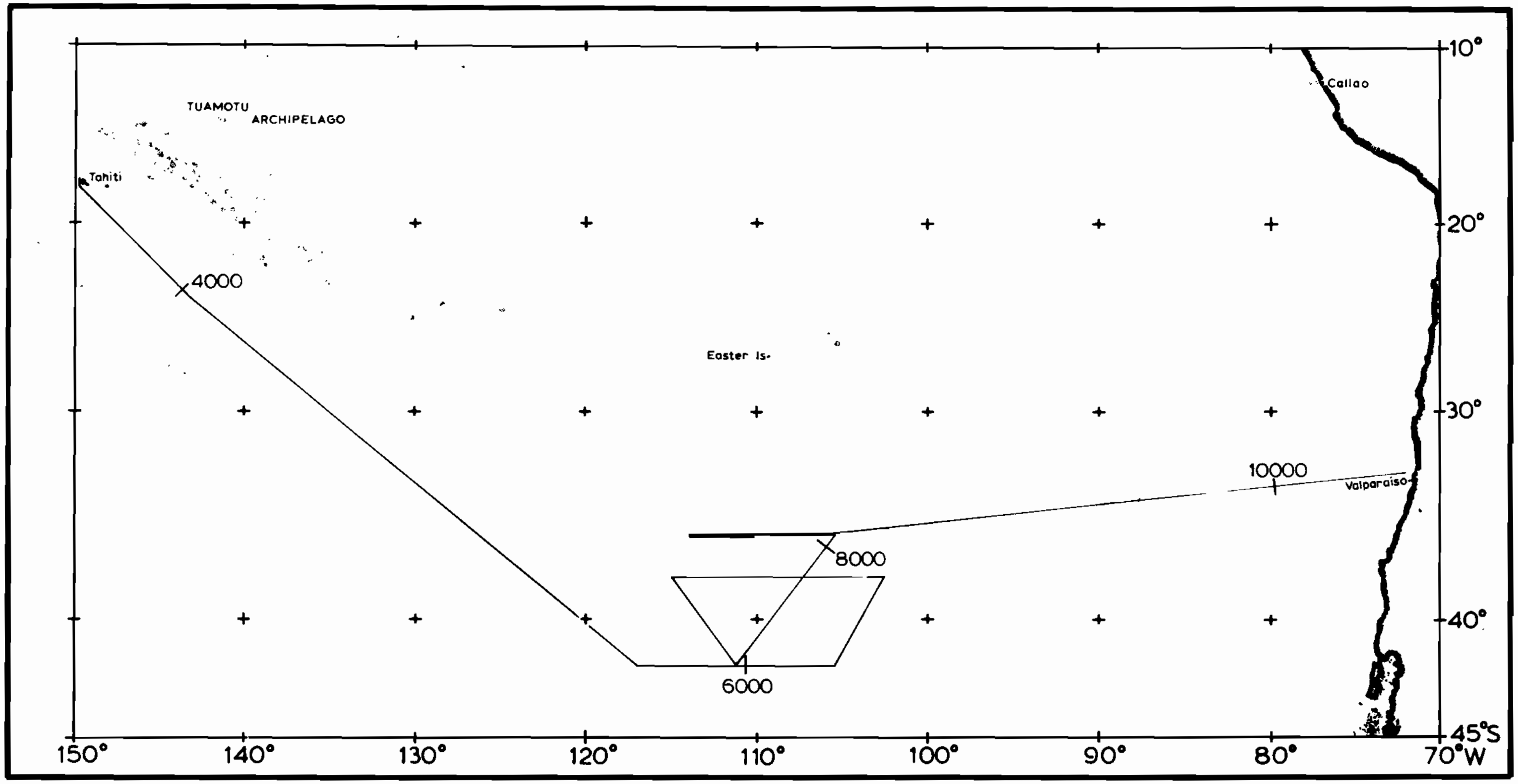


Figure 3. Leg II Tahiti - EPR - Valparaiso
Trackline Distance (n. mi.) 3417.9 - 10397.4

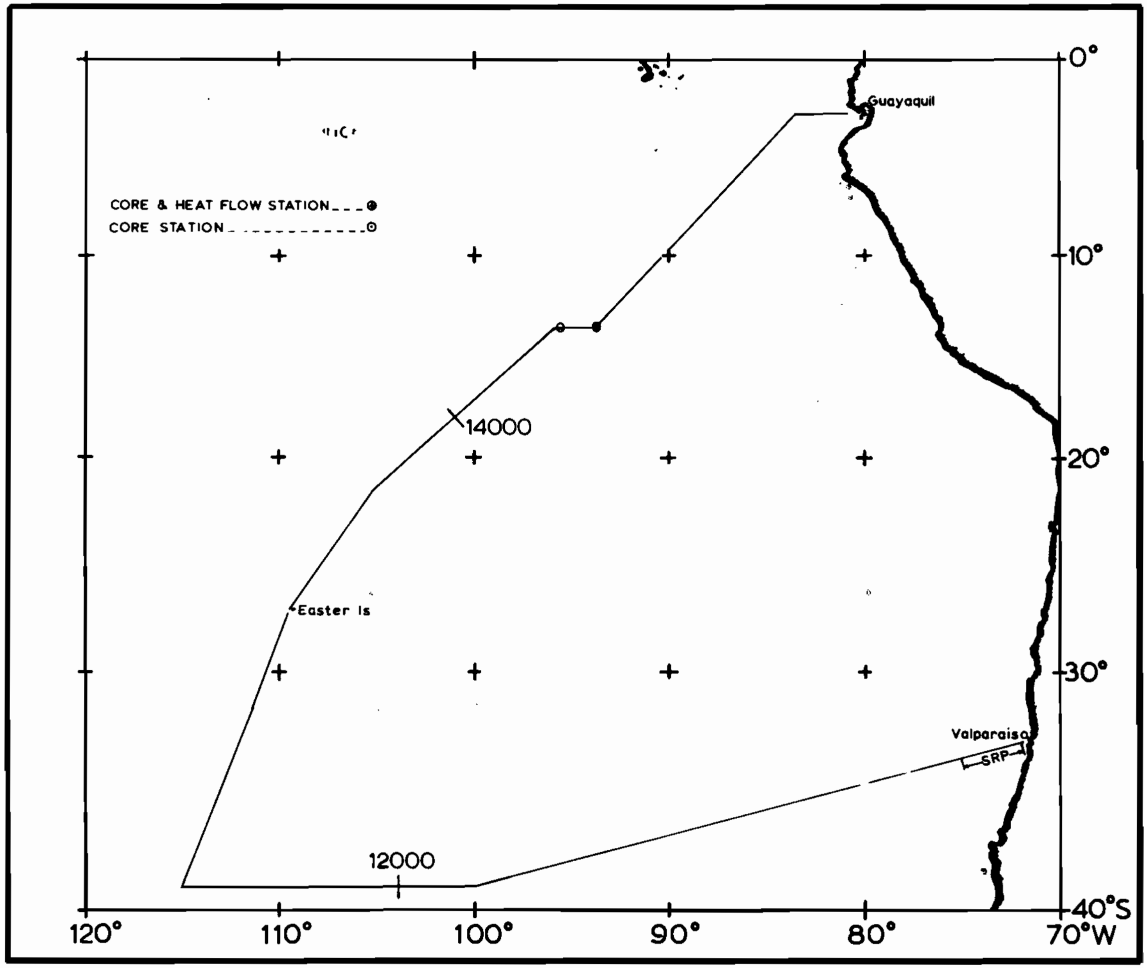


Figure 4. Leg III Valparaiso - EPR- Guayaquil
Trackline Distance (n. mi.) 10405 - 15579.9

3. OBJECTIVES

Leg I. The USC&GSS OCEANOGRAPHER departed Seattle 13 January. A gravity signature line was run off Cape Flattery, Washington. The collection of underway geophysical data commenced 17 January at 37.10°N and 129.96°W.

The principal objectives for this Leg were to obtain gravity, magnetic, and bathymetric data across the Murray, Molokai, Clarian, Clipperton, and Marquesas Fracture Zones. A secondary objective was to develope a routine for shipboard data processing which would permit a preliminary evaluation of the data while the cruise was in progress (see section 6 Data Processing).

Leg II. The OCEANOGRAPHER left Papeete, Tahiti on 31 January for the East Pacific Rise (EPR) working area and Valparaiso. One of the primary objectives was the acquisition of underway geophysical data along the overall trackline that included three crossings normal to the general axial trend of the East Pacific Rise. These traverses were made along the 42°S, 38°S, and 36°S parallels. Boundaries for the area to be investigated were set at 30°S to 45°S and 105°W to 115°W. Other objectives were to obtain on-station data from coring and heat flow operations along 36°S latitude between 106°W and 114°W.

Leg III. The ship left Valparaiso on 10 March for the EPR and Guayaquil. Basic objectives were continued on this Leg. Underway bathymetric, gravity, and magnetic data were collected and heat flow operations were conducted along the 39°S parallel from 102°43'W to 115°96'W and along 13°37'S between 95°31'W and 93°44'W.

In addition to the principal geophysical objectives special projects were undertaken on all three Legs of OPR-1-OC-70. This work is summarized in APPENDIX B.

4. NAVIGATION

Most of the trackline was controlled by AN/SRN-9 Satellite Navigation equipment with an average time between fixes of about two hours. Position control was within 0.2 n mi in most cases.

Where convenient or necessary satellite navigation was supplemented with other procedures. Celestial navigation was used when the satellite system was inoperative. For near shore operations, such as the chart verification project, radar and visual fixes were employed. Positioning along the Cape Flattery Signature Line, which was run shortly after leaving Seattle, was obtained by visual bearings and Loran A.

5. INSTRUMENTATION/EQUIPMENT

5.1 Coring and Heat Flow

A Ewing piston corer with a 3.5 m barrel was used in coring operations. APPENDIX C lists the location, depth and lengths of core and pilot core for each successfully occupied coring station.

Several different instruments and procedures were employed in conducting the heat flow measurements. On Legs II and III a majority of thermal gradient measurements were made with outrigger type thermistors attached to the core barrel and a recorder, inside a pressure case, strapped between the corer's fins.

Two types of geothermal gradient recorders were used. A Massachusetts Institute of Technology (MIT) instrument photographically recorded the gradient temperatures in analog form to the nearest 0.01°C. Data were obtained from six thermistors, including one thermistor that sensed bottom water temperatures. This recorder had two disadvantages. Loading and unloading of film was done in the dark and errors could be introduced when reading the processed film and digitizing the analog data.

The other gradient recorder used with the piston corer was an ESSA instrument which employed three thermistors and recorded digitally on punched plastic tape. Values were read to the nearest 0.01°C. Punched plastic tape had the advantage that it could immediately be taken from the pressure case, checked, and run through the computer without need of first digitizing the data.

In addition to the MIT and ESSA gradient recorders, used in conjunction with the piston corer on Legs II and III, an *in situ* thermal gradient/conductivity probe was used on several Leg II stations. This instrument, developed by Clive Lister of the University of Washington, functioned as an independent unit. While in position on the ocean bottom it measured both the conductivity of the sediment and the thermal gradient. Gradient temperatures were measured for 10 minutes. A heating element in the probe was then activated for 20 minutes to measure the rate of temperature increase and permit conductivities of the sediment to be determined.

The Lister instrument obtained measurements in the sediment at three positions along an 8 ft probe of 1/2 in diameter. Data were recorded digitally on punched plastic tape. The 80 lb weight of the equipment made handling and lowering relatively easy in contrast to that of the piston corer which required more manpower and heavier equipment.

Thermal conductivities of sediments collected with the piston corer were determined by the transient measurement method described by Von Herzen and Maxwell (1959). A needle containing a wire heating element was inserted into the core after its recovery from the bottom. Heat was applied at a known and constant rate. The rise in temperature with time was monitored and from this the thermal conductivity of the sediment was determined.

APPENDIX D lists the location, type of equipment used, and the heat flux value for each successfully occupied station.

5.2 Gravity

The gravity meter aboard the OCEANOGRAPHER was an Askania GSS2, number 22. Gravity data were recorded continuously on an analog trace and also digitized at 5 min intervals on punched paper tape.

Heavy seas, encountered in the early part of February, introduced large cross-coupling errors into the data. Because of this and accompanying gyrotable jitter these data were unreliable and eliminated from the geophysical profile presented in section 7. The quality of other gravity data acquired throughout the cruise is good. APPENDIX E gives the gravity base tie summary.

5.3 Magnetics

A varian V-4937 proton magnetometer was towed at a cable length of 650 ft. Total field magnetic intensities were recorded continuously on an analog trace and also digitized at 5 min intervals on punched paper tape. The magnetic data were computer processed and are presented in two formats. These are referred to as the Revised Geophysical Report and the Geophysical Profile. The quality of the data is considered good.

5.4 Seismic Profiling

Over 1200 n mi of seismic reflection profiling were completed over the East Pacific Rise and across the Peru-Chile Trench (see fig. 5). This work was a joint ESSA-University of Washington effort.

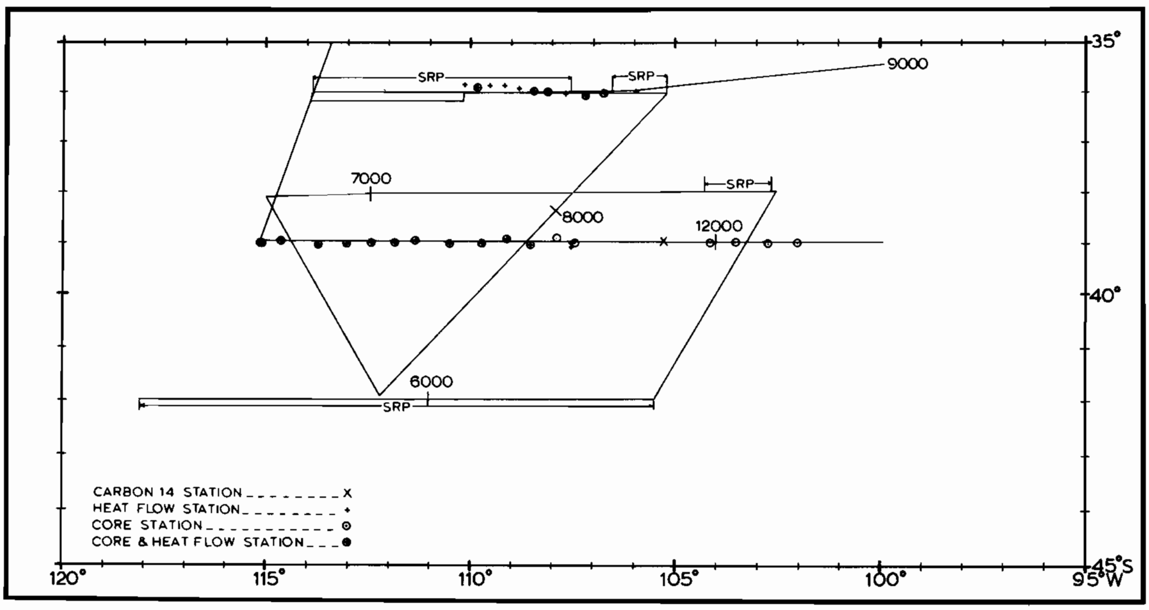


Figure 5. East Pacific Rise.

The profiler was developed by Clive Lister. It operated at the relatively high frequency of 200 Hz and transmitted a single pulse at a 4 sec repetition rate. Bottom penetration of the generated signal was limited to the upper sediments. Resolution of the record was excellent.

The pulser was mounted on a float and towed 6 ft below the surface at a cable length of 150 ft. The hydrophone array was towed 500 ft behind the ship at approximately 8 knots.

5.5 Sounding Equipment

Edo transceivers and depth recorders were used to obtain 12 kHz bathymetric data. The transceivers were Edo models 248-16 and 248 B. Sounding traces were recorded on Edo model 33A Precision Bottom Recorders (PBR). Edo wide beam transducers and General Electric narrow beam transducers were used in conjunction with a PBR. All soundings were recorded in fathoms.

6. DATA PROCESSING

Data acquired during underway operations were processed aboard ship and ashore. The Revised Geophysical Report and the Geophysical Profile are the end products of a series of processing procedures illustrated in the Data Processing Flow Charts (see figs 6 and 7). The archive retrieval information and editing system (ARIES) used at POL is described by Holloway (1971).

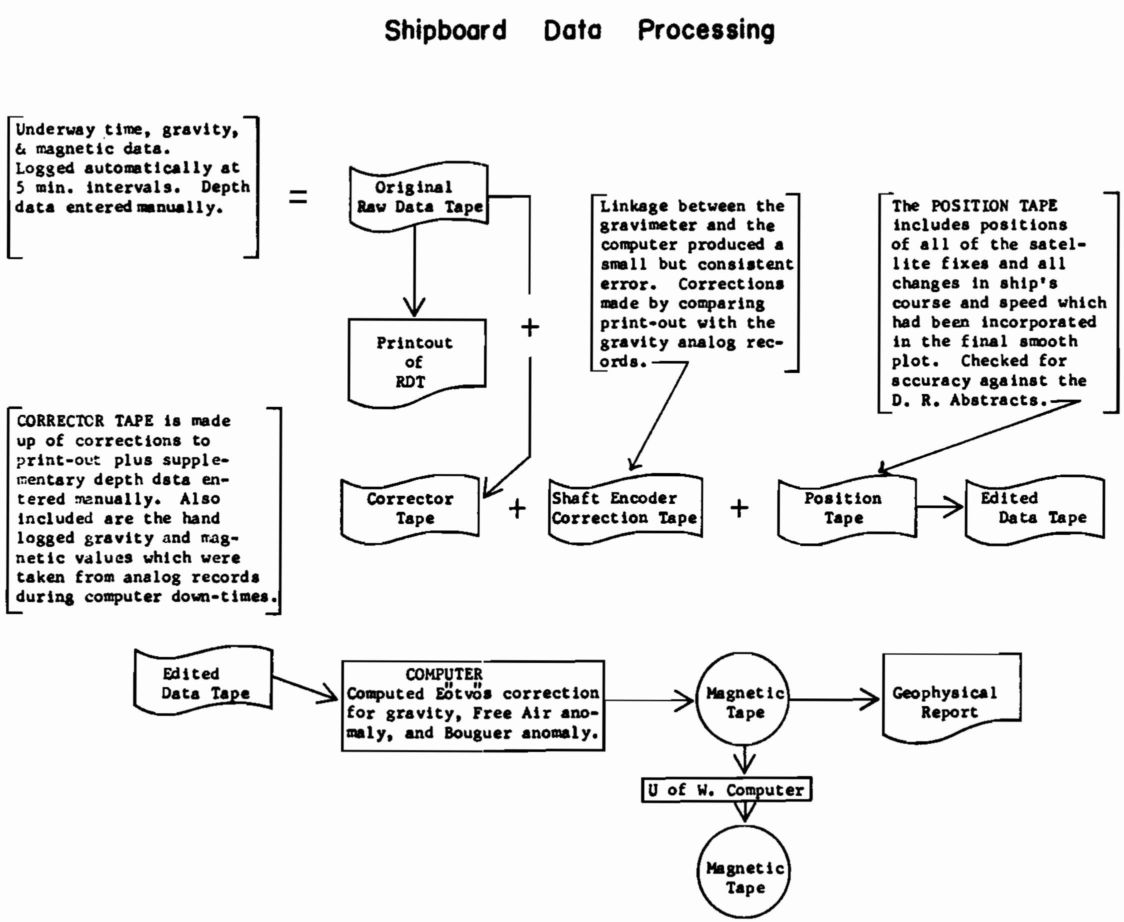


Figure 6. Data Processing Flow Chart - (1970) USC&GSS OCEANOGRAPHER.

P. O.L. Data Processing

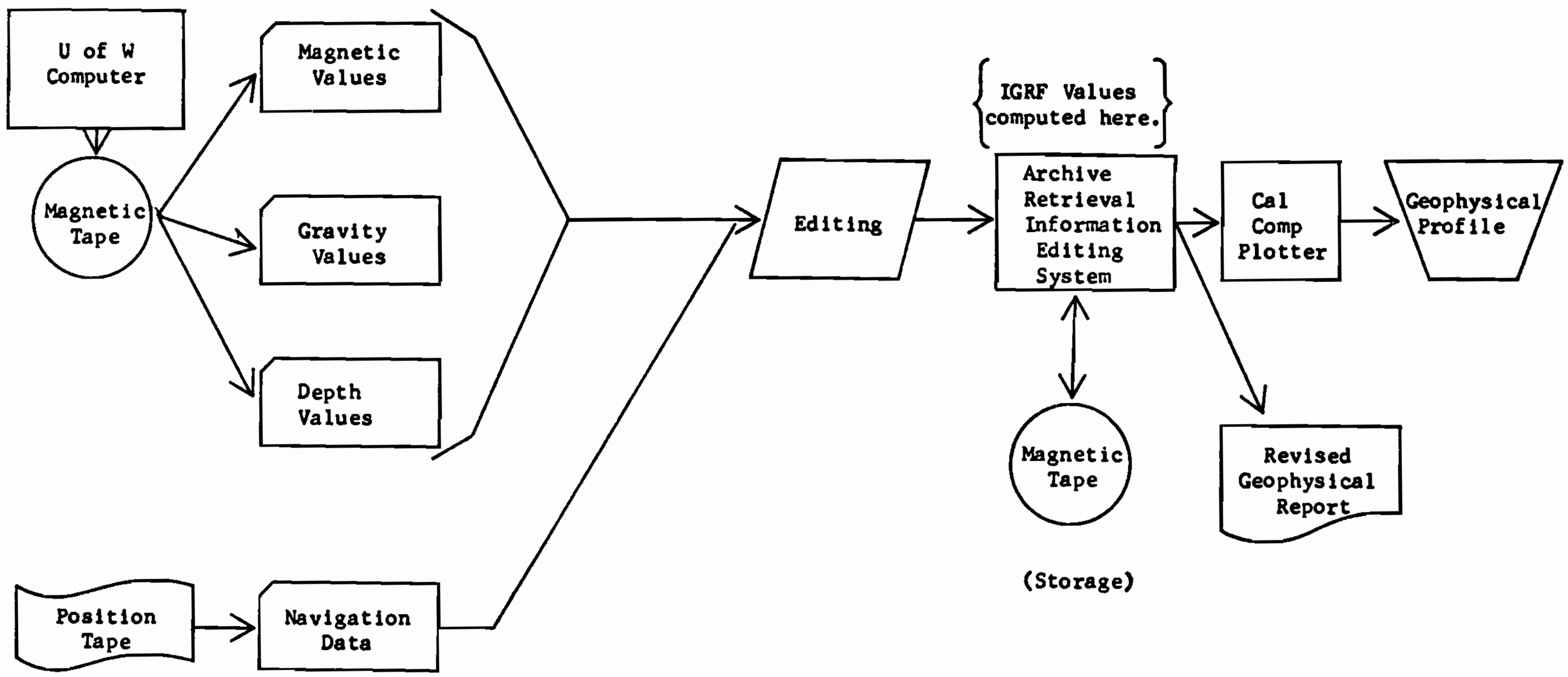


Figure 7. Data Processing Flow Chart -- P.O.L.

7. PRESENTATION OF THE PROFILE

A profile and a print-out are the finalized forms of POL geophysical data reduction and processing. The profile is a part of this report. Other RP-1-OC-70 data which may be of special interest can be obtained by writing to:

National Oceanic and Atmospheric Administration
Environmental Data Service
Chief, Solid Earth & Marine Geophysical
Data Services Division
Boulder, Colorado 80302

In descending order on each page are the profiles of the Magnetic Anomaly, Free Air Anomaly, Bathymetry, and Bouguer Anomaly. Appropriate scales are found along the profile sections. The distance traveled, course changes, and the ship's positions are shown in conjunction with the profiles. Latitude and Longitude are indicated at the half-tic marks and the full-tic marks denote position fixes.

Positions or areas of interest in the trackline charts (figs. 1-5) may be quickly located with the aid of the four Location Indices (figs. 8-10).

FIGURE 8

LOCATION INDEX

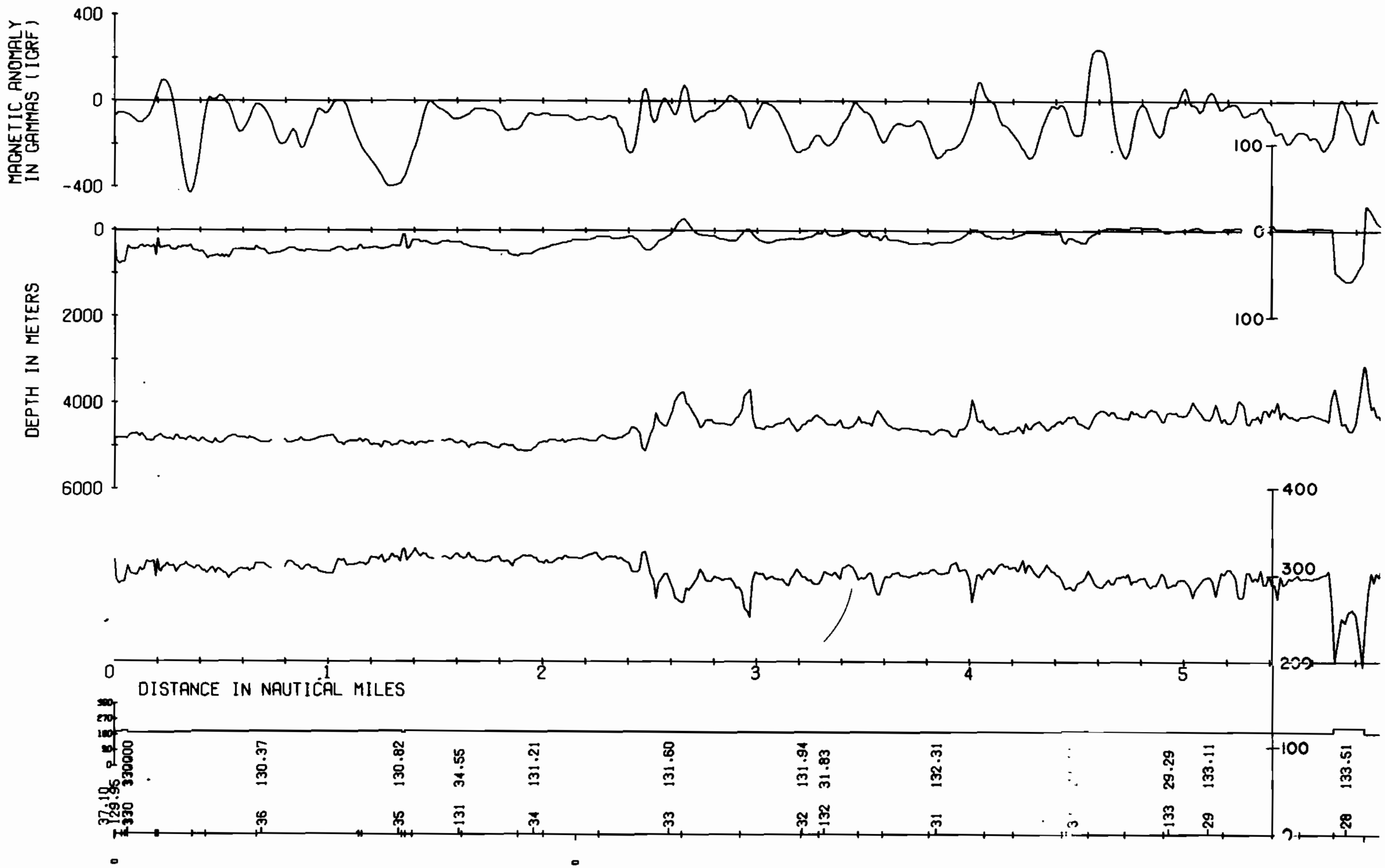
Leg I. SEATTLE - TAHITI (See Figure 2)

Distance in n miles along track	Degrees Lat. - Long.	To	Degrees Lat. - Long.	Pages
0 to 500.2	37.10°N - 129.96°W	to	29.18°N - 133.04°W	
500.2 to 1000.6	29.18°N - 133.04°W	to	21.34°N - 136.09°W	
1000.6 to 1499.8	21.34°N - 136.09°W	to	13.43°N - 138.77°W	
1499.8 to 2000.3	13.43°N - 138.77°W	to	5.48°N - 141.32°W	
2000.3 to 2499.6	5.48°N - 141.32°W	to	2.32°S - 144.21°W	
2499.6 to 2999.8	2.32°S - 144.21°W	to	10.18°S - 146.98°W	
2999.8 to 3433.9	10.18°S - 146.98°W	to	17.00°S - 149.39°W	

FRACTURE ZONES: (1) Murray, (2) Molokai, (3) Clarion, (4)Clipperton and (5) Marquesas.

(1) 133.6 to 321.5	34.99°N - 130.83°W	to	32.00°N - 131.94°W	
(2) 765.4 to 958.3	25.01°N - 134.62°W	to	22.00°N - 135.85°W	
(3) 1273.4 to 1400.4	17.01°N - 137.54°W	to	15.00°N - 138.23°W	
(4) 1904.0 to 2094.8	7.02°N - 140.87°W	to	4.01°N - 141.90°W	
(5) 2861.1 to 3372.8	8.00°S - 146.20°W	to	16.01°S - 149.17°W	

RP-1-OC-70
Fig 8



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RP-1-OC-70
Fig 8

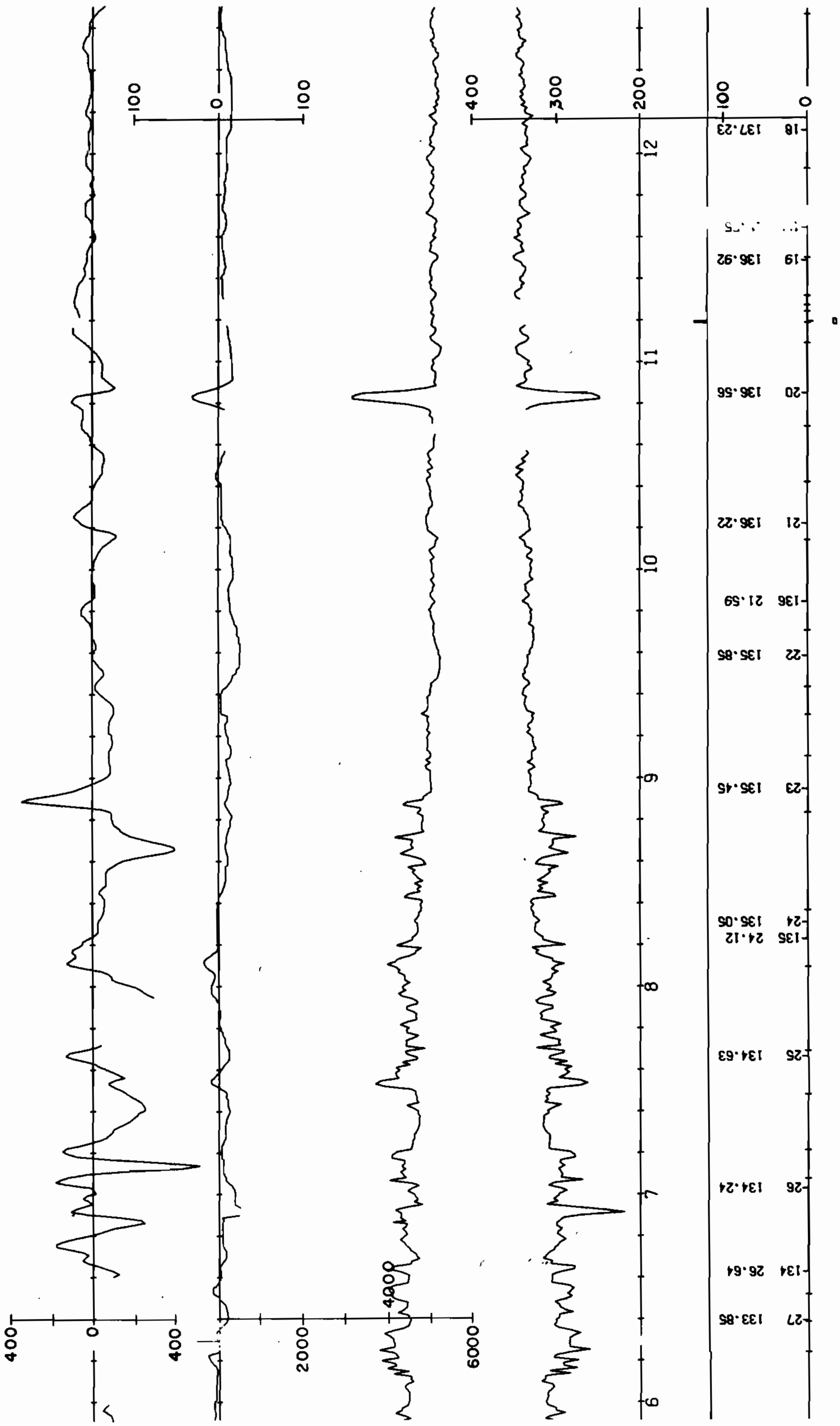

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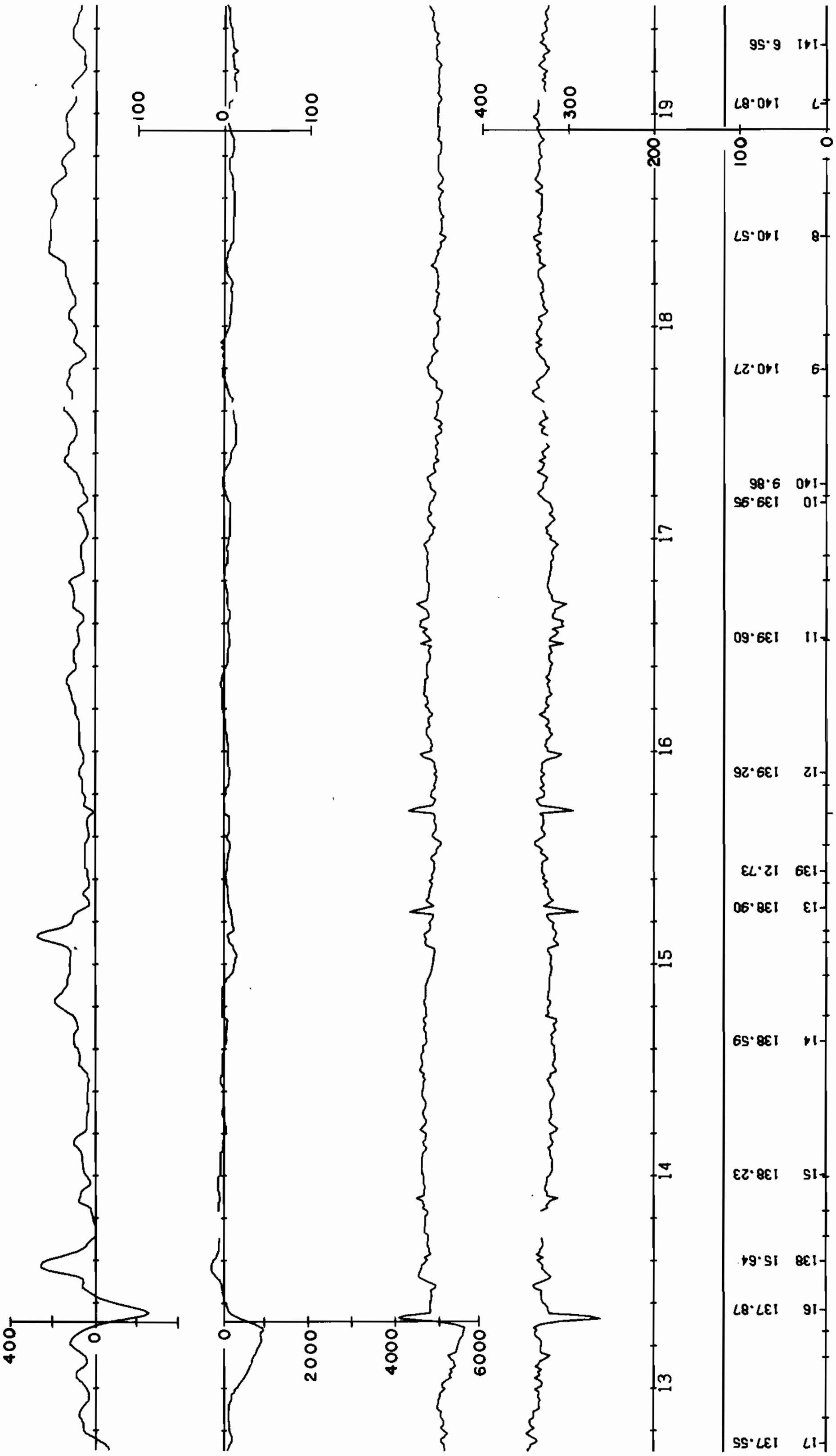
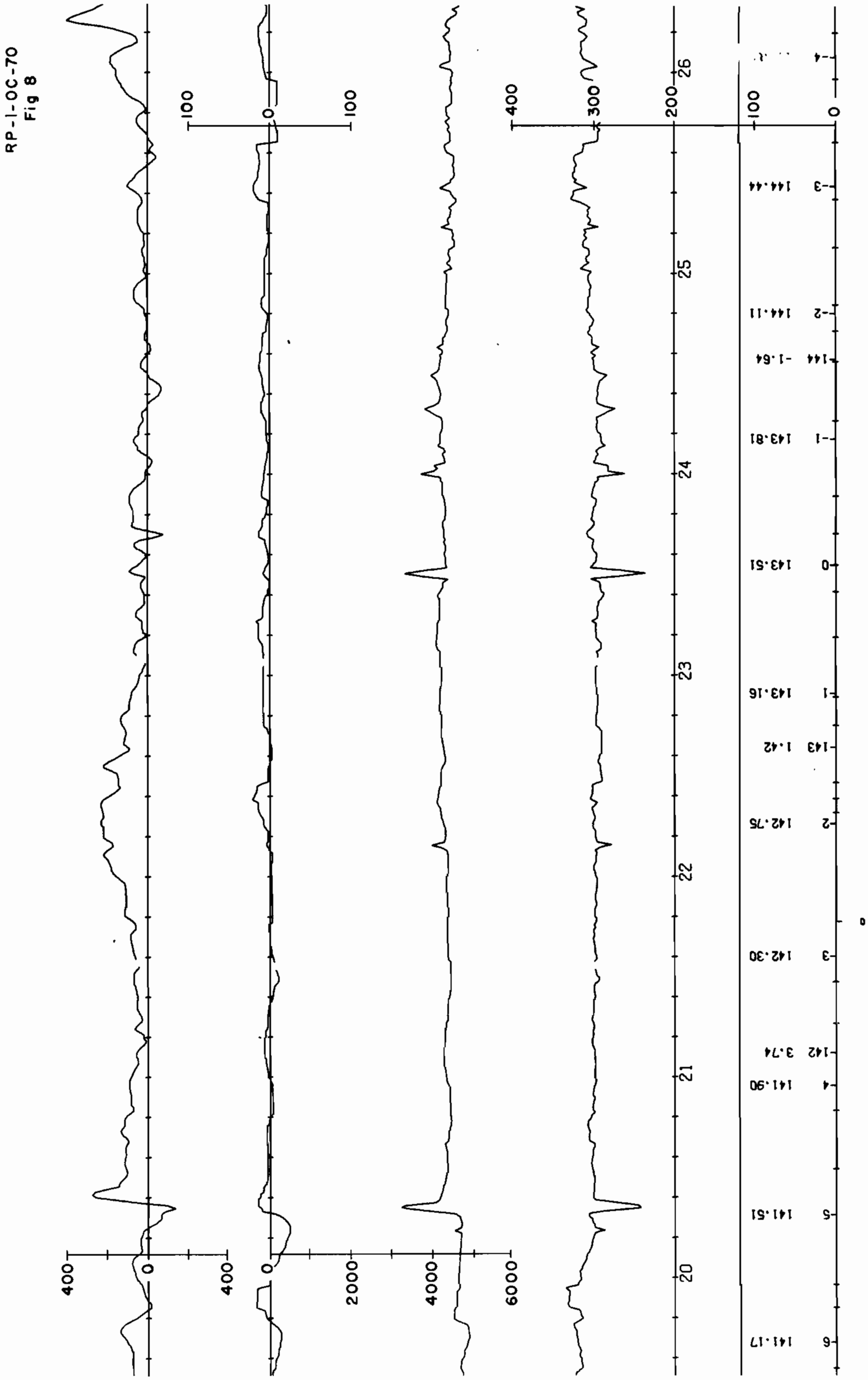
Fig 8




RP-1-OC-70
Fig 8
100
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RP-I-OC-70
Fig 8

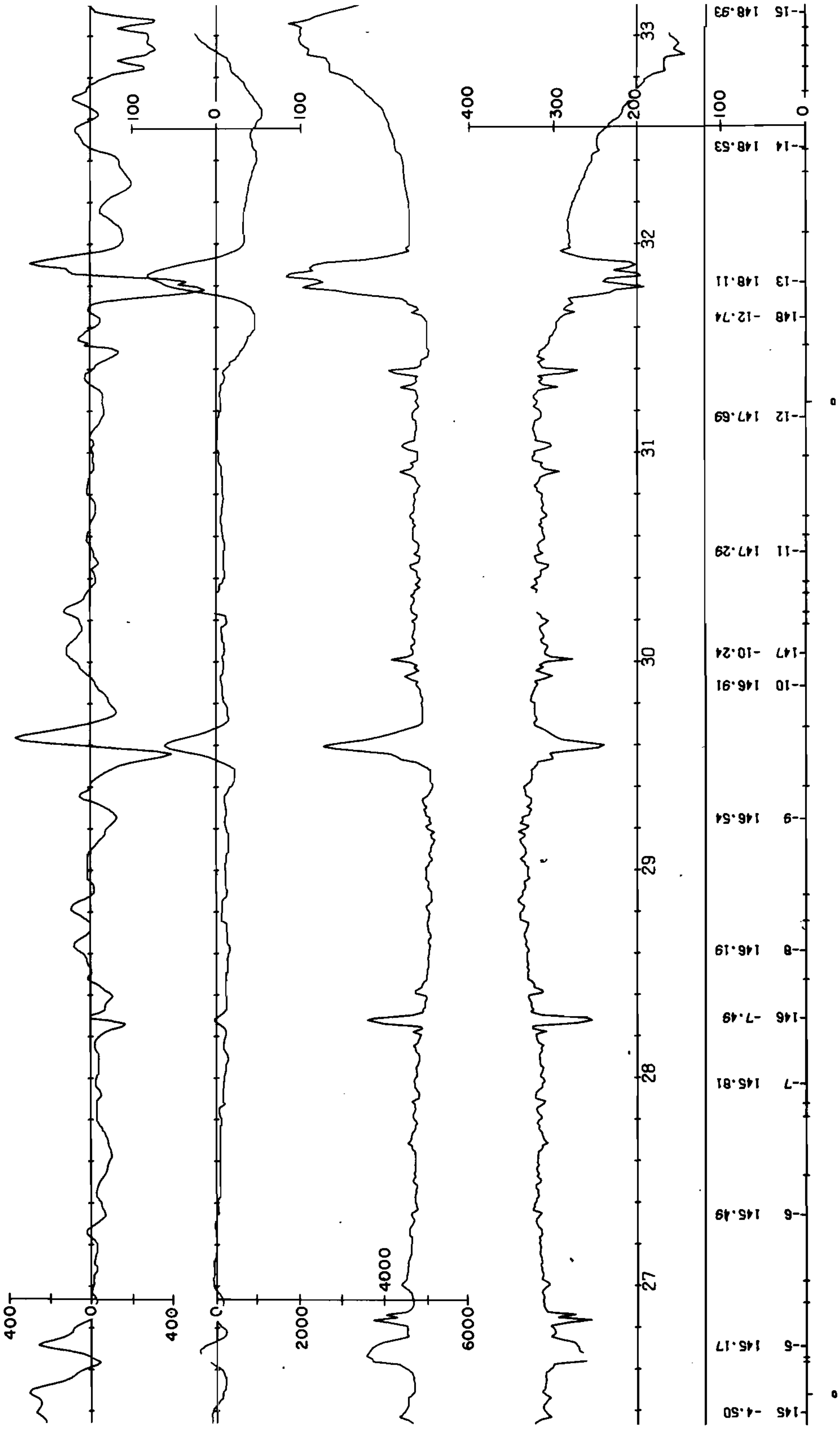


FIGURE 9

LOCATION INDEX

Leg II. TAHITI - EPR - VALPARAISO (See Figures 3 & 5)

Distance in n miles along track	Degrees Lat. - Long.	To	Degrees Lat. - Long.	Pages
3471.9 to 3999.1	17.58°S - 149.66°W	to	23.54°S - 143.15°W	
3999.1 to 4499.2	23.54°S - 143.15°W	to	28.88°S - 136.03°W	
4499.2 to 4999.1	28.88°S - 136.03°W	to	34.31°S - 128.66°W	
4999.1 to 5500.2	34.31°S - 128.66°W	to	39.63°S - 120.62°W	
5500.2 to 5999.8	39.63°S - 120.62°W	to	41.94°S - 111.06°W	
5999.8 to 6499.7	41.94°S - 111.06°W	to	38.40°S - 102.75°W	
6499.7 to 6999.6	38.40°S - 102.75°W	to	38.04°S - 112.47°W	
6999.6 to 7500.3	38.04°S - 112.47°W	to	40.82°S - 109.83°W	
7500.3 to 8000.2	40.82°S - 109.83°W	to	36.04°S - 107.81°W	
8000.2 to 8488.2	36.04°S - 107.81°W	to	36.19°S - 110.13°W	
8488.2 to 8999.3	36.19°S - 110.13°W	to	35.42°S - 99.89°W	
8999.3 to 9499.1	35.42°S - 99.89°W	to	34.59°S - 89.90°W	
9499.1 to 9999.4	34.59°S - 89.90°W	to	33.90°S - 79.85°W	
9999.4 to 10395.4	33.90°S - 79.85°W	to	33.06°S - 72.01°W	

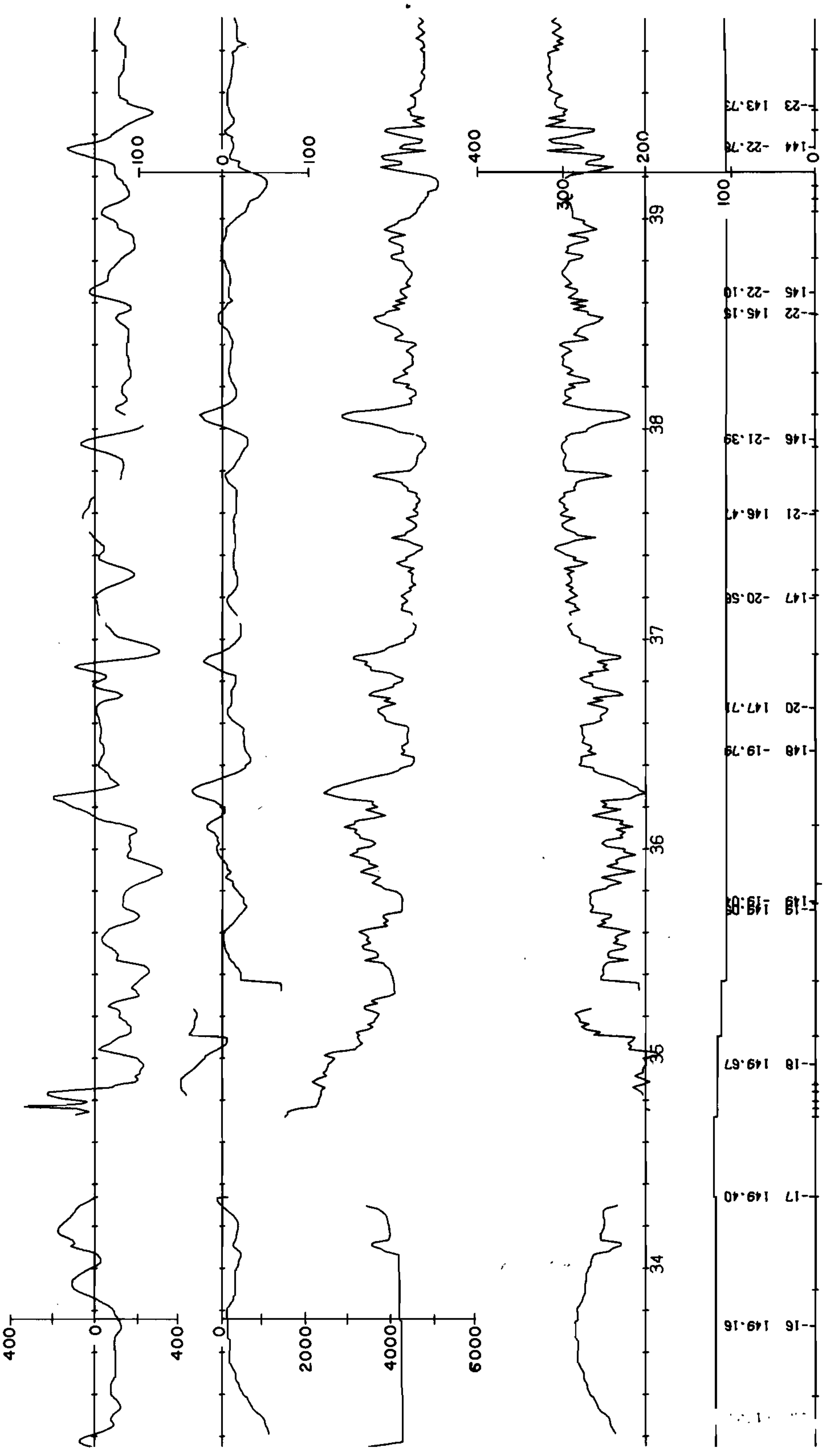
EAST PACIFIC RISE, Phase 1:

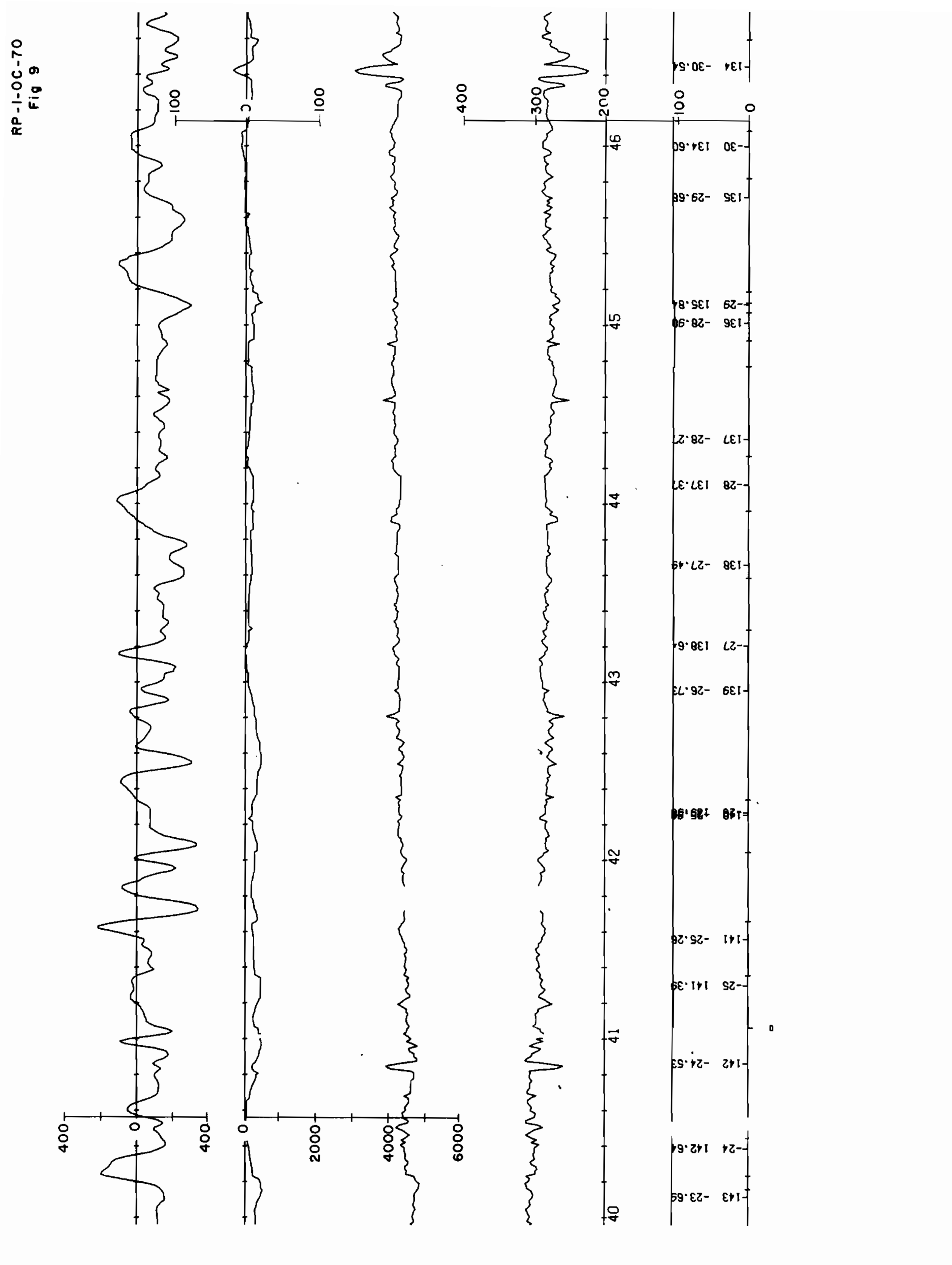
5726.4 to 8950.0	42.00°S - 116.93°W	to	35.56°S - 101.00°W	

PERU - CHILE TRENCH:

	33.26°S - 73.99°W	to	33.06°S - 72.01°W	

RP-1-OC-70
Fig 9





RP-I-OC-70
Fig 9
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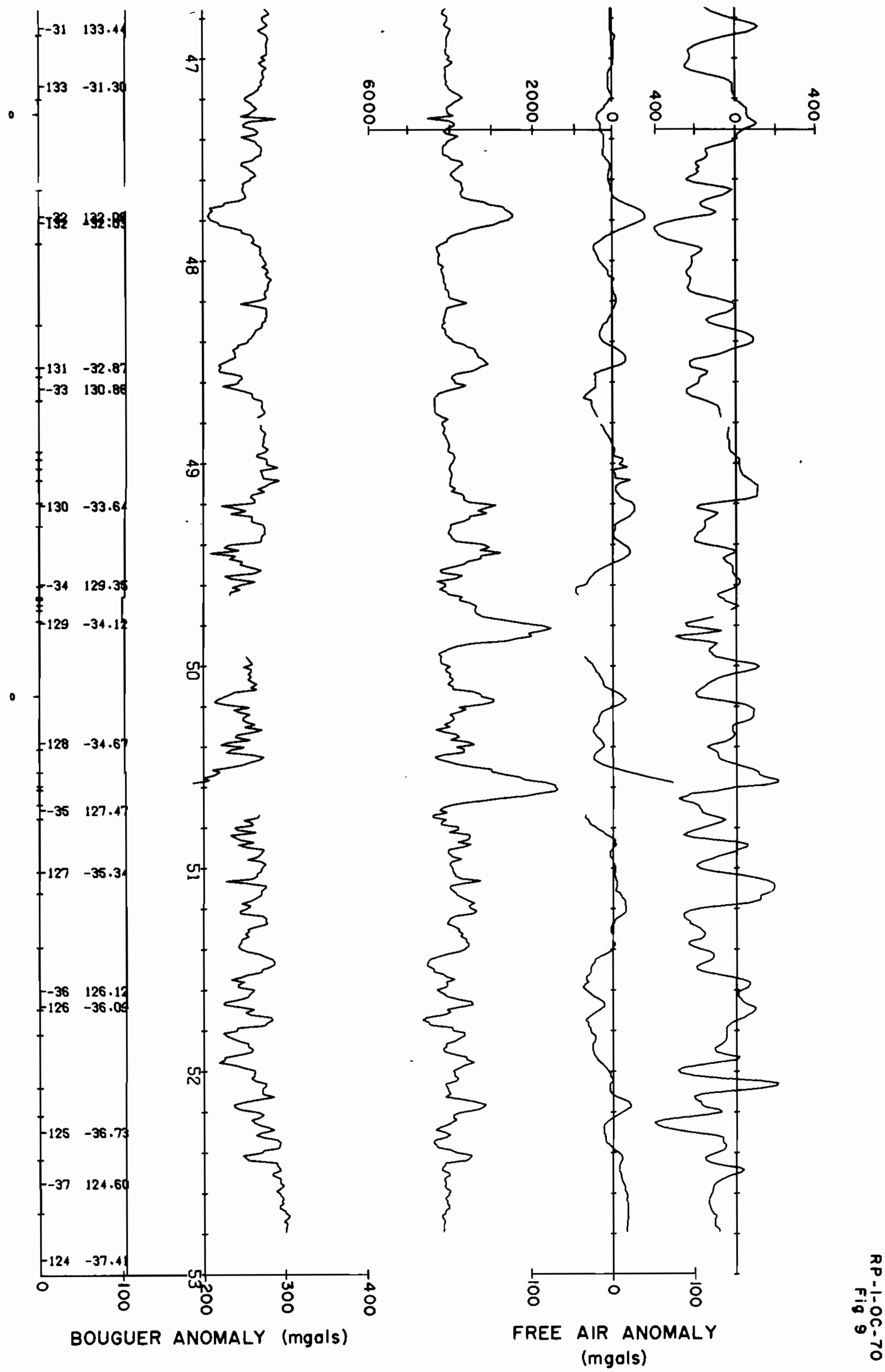
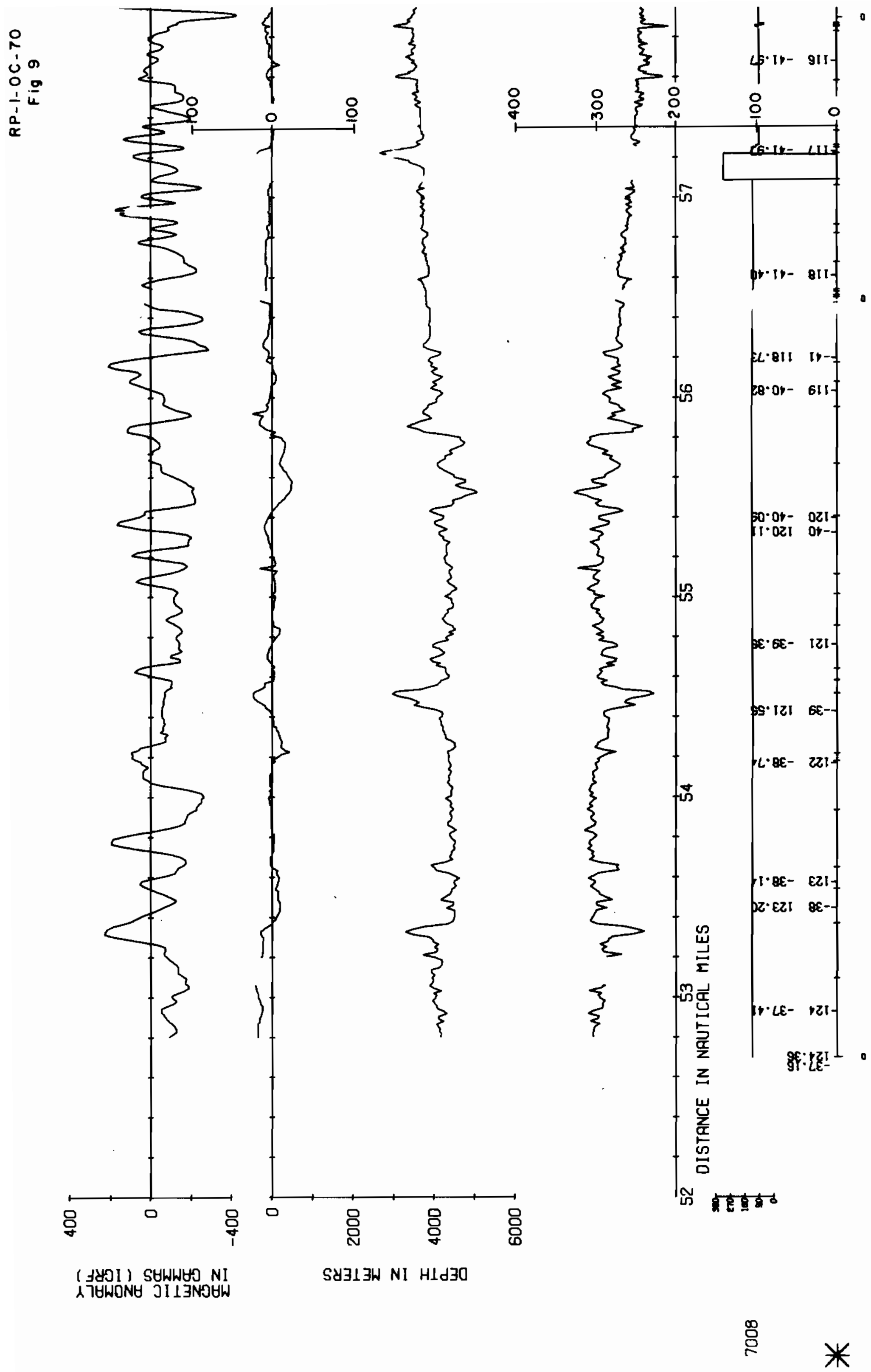

BOUGUER ANOMALY (mgals)
FREE AIR ANOMALY (mgals)
RP-1-OC-70
Fig 9


RP-1-OC-70
Fig 9
MAGNETIC ANOMALY
IN GAMMAS (IGRF)
DEPTH IN METERS
DISTANCE IN NAUTICAL MILES
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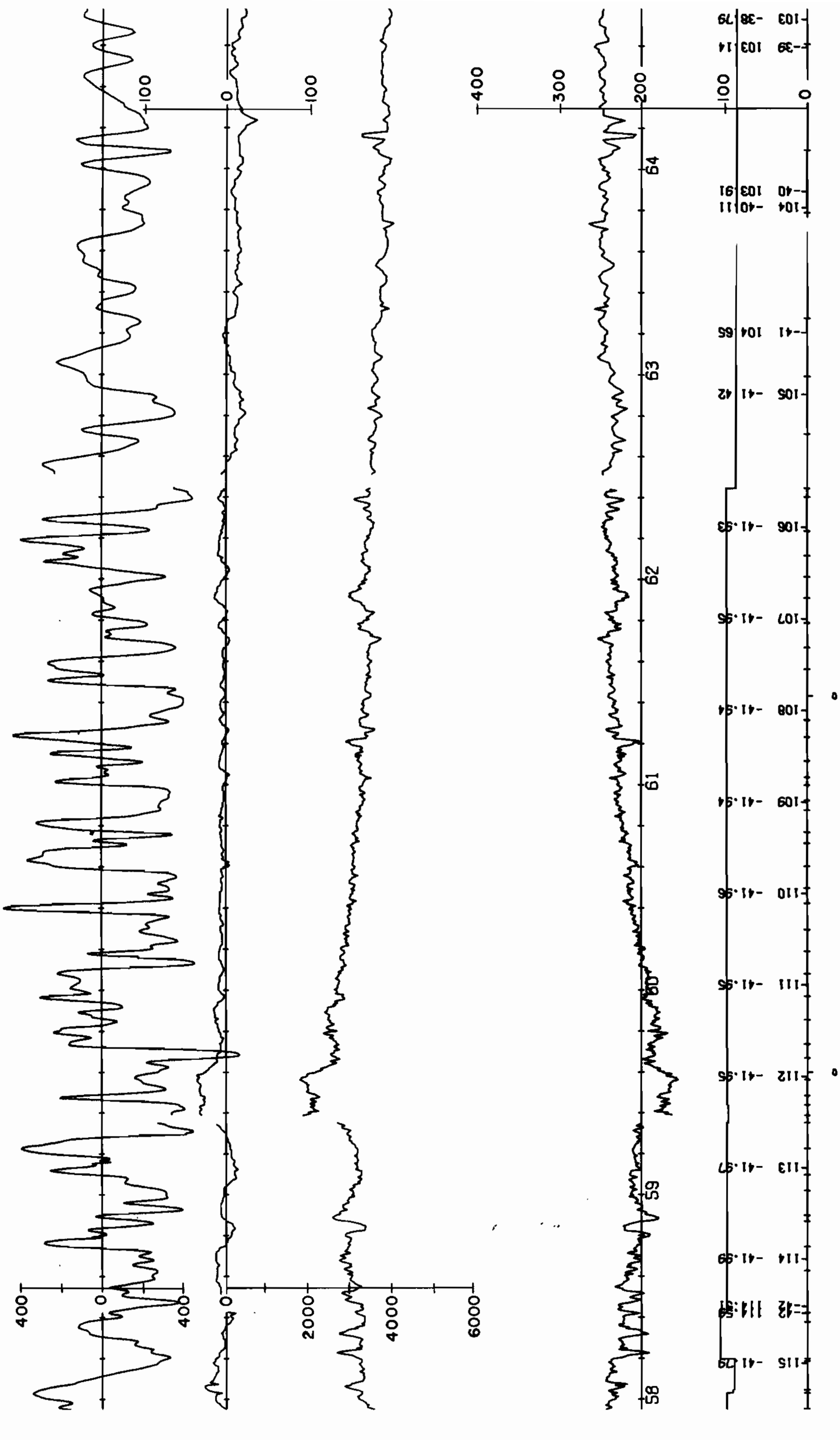

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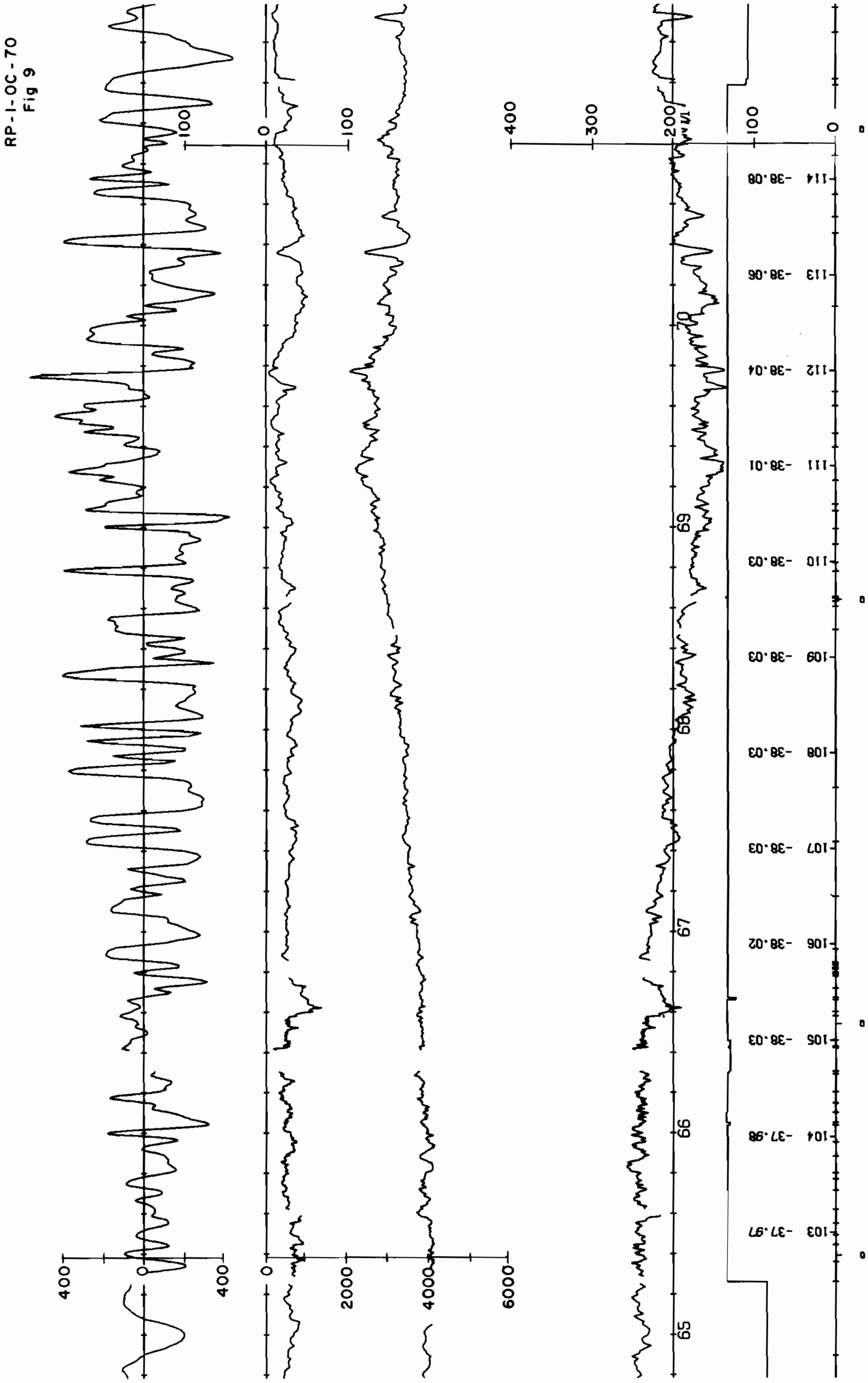
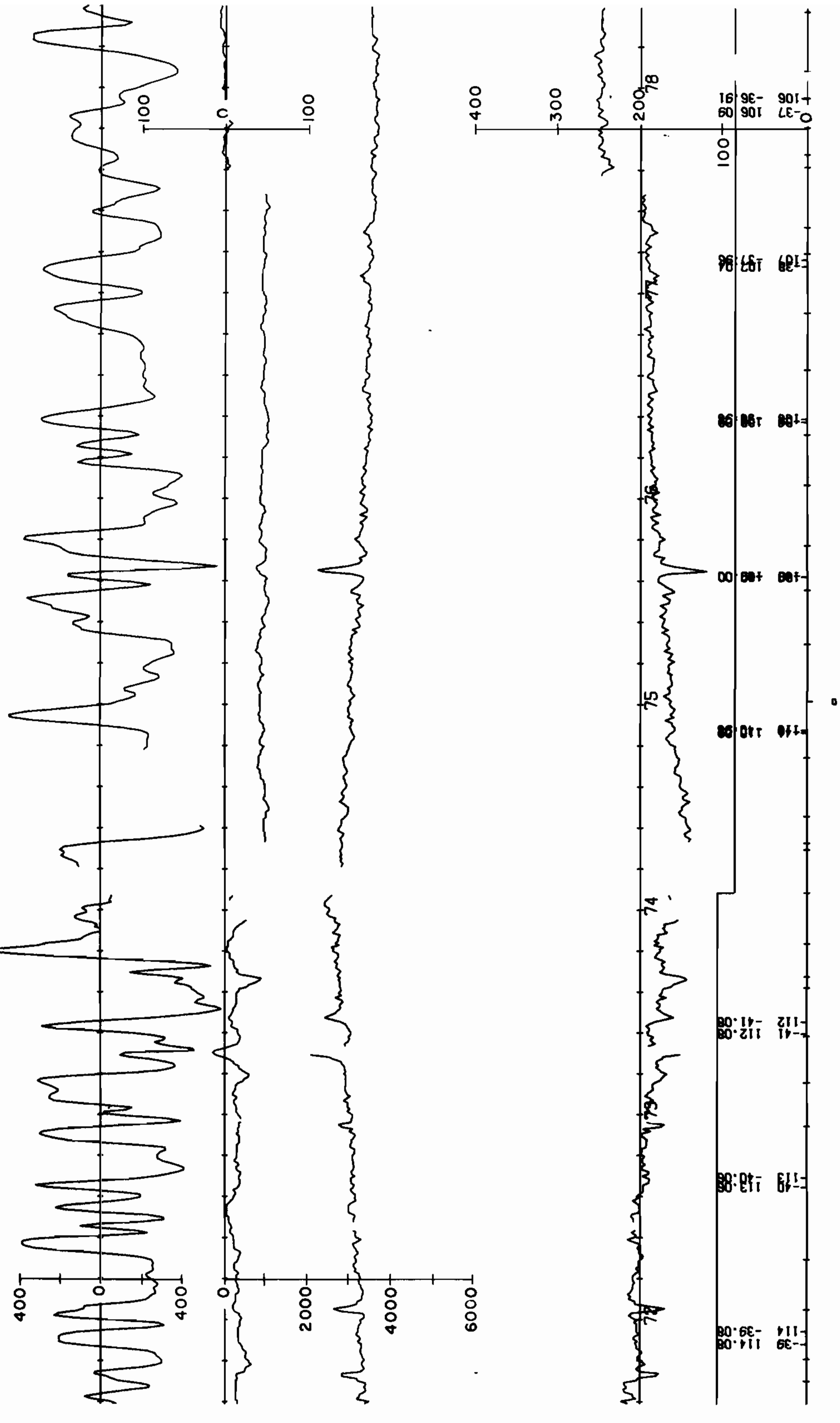

RP-1-OC-70
Fig 9

RP-1-OC-70
Fig 9



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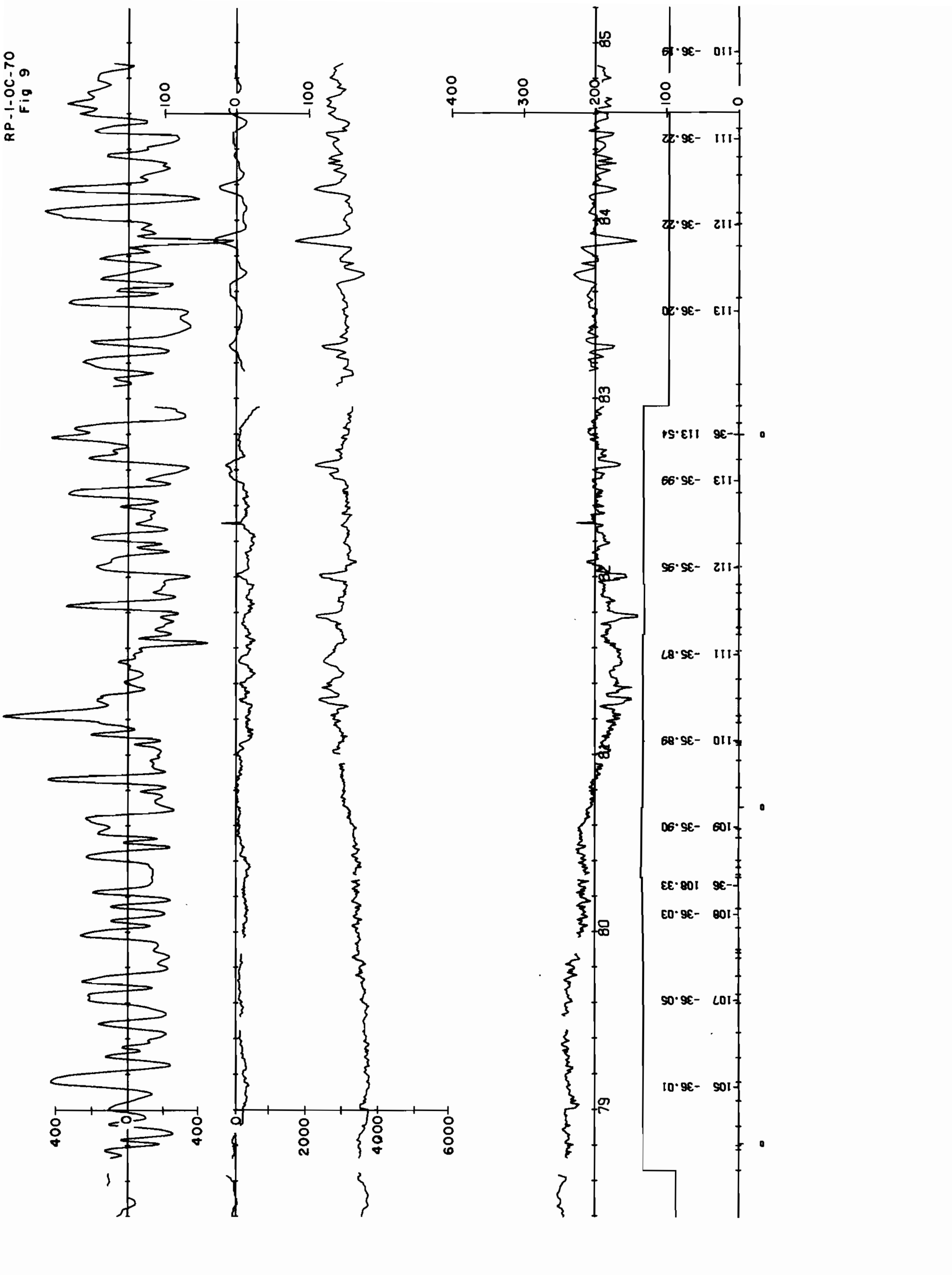

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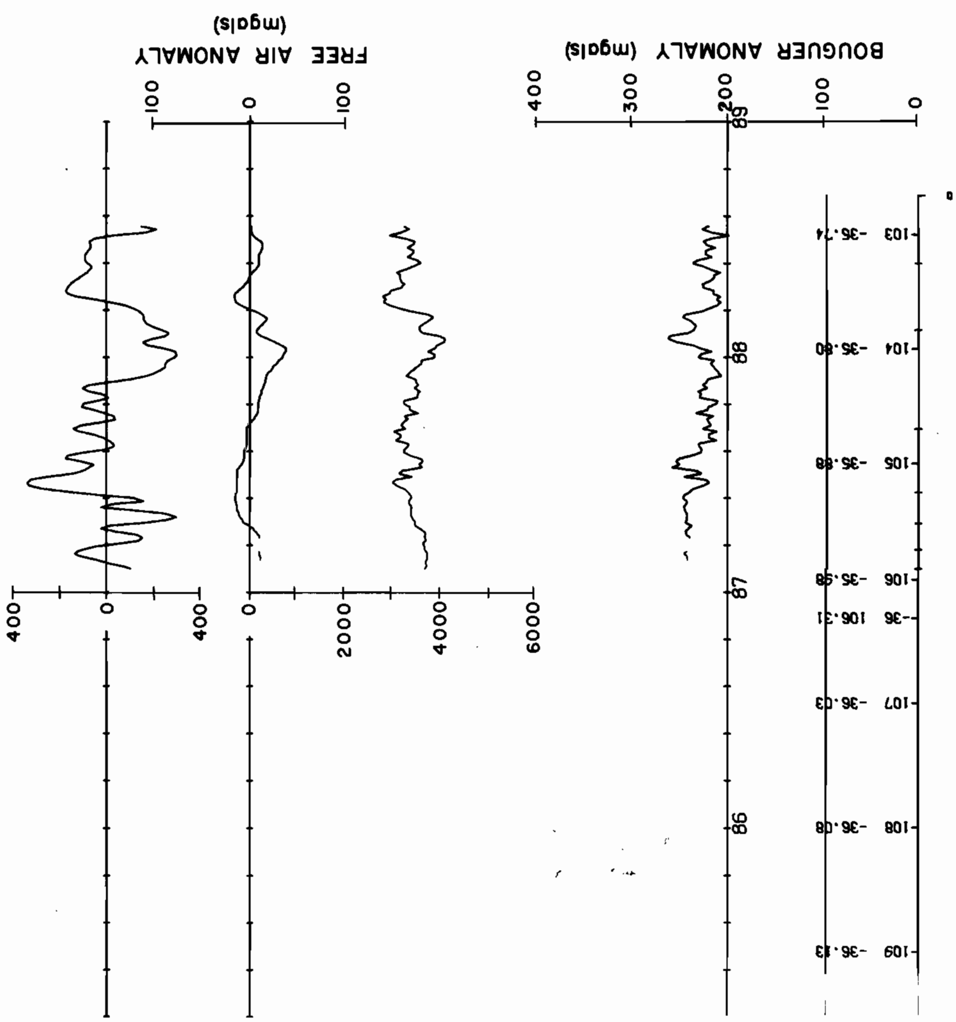

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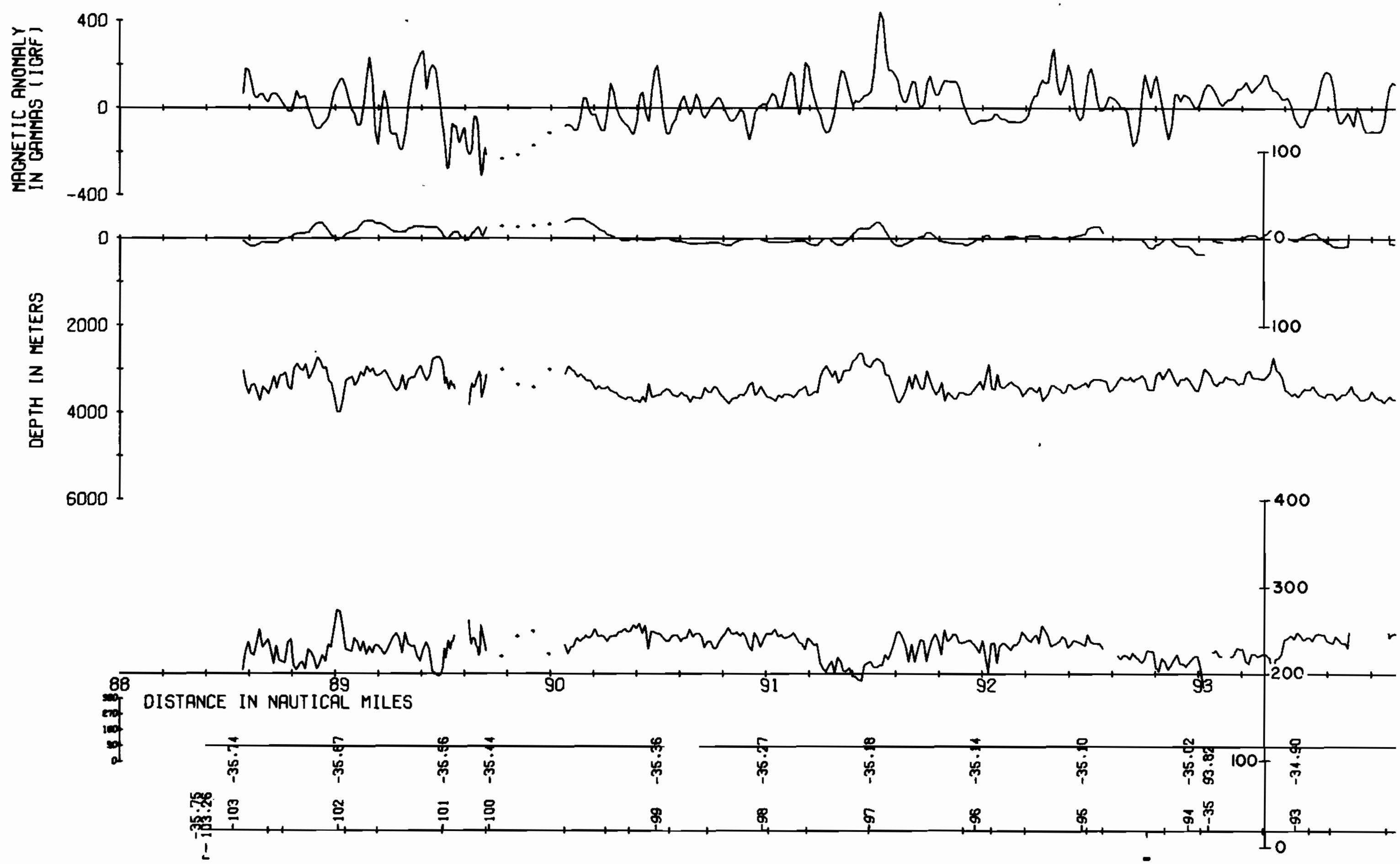
Fig 9



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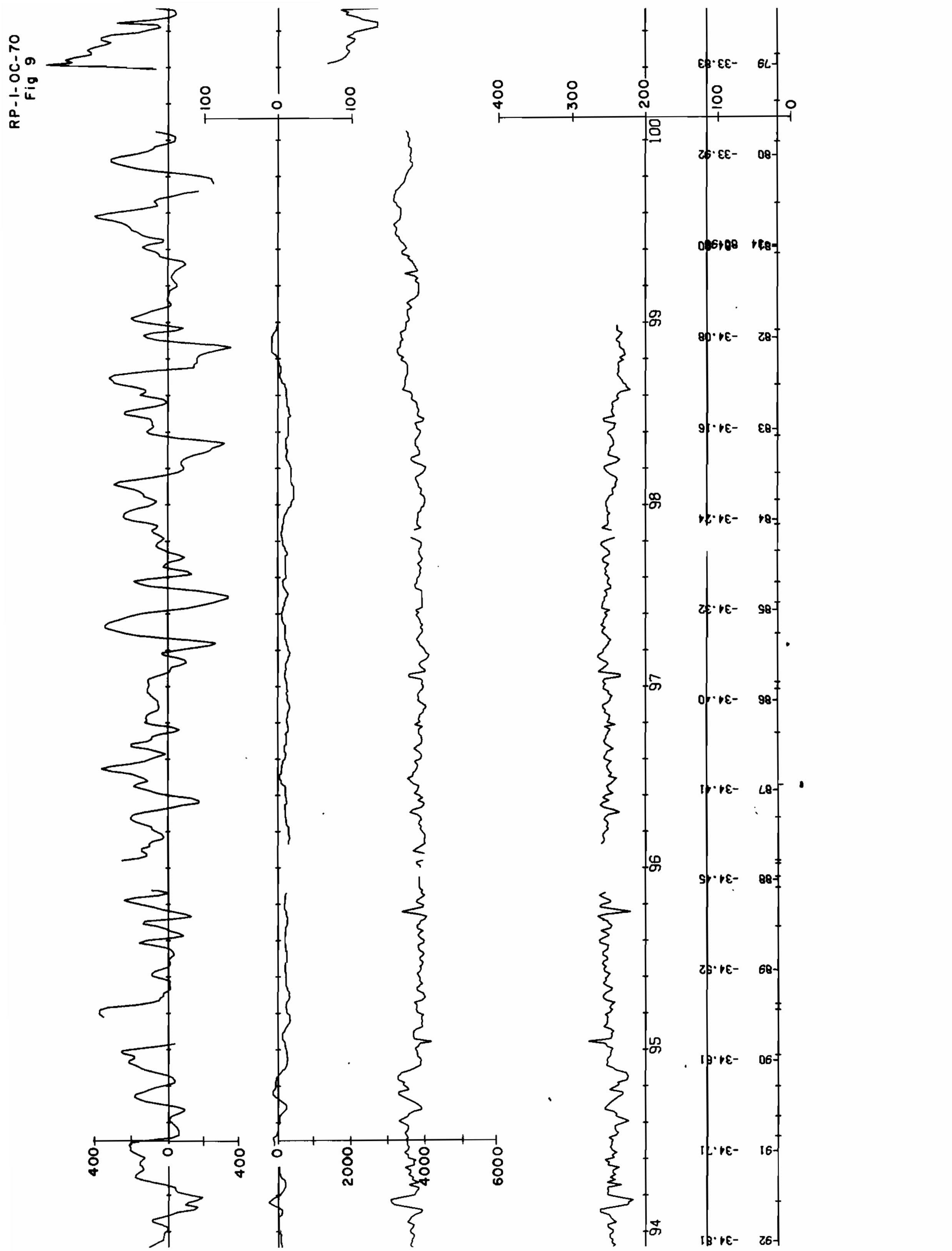
RP-I-OC-70
Fig 9

FIGURE 10

LOCATION INDEX

Leg III. VALPARAISO - EPR - GUAYAQUIL (See Figures 4 & 5)

Distance in n miles along track	Degrees Lat. - Long.	To	Degrees Lat. - Long.	Pages
10404.5 to 10999.7	33.03°S - 71.88°W	to	35.59°S - 83.48°W	
10999.7 to 11499.9	35.59°S - 83.48°W	to	37.66°S - 93.54°W	
11499.9 to 11809.5	37.66°S - 93.54°W	to	38.99°S - 99.89°W	
11809.5 to 12518.7	38.99°S - 99.89°W	to	38.98°S - 115.09°W	
12518.7 to 13000.4	38.98°S - 115.09°W	to	31.54°S - 111.42°W	
13000.4 to 13500.6	31.54°S - 111.42°W	to	24.19°S - 107.17°W	
13500.6 to 14000.6	24.19°S - 107.17°W	to	18.17°S - 101.08°W	
14000.6 to 14499.9	18.17°S - 101.08°W	to	13.62°S - 94.26°W	
14499.9 to 15000.2	13.62°S - 94.26°W	to	7.79°S - 88.50°W	
15000.2 to 15579.7	7.79°S - 88.50°W	to	2.75°S - 80.93°W	

EAST PACIFIC RISE, Phase 2:

11809.5 to 12518.7	38.99°S - 99.90°W	to	38.99°S - 115.09°W	

RP-1-OC-70
Fig 10

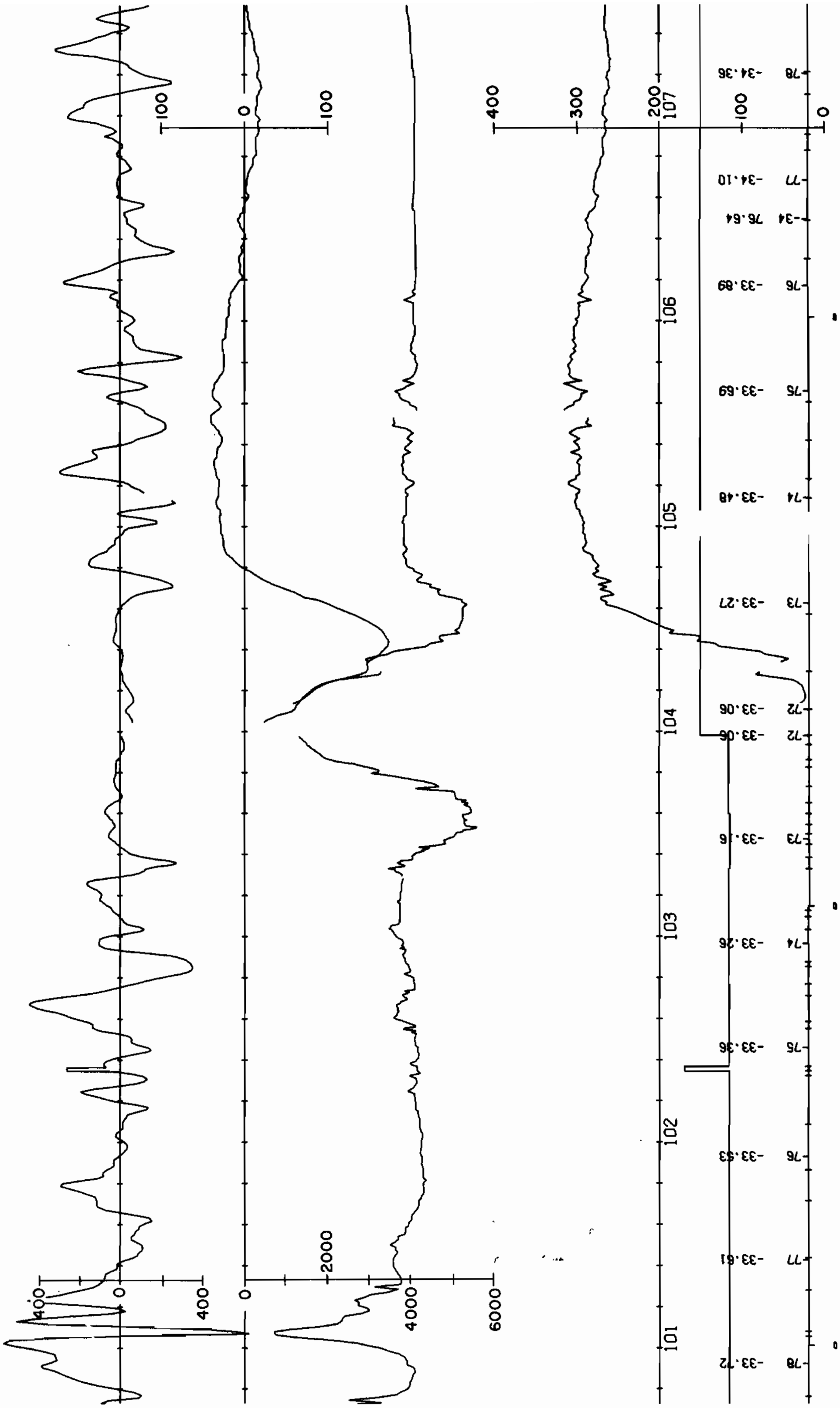

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Fig 10

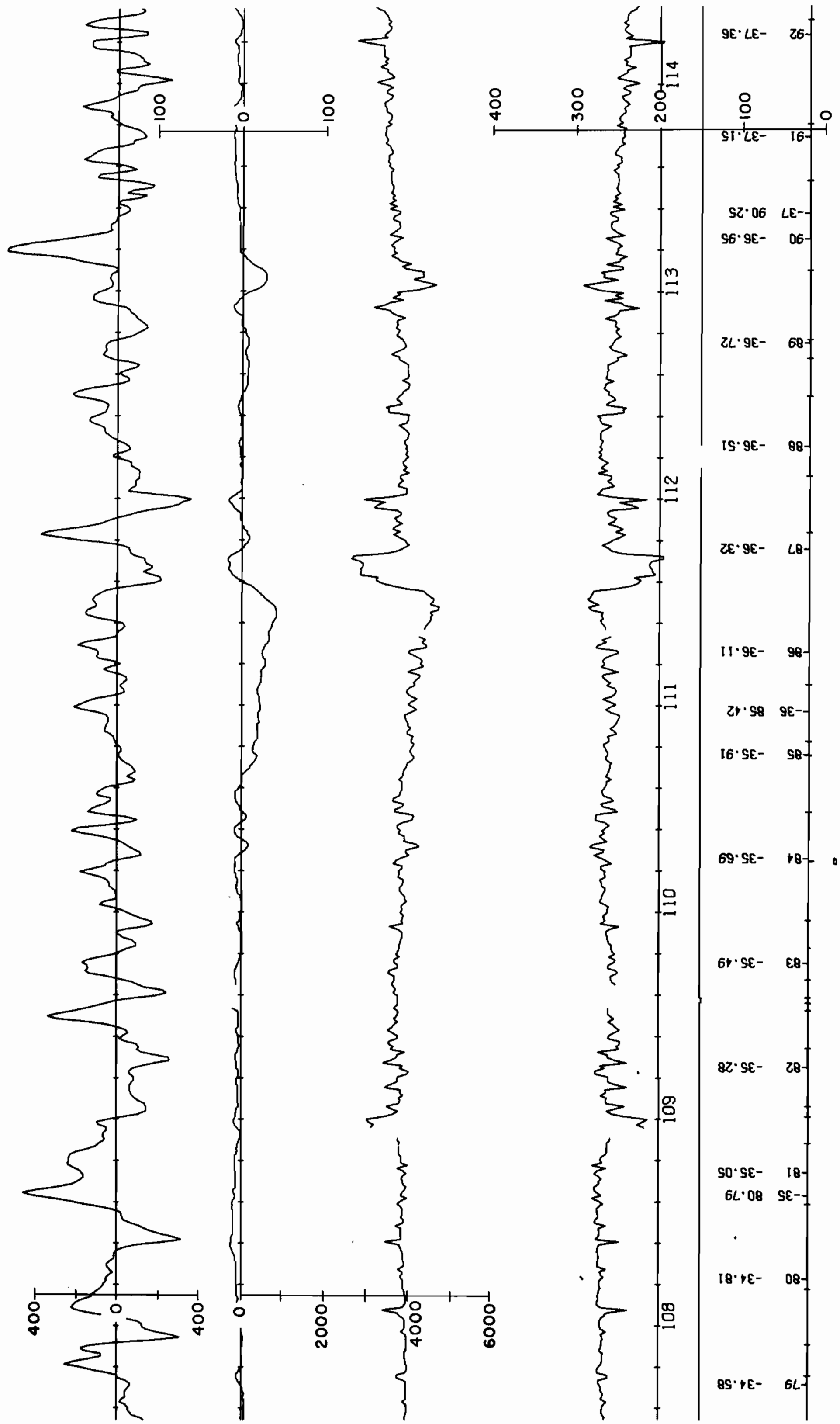

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Fig 10

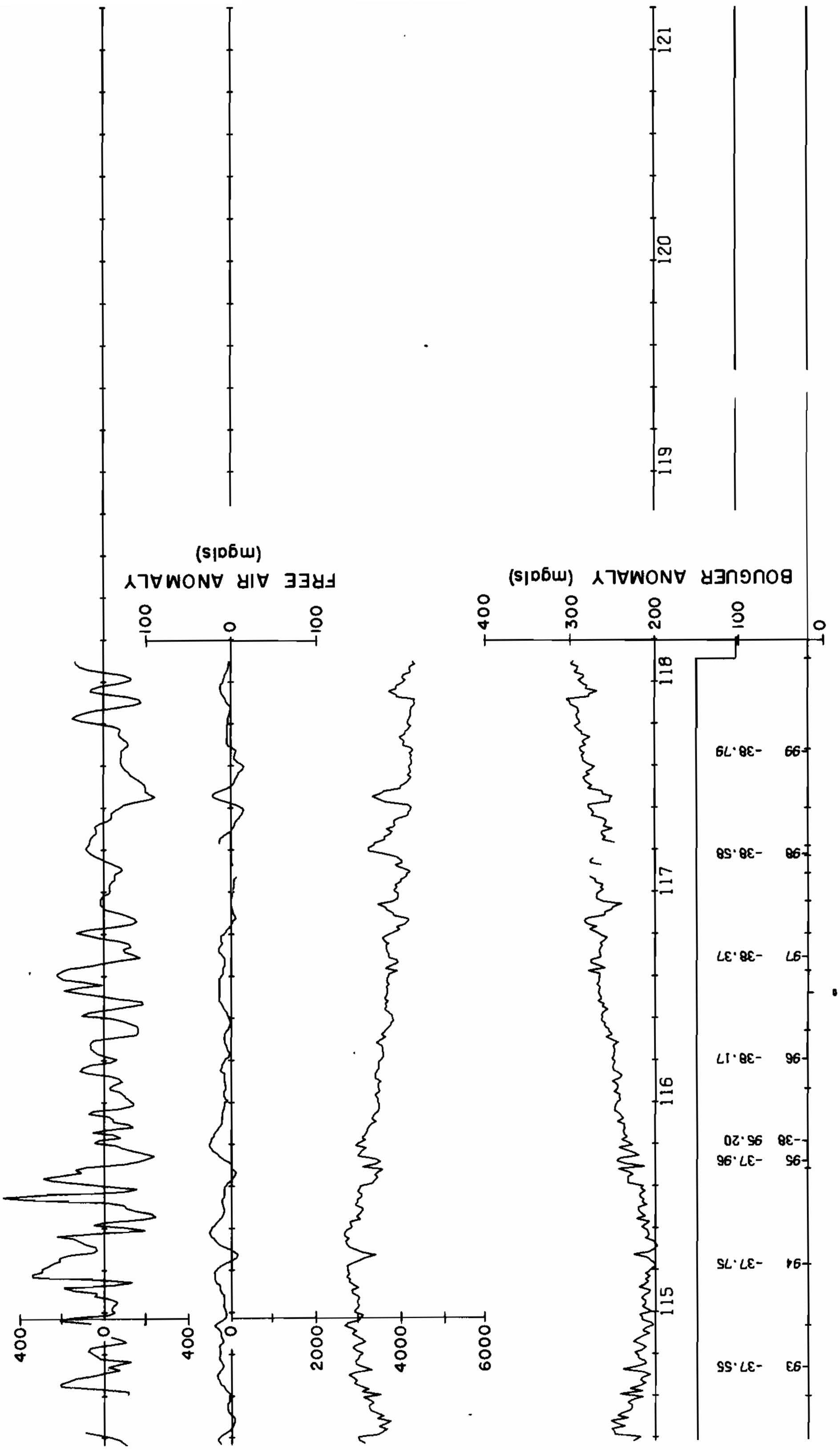

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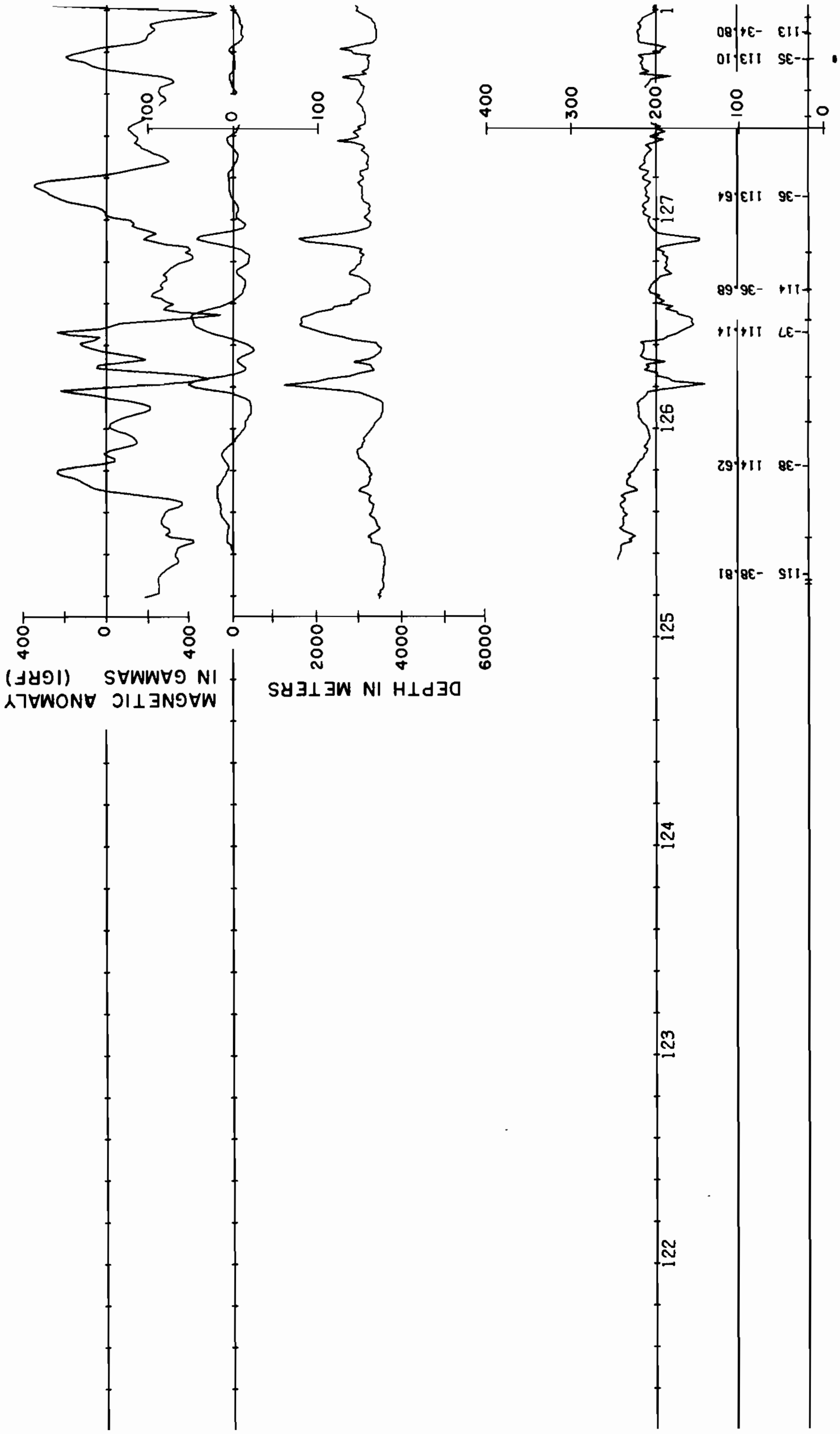
Fig 10



RP-1-OC-70
Fig 10

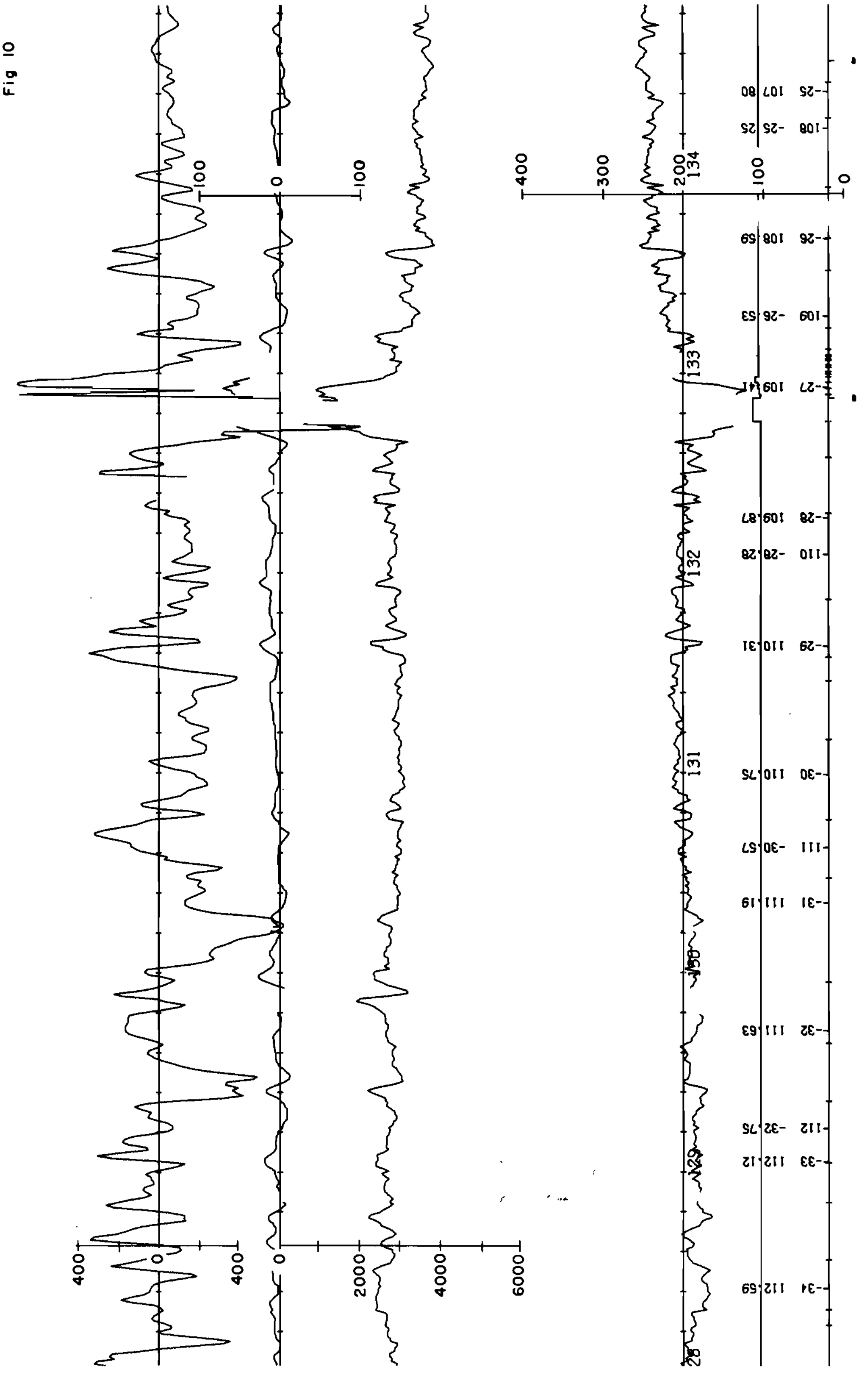


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Fig 10

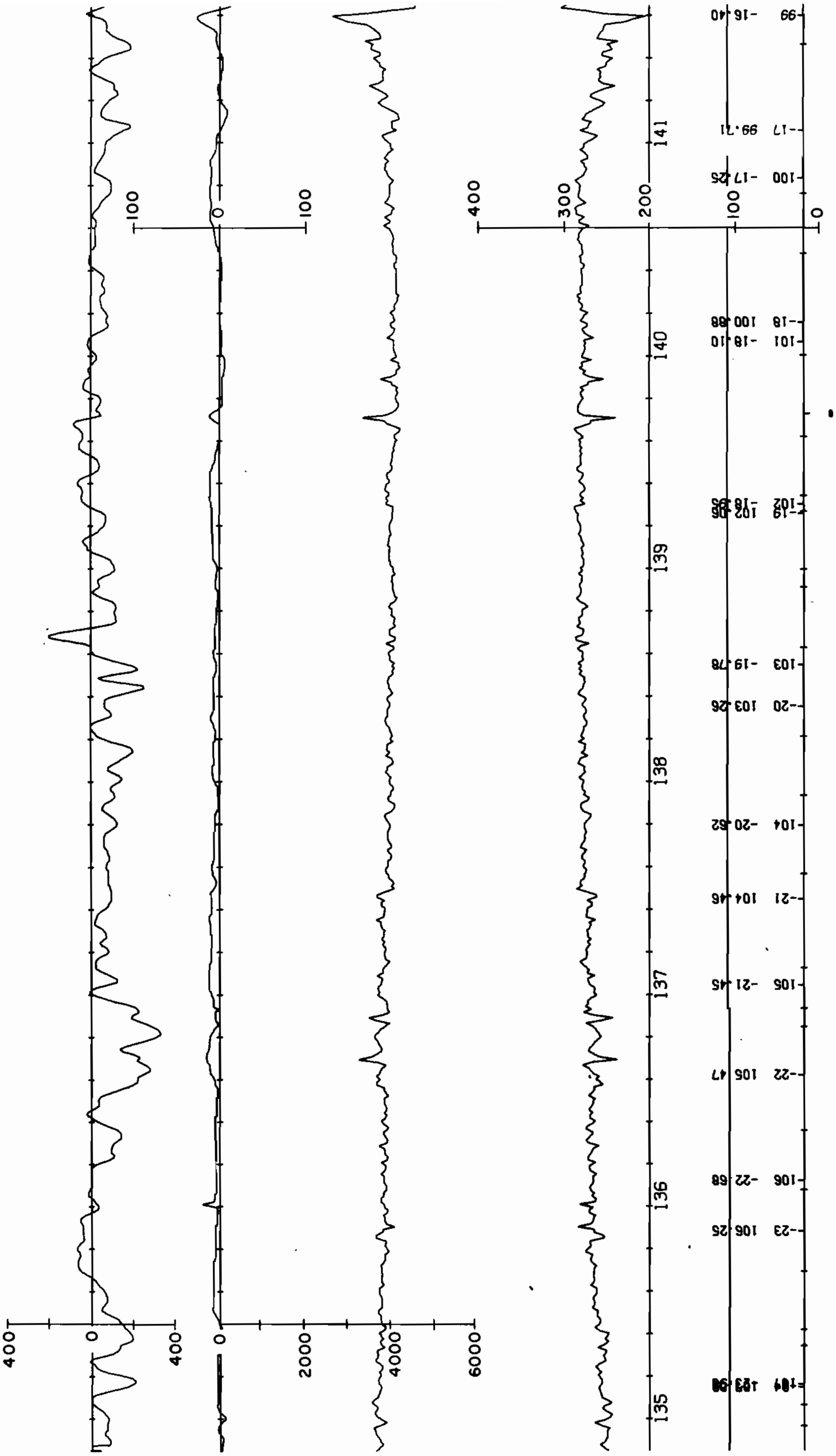

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Fig 10

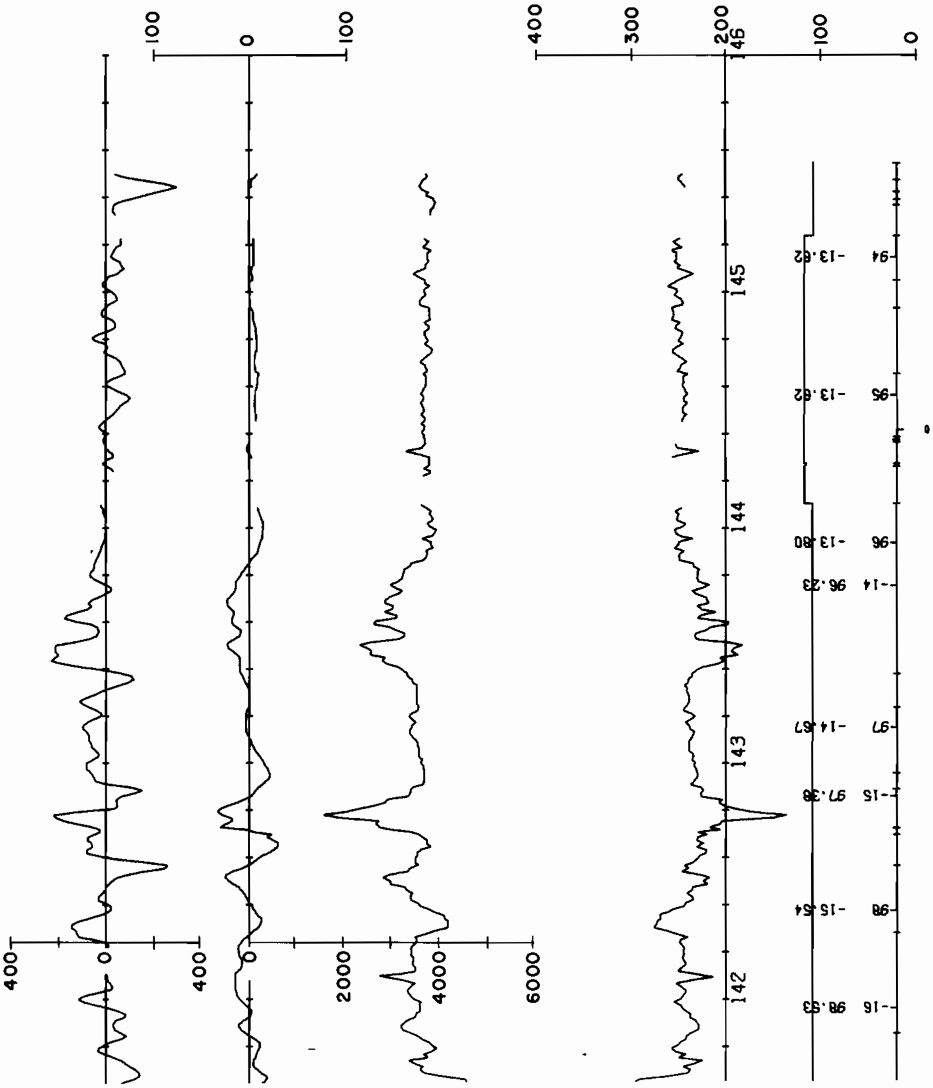

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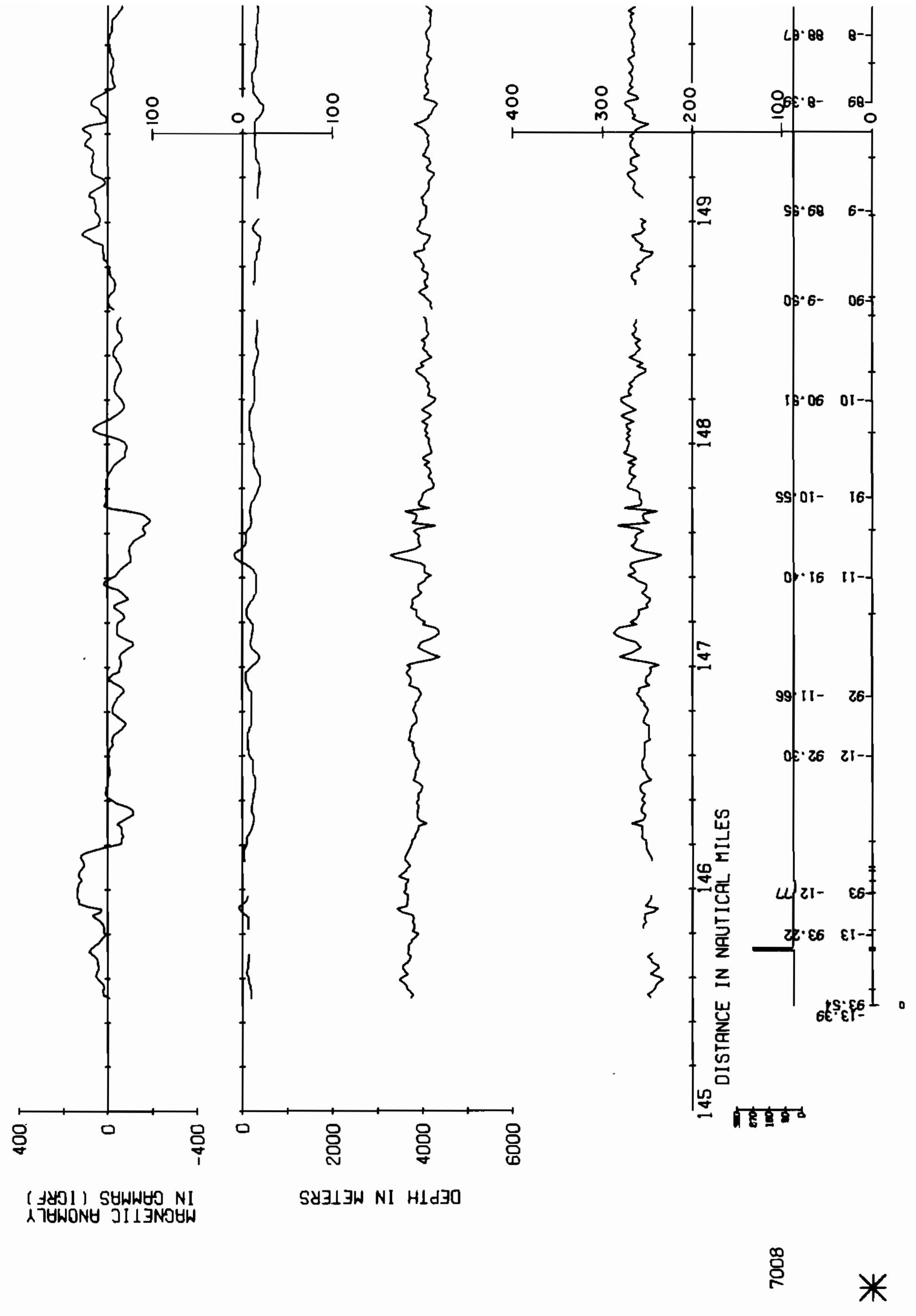
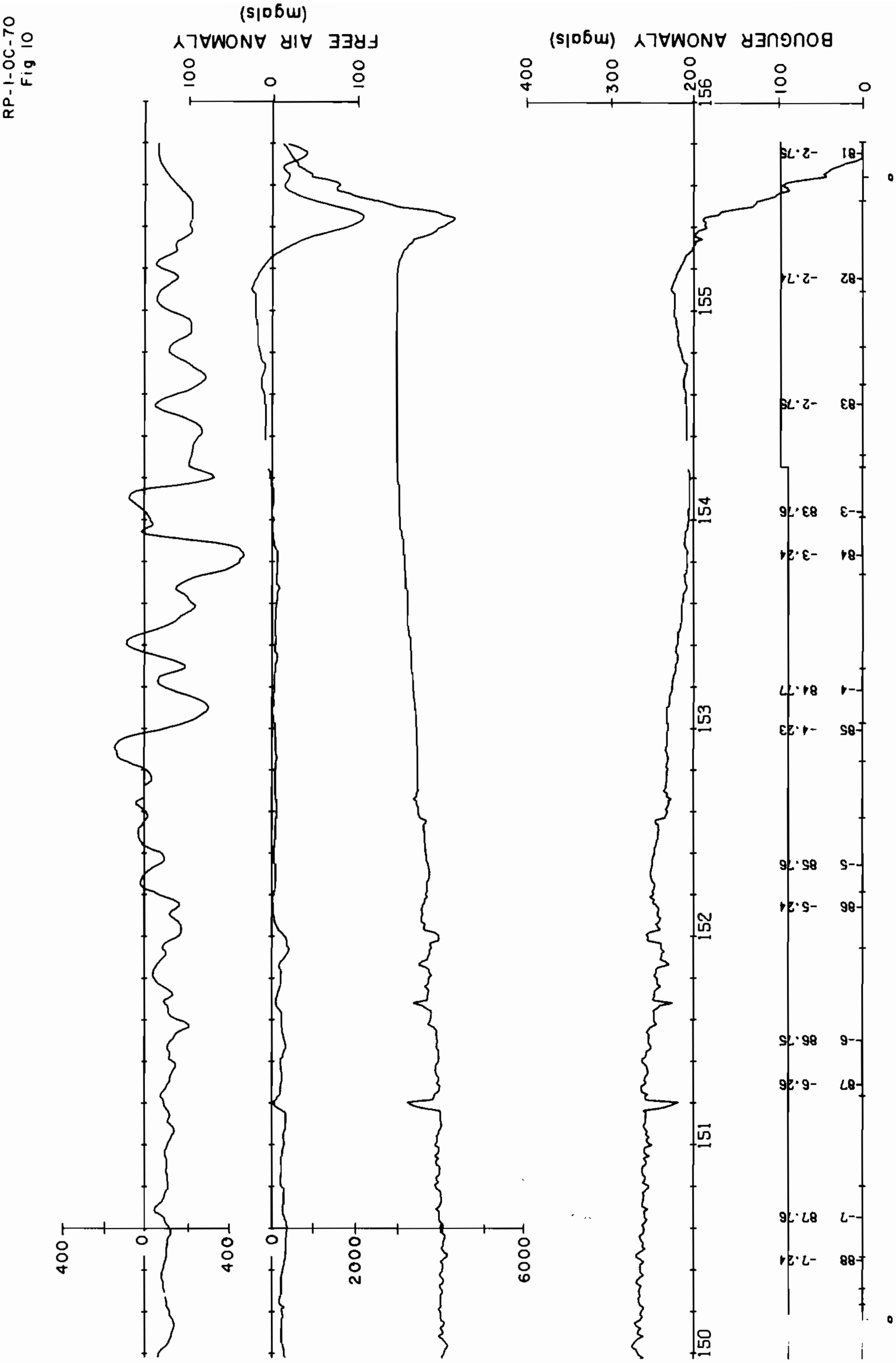
Fig 10




RP-1-OC-70
Fig 10
FREE AIR ANOMALY
(mgals)
BOUGUER ANOMALY (mgals)
100
0
100
400
300
200
100
0
156
155
154
153
152
151
150
400
0
400
0
2000
6000
-81
-2.75
-82
-2.74
-83
-2.75
-3
83.76
-84
-3.24
-4
84.77
-85
-4.23
-5
85.76
-86
-5.24
-6
86.75
-87
-6.26
-7
87.76
-88
-7.24

8. ACKNOWLEDGEMENTS

I thank F.P. Naugler, J.M. Wageman, and D.A. Emilia for helpful suggestions used in the preparation of this report. They, along with R.E. Burns, read the manuscript and offered constructive criticisms. S.P. Perry was responsible for producing the geophysical profile. R.R. Uhlhorn did the drafting. Laurie Burgess typed the manuscript.

A special acknowledgement is due the officers and crew of the OCEANOGRAPHER. Their efforts contributed to the success of RP-1-OC-70.

9. REFERENCES

Holloway, Gregory (1971), A Quick Users Guide to ARIES. Archive Retrieval Information Editing System, (POL Manual).

Von Herzen, R.P. and A.E. Maxwell (1950), The measurement of thermal conductivity of deep-sea sediments by a needle probe method. J. Geophys. Res, Vol. 64, 1557-1563.

APPENDIX A SCIENTIFIC PERSONNEL

NAME	AFFILIATION	DATE
Robert E. Burns*	ESSA - POL	13 January-31 March
Clive R.B. Lister	U. of Washington	13 January-5 March
Alexander Malahoff	U. of Washington	13 January-30 January
Richard W. Marvin	U. of Washington	13 January-30 January
Robert G. Zachariadis	U. of Washington	13 January-30 January
Albert Erickson	M.I.T.	2 March-31 March
Stanley Cisowski	M.I.T.	2 March-31 March
Beverly Carroll	M.I.T.	2 March-31 March
Elaine Papworth	M.I.T.	2 March-31 March
Lawrence Machesky	U. of Hawaii	5 March-31 March

*Chief Scientist

APPENDIX B SPECIAL PROJECTS

B 1. Bathythermographs

Expendable bathythermograph (XBT) observations were made daily at 0000Z, 0600Z, 1200Z, and 1800Z while enroute to Tahiti (Leg I). Surface bucket temperatures were taken for reference. The seawater temperature recorder operated continuously. These readings agreed within ± 0.2°C of bucket temperatures.

B 2. Chart Verification

Leg I: Matahive Island

Date Position Verified: 25 January 1970

Findings: The position check utilized Satellite Navigation, visual bearings, and radar distances. The island's position was found to lie as charted on H.O. Chart 5732.

Leg II: Juan Fernandes Islands: Robinson Crusoe, Santa Clara, and Alejandro Selkirk Island (Mas Afuera)

Date Position Verified: 25 February 1970

Findings: Positions were checked utilizing Satellite Navigation, visual bearings, and radar distances. The charted positions of Robinson Crusoe and Santa Clara Islands on H.O. Chart 1267 differ up to 5 n mi from the positions shown on the 1969 Chilean Chart No. 509. The positions as shown on the Chilean chart were substantiated. The position of Alejandro Selkirk Island appeared to be 2.6 n mi southwest of its charted position on H.O. 1267.

B 3. Deep Sea Camera

The Massachusetts Institute of Technology supplied an EG&G camera and strobe light for the deep sea photography operations. The camera apparatus and the Edo pinger were lowered at positions 39.01°S - 105.24°W, 39.03°S - 107.56°W, 38.76°S - 111.36°W, and 39.02°S - 115.08°W on Leg II.

The camera focal length was set between 4 and 20 ft. Depth control was maintained by using the PBR in conjunction with an oscilloscope. The camera unit was kept at a distance of approximately 12 ft off the bottom with the aid of the pinger. Malfunctioning of the camera brought negative results at two stations.

B 4. Easter Island (Rapa Nui) Gravity Survey

The land gravity survey of Easter Island was not initially one of the OPR-1-OC-70 projects but resulted from the illness and subsequent medical evacuation to the Island of the OCEANOGRAPHER'S 3rd Assistant Engineer. The stop-over at Easter Island offered an opportunity to obtain gravity data that could be tied into the first order world gravity net. A successful reconnaissance gravity survey was made on the 22nd and 23rd of March during Leg III portion of the cruise. Readings were taken at 23 stations.

Ship personnel involved in these measurements were Mr. L.F. Machesky, U. of Hawaii, Lt. F.P. Rossi, and Ensigns J.A. Miller, and A. N. Flior USESSA of the USC&GSS OCEANOGRAPHER. Their efforts were combined with those of Mr. Mark Speath, USC&GSS, Rockville, Maryland, Mr. Dan Walker, U. of Hawaii, and Sr. Bernardo, U. of Chile. These men who volunteered their services, were living on the island at the time and engaged in completing a new seismic vault. Island transportation was provided by the Chilean Air Force, Easter Island Detachment.

B 5. Equatorial Surface Current Study

Velocities and directions of equatorial surface currents were measured between 135°W and 150°W longitude during Leg I of the cruise. The method of determining ship set and drift used in this study is not complex but it does require highly accurate navigation. The computed direction and speed of the surface current is expressed as a vector quantity obtained after the difference between the indicated course and distance and the actual course and distance-made-good has been established. Primary control of the trackline was maintained with AN/SRN-9 Satellite Navigation equipment. Course errors, after averaging, are believed to be within ± 1°. Distance through the water, determined by the underwater log distance indicator (ULDI), is believed to be accurate to within ± 0.1 n mi/hr. This includes effect of wind on ships speed. After completion of the smooth plotting, the ship's actual course and distance are probably accurate to within 0.5° and 0.5 n mi/hr.

The results of this surface current study are in general agreement with the findings of others (summarized by Neumann and Pierson, 1966). Data acquired along the OCEANOGRAPHER'S trackline indicates that a marked change in the direction of the South Equatorial Current occurs approximately 1° south of the equator. The surface currents south of the South Equatorial Current, at about 6°S latitude, also turn from a south-south-westerly direction and flow south-southeastward around the western edge of the Marquesas Islands and the Tuamotu Archipelago. The suggestion has been made that these islands may partially divert the flow of the South Pacific Gyre with a resulting surface current pattern that is not a part of the large scale circulation. It is necessary to emphasize, however, that the data from this surface current study are applicable only to the region investigated between 135°W and 150°W in January 1970.

B 6. Meteorology

Surface meteorological observations were taken daily at 0000, 0600, 1200, and 1800 hrs except when in port. The weather program began 17 January and continued for the remainder of the cruise. A recording barograph operated from 13 January to 30 March.

Forecasts and facsimile weather charts, transmitted from Navy Fleet Weather Central in Honolulu, aided the ship's meteorology officer in setting up weather forcasts for shipboard use.

A total of 208 observations were recorded. Of these, 198 were transmitted for relay to weather centers in Washington, D.C. and Honolulu, Hawaii. Synoptic weather observations and barogram records were checked and filed for later shipment to the Marine Climatological Branch, U.S. Weather Bureau.

B 7. Radiocarbon Study

Water samples for a Carbon-14 study were taken at 39°00'S and 105°15'W for Anthony W. Young of the University of Washington Chemistry Department. Fifteen gallon samples were obtained from the surface and at depths of 50, 100, 200, 300, 500, 750, 1600, 2000 and 2400 meters. The samples were processed aboard ship to remove the dissolved carbonate fraction and later sent to the University's Radiocarbon Dating Laboratory for analyses.

B 8. References

Knauss, J.A. (1963), Equatorial Current Systems, in The Sea, ed. M.N. Hill, 2, 235-252, (Interscience Publishers, New York - London)

Neumann, G. and W.J. Pierson, Jr. (1966), Principles of Physical Oceanography, (Prentice - Hall, Inc., New Jersey).

APPENDIX C CORING STATION SUMMARY

Position Number	Location Lat. - Long.	Depth (meters)	Core Length(cm)	Pilot Core Length(cm)
1059	36° 02'S - 133° 53'W	3236	187	--
1089	35° 54'S - 109° 51'W	2850	201	--
1093	35° 59'S - 108° 28'W	3374	229	52
1096	36° 04'S - 107° 11'W	3437	110	45
1097	36° 02'S - 106° 46'W	3595	130	46
1440	39° 01'S - 102° 01'W	3994	164	51
1449	39° 01'S - 102° 43'W	3952	98	37
1465	39° 00'S - 103° 32'W	3889	134	59
1473	39° 00'S - 104° 07'W	3737	236	51
1503	38° 59'S - 107° 30'W	3509	246	53
1504	38° 59'S - 107° 33'W	3540	203	28
1506	39° 04'S - 107° 34'W	3548	233	--
1520	38° 58'S - 107° 54'W	3510	149	57
1521	39° 02'S - 108° 33'W	3397	219	47
1528	38° 56'S - 109° 06'W	3074	214	55
1534	39° 01'S - 109° 44'W	3170	177	54
1540	39° 01'S - 110° 31'W	2811	184	53
1549	38° 58'S - 111° 21'W	2754	159	46
1560	39° 00'S - 111° 51'W	2924	136	54

APPENDIX C (continued)

Position Number	Location Lat. - Long.	Depth (meters)	Core Length(cm)	Pilot Core Length(cm)
1567	39° 01'S - 112° 26'W	2922	207	52
1575	39° 01'S - 113° 01'W	3302	142	42
1582	39° 02'S - 113° 43'W	3337	233	57
1590	38° 58'S - 114° 38'W	3431	200	51
1597	39° 01'S - 115° 05'W	3530	49	50
1598	39° 02'S - 115° 06'W	3548	269	--
1779	13° 37'S - 095° 36'W	3811	121	30
1796	13° 37'S - 093° 44'W	3784	93	54

Note: Cores are archived at the University of Washington in the Department of Oceanography's Marine Sediment Library.

APPENDIX D HEAT FLOW STATION SUMMARY

Position Number	Location Lat. - Long.	Type of Equipment	Heat Flow µcal/cm sec
1088	35° 52'S - 110° 09'W	Lister - Probe	4.0
1089	35° 54'S - 109° 51'W	ESSA - Outrigger	2.7
1090	35° 53'S - 109° 31'W	Lister - Probe	3.2
1091	35° 53'S - 109° 10'W	Lister - Probe	1.4
1092	35° 55'S - 108° 50'W	Lister - Probe	3.3
1093	35° 59'S - 108° 28'W	ESSA - Outrigger	3.1
1094	36° 02'S - 108° 07'W	Lister - Probe	0.5*
1095	36° 02'S - 107° 41'W	Lister - Probe	2.0
1096	36° 04'S - 107° 11'W	ESSA - Outrigger	1.9
1097	36° 02'S - 106° 45'W	ESSA - Outrigger	3.9
1098	36° 00'S - 105° 59'W	Lister - Probe	2.7
1504	38° 59'S - 107° 33'W	MIT - Outrigger	0.79
1521	39° 02'S - 108° 33'W	MIT - Outrigger	2.08
1528	38° 56'S - 109° 06'W	MIT - Outrigger	2.32
1534	39° 01'S - 109° 44'W	MIT - Outrigger	4.32
1540	39° 01'S - 110° 31'W	MIT - Outrigger	4.05
1549	38° 58'S - 111° 21'W	MIT - Outrigger	1.50
1560	39° 00'S - 111° 51'W	MIT - Outrigger	2.81
1567	39° 01'S - 112° 26'W	MIT - Outrigger	3.71

*Surface sediment colder than bottom water.

Position Number	Location Lat. - Long.	Type of Equipment	Heat Flow μcal/cm sec
1575	39° 01'S - 113° 01'W	MIT - Outrigger	1.17
1582	39° 02'S - 113° 43'W	MIT - Outrigger	1.48
1590	38° 58'S - 114° 38'W	MIT - Outrigger	1.62
1597	39° 01'S - 115° 05'W	MIT - Outrigger	2.40
1598	39° 02'S - 115° 06'W	MIT - Outrigger	4.10
1796	13° 37'S - 093° 44'W	MIT - Outrigger	1.91

APPENDIX E GRAVITY BASE TIE SUMMARY

Place	Date	Meter	Sea-level Grav. (gals)	Zero Meter Grav.	Drift (mgals)
PMC	30 Dec.	38.150	980.7428	976.8401	-----
PMC	12 Jan.	38.290	980.7428	976.8257	-14.4*
Papeete	26 Jan.	18.300	978.7123	976.8402	14.5
Papeete	30 Jan.	18.300	978.7130	976.8409	0.7
Valparaiso	27 Feb.	27.285	979.6349	976.8436	2.7
Valparaiso	9 Mar.			976.8456	2.0
Guayaquil	31 Mar.			976.8462	0.6

* This reading appears to be spurious. The second base tie in Papeete, Tahiti shows negligible drift. No tares had occurred and the gravimeter showed no drift. Therefore, the base tie made in Seattle on 30 December 1969 was used instead of the 12 January 1970 base tie.

Trackline Gravity

Leg I	Seattle to Tahiti	3,737.8
Leg II	Tahiti to Valparaiso	6,632.0
Leg III	Valparaiso to Guayaquil	4,683.3
		15,053.1 Lin. Naut. Miles

Trackline Magnetics

Leg I	Seattle to Tahiti	3,730.6
Leg II	Tahiti to Valparaiso	6,584.1
Leg III	Valparaiso to Guayaquil	4,695.3
		15,010.0 Lin. Naut. Miles

Trackline Soundings

Leg I	Seattle to Tahiti	3,737.8
Leg II	Tahiti to Valparaiso	6,827.2
Leg III	Valparaiso to Guayaquil	5,219.0
		15,784.0 Lin. Naut. Miles

BT lowerings (Expendable)	36
Bottom sample, cores - more than 1000 m	27
Heat flow - (Needle Probe)	7
(Outrigger)	18
Meteorological observations	208
Oceanographic Stations occupied	34
Photography, underwater - more than 1000 m	2 stations
Radionuclide water samples	9

APPENDIX F (continued)

Sub-bottom profile	1200 Lin. Naut. Miles
Water samples analyzed, salinity	36
Water temperature observations	continuous

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