

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

**CRUISE No. 45**

**4th to 26th October, 1988**



**National Institute of Oceanography  
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REPORT ON  
45TH OCEANOGRAPHIC CRUISE OF  
O.R.V. SAGAR KANYA

(4 to 26 October 1988)

**REPORT ON THE OCEANOGRAPHIC CRUISE**

**OF ORV SAGAR KANYA**

**(CRUISE NO.45)**

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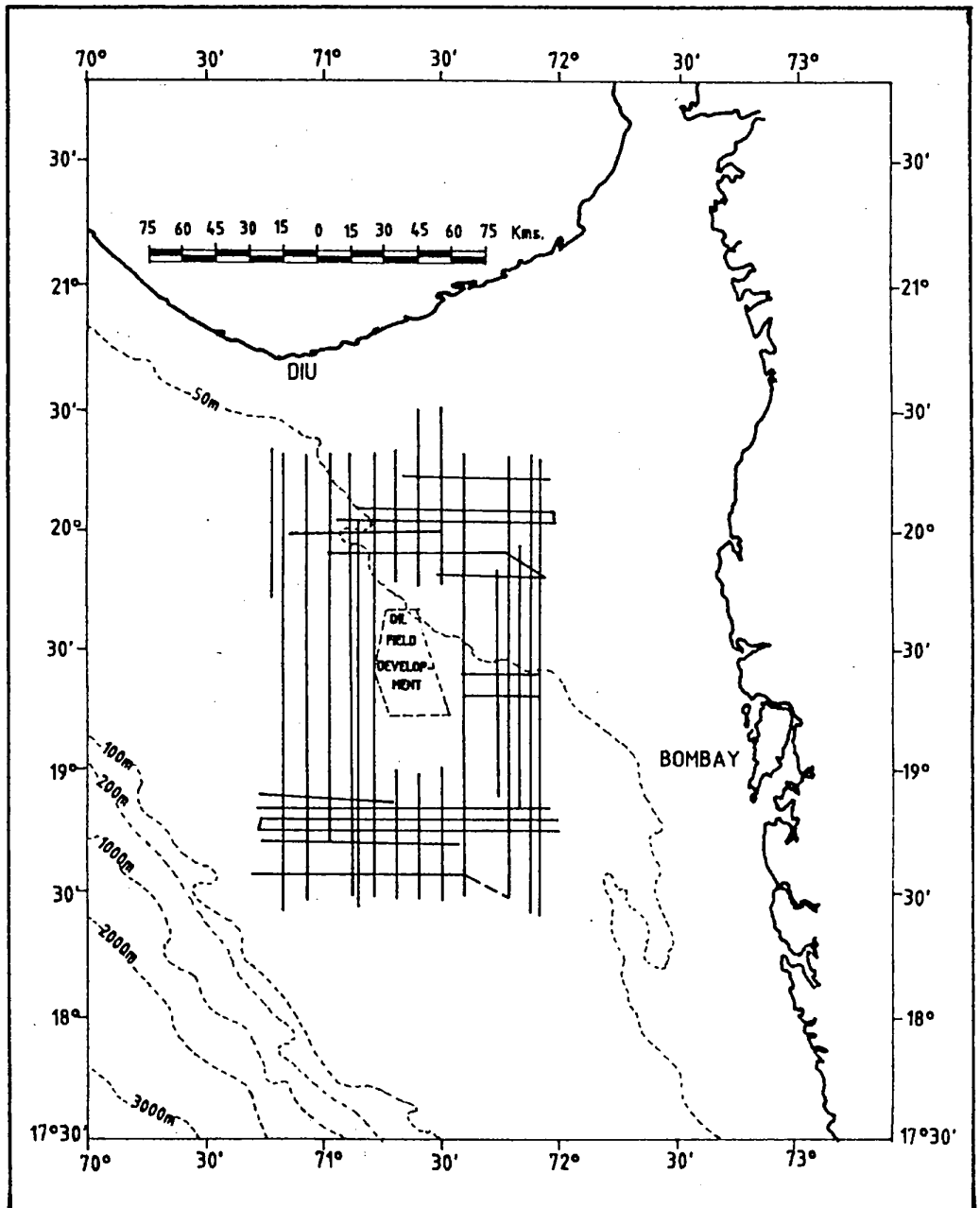
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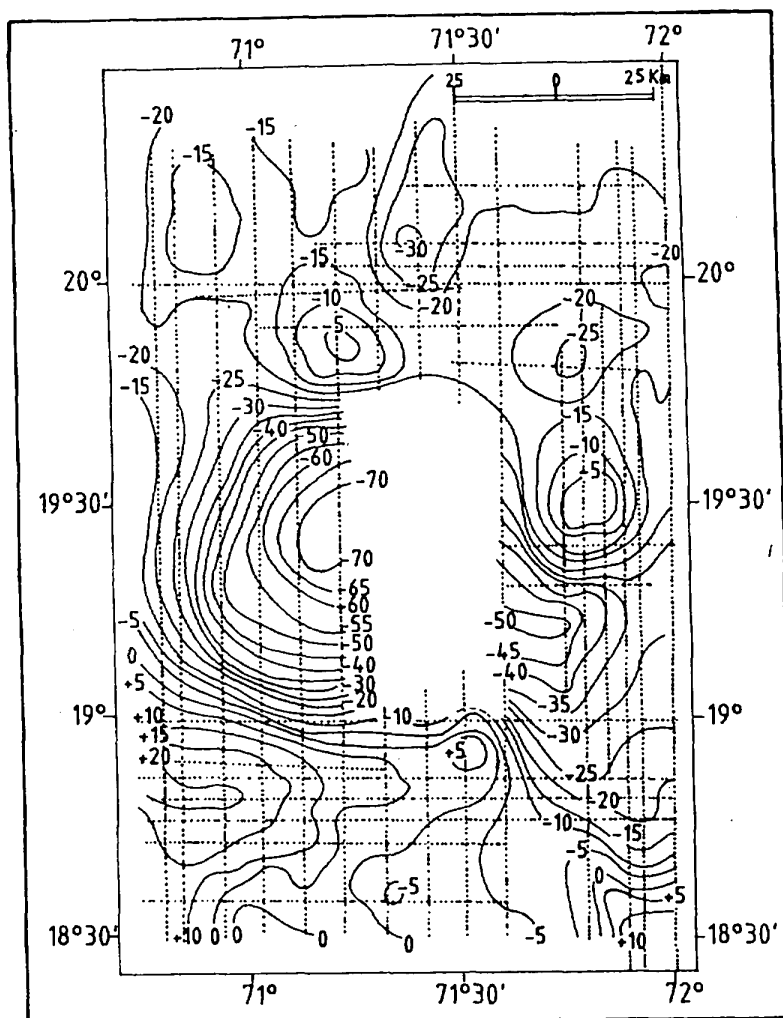
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**Acknowledgements**



MAP SHOWING THE SURVEY TRACKS

Figure 1



MAP SHOWING THE FREE AIR GRAVITY ANOMALIES  
IN THE BOMBAY HIGH AREA (Contour Interval 5mgal).

Figure II

## 2.2. SUMMARY

As part of a collaborative project between NIO and ONGC, gravity data were planned to be acquired in the Bombay High and adjoining areas. During 39th cruise of ORV Sagar Kanya about 50 percent data were acquired. During the 45th cruise, data were acquired in the remaining areas.

The INS system worked excellently during the cruise and with appropriate operator interaction provided a very high quality navigational data.

The sea bottom in the study area can be broadly divided into 3 characteristic zones. The northern portion of the study area is smooth whereas the southern portion depicts unevenness. West of Bombay High the seabed is characterised by short wave length irregularities probably due to sandwaves. The Free air anomaly map indicates the presence of a prominent gravity low (about -70 mgal) closure centered around 19° 30' N and 71° 10' E. The gravity field in general increases gradually towards west.

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PARTICIPANTS

a) Scientific component

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b) Ship's Complement

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R. V. Lad	- Chief Eng. Officer
Arun Ajmani	- Second Eng. Officer
T. Dasgupta	- Third Eng. Officer
A. Duttachoudhury	- Fourth Eng. Officer
M. S. Malham	- Fifth Eng. Officer
S. D. Warke	- Chief Radio Officer
Jairaj Nair	- Radio Officer
B.K. Vashishat	- Electrical Officer
B. N. Mistry	- Electrical Officer
R. G. S. D'Silva	- Purser
R. Fernandes	- Catering Officer
S. Gokulnath	- Medical Officer



#### 4 INTRODUCTION

##### 4.1 Background:

The western continental shelf of India has been surveyed by the ONGC in detail using seismic reflection, gravimetric and magnetic methods. ONGC requested NIO to acquire, detail gravity data in a 5 x 10 km grid in the Bombay High and adjoining areas. This work was taken up by the NIO as a collaborative project with the ONGC. As a part of this project during the 39th cruise (February- March 1988) of ORV Sagar Kanya about 3200 line kilometres of data were acquired. The 45th cruise was planned to acquire data along the remaining lines of the grid.

##### 4.2 Quantum of work:

During the cruise following data were collected.

Bathymetric data : 3699 lkm.

Gravimetric data : 3699 lkm.

Magnetic data : 1072 lkm.

##### 4.3 Itinerary:

<u>Date</u>	<u>GMT</u>	<u>Schedule</u>
5.10.88	0430	Dep: Mormugao for survey area.
26.10.88	1630	Arr: Mormugao at the end of the cruise.

#### 5 ACQUISITION OF UNDERWAY DATA

##### 5.1 Navigation:

During the cruise the navigation along the tracks were carried out using the MAGNAVOX series 5000 Integrated Navigation System (INS). This INS system uses a MAGNAVOX (model 1107 RXT) dual channel satellite navigator as primary navigational aid. It

further obtains the speed of the vessel from a Doppler Sonar (KRUPP ATLAS DOLOG) and the course from the ship's gyrocompass. The INS system integrates all these above mentioned navigational data and can give the dead reckoning positions of the vessel at desired interval of either time or distance. During the cruise the dead reckoning positions were obtained at every 125 meters of distance travelled. In order to find out the cumulative bias of individual subsystems a calibration line was run. The computed bias parameters were provided to the INS system computer as initial input. However, during the actual work it was noticed that the ship's gyro is varying between  $\pm 0.5^{\circ}$ . Even this small variation was found to have a large effect on the accuracy of INS determined dead reckoning positions. Therefore the angular gyro bias and sonar speed bias was routinely estimated at each good SATFIX and the determined parameters were provided to the INS system. This procedure resulted in achieving a high degree of Navigational accuracy.

## 5.2 Bathymetry:

During the cruise the bathymetric data was obtained using a shallow water echosounder (M/S. Honeywell Elac, model LAZ 72). The analog recording of the data was obtained on a 25.5 cms wide electrostatic paper. The frequency of this echosounder transducer is 150 KHz and during the entire cruise, the stern transducer was used. To all the bathymetric data recorded during this cruise 5.3m should be added (mean draught of the ship) as transducer correction.

### 5.3 Gravimetry:

The gravity data was collected using a marine gravimeter (M/S Bodenseewerk, GMBH, FRG, model KSS-30). To ensure accuracy of the gravity data, recommended tests (such as parabola maximum and ball calibration ) were carried out in the harbour before sailing and subsystem of the gravimeter were adjusted as per procedure. The gravity data were logged on a teletype at every 60 secs whereas on the INDAS data logger it was recorded at every 6 seconds. In addition analog record of the measured gravity values were obtained on a strip chart recorder.

### 5.4 Magnetics :

During the cruise magnetic total field data was also collected using a proton precision magnetometer (M/S Geometrics, U.S.A., model G801/3). This magnetic data is available in strip chart record as well as in INDAS tapes.

### 5.5 Onboard data processing :

During the cruise data acquisition along the tracks was carried out in a shot point mode with a shot point at every 125m of total distance travelled. Various data (such as Navigational, Bathymetry, Gravity and Magnetic) were continuously recorded in half inch magnetic tape (800 BPI) in free format using the INDAS data logger. During the cruise each raw data tape were read using the onboard general purpose computer and following preprocessing work were completed for the entire survey data.

- 1) Extraction of all the satellite update informations.
- 2) Extraction of all shot point data along survey tracks.
- 3) Extraction of all 6 second gravity measurements.

- 4) Conversion of all these data into ASCII.
- 5) Computation of preliminary free air anomaly and bouguer anomaly values at shot points along the lines.

In addition all the geophysical data were also plotted in the form of multichannel profiles using the HP plotter available on board.

## 6 PRELIMINARY RESULTS

### 6.1 Bathymetry:

A minimum of about 25 m depth towards the northeastern boundary and a maximum depth of about 90 m towards the southwestern boundary of the study area was observed. The depth sections indicate the following.

i) Approximately between 25m and 35m isobath the seafloor is having smooth topography. It gently dips from north east towards south west.

ii) Between 35m and 65m isobath the smooth seafloor shows a sudden increase in its gradient. This relatively high gradient slope zone is about 25km wide and do show a NW-SE trend and is more pronounced in the areas east of Bombay High.

iii) After 65m isobath the seafloor again shows gentle dip but have a contrastingly irregular topographic expression. Probably these areas are devoid of modern sediment cover. Based on the preliminary inspection of the echograms the seabottom in the study area can be divided into three distinct topographic regions. The areas are as follows:-

a) Area with smooth topography:

This zone covers extensively the northern portion of the study area.

b) Areas with short wavelength bottom irregularity:

This zone is characterised by narrow seabottom irregularities with a relief of about 2-3 meters. This type of seabottom was observed west of Bombay High oilfield area and its northern and southern boundaries are marked by 20° 00' N and 19° 00' N latitudes respectively. The water depth in this area ranges from 70 - 90 meters. These features are probably the sandwaves.

c) Areas with uneven topography:

The seabed in this area is very uneven with a relief of about 5 meters. Seabed with this characteristic was found to be confined towards the southern portion of the study area (i. e. south of 19° 00' N latitude) where the water depth varies from 65 meters in the east to about 90m towards the west.

## 6.2 Gravimetry:

Using the onboard monitor output of the gravity meter a preliminary Free air (FA) gravity anomalies map of the study area was prepared (Figure II). This FA anomaly of the study area indicates the following features:

1) A prominent FA anomaly low closure centred around 19° 30' N and 71° 10' E. The minimum value of FA is about -70 mgal. However, the western half of this anomaly only could be mapped because the eastern half falls in the Bombay High oil field zone which could not be surveyed.

2) In the northern portion of the study area i. e. north of Bombay High area the gravity field is generally subdued. However, the anomaly map indicates the presence of isolated broad gravity lows which trends approximately in a NNW-SSE direction.

3) In the areas immediately south of Bombay High field a prominent approximately east-west trending gravity high (maximum +20 mgal ) was observed. This high trend appears to have been truncated by a north-south trending boundary around 71° 40' E longitude. Further west the gravity field rapidly becomes negative.

### 6.3 Magnetics:

In general it was noticed that the gravity low areas are characterised by broad wavelength magnetic high anomalies.

## 7 ACKNOWLEDGEMENTS

The chief scientist and all the members of the scientific team would like to express their thanks to Capt. G. W. Vandergucht Master and other officers and crew members of ORV Sagar Kanya for their co-operation for the successful completion of the cruise.