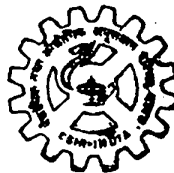


# Report on Oceanographic Cruise of O. R. V. Sagar Kanya

**CRUISE No. 57**

**25th September to 8th October 1990**



**National Institute of Oceanography  
Dona Paula-403 004, Goa  
INDIA**

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

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

(25 th September to 8 th October, 1990)

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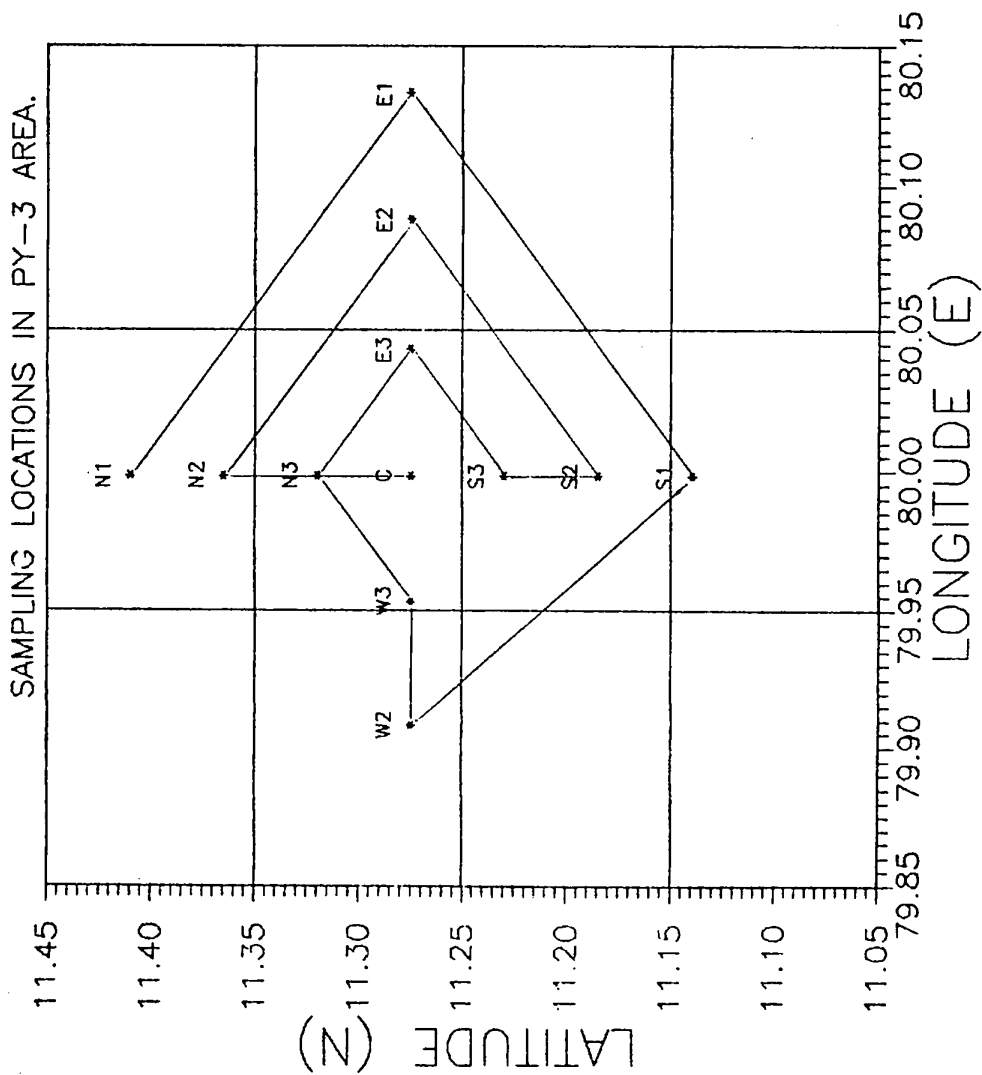
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ORV Sagar Kanya  
Cruise 57



## 2 CRUISE SUMMARY

Cruise 57 of O.R.V. SAGAR KANYA was devoted to chemical, physical and microbiological investigations in the PY-3 area (lat 11<sup>o</sup> , 16.5 N; long 79<sup>o</sup> , 59.9 E) in the Bay of Bengal in connection with the project 'Seawater Injection Analysis for PY-3 area' sponsored by Oil & Natural Gas Commission, Madras.

The vessel sailed from Madras on 26/9/90 for the work-site. After investigations for 7 days (from 27/9/90 to 4/10/90) in the PY-3 area, it sailed back for Marmagoa and reached the port on 8/10/90.

The main objective behind these studies was to identify a location and a depth in the PY-3 area where seawater of suitable quality could be available for the purpose of injection in the oil well for secondary recovery of oil. The team of 9 scientists investigated 10 depths at 12 pre-selected sites in the PY-3 area. A total of 127 water samples were collected and analysed for various physico-chemical and microbiological parameters (see annex-1 and 2). A 70 m depth at station E3 was decided as an ideal location for the intake of water.

### 3. PARTICIPANTS

#### a. Scientific Component

P.V. Narvekar	...	Chief Scientist
M. Manoharan	...	Dy. Chief Scientist
M.S. Shailaja	:	
D. Amal Jayakumar	:	
R. Nagarajan	:	National Institute of
D.P. Ehobe	:	Oceanography, Goa.
P.A. Lokabharathi	:	
S.G.P. Matondkar	:	
Ram Kumar	:	Oil & Natural Gas Commission, Madras.

#### b. Ship's Complement

Capt. Surjit Singh	...	Master
P.K. Rastogi	...	Chief Officer
Satish Kumar	...	Fourth Officer
V. Ramdas	...	Trainee Navigational Officer
V. Mohanraj	...	Cadet
H.N. Shewale	...	Chief Engr. Officer
B. Singh	...	Second Engr. Officer
A.K. Banerjee	...	Fourth Engr. Officer
A. Das	...	Fifth Engr. Officer
A. Dey	...	Fifth Engr. Officer
D.R. Gora	...	Electrical Officer
A.H. Thammaiah	...	Electrical Officer
K. Rajan	...	Chief Radio Officer
L.G. Varghese	...	Radio Officer
C.D. Sundaram	...	Purser Officer
L.M.F. Rodrigues	...	Catering Officer
U.R. Naik	...	Asst. Catering Officer

#### 4. OBJECTIVES

Oil and Natural Gas Commission (ONGC), Madras approached the National Institute of Oceanography (NIO), Goa to undertake the sampling and analysis of seawater in the PY-3 region to evaluate the physico-chemical characteristics and to decide the best depth for intake of water for injection.

Seawater is used for water flooding or pressure maintenance in the offshore oil fields for the secondary recovery of oil. The complex reactions after water injection lead to the precipitation of salts, corrosion of down-hole equipments, formation of insoluble scales, deposition of paraffin, etc which adversely affect the oil-production.

Suitable chemical/physical treatment prior to injection in order to eliminate the ions incompatible with those of the interstitial water is desirable to protect the formation. Detailed knowledge of the quality of injection water and the variability of physico-chemical parameters therein is essential to decide upon the nature and degree of treatment needed prior to injection and also to evolve the design parameters for treatment systems.

The present cruise was devoted for the physico-chemical and microbiological studies in the PY-3 area with the objective of identifying best location and depth of suitable water quality.

## 5. SAILING SCHEDULE

The vessel sailed from Madras Port at 1500 hrs on 26/9/90 and arrived at the PY-3 area at 0600 hrs on 27/9/90. After working at 17 stations for 7 days, the vessel sailed at 0800 hrs on 4/10/90 for Mormugoa where it berthed at 1000 hrs on 8/10/90.

## 6. OBSERVATIONAL PROGRAMME

The detailed sampling programme is given in annex-1. Hydrobios TPN samplers were operated from 10 to 100 m at 10 m interval and Zobell samplers were operated from 1 to 100 m at 10 m interval. Neuston net was operated at all stations excepting repeated stations. Bottom sediments were collected by Peterson grab. Analysis of water samples was carried out immediately after sampling before moving to the next station. The analysis chart is given in annex-2.

Following physico-chemical and microbiological parameters were studied: In-situ temperature (using protected reversing thermometers), conductivity (using Autosal), total suspended solids and Cerini by filtration through membrane filters, turbidity, pH, total alkalinity, carbonate, bi-carbonate, total carbon dioxide, iron, dissolved oxygen, chlorine demand, total sulphate reducing bacteria (SRB) and anaerobic bacterial population (An.B). Samples were also collected and preserved for analysis of particle size distribution, total iron, calcium and magnesium at N.I.O. laboratory.



## 7. SALIENT FEATURES

The density structure of the water column in the PY-3 area revealed a mixed layer depth of 30-50 m. The concentration of suspended solids and number of particles were high upto this depth and remained uniform.

Stations located on the western and southern transects and station C having shallower depths showed greater number of particles due to re-suspension of bottom sediments. These stations were unsuitable for water intake since high dissolved oxygen and high SRB were also found. The northern transect stations were not considered suitable for water intake since DO levels and number of particles were high throughout the water column at these stations. The stations on the eastern transect showed a small number of particles. Levels of DO, pH, chlorine demand, SRBs and total anaerobic bacteria populations were lowest at 70 m depth at station E3, which was, therefore, decided as an ideal point for the intake of water for injection.

## 8. RECOMMENDATIONS/ SUGGESTIONS

The 70 m depth at station E3 was tentatively suggested to the sponsors, D.N.G.C., Madras, as the ideal depth for the intake of water for injection purpose. It was found that a single observation is not sufficient as seasonal variations will surely occur in almost all the parameters studied. It was, therefore, recommended to the sponsors that further similar studies during different seasons are essential to give a broader picture of the

variability of physico-chemical parameters in this region and to enable us to give definitive recommendations.

#### 9. ACKNOWLEDGEMENT

The Chief Scientist is grateful to all the participating scientists, Master, Officers and Crew of the vessel for their co-operation in making the cruise a success.

Annexure-1

Station positions, performance chart and other details.

STN	DATE 1990	LATITUDE		LONGITUDE		TIME		DEPTH (m)	HYD		Z	N	G
		N		E		from	to		c	b			
N1	27/9	11 24.6'	□	79 59.9'	□	0600	1515	550	2	10	11	1	
E1	27/9	11 16.5'	□	80 8.0'	□	1630	2230	680	2	10	11	1	
S1	28/9	11 8.4'	□	79 59.9'	□	0600	0900	50	1	4	5	1	1
W2	28/9	11 16.5'	□	79 54.5'	□	1030	1200	33	1	2	3	1	1
W3	28/9	11 16.5'	□	79 57.2'	□	1230	1700	42	1	3	4	1	1
N3	29/9	11 19.2'	□	79 59.9'	□	0600	1030	140	1	8	9	1	
E3	29/9	11 16.5'	□	80 2.6'	□	1115	1600	210	1	10	11	1	
S3	30/9	11 13.8'	□	79 59.9'	□	0600	0815	60	1	5	6	1	1
S2	30/9	11 11.1'	□	79 59.9'	□	0900	1030	58	1	5	6	1	
E2	30/9	11 16.5'	□	80 5.3'	□	1215	1645	550	1	10	11	1	
N2	1/10	11 21.9'	□	79 59.9'	□	0600	1015	320	1	10	10	1	
C	1/10	11 16.5'	□	79 59.9'	□	1145	1445	77	1	6	7	1	1
N1-R	2/10	11 26.6'	□	79 59.9'	□	0600	0915	550	1	10			
E1-R	2/10	11 16.5'	□	80 8.0'	□	1100	1415	680	1	10			
E3-R	3/10	11 16.5'	□	80 2.6'	□	0600	0800	210	1	10			
N3-R	3/10	11 19.2'	□	79 59.9'	□	1015	1100	140	1	8			
S3-R	4/10	11 13.8'	□	79 59.9'	□	0600	0800	60	1	6			

HYD- hydrocasts; Z- Zobell sampler; N- neuston net horizontal trawl; G- Peterson grab; c- casts; b- bottles

Annexure-2

Analysis chart showing number of samples analysed for different parameters.

STN	TEMP	COND	TSS	TURB	PSD	CER	pH*	DO	CL2-D	CA	MG	FE	SRB	ANB
N1	10	10	5	10	10	5	1	10	2	10	10	10	11	11
E1	10	10	5	10	10	5	-	9	-	10	10	10	11	11
S1	4	4	4	4	4	4	4	4	4	4	3	4	5	5
W2	2	2	2	2	2	2	2	2	2	2	2	2	3	3
W3	3	3	3	3	3	3	3	3	3	3	3	3	4	4
N3	8	8	8	8	8	8	8	8	8	8	8	8	9	9
E3	10	10	10	10	10	10	10	10	10	10	10	10	11	11
S3	5	5	5	5	5	5	5	5	5	5	5	5	6	6
S2	5	5	5	5	5	5	5	5	5	5	5	5	6	6
E2	10	10	10	10	10	10	10	10	10	10	10	10	11	11
N2	10	10	10	10	10	10	10	9	10	10	10	10	10	10
C	6	6	6	6	6	6	6	6	6	6	6	6	7	7
N1-R	10	10	-	-	-	-	10	10	10	-	-	-	-	-
E1-R	10	10	-	10	-	-	10	10	5	-	-	-	-	-
E3-R	10	10	-	10	-	-	10	10	6	-	-	-	-	-
N3-R	8	8	-	7	-	-	8	8	4	-	-	-	-	-
S3-R	6	6	-	6	-	-	6	6	6	-	-	-	-	-

STN- Station; TEMP- in-situ temperature; COND- conductivity; TSS- total suspended solids; TURB- turbidity; PSD- particle size distribution; CER- cerini; pH\*- pH, carbonate, bicarbonate and total carbon dioxide; DO- dissolved oxygen; CL2-D- chlorine demand; CA- calcium; MG- magnesium; FE- total and reactive iron; SRB- sulphate reducing bacteria; ANB- anaerobic bacterial population.