

NATIONAL INSTITUTE OF OCEANOGRAPHY
(Council of Scientific & Industrial Research)
Dona Paula – 403 004, Goa

XXVIII Oceanographic Cruise Report

of

ORV SAGAR KANYA

NATIONAL INSTITUTE OF OCEANOGRAPHY
(COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH)

DONAPAULA-GOA 403 004

REPORT ON

28 TH OCEANOGRAPHIC CRUISE OF ORV SAGARKANYA
(15 TH DECEMBER 1986 TO 14 TH JANUARY 1987)

SAGARKANYA CRUISE 28

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PARTICIPANTS

1. S/SRI V.N.KODAGALI Chief Scientist
2. R.MUKHOPADHYAY
3. RAHUL SHARMA
4. MISS PRATIMA JAUHARI
5. S/SRI K.SHRIKRISHNA
6. ANIL KUMAR CHAUBEY
7. B.CHAKRABORTY
8. V.D.KHEDEKAR
9. G.JANAKIRAMAN
10. K.M.SHIVKHOLUNDU
11. S.S.GAONKAR
12. C.PRABHAKAR S.MURTHY
13. ANTHONY JOSEPH MICD
14. R.BRAGANZA GOA UNIVERSITY
15. JOSEPH DESOUZA -DO-

SHIP'S COMPLEMENT

J. S. BAWA	MASTER
GURDEEP SINGH	CHIEF OFFICER
A. KUMAR	2ND OFFICER
R. IYER	3RD OFFICER
J. COUTINHO	4TH OFFICER
KRISHNAN	CHIEF ENGINEER
R. K. DIWAKAR	3RD ENGINEER
A. SARASWAT	4TH ENGINEER
R. NAIR	5TH ENGINEER
P. S. DHILLON	ELECT. OFFICER
CORNEIRO	CH. CATERING OFFICER

OBJECTIVES

1. Detailed bathymetrics survey at seamount -Central Indian Ocean Basin
2. Free fall grab sampling -Central Indian Ocean Basin.
3. Geophysical surveys (echosounding, magnetics, gravity) at southern portion of 90 deg. east ridge area.

SUMMARY

Based on the previous cruises of RV GAVESHANI, MV SKANDI SURVEYOR, MV FARNELLA, MV GA REAY and ORV SAGARKANYA area of detailed exploration for Polymetallic nodules in Central Indian Ocean basin is identified. Closer grid (7.5 nautical miles interval) free fall grab sampling was done in present cruise in this area. Total 11 stations were covered by free fall grab sampling. 4 samplers were lowered in each station one of which was with a Camera.

In Central Indian Ocean a seamount was located and detailed echosounding and magnetic survey was carried out to know the extent and orientation of the seamount.

Geophysical surveys (echosounding, magnetics and gravity) was carried out in the 90 deg. east ridge area (2 deg. south to 7 deg. south latitude.)

Quantum of data collected is as under.

a. Underway data.

1. Echosounding - 11,600 lkm
2. Magnetics - 7361 lkm.
3. Gravity - 7670 lkm.

b. Free fall grab sampling.

1. stations -11

2. Total FFG -44

3. Photo Grabs- 12

Operations with abundance <1 kg/sq.m ----25

Operations with abundance 1-5 kg/sq.m ----06

Operations with abundance >5 kg./sq.m ----13

1.0 INTRODUCTION

The present cruise was planned to carry out 5 days of detailed sampling and echosounding work in Central Indian Ocean Basin and 12 days detailed geophysical surveys at 90° east ridge area.

Project Surveys for Polymetallic nodules was initiated after successful collection of nodules in the Arabian Basin by RV GAVESHANI in 1981. Ships like RV GAVESHANI, MV FARNELLA, MV SKANDI SURVEYOR, ORV SAGARKANYA were utilised to speed up the exploration- free fall grab sampling, echosounding and bulk sample collection work. In the present cruise of Sagarkanya, Free fall grab sampling at closer intervals (7.5 nautical miles) at 11 stations was planned. Detailed bathymetric survey around a seamount was also planned.

90° east ridge, the aseismic ridge in the Indian Ocean has been a place of interest for Geologists and Geophysicists for long. The southern portion of the ridge (2° South to 7° south latitude) was chosen for detailed geophysical surveys (echosounding, gravity and

magnetics) in the present cruise. 5 E-W lines each of 300 nautical mile length and 3 cross lines survey was planned.

ITINERARY

15-12-1986	1745	DEPARTURE MARMAGAO
14-01-1987	1030	ARRIVAL MARMAGAO

2.0 WEATHER

Weather during the cruise was by and large pleasant. Generally the sea state was in the range 2-3. Windspeed 7-10 knots and wave height 1-2 m. Same type of weather prevailed both in Central Indian Ocean Basin and 90⁰ east ridge areas. The sea was rough for only 3-4 days when seastate was 4-5 and wind speed 20 kn. Journey from CIOB to 90 deg. east ridge was marked by heavy rains for about 4-5 days. Other days there were occasional rains. During the return journey in coastal waters sea was calm and sky clear:

3.0 POSITION FIXING

The ship has integrated Navigation system for accurate position fixing. There were some problems with the new software of INS. No automatic line change was occurring. Beyond 999 m. depth INS interpreted depth incorrectly thus recording wrong depth on the tape. The Head Quarter was informed in detail regarding the problems faced. Magnavox MX 1105 single channel satellite navigator (with

Omega) was hence used during this cruise. Printer was utilised to get half hourly print out of the position. The MX 1105 system is programmed to reject unsatisfactory (With very high or very low elevations) passes and update only reliable passes. About 10-15 good passes were received daily. Magnavox 1107 dual channel satellite navigator was also in operation. Both MX 1105 and 1107 worked trouble free all through the cruise.

4.0 BATHYMETRY

A total 11,600 line km. was covered by echosounding during the present cruise. Echosounding was carried out using the HONEYWELL ELAC Deep Sea Echosounder. In the survey area the range of the analogue record was adjusted to 2000 m. In very shallow (coastal) waters the shallow water echosounder was used.

a. Bathymetry to and fro Marmagao.

During journey from Marmagao to Central Indian Ocean Basin a track parallel to the west coast of India, till ship reached Off Trivendrum was followed. Depth till this point was in the range 35-55 m. only. Fix 79 onwards depth increased steadily from 120 m to 3250 m at F-127. Depth came down gradually to 5000m at F-237. As the ship entered the survey area the depth was still more.

The return journey to Marmagao commenced from 90 deg. east ridge area- F-1020 (Depth 5035 m.) Depth was in the range of 5000-4700 m. till fix 1060 m. F-1060 to F-1072 the ship crossed the Afonesi-Niketin Seamount, the shallowest point of which was 2900 m. (F-1069)

F-1072 to F-1158 the depth was in 4900-4000 m. range. From here onwards up to F-1178 (6° N latitude) the depth shot up to 2200 m. The shelf break was encountered from this fix to F-1183 Depth coming up to 175 m. suddenly from 2220 m. F-1188 onwards the track followed was parallel to West coast of India depth was in 30-45 m. range till ship reached outer anchorage Marmagao.

b. Bathymetry CIOB

A uncharted seamount of height 1200 m. was located at 10° 22' S and 80° 02' E. Detailed bathymetric and magnetic/gravity survey was done at this seamount. 4 N-S lines and 5 E-W lines were covered by survey which helped in demarkating the extent and orientation of seamount. The seamount is approximately NNE-SSW trending. Detailed study of the echograms from this seamount area is being carried out.

At the free fall grab sampling sites the bathymetry varied considerably. Average depth was 5100 m. Two of the stations- 335 and 336 were at shallower depths 4800 and 4900 m. respectively. Depth in station 332 was more (5303 m.). Within individual stations the seafloor was comparatively plain.

5.0 SEABED SAMPLING

5.1 Free fall grab sampling

Sampling for polymetallic nodules at 7.5 nautical mile interval was done using free fall (Boomerang) grabs. Total of 11 stations were sampled with 4 grabs in each lowered in a square pattern. One of these four used to be a photo boomerang grab.

Of the total 44 operations (12 PEG) 25 had 1 kg/sq.m abundance, 6 had abundance between 1 and 5 kg./sq.m. and 13 operations yielded more than 5 kg/sq.m abundance. At stations 337 C maximum abundance of 16.307 kg./sq.m. was observed. Average depth in stations is about 5100 m and most of the stations were on plain area.

5.2 Van Veen Grab

One operations for collecting sediment samples (station 339) was done at 90⁰ E ridge area on the ridge crest. (depth 3400 m.) As there was not much of deep sea winch wire the operation could not be carried out at deeper depths (on flanks and bases of the ridge). ORE Finger was used to get the distance of grab from the seabed. though the grab closed, unfortunately no sediment sample was obtained. Probably there was not much of sediment cover on the ridge crest.

6.0 GEOPHYSICAL SURVEYS AT 90⁰ EAST RIDGE AREA

Bathymetry, magnetic and gravity survey were carried out along the east-west and northwest-south east profiles on the 90 deg. east ridge area. About 2800 lkm each of bathymetric, magnetic and gravity data was collected. The preliminary report of the surveys is as under.

Bathymetry: Bathymetric survey was carried out by deep sea echosounder (Honeywell Elac). The analogue recordings of the data were done on a 10" wide electrostatic paper. The depth varied from 2500-5500 m. Along the east-west lines, the ridge crest and the rift valley were clearly identified. The trend of the ridge system is

almost north-south. A vanveen grab sediment sampler was used on the ridge crest but no sample was obtained.

Magnetics: Earth's total magnetic intensity values were collected with Geotrix, model G801/3 proton precision magnetometer. The sensor of the magnetometer was towed about 250 m. astern of the ship to avoid magnetic disturbances due to ship's material. The total magnetic field of the earth varied between 42000 nT to 44300 nT in the survey area. A pronounced magnetic field intensity was observed over the ridge axis on all the profiles. This may be associated with a block of strong magnetizing material. A typical seafloor spreading type of anomaly was also observed over the sides of ridge axis.

Gravity: Gravity surveys along the profiles were carried out with KSS-30 Bodenswerk gravitometer. The system consists of a GSS-30 Gravity sensor system, KT 30 stabilization subsystem and ZE-30 data handling system. The data were printed at 60 seconds interval with the teletype printer. The analogue data of free air anomaly and gravity value were recorded on the Phillips dual channel recorder with 10" wide chart paper. Digital raw gravity value along the navigation track was recorded on magnetic tape by the navigation computer at every 30 seconds. The free air anomaly varied from -40 mgal to +30 mgal. Raw gravity varied from -2415.0 mgal. to -2670.0 mgal. There is generally a strong correlation between free air gravity anomaly and bathymetry over ridge and flanks. Positive free air anomaly was observed over the ridge axis. The detailed processing

and interpretation of the data is in progress to study seafloor spreading anomaly and isostatic mechanism.

7.0 LOSSES AT SEA

One free fall grab with a radiomarker was lost at station 329 during the cruise. This was the only loss out of 44 Free fall grab operations. Fully charged radiomarker was used for the grab which was lost. Mandatory search for over 6.5 hours was carried out for this grab but it did not pop up at all.

8.0 RECOMMENDATIONS

1. The narrow beam echosounder was not working during the cruise. In cruises like this where the thrust is on collecting echosounding, gravity and magnetic data, it is essential that the NBS works.

2. Deep sea winch though working satisfactorily for the only operation for which it was used, was not showing the tension on the wire. Even the electronic counter in starboard dry laboratory during heaving up of grab did not work properly. The winch wire is not sufficient for deep sea operations. These all problems should be rectified.

3. INS, Gravimeter and magnetometer all had some problems. Detailed report was sent to Head Quarters time to time regarding the problems faced.

4. More number of scientific and general books should be added to the ship's library.