

NATIONAL INSTITUTE OF OCEANOGRAPHY

(Council of Scientific and Industrial Research)

DONA PAULA, GOA-403 004, INDIA



REPORT ON 73rd OCEANOGRAPHIC CRUISE OF O.R.V. SAGAR KANYA (HYDROSWEEP SURVEY CRUISE)

Project : POLYMETALLIC NODULES

Chief Scientist : GOVIND RANADE
Project Leader : R. R. NAIR

Cruise Period : 25th April, 1992 — 27th May, 1992

CRUISE REPORT FOR CRUISE SK73
ON BOARD ORV SAGAR KANYA.

ITINERARY:

DEPARTURE:	24.04.1992	N.I.O.	1300 HRS.
BOARDING:	24.04.1992	MARMAGOA	1500 HRS.
ETD:	25.04.1992	MARMAGOA	1700 HRS.
ETA:	27.05.1992	MARMAGOA	1030 HRS.
ARRIVAL:	27.05.1992	N.I.O.	1400 HRS.

LIST OF PARTICIPANTS FROM SCIENTIFIC CONTINGENT:

FROM NIO HEADQUARTERS, DONAPAUOLA GOA:

Sr.No.	Name	Designation
1.	Shri GOVIND RAMADE	Chief Scientist.
2.	Shri T. RAMAPRASAD	Scientist C
3.	Shri SANJEEV APZULPURKAR	Scientist C
4.	Shri A. K. CHAUBEY	Scientist C
5.	Shri TATA SUDHAKAR	STA
6.	Shri R. VENKATESHAN	STA
7.	Shri P. GANESAN	STA
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9.	Shri PIUS GEORGE	JTA
10.	Shri S. JAYSHANKAR	JTA
11.	Shri N. SUKUMAR	JTA
12.	Shri PRAMOD KUMAR	SHIPBOARD TRAINEE
13.	Shri C. RAVI	-- DO --
14.	Shri SUBRAMANIAM	-- DO --
15.	Shri G. CHANDWALE	-- DO --

FROM RC COCHIN:

16. Shri T. J. THOTTAM STA

FROM CMC:

17. Shri HARISH WAGLE CMC

FROM GSI:

18. Shri J.E. SINHA GSI

19. Shri C. CHITTIBABU GSI

CRUISE REPORT.

INTRODUCTION: The cruise SK-73 onboard ORV Sagr Kanya was taken up under the project 'Survey for Polymetallic Nodules'. In order to obtain detailed bathymetry information for the allotted mine-site and to decide on relinquishing of the part of the allotted area, Multibeam Swath Bathymetry System procured by NIO for this purpose under DOD grant-in-aid project was used. Along with the HYDROSWEEP system an additional data on GRAVITY and MAGNETICS was also collected in this cruise. A water sampling station was carried out for the purpose of studying the radio active trace elements. Prior to the beginning of the cruise area between 10 35 S and 16 45 S to 74 E and 74 55 E was to be covered. The programme was changed as 4 ship days were lost due to diversion vessel to COCHIN. A total of 28 lines, 18 lines of 75 nautical miles and 10 lines of 160 nautical miles respectively were covered along with a water sampling station.

Equipment used:

Multibeam Swath Bathymetry System is a unique type of equipment for bathymetry data acquisition, covering large areas in a short time, compared to the conventional equipment like an echosounder. HYDROSWEEP, the multibeam Swath bathymetry system, provides a swath coverage of double the water depth in transverse direction. The transmission is facilitated through two transducer arrays, one in the longitudinal direction and the second in transverse direction in a planar T configurational. The arrays can be interchanged for transmission and reception functions as they are identical. This interchanging facility is made use of for calculation of raybend-

ing parameters, by comparing the measurements made for the centre beam in transverse mode (survey mode), with those obtained in the fore-aft mode (calibration mode), by means of interactive computation. A fairly accurate mean sound velocity through water column can be obtained by this procedure, which is used in depth calculations from outer beams (oblique angles) which are corrected for refraction effects.

Transmitted and received beams are compensated for roll, pitch and heave motions of the vessel. This electronic beam steering process ensures that the received and processed data is stabilized against any movement of the ship and is position corrected.

A powerful processing system based on bit sliced processor architecture and around various sub processors (8088 based) which provides highly reliable bathymetry data, forms the heart of the system. It uses beam forming technique to obtain 59 performed beams, by using digital delay lines.

The calculations for horizontal distances, cross track deviations and to provide relative position for each depth point, the navigation data is interfaced to this system from the ships INS. With GPS also being interfaced to the INS, positioning has been very accurate.

The operator console provides the man machine interface required to initiate different control commands and required input data information like C keel values, gain level changes and peripheral control commands. All the data acquired by the system is logged on to the magnetic tapes of 1600 bpi density for further

data processing. The system operating frequency is 15.5 KHz. The accuracy of the system is better than .05 percent.

HYDROMAP:

The Hydromap system is used to post process the hydrographic measurements values that have been recorded with the Hydrosweep system. This facilitates, data input from tape to Hydromap system, position post processing, profile data or track data generation, 3D map generation and grid generation. The system is designed with EPR 1300 process computer, which has a bit slice architecture. A series of system programs like file manager (*FM) job generator (*JG), screen editor (*BTE), system operator (*SO), FORTRAN compiler and a FORTRON compiler, along with different functional programs for, position post processing, track data processing, area data processing, profile editing for specious data editing, banking editor for making off missing points, 3D map generation on graphic colour monitor provided with the system makes it a very powerful tool for postprocessing of hydrographic measurements.

The system comprises of Data Processing Console with computer interfaces for alphanumeric key board, monitor, graphic colour (VGA) monitor, magnetic tape drive for inputting of data, a colour matrix painter and a HP Draftmaster plotter.

System Performance:

The HYDROSWEEP system worked satisfactorily during entire survey

period. GPS was not available on few occasions for about 30 to 45 minutes, in survey area. In case of magnetometer, due to water seepage in to the cable, was hauled up twice to dry the cable and patch up cuts on the cable. The magnetics data was noisy due to this problem. Gravimeter functioned satisfactorily.

SURVEY DETAILS:

After boarding the vessel on 24.4.1992, sailing was postponed to 25.4.1992 due to delay in bunkering. On sailing and crossing 5 degrees N, the vessel was turned back to Cochin to disembark a sick crew. The HYDROSWEEP was started and tested completely prior to reaching the survey area. Survey started on 5.5.92 for line 7301. Weather was bad during most of the survey period. On completion of line 7321 it was noticed on completion of dataprocessing that for a large portion of line 7308 data was not recorded on the tape due to time and date jump in the INS. This portion was repeated. Considering the weather condition and reduced ship speed in the middle of the survey and due to repetition of line 7308 it was thought that for longer lines the area could be covered only upto 1245 S. Later on reassessing the situation it was felt that area upto 1310 S could be covered.

Water sampling station was carried out at location 12 degrees south and 74 30 east. Water cast was lowered three times to collect water samples at different depths up to 4700 meters. Required preliminary chemical analysis was also carried out onboard.

On the return journey, a topographic high shown on the navigation chart was surveyed. No such feature could be identi-

fied within a radius of 6 to 7 nautical miles of the apparant location.

RESULTS:

A: BATHYMETRY:

During the cruise the multibeam bathymetric surveys were carried out in two segments.

1. From 10 035, to 110 50, S latitudes and between longitudes 720 35, E and 740 05, E, and
2. from 100 35, to 130 10, S latitudes and between longitudes 740 10, E and 750 E.

The survey lines were five miles apart and were traversed in N-S direction. The depths in the western segment ranged between less than 3600 meters to more than 5400 meters. The bathymetry in general shows a distinct variation in the seafloor fabric from a very rugged to a gentle seafloor from western to eastern segment. In the North-Western corner of this segment a nearly north-south running ridge like feature rises to about 3800 meters which abuts a parallel linear trough of 6000 meters deep to the west. In the east it is adjoining a parallel ridge-trough feature of reducing amplitudes about 5400 meters deep. In the south-western corner a topographic high of 3800 m depth is encompassed by the curvilinear fabric of highly rugged topography. A nearly circular seamount of about 5 nautical mile radius and 1500 m height rising from the seafloor at a depth of 5400 m, is located at 110 03' E. The 730 E longitude forms a boundary to the rough topography seafloor having oblique features trending N 1450 E, to comparatively smoother

topography with alternative ridge-trough sequences trending N 95° E. Towards east of the area the seafloor is characterised by ridge-trough parallel fabric running roughly N 95° E.

Two parallel-running features occur separated by about seven nautical miles disrupting the ridge-trough parallel fabric. This dual feature probably represent two fracture zones striking approximately N 10° E. The seafloor east of this fracture is less rugged when compared to that in the west. The contours representing linear features perpendicular to these fracture zones, turn into the fracture zones, indicating the lateral movement of the seafloor towards south. The intensity of this process is decreasing towards north when compared to the southern portions. Three pinnacles of about 600-700 m are noticed at 10° 55' S and 73° 55' E, forming the corners of a right angle triangle.

In the east segment the general bathymetry is more or less smooth with depths varying from 4900 to 5100 m. In the south-east quadrant of the survey eight seamounts of varying heights from 400 to 600 m are noticed. These seamounts follow a linear pattern.

B:MAGNETICS DATA:

The total magnetic intensity data was collected for most of the lines using EG&G proton precision magnetometer. Due to high frequency noise in the data due to improper shielding, the data is needed to be filtered. However this data exhibits a series of moderate frequency anomalies of the order of 200-300nT. An anomaly lineation of about 600-800nT is noticed between latitudes 10° S to 11° S. Parallel to 12° 45' S latitude a magnetic lineation of 500-600nT is observed.

GRAVITY DATA:

The gravity data was collected using Bodensewerk KS30 marine gravimeter. Since the frequent change in course of the vessel was required, for hydrosweep operation, it induced large large values in X and Y acceleration components. This has resulted in high frequency noise in the gravity data. Before giving any interpretation based on this data, a data filtering and processing technique will be applied.

