

Report on Oceanographic Cruise of O. R. V. Sagar Kanya

CRUISE No. 72

12th February to 17th March, 1992



**National Institute of Oceanography
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NATIONAL INSTITUTE OF OCEANOGRAPHY
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REPORT ON
SEVENTY SECOND OCEANOGRAPHIC CRUISE
ORV SABARKANYA
(12 TH FEB, 1992 - 17 TH MAR, 1992)

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REPORT ON OCEANOGRAPHIC CRUISE OF
ORV SAGARKANYA
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SHIP'S COMPLIMENT

1.	Capt. F.N.Behre	Master
2.	Sri. A.P.Majundar	Chief Officer
3.	" Suresh George	Navigation Officer
4.	" D.Bhaskaran	
5.	" J.C. Ghosh	Radio Officer
6.	" Shiju Thomas	Trainee Radio Officer
7.	Dr. S.Gokulnath	Medical Officer
8.	Sri. M.A.R. Mohammed	Purser Officer
9.	Sri. P.K.Ghosh	Chief Engineer
10.	Sri. M.Talapatra	2 nd Engineer
11.	Sri V.Raina	3 rd Engineer
12.	" R.Srinivas	5th Engineer
13.	" K.A.Simon	Elec. Officer
14.	" B.G.Patel	Elec. Officer
15.	" M.F.Rodrigues	Catering Officer
16.	" L.C.Dias	Asst. Cat. Officer

3.0

SUMMARY

The Cruise covered an area of about 0.108 million km², in northern Bay of Bengal between latitudes 08° and 15° 20' and longitudes 80° and 90° 30' E (Fig.1). During the cruise about 8060 lkm of bathymetric gravity total magnetic intensity and 80 lkm of multichannel seismic reflection data were collected along six SE-NW trending tracks and one E-W profile along 12° N parallel. The depths in the area vary from 40 m to 3600 m. Several seafloor channels, microtopographic variations were noticed in study area. The magnetic anomaly depicts some NE-SW trending magnetic lineations probably corresponds to the early Mesozoic crust. The gravity data indicate that the shelf margin basins is associated with a large amplitude negative free-air gravity anomaly. However the 85° E ridge is characterized by prominent negative free-air anomaly.

Multichannel seismic reflection system was operated satisfactorily and data was recorded on a digital tape across 85° ridge. Due to the problem generated in EPC Analog recorder, the single channel near trace monitor record could not be obtained.

Apart from the geophysical data, one deep sea core was collected north of Ninetyeast Ridge and five Ocean Bottom Magnetometer were deployed on either sides and crest of the 85° ridge, and two on the eastern continental margin of India, west of 85° E Ridge.

Deep sea coring work could not be completed as per the schedule. This was due to the failure / malfunctioning of deep sea winch and Storage winch. Due to the non synchronization of the winches the

18 mm wire rope got several kinks during one of the core operation and it was cut and long spliced for retrieving the corer with attached weights.

INTRODUCTION

4.1 Back Ground : As a part of National Institute of Oceanography's programme of Geological and Geophysical studies in Bengal Fan, ORV Sagarkanya had carried out sampling, gravity, magnetic and seismic data along 13 and 15 latitude and gravity & magnetic data on a small grid off Madras. Subsequently, in 1989-'90 DSV Nanda Rachit was chartered by NIO, GOA and was deployed to collect the bathymetry and magnetic data along the predetermined tracks. The geophysical data thus collected on board Nanda Rachit indicated the presence of some linear magnetic anomalies. The NNE-SSW trending magnetic lineation appears to be one of the Mesozoic anomaly lineations. It is with this background the present cruise was planned to investigate the nature of the crust and establish some of the Mesozoic lineations.

4.2 Quantum of work :

During the cruise following data were collected

- | | | |
|-----------|--|------------------------|
| 4.2.1 (a) | Echo sounding | 8060 lkm |
| (b) | Gravity | 8060 lkm |
| (c) | Magnetics | 8060 lkm |
| (d) | Multichannel Seismic | 80 lkm reflection data |
| (e) | Deep Sea Core | one |
| (f) | Deployment of Ocean Bottom Magnetometers | 5 Nos |

4.3 Itinerary

Dep : Madras 12- 02 - 1992

Arr : Mormugao 17- 03 - 1992

5.0 Results of Survey

5.1 Position fixing by GPS:

Navigational information was also logged along with all geophysical data in Integrated Navigation System (INS Series 5000). The WGS - 72 Satellite datum was used for system datum. Navigational information for INS was derived mainly from Global Positioning System (GPS). GPS positioning system popularly known as NAVSTAR (Navigation system with Time And Ranging) consists of satellite circle the earth in nominally 20,200 km (10,900 nautical miles) orbits. Each satellite has an orbital period of 12 hours. They transmit signals to both the control segment and the user segment. The control segment monitors the satellite and transmits the corrected ephemerides, constellation almanac, corrected time to the satellites. The user position is determined by taking time of arrival (TOA) measurements on the satellite signal, and the use of the satellite ephemerides to calculate the position of each satellite being tracked, at the precise time of transmission of its signal. The TOA at the receiver is determined, to within the clock bias of the signal, by synchronization of the receiver with the C/A code generated by the satellite. The receiver can then calculate pseudo - range by scaling the sums of the signal propagation delays and clock bias by speed of light. This range is called pseudo - range because of clock errors of the receiver and satellite clocks. Information on the satellite clock bias

contained in the signal from the satellite allows correction of pseudo-range by accounting for the effect of clock bias in the satellite clock.

By using three satellites and known height, or four satellites when height is unknown, for a position solution, the clock bias for the receiver clock can be determined.

Velocity is calculated by making Doppler measurements on the carrier frequency of the broadcast signal. Each set of four Doppler measurements is processed to calculate three - dimensional velocity. Navigation is accomplished using the Kalman Filter, which is a software - based navigation model stored in the receiver. It predicts and produces a continuous navigation solution based on the TOA and Doppler measurements.

In MAGNAVOX MX 4400 GPS receiver position can be obtained in the following three modes.

- * Four satellites being tracked: Latitude, Longitude, Altitude (height) and time being obtained from the satellites.
- * Three satellites being tracked: Latitude, Longitude and time being received from the satellites: Altitude is fixed or input of altitude supplied by manually or ext. devices.
- * Two satellites being tracked: Latitude, Longitude only being received from satellites: by Altitude and clock aiding (time).

During the cruise the GPS set was used in the ALT - HOLD mode. In this mode three satellites are used in the position determination of vessel as altitude (i.e antenna) height fixed from the sea level.

Position fixing by Magnovax 1107: The satellite navigation system (Magnovax 1107) was also used for position fixing. Satellite

transmits information, as a function of time, about its position relative to the centre of the earth. By measuring the change of the Doppler frequency of the received signals as the satellite approaches, passes and recedes, it is possible to fix the position of the ship relative to the satellite and hence precise position of the observation. Between the two satellite fixes the positions were obtained under a dead reckoning mode.

5.2 Echosounding: The data was collected with 12 khz deep sea Elac echosounder. The depth in the area surveyed range from about 40 m to 3600 m. Turbidity channels exist between 85° E longitude and west of Ninetyeast ridge, and are seen conspicuous from north to south. Most of the study area is having smooth topography except in the near shore regions off Madras.

5.3 Magnetics: During the cruise earth's total magnetic field intensity was measured along the tracks using a Geometrics proton precession magnetometer. The sensor was towed approximately 200m stern of the ship to avoid the ship's noise. The data were recorded continuously in analog form with sampling interval 6 sec. The earth's total intensity magnetic field in the study area varies between 40321 nT to 41713 nT. The stacked anomaly shows the anomaly resembling sea floor spreading magnetic anomalies. A close study of the these anomalies and their comparison with Mesozoic anomaly sequences indicate that the anomalies M2 to M4 on the Eastern side of the 85° E ridge and M9 to M11 on the western side of the 85° E ridge. Further it seems around M12 time India might have separated from Australia.

5.4 Gravity: The gravity data was collected along six traverses using the sea gravimeter system KGS 30, which consists of GSS 30

gravity sensor subsystem, KT 30 stabilization subsystem and data handling subsystem. Along the profile No.3, the free air gravity field varies from -65 mgal to +4 mgal. The -65 mgal anomaly was observed over the shelf break region. After shelf break towards offshore the field gradually raises to a maximum of about -15 mgal probably indicating the crustal thinning. On the 85 E Ridge a low a broad mgal was observed. Further, the field gradually rises towards offshore end. Towards offshore the free air gravity shows highs and lows may be due to the density variations in the crustal layers.

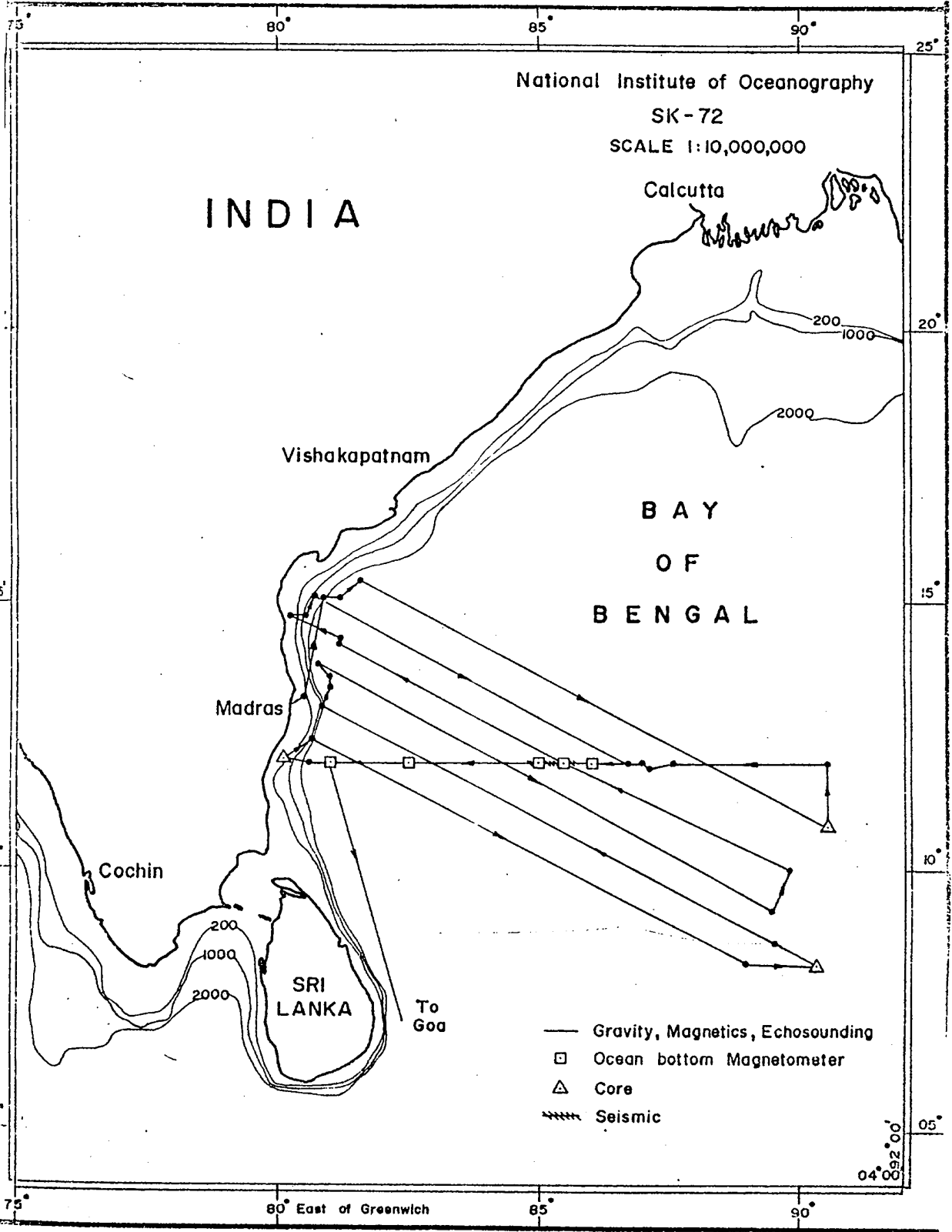
Between 85 E ridge and 90 E ridge broad free air gravity highs and lows are observed. Some of the these highs and lows may be attributed to the effect of overlying sediments. 5.5 Multichannel Seismic reflection measurements: 24 channel seismic reflection data was collected across 85 Ridge using 7 gun D-array (6 litre capacity, 150 bars pressure).

5.6 Sampling : One box core was collected north of 90 E Ridge approximately 11 N latitude and subsampling at 2 cm/5 cm was carried out after logging the core.

5.7 OBM Operations : Five Ocean Bottom Magnetometers were deployed on 12 N parallel between 81 -86 E Longitudes and were retrieved safely onboard after three weeks of their deployment.

6.0 ACKNOWLEDGEMENTS:

The Chief Scientist and all the members of the scientific team would like to express their sincere thanks to Captain Behere, Master and other Officers and crew members of ORV Sagarkanya for their excellent cooperation for the completion of the cruise.



National Institute of Oceanography

SK-72

SCALE 1:10,000,000

INDIA

Calcutta

Vishakapatnam

BAY
OF
BENGAL

Madras

Cochin

SRI
LANKA

To
Goa

- Gravity, Magnetics, Echosounding
- Ocean bottom Magnetometer
- △ Core
- ~~~~~ Seismic

04° 09' 00" 05°'

80° East of Greenwich