

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

CRUISE No. 64

10th May to 1st June, 1991

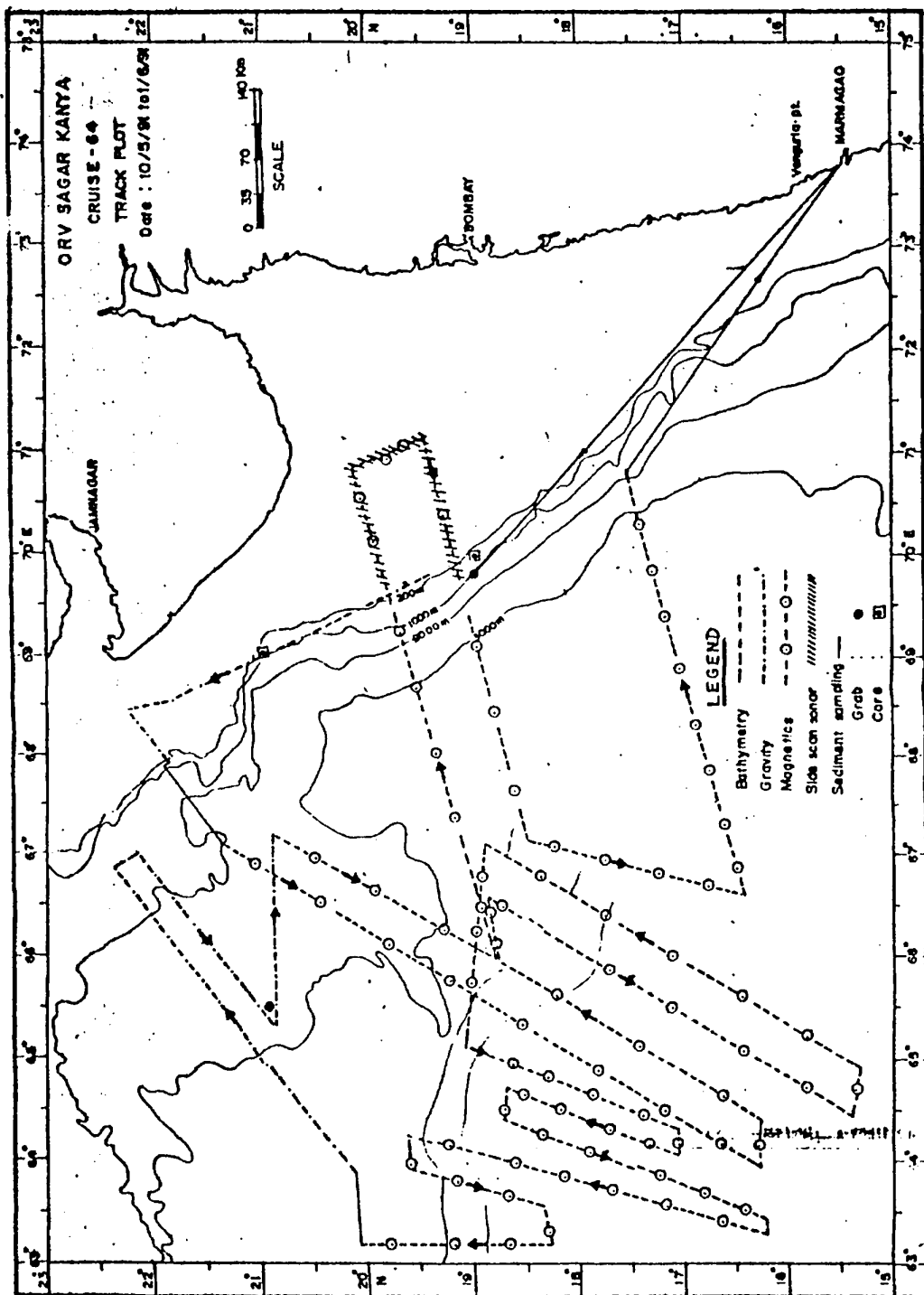


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REPORT ON THE
64TH OCEANOGRAPHIC CRUISE OF
O.R.V. SAGAR KANYA

(10th May to 1st June, 1991)



2.0 CRUISE SUMMARY

The cruise was organised as a part of the EEZ programme of the Institute to study the morphology and sediment characteristics of the western continental margin and geophysical signatures especially the seafloor spreading type magnetic anomalies west of the Laxmi Ridge. During this cruise, 5170 line km of bathymetric, magnetic and gravity and 200 line km of side scan sonar data and two grabs and two cores were collected between 15° and 23°30'N and 63° and 71°E. The positions during the cruise were obtained using the integrated satellite navigation system (GPS).

The water depths in the surveyed area vary from 70 to 3500 m. The topography of the outer shelf off Bombay is marked by a series of prominent reef-like mounds and depressions. The reefs vary in height from 2 to 20 m and trend NNW-SSE. The topography of the deep-sea floor west of Bombay is characterised by prominent bathymetric highs and lows, the prominent topographic high being the Laxmi Ridge. The water depths on the ridge are on the order of 2700 m and the ridge is marked by a trough. The magnetic data revealed (i) the extension of past A 28 anomalies far eastward than mapped so far and (ii) the existence of linear trending gravity and magnetic anomalies in the continental margin area east of the Laxmi Ridge.

The cruise started from Mormugao Harbour on 10 May, 1991 and ended at the same port on 1 June, 1991.

3.0 PARTICIPANTS

a) Scientific component :

M. Veerayya	--	Chief Scientist
G.C. Bhattacharya)	
V. Subrahmanyam)	
K. Srikrishna)	
A.K. Chaubey)	
K.V.L.N.S. Sarma)	
S.K. Nanyasi)	
B. Ramalingeswara Rao)	Geological Oceanography
V.S. Rajaraman)	Division, N.I.O.
Tony J. Thottam)	
D.K. Naik)	
K.M. Sivakolundu)	
D. Gracias)	
V. Gowthaman)	
Cesar Moraes)	
P. Henriques)	
N.P. Sukumaran)	
D. Illangovan	-	Ocean Engineering Division, N.I.O.
M.U. Ghewalla	-	CMC Engineer
K. Muralidharan)	
V.K. Patil)	
C. Ravi)	
U.B. Pramod Kumar)	Shipboard trainees
G.M. Chandvale)	
N. Paul)	
M.M. Subramaniam)	

b) Ship's complement :

Capt. J. Abraham	-- Master
A.P. Majumdar	-- Chief Officer
Hari Prasad	-- AWKO
K. Chandrakant	-- TNO
C.S. Nagarcenkar	-- Chief Radio Officer
P.A. Biju	-- Telephone & Radio Officer
S. Suresh Kumar	-- Purser
D.S. Murty	-- Medical Officer
Rashpaul Singh	-- Chief Engineer
M. Talapatra	-- Second Engineer
Shivaji Singh	-- Third Engineer
J. Pratap	-- Fourth Engineer
V.G. Nair	-- Electrical Officer
M. Dias	-- Electrical Officer
M. Fernandes	-- Catering Officer

4.0 INTRODUCTION

4.1 Background

The objectives of this cruise were (i) to collect underway magnetic, gravity, bathymetry and side-scan sonar data along the western continental margin of India and the adjoining Arabian Sea with special emphasis on seafloor spreading type anomalies west of the Laxmi Ridge and (ii) to collect sediment samples using grab/corer along the continental slope and the adjoining Arabian Sea between Bombay and the Gulf of Kutch for sedimentological, micro-palaeontological, geochemical and geotechnical studies, as part of the EEZ programme of the Institute. During this cruise, the underway surveys were carried out along 18 transects and collected two grab and two core samples between 15° and 23°30'N and 63° and 71°E.

4.2 Itinerary

- 09-5-91 All the participants boarded the ship at Mormugao Harbour. Sailing was postponed to 10-5-91 due to delay in bunkering.
- 10-5-91 Departure: Mormugao Harbour for the survey area.
- 12-5-91 Arrival : Sediment sampling station off Bombay. One grab sample at station 1 and one core sample at station 2 were collected.
- 13-5-91 Proceeded to sampling station 3, off Mongrol.
- 14-5-91 Attempted sediment sampling by corer at station 3; but to due to winch wire problem, the coring operation was suspended temporarily. Geophysical surveys commenced and the same were carried out along the Lines 1 to 10.

- 23-5-91 Coring at station 4 abandoned due to winch wire problem. Bathymetric survey continued along the Lines 11 and 12.
- 25-5-91 One grab and one core sample were collected. Proceeded to next sampling station.
- 26-5-91 Bathymetric survey was carried out along the Line 13. Again coring was attempted at station 5. Due to winch wire problem, further programme of sediment sampling was suspended.
- 26-5-91 Underway geophysical surveys (GMB) resumed and surveys to completed along the Lines 14 to 18.
- 31-5-91 Side-scan sonar was also operated on two tracks (Lines 15 and 16) on the shelf off Bombay.
- 1-6-91 Arrival: Mormugao Harbour on the completion of the cruise.

4.3 Quantum of work planned and carried out

Detailed geological and geophysical surveys were carried out on the continental shelf and some parts of the continental slope off western India. In order to understand the morphology and sediment characteristics in and around the Laxmi Ridge and geophysical signatures especially the seafloor spreading type magnetic anomalies west of the Laxmi Ridge, a multi-disciplinary cruise was planned. However, sediment sampling could not be carried out as per the plan due to coring winch/wire problem on board the vessel. Alternatively, geophysical surveys continued during the rest of the cruise. During this cruise, the following

data were collected :

(i) Underway data :

Echosounding	--	5170	1km
Magnetics	--	5170	1km
Gravity	--	5170	1km
Side scan sonar	--	200	1km

(ii) Sediment sampling :

Cores	--	2	Nos.
Grabs	--	2	Nos.

5.0 EQUIPMENT USED AND RESULTS OF SURVEYS

5.1 Position fixing : The positions during the cruise were obtained by an Integrated Navigation System (INS) using Global Position System (GPS, Model MX 4400) as a primary navigational aid. The GPS is a satellite based radio navigational system. The survey lines were shot in a "distance along track" mode with 250 m as shot point interval. The navigation as well as the geophysical data were recorded on magnetic tapes at every shot point. A data print out was obtained at every one kilometer interval.

5.2 Echosounding : During the cruise, the bathymetric data were obtained using a Honeywell Elac Deep Sea echosounder (12 kHz frequency). The data were recorded in analog format on a 25.5 cm wide electrostatic recording paper. The water depths in the survey area range from 70 to 3500 m. The topography of the outer shelf off Bombay is marked by a series of prominent reef-like

mounds and depressions. The reefs vary in height from 2 to 20 m. Prolific reefs occur in a lagoon on the Fifty Fathom Flat between 80 and 85 m. The topography of the deep seafloor west of Bombay is characterised by prominent topographic highs and lows, the prominent topographic high being the Laxmi Ridge. The water depths over the ridge are on the order of 2700 m. The topography of the ridge shows marked variation and the depths descend to 3500 m in the east, >3500 m in the west and 3800 m in the south. The centre of the ridge is marked by a trough.

5.3 Side scan sonar : An EG&G side scan sonar system consisting of SMS recorder and a tow fish was used for seafloor mapping on the outer continental shelf off Bombay. The data reveal that the outer shelf is marked by a series of spectacular reef-like mounds and minor depressions. The mounds occur in isolation and also coalesce each other at places. The reefs trend NNW-SSE and extend over 250 m across the sonograph records.

5.4 Seabed sampling : During this cruise, sampling was attempted at 7 stations; but 2 grabs and 2 gravity cores were retrieved. The cores were subsampled on board the vessel for geological, sedimentological, micropalaeontological and geotechnical studies.

5.5 Gravimetry : The gravity data were collected using a marine gravimeter (Bodenseewerk, Model KSS - 30). To ensure the accuracy of the gravity data, recommended tests such as parabola and ball calibration tests were carried out prior to the commencement of the cruise. A hard copy print out of the gravity data was obtained

at every 5 minute interval. Also, an analog record of the measured gravity values was obtained on a strip chart recorder throughout the survey. On all the profiles over the Laxmi Ridge, its characteristic gravity low could be traced. This gravity low appears to extend westward to at least up to 64°E.

5.6 Magnetics : The earth's total magnetic field intensity values were recorded along the tracks using a Geometrics Proton Precession Magnetometer (Model G801/3). The sensor was towed about 250 m aft of the vessel to minimise ship's effect. The magnetic data were collected in analog form using Hewlett Packard Recorder (Model 71304) and also stored in digital form on magnetic tapes along with navigational data on computer. Preliminary results indicated that in the northern Arabian Sea immediately south of the Laxmi Ridge, anomaly 27 extends at least up to 66°E. However, between 64°30'E and 66°E this anomaly does not trend east-west but veers towards the southeast. Anomaly 26 appears to follow the same trend and extends up to 66°E. These anomalies are right laterally offset by some hitherto unmapped fracture zones.

The gravity and magnetic data over the continental margin area between the Laxmi Ridge and the western continental shelf of India indicate a linear NNW-SSE trend.

6.0 ACKNOWLEDGEMENTS

The Chief Scientist and all members of the scientific team wish to express their grateful thanks to Capt. J. Abraham, Master and other officers and crew members of O.R.V. Sagar Kanya for their cooperation during the cruise.

ANNEXURE - I

O.R.V. SAGAR KANYA CRUISE 64

Sample locations

Stn No.	Day	Mon	Yr	Time in GMT (hrs)	Depth(m) Uncorrected	Position		Type of sample
						Lat. Deg. Min.	Long. Deg. Min.	
SK 64/1	12	05	91	0603	950	19	00 69 44	Grab
SK 64/1B	12	05	91	1105	320	18	58 69 58	Core
SK 64/2	13	05	91	1105	1010	20	58 69 00	Core
SK 64/3	25	05	91	0600	2626	20	55 65 29	Grab

ANNEXURE - II
SUMMARY OF LINES
Lines along which GMB data were collected during
the 64th Cruise of O.R.V. Sagar Kanya

Line Id.	Shot No.	Date	GMT	LAT (N)			LONG (E)		
				DD	MM	SS.S	DD	MM	SS.S
SK64-01									
B.O.L.	2	220591(142)	08:21	19	39	52.2	63	53	58.2
E.O.L.	61	220591(142)	09:09	19	32	09.6	63	51	42.6
SK64-01A									
B.O.L.	94	220591(142)	09:37	19	27	52.2	63	50	24.0
E.O.L.	575	220591(142)	15:55	18	25	03.6	63	32	06.0
SK64-02									
B.O.L.	6	210591(141)	10:19	16	17	41.4	63	16	04.8
E.O.L.	1552	220591(142)	05:43	19	40	04.8	64	14	52.2
SK64-03									
B.O.L.	3	200591(140)	18:05	18	46	45.0	64	23	52.4
E.O.L.	1195	210591(141)	09:20	1	17	39.0	63	24	03.6
SK64-04									
B.O.L.	1	200591(140)	06:30	17	08	00.6	64	00	58.8
E.O.L.	770	200591(140)	16:00	18	45	05.4	64	40	35.4
SK64-05									
B.O.L.	1	190591(139)	16:47	19	08	00.0	65	05	00.0
E.O.L.	940	200591(140)	04:45	17	09	22.2	64	17	00.6
SK64-06									
B.O.L.	5	180591(130)	05:02	15	23	29.4	64	53	15.0
E.O.L.	1798	190591(139)	03:54	18	52	08.4	67	02	34.8
SK64-07									
B.O.L.	7	170591(137)	03:05	18	53	18.0	66	32	33.6
E.O.L.	1772	180591(138)	01:23	15	28	09.6	64	25	06.6
SK64-08									
B.O.L.	8	160591(136)	08:13	16	20	55.8	64	23	18.6
E.O.L.	1306	170591(137)	00:03	18	51	30.0	65	58	11.3
SK64-09									
B.O.L.	48	140591(134)	20:22	21	24	33.0	67	06	30.0
E.O.L.	2630	160591(136)	05:19	16	25	01.2	63	57	21.4
SK64-10									
B.O.L.	1	220591(142)	18:13	18	21	00.0	63	09	52.2
E.O.L.	761	230591(143)	04:23	20	05	39.0	63	10	59.4
SK64-14									
B.O.L.	95	200591(140)	19:41	20	42	57.0	67	05	35.3
E.O.L.	1074	270591(147)	04:13	18	50	16.2	65	57	24.0

ANNEXURE - II (CONTD).

Line Id.	Shot No.	Date DDMMYY(JDAY)	GMT	LAT (N)			LONG (E)		
				DD	MM	SS.S	DD	MM	SS.S
SK64-15									
B.O.L.	1	270591(147)	04:33	18	49	59.4	65	57	13.8
E.O.L.	2130	280591(148)	12:45	20	09	56.4	70	49	47.9
SK64-16									
B.O.L.	7	280591(148)	19:58	19	29	48.0	71	09	10.2
E.O.L.	1759	290591(149)	22:23	18	32	04.2	67	07	03.0
SK64-17									
B.O.L.	2	290591(149)	22:37	18	31	47.4	67	07	01.7
E.O.L.	285	300591(150)	02:04	17	54	54.0	66	57	00.6
SK64-17A									
B.O.L.	285	300591(150)	04:46	17	54	53.4	66	56	47.3
E.O.L.	931	300591(150)	13:26	16	29	56.4	66	34	58.8
SK64-18									
B.O.L.	7	300591(150)	13:38	16	30	06.6	66	35	50.3
E.O.L.	1678	310591(151)	10:25	17	30	00.0	70	23	19.2