

# CRUISE REPORT

ORV SAGAR KANYA

Cruise No. 118

(15 October to 11 November 1996)



राष्ट्रीय समुद्र विज्ञान  
संस्थान

NATIONAL INSTITUTE  
OF  
OCEANOGRAPHY

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**NATIONAL INSTITUTE OF OCEANOGRAPHY**

(Council of Scientific and Industrial Research)

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# **REPORT ON THE 118<sup>th</sup> OCEANOGRAPHIC CRUISE OF O.R.V. SAGAR KANYA**

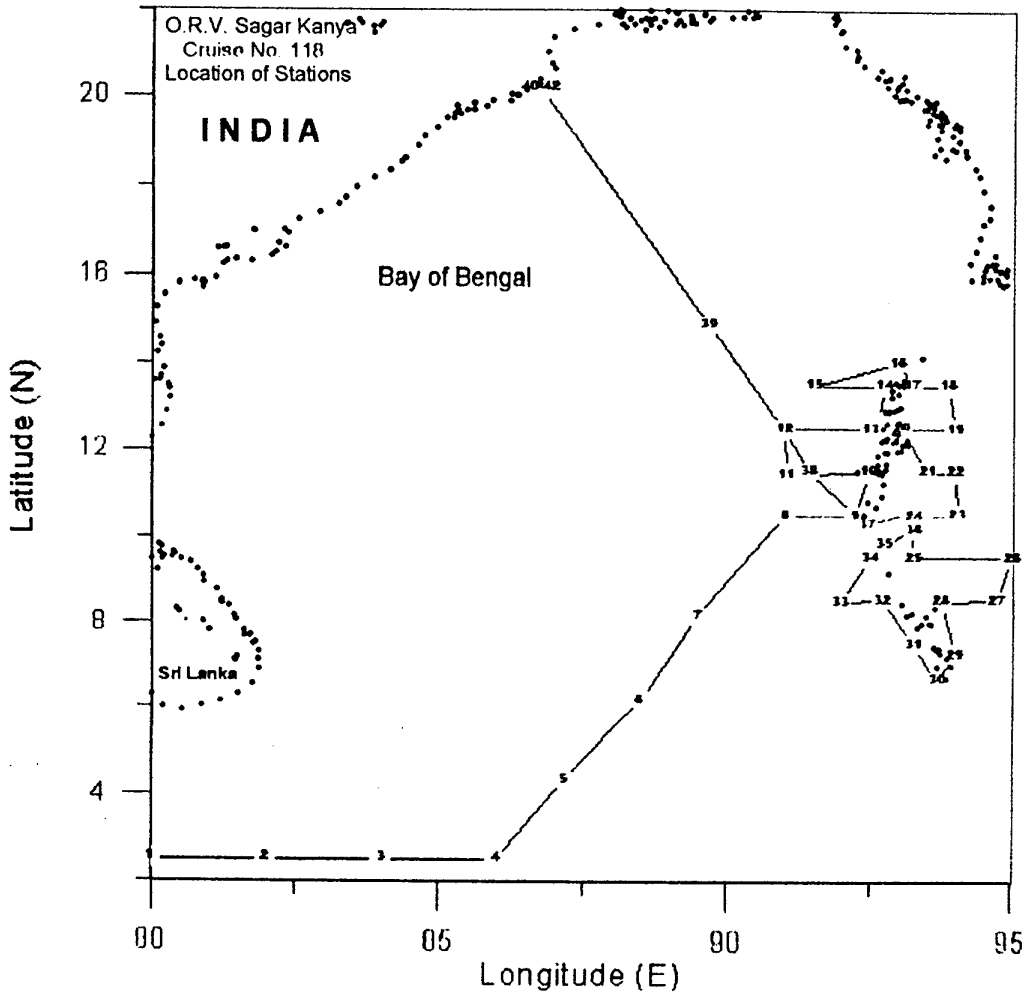
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# 1. CRUISE TRACK



## 2. CRUISE SUMMARY

The objective of the cruise was to undertake time series mapping of biological and chemical characteristics in the Andaman and to carry out sedimentological and geochemical studies in the EEZ of Andaman and Nicobar Islands.

The vessel sailed from Mormugao harbour on 15 October 1996. Some CTD and physical oceanographic studies were made at seven stations in the Bay of Bengal enroute to the main study area. The vessel reached the Andaman Sea on 24th October, where major multidisciplinary studies were carried out.

At 31 stations in the Andaman Sea region (between 6.66-14 N and 91-95 E), extensive physico-chemical, biological and geological sampling and observations were made. Time series observations were also carried out at 10.25 N, 93.25 E over 24 hrs. After completing all the work in the Andaman Sea and on the way back to Paradip, CTD was taken at one station and sediment samples were collected at 3 additional stations close to Paradip. A search for a TOGA drifter buoy off Paradip was also made. After the completion of all work, the ship arrived at Paradip port at 1400 hrs on 11 November.

In this multidisciplinary cruise 42 stations were covered. CTD was operated 69 times and water samples were collected. Various physico-chemical properties were studied. Meteorological observations were carried out at 3 hourly intervals in addition to those at all CTD stations and various meteorological parameters were recorded. Horizontal towing (54) and vertical hauls (38) of Heron Tranter and Bongo net were made to collect zooplankton for species diversity, cytogenetical and biochemical studies. Multiple plankton net was operated 14 times at various stations to study zooplankton stratification in five depth zones. These biological observations were also made in a time series study at a station in the Andaman basin. Phytoplankton was collected for biochemical studies and primary productivity was measured using C-14 method. Problems were faced while operating a large Peterson Grab due to its faulty catch release mechanism. A small grab was lost during one operation due to heavy swells and bad weather. However, 6 sediment samples for geochemical analyses were collected in this cruise.

During the entire cruise the ship covered 4350 nautical miles at an average speed of 9 knots. The sea state and weather conditions were mostly fine throughout the cruise.

### 3. PARTICIPANTS

#### 3.1 Scientific component

P.V. Narvekar	) —	Chief Scientist
V.V.S.S. Sarma	) —	N.I.O., Goa
Brenda Fernandes	)	
Vasanth Samaga	)	
Y. Sadhuram	)	
P.N.M. Shastri	) —	N.I.O., R.C., Waltair
M.V. Subrahmanyam	)	
G. Padmavati	) —	N.I.O., R.C., Cochin
I.K. Pai	) —	Goa University
Sameer Terdalkar	)	
I. Nageshwara Rao	)	
Y. Sarojini	) —	Andhra University
G. Krupanidhi	)	
K.R. Jagadeesan	) —	Mangalore University
A.V. Saxena	) —	Indian Navy
P.S. Rawat	)	
K. Balakrishna	)	
Brian Tellis	) —	Norinco, Goa
P. Boopathi	)	
Abdul Nazar	)	
<b>3.2 Ship's complement</b>		
R.M. Verma, Captain	) —	Master
V. Subramanian	) —	Chief Officer
R. Pandey	) —	Third Officer
J.M. Pinto	) —	Radio Officer
R.G.S. D'silva	) —	Purser
S. Roy	) —	Medical Officer
U. Gurayya	) —	AWKO
S. Janaka	) —	Chief Engineer
V. Singh	) —	Second Engineer
A.S. Bhatia	) —	Electrical Officer
D.P. Sharma	) —	Electrical Officer
L.M.F. Rodrigues	) —	Catering Officer

#### 4. OBJECTIVES OF THE CRUISE

The objective of the cruise was to make time series mapping of biological and chemical characteristics in the Andaman Sea and also to carry out sedimentological and geochemical studies in the EEZ of Andaman and Nicobar Islands. Physical Oceanographic studies were accommodated later in the program and some CTD and XBT studies together with meteorological observations in the Bay of Bengal were planned to study heat content and cyclonic heat potential.

Although the Andaman Sea area has been investigated to study various biological and geochemical characteristics during earlier cruises, very few chemical studies were carried out in the past. In order to fill this gap it was decided to carry out extensive chemical studies in the sea around Andaman. Considerable data has been collected in the past from the Bay of Bengal to understand the carbon dioxide (CO<sub>2</sub>) chemistry and CO<sub>2</sub> fluxes. However the data from the Andaman region was lacking. It was therefore felt it worthwhile to collect data on CO<sub>2</sub> parameters like pH and alkalinity from various depths at different stations and in a time series measurements. Continuous underway surface pCO<sub>2</sub> measurements were planned to complement these studies and to facilitate estimation of CO<sub>2</sub> fluxes from this region.

#### 5. SAILING SCHEDULE AND OPERATIONAL PROGRAMME

All participants boarded the vessel at Mormugao harbour on 15 October 1996 and sailed off to Bay of Bengal as planned. CTD operations were carried out at seven stations enroute to the Andaman Sea. XBT operations could not be carried out due to faults developed in the hardware.

The vessel arrived in the Andaman Sea on 24th October for major multidisciplinary studies. Altogether 31 stations in the Andaman Sea region fixed around the Andaman and Nicobar islands (between 6.66-14 N and 91-95 E) were covered. Extensive physico-chemical, biological and geological observations, samplings and analyses were carried out at these stations.

CTD was operated at all stations in two casts; deep followed by a shallow, to obtain continuous profiles of temperature, salinity, fluorescence and the beam attenuation coefficients. Meteorological parameters such as temperature and salinity at the sea surface, air temperature, humidity, wind speed and direction, barometric pressure, visibility, cloud coverage and types were recorded at 3 hourly interval throughout the cruise as well as at the stationary positions.

At a location in the Andaman basin (Station 24; Position: 10 30'N, 93 15'E; depth: 2300m) on 31st October, abnormal deviations in temperature and salinity at 100-120m water depths in the downcast and the upcast profiles of a CTD cast were noticed. It was decided to reoccupy the station to investigate this peculiar feature in more details.

The CTD carousel fitted with Niskin bottles was used to obtain water samples from different depths for chemical and biochemical analyses. The chemical analyses performed on board included dissolved oxygen, nutrients, pH, alkalinity and TEPs. Samples were collected and pre-processed for trace metals, particulate organic carbon, carbohydrates, lipids, proteins and dissolved nitrous oxide analyses in the shore laboratories. Continuous underway measurement of surface pCO<sub>2</sub> were made during this cruise.

Extensive biological sampling was done at 31 stations surrounding Andaman and Nicobar islands. Horizontal towing (for 10 min at 2 knots; 54 times) and vertical hauls (from 150 m depth; 38 times) of Heron Tranter and Bongo nets were carried out to collect



zooplankton to study species diversity and to carry out cytogenetical and biochemical analyses for trace metals, carbohydrates, lipids and proteins. Multiple plankton net was operated for the first time in this region at 10 locations (14 times) to study zooplankton stratification with respect to species composition and biomass distribution in five depth zones. These depth zones covered the deep waters, thermocline and the mixed layer. All these biological studies were also carried out in a time series study at a station in the Andaman basin. Phytoplankton was collected at all stations for biochemical studies (proteins, carbohydrates and lipids) and primary productivity was measured by C-14 method.

Problems were faced during large Peterson Grab operations due to its defective catch-release mechanism. A small grab was lost during one operation (at 10 30'N, 92 15'E) on 24 October due to bad sea and weather conditions accompanied with heavy swells. Three sediment samples were collected from the Andaman Sea region for geochemical analyses (trace metals, radio isotopes and other chemical analyses) and benthos studies.

Station 24 (10 30' N, 93 15' E) was re-visited to investigate the eddy feature in more details and to carry out time series observations for 24 hrs. After achieving the main target of sampling and analyses at stations around the Andaman and Nicobar, the vessel headed for Paradip.

On the way back to Paradip, CTD was operated at one station to collect water samples and sediment sampling was done at 3 stations centred around Paradip port. A three hour search carried out for a TOGA drifter buoy near Paradip was unsuccessful. After the completion of all work, the ship arrived at Paradip port at 1400 hrs on 11 November.

## 6. SALIENT FEATURES

While operating CTD at a station in the Andaman basin (location: 10 30'N, 93 15'E; depth: 2300m) on 31st October 1996, abnormal variations in temperature and salinity in the 100-120m layer were noticed. During a downcast at 0630 hrs, the temperature at 100m was 22.86 C while during the upcast at 0830 hrs the same was 18.6 C. The corresponding salinities in the upcast were lower. This was a short lived phenomenon as observed in the succeeding shallow cast at the same station where the temperature difference of 1.5 C was observed between the down and upcast. Such abnormal variations were not noticed at other nearby locations. It is believed that the peculiar observation was a result of movement of a small-scale cold-core eddy. Some chemical measurements made on the samples collected in the core of this feature also revealed large differences. The pCO<sub>2</sub> and silicate concentrations were higher by 100 µatm and 10 µM respectively whereas oxygen concentration was lower by 5 µM. This site was revisited and time series observations were made after completing all other planned observations in the Andaman Sea. However, when the station was re-occupied 6 days later, the signatures of this feature had faded, suggesting that the eddy had migrated away.

Our surface carbon dioxide measurements in the Andaman Sea revealed that the surface water was saturated with atmospheric CO<sub>2</sub>. This whole region acts as a source of CO<sub>2</sub>, with a net flux to the atmosphere.

Zooplankton biomass estimated in the samples collected by multiple plankton net revealed highest biomass at St. 23 in the mixed layer while lowest numbers were obtained in the deep strata at St. 22.

## 7. LOSSES

A small grab was lost during one operation (at 10 30'N, 92 15'E on 24 October) due to bad sea and weather conditions accompanied with heavy swells.

## 8. PERFORMANCE OF THE EQUIPMENTS ON BOARD

- a) Deep Sea winch, bongo and multiple plankton nets, shallow water and deep sea echosounders, Pinger, vacuum pump, thermosalinograph and photocopier worked well.
- b) CTD and hydrographic winches : The joystick controls were not smooth causing jerks in wire while lowering or heaving of the CTD and other gears. There was hydraulic oil leakage from the winch on one occasion. These problems were fixed by ship's staff.
- c) Sea Bird CTD profiler : The transmissometer and the fluorometer (both of Chelsea make) mounted on the CTD malfunctioned at greater depths. This was noticed during almost every CTD cast.
- d) Computers : Both the CTD and data processing computers are not satisfactory for onboard data processing as they are slow
- e) Skalar autoanalyser: The recorder response to photometric signals was poor.
- f) Peterson grab: The large volume grab has a faulty catch-release mechanism. Many attempts at collecting the sediments met with failure due to this.
- g) XBT: A damaged component in the XBT's hardware card led to the failure of XBT software. XBT observations could not be carried out as there was no spare card available on board.

## 9. RECOMMENDATIONS

- a) The wire on the hydrographic winch drum is rusted and kinked. It needs to be replaced immediately.
- b) There are only four Niskin bottles of 5 l capacity available on board. It is necessary to have more of these samplers to avoid time lost in repeated casts for want of larger sample volumes.
- c) The Personal Computers on board frequently hang up during data acquisition and processing due to lack of sufficient memory. The existing PCs are slow, low on RAM and have limited disk storage capacity. For on-board data processing, faster PCs (486s or up) are required.
- d) The chemistry laboratory lacks such essential facilities as electronic balance and sensitive pH meter. These need to be made available at the earliest.

## 10. ACKNOWLEDGEMENT

The Chief Scientist and his team wish to thank Captain R.M. Verma, his officers and crew for their co operation.

## ANNEXURE 1

## PERFORMANCE CHART

Sta. No.	Date	TIME		Lat (N)		Long (E)		Depth (m)	CTD	ZV	ZH	GR	MN
		Start	End	deg	min	deg	min						
1	10/19/96	01:35	05:25	2	30.20	80	0.28	4200	Y				
2	10/20/96	05:30	06:00	2	30.00	82	0.00	4200	Y				
3	10/20/96	18:00	19:00	2	30.00	84	0.00	3700	Y				
4	10/21/96	07:00	09:10	2	30.00	86	0.00	4000	Y	Y	YY		
5	10/21/96	23:00	23:25	4	20.00	87	10.00	2300	Y				
6	10/22/96	14:05	14:45	6	10.00	88	30.00	3700	Y				
7	10/23/96	05:00	06:00	8	10.00	89	30.00	3600	Y				
8	10/24/96	01:35	05:25	10	30.02	90	59.68	3350	YY	Y	YY		
9	10/24/96	13:20	16:12	10	29.61	92	14.12	25	Y	Y	YY	X	
10	10/24/96	21:55	11:15	11	30.17	92	28.40	65	Y	Y	YY		
11	10/25/96	09:30	13:20	11	26.92	91	1.83	3300	YY	Y	YY		
12	10/25/96	19:05	23:25	12	29.90	91	0.26	3100	YY	Y	YY		
13	10/26/96	09:30	14:45	12	30.20	92	29.90	78	Y	Y	YY	X	
13A	10/26/96	14:00	15:00	12	39.60	92	38.01	52			XXY		
14	10/26/96	22:15	23:30	13	29.87	92	44.86	65	Y	Y	YY	X	
15	10/27/96	09:00	13:00	13	30.95	91	30.26	2900	YY	Y	YY		
16	10/27/96	23:00	24:00	14	0.85	92	59.61	146	Y	Y	YY	X	
17	10/28/96	07:35	08:30	13	30.72	93	14.52	630	Y	Y	YY		
18	10/28/96	13:30	16:45	13	30.00	93	53.00	960	YY	Y	YY		
19	10/28/96	23:00	14:45	12	30.00	94	0.00	2200	YY	Y	YY		
20	10/29/96	08:30	12:10	12	31.01	93	2.69	58	YY			Y	Y
21	10/29/96	21:15	00:30	11	30.22	93	29.95	480	Y	Y	YY	X	Y
22	10/30/96	05:30	10:00	11	30.66	94	0.37	2350	YY	Y	YY		Y
23	10/30/96	18:00	23:30	10	30.93	94	1.69	3100	YY	Y	YY		Y
24	10/31/96	06:30	12:00	10	30.24	93	15.26	2300	YY	Y	YY		Y
25	10/31/96	18:15	01:30	9	30.79	93	15.18	1550	YY	Y	YY	X	Y
26	11/01/96	05:30	11:45	9	30.87	94	59.80	3500	YY	Y	YY		Y
27	11/01/96	20:45	23:45	8	31.86	94	44.94	1750	YY	Y	YY		
28	11/02/96	07:10		8	30.59	93	45.10	70	Y	Y	YY		Y
29	11/02/96	20:00	23:00	7	16.02	93	59.74	1650	YY	Y	YY		
30	11/03/96	06:30	08:30	6	40.27	93	40.74	260	Y	Y	YY		
31	11/03/96	16:20	20:00	7	30.10	93	16.02	580	YY	Y	YY	X	
32	11/04/96	04:00	08:45	8	32.08	92	42.75	900	YY	Y	YY		Y
33	11/04/96	14:30	19:00	8	29.60	91	59.22	2500	YY	Y	YY		Y

Sta. No.	Date	TIME		Lat (N)		Long (E)		Depth (m)	CTD	ZV	ZH	GR	MN
		Start	End	deg	min	deg	min						
34	11/05/96	01:30	05:00	9	31.30	92	29.70	940	YY	Y	YY		Y
35	11/05/96	07:50	08:15	9	50.00	92	45.00		Y				
36	11/05/96	11:30		10	10.12	93	14.99	1200	Y				
24R1	11/05/96	15:20	16:00	10	29.42	93	14.83	2600	Y	Y			
24R2	11/05/96	17:00	17:25	10	31.14	93	15.53		Y	Y			Y
24R3	11/05/96	19:00	19:25	10	32.66	93	16.24		Y	Y			
24R4	11/05/96	21:00	21:35	10	34.15	93	17.03		Y	Y			
24R5	11/05/96	23:00	23:30	10	34.05	93	20.03		Y	Y			Y
24R6	11/06/96	01:00	01:30	10	36.50	93	23.60		Y	Y			
24R7	11/06/96	03:00	03:30	10	38.00	93	25.70		Y	Y			
24R8	11/06/96	05:00	05:30	10	39.10	93	27.30		Y	Y			Y
24R9	11/06/96	08:15	08:40	10	39.90	93	28.22		Y	Y			
24R10	11/06/96	09:45	10:15	10	39.90	93	28.20		Y	Y			
24R11	11/06/96	11:05	11:30	10	42.36	93	30.58	580	Y	Y		X	Y
37	11/07/96	00:45	01:15	10	18.17	92	26.38	720	Y				
38	11/07/96	12:50	13:20	11	30.07	91	25.07	3000	Y				
12R	11/07/96	20:20	20:50	12	30.07	90	58.74	1050	Y				
39	11/08/96	14:20	14:50	14	53.82	89	40.16	2900	Y				
40	11/10/96	07:00	07:25	20	7.11	86	45.67	24					Y
41	11/10/96	08:45	09:15	20	21.55	86	54.24	18					Y
42	11/10/96	09:45	10:00	20	11.30	86	42.10	20					Y

\*Meteorological observations, sea surface temperature and salinity measurements were made at 3 hourly intervals throughout the cruise and at every station.

Abbreviations:

R : Reoccupied station.

Z(V) : Zooplankton net Vertical hauls.

Z(H) : Zooplankton net horizontal tows.

GR : Grab operation

MN : Multiple plankton net hauls.

X : Unsuccessful attempt

Y : One operation; YY : Two operations