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

CRUISE No. 39

14th February to 11th March, 1988

National Institute of Oceanography
Dona Paula–403 004, Goa
INDIA

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

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39TH OCEANOGRAPHIC CRUISE OF
O.R.V. SAGAR KANYA

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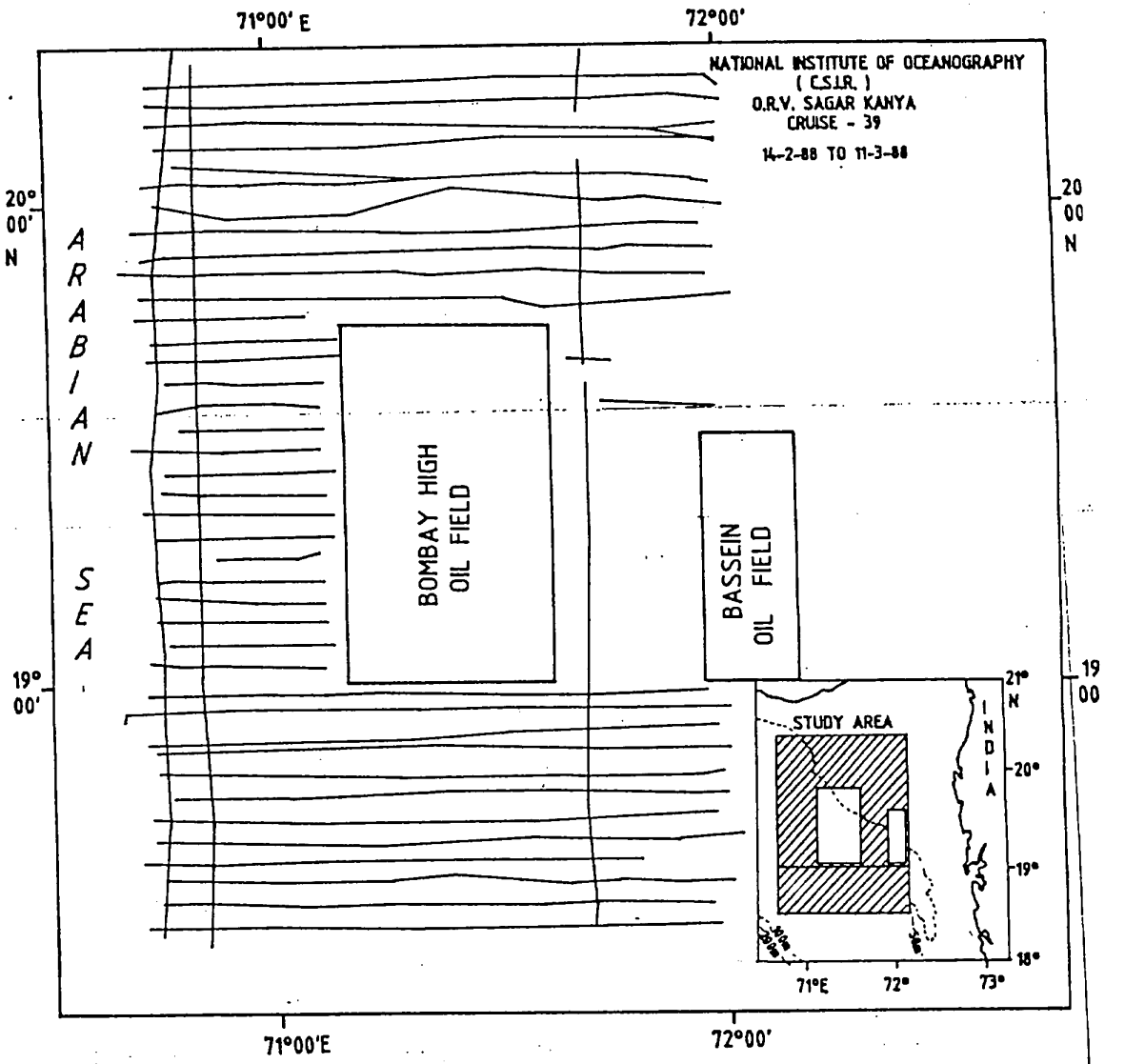

CRUISE TRACK

2.0 SUMMARY

The Oil and National Gas Commission (ONGC) and the National Institute of Oceanography (NIO) agreed on a collaborative research project for acquistion of high precision gravity data in the Bombay High and adjoining areas. Under this project about 8100 line kilometers of bathymetric and gravity data was planned to be acquired in a 5 x 15 km grid. During the present cruise about 4000 line km of data have been acquired. A preliminary appraisal of the data indicated the following :

The seabottom 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 closure centered around 19° 30' N and 71° 10' E. The gravity field in general increases gradually towards west. In the area south of Bombay High a pronounced gravity anomaly was observed. The anomaly coinciding approximately with the basement fault marking the eastern boundary of the Bombay High. The Bombay High is reflected as gravity High.

3.0 PARTICIPANTS

a) Scientific component :

G.C. Bhattacharya	-	Chief Scientist
V. Subrahmanyam		
K. Sreekrishna		
A.S. Muralinath		
C. Prakash Babu		
A.P. Selvam		Geological Oceanography Division, NIO
V.D. Khedekar		
Tony Thottam		
D.K. Naik		
P. Ganesan		
V. Tari		
S. Talaulikar		
Maria A. D'Cruz		
Mahmmod R. Bepari		
S.S. Virnodkar		
* D. Sar		
* S.R. Madabusi		ONGC
** K. Ramamurthy		
** K. Ramakrishna		
S.H. Nargund		CMC

* Participated from 11.2.88 to 29.2.88

** Participated from 29.2.88 to 11.3.88

b) Ship's Complement :

Capt. M.V. Agarkar	- Master
C. Carneiro	- Chief Officer
M.A. Khot	- Second Officer
A.Nair	- Third Officer
R.V. Lad	- Chief Eng. Officer
K.I. Singh	- Second Eng. Officer
C.T. Dharmik	- Third Eng. Officer
T. Dasgupta	- Fifth Eng. Officer
P.P.R. Nair	- Radio Officer
Mohan Awardi	- Electrical Officer
Om Prakash Bharadwaj	- Electrical Officer
Aboo Md. Tarique	- Purser
R. Fernandes	- Catering Officer
D.S. Murty	- Medical Officer
R.A. Bhatt	- C.R.O.

4.0 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. The objective of the 39th cruise of ORV Sagar Kanya was to acquire the same.

4.2 Quantum of work :

During the cruise following data were collected.

Bathymetric data : 4362 lkm

Gravimetric data : 4362 lkm

4.3 Itinerary :

Date	GMT	Schedule
14.2.88	1830	Dep: Mormugao for survey area
17.2.88	1300	Arr: Bombay harbour for repair of Gyro
18.2.88	1450	Dep: Bombay Harbour for survey area
29.2.88	0400	Arr: Bombay Harbour for repair of Gyro and replacement of ONGC personnel
29.2.88	1730	Dep: Bombay Harbour for survey area
11.3.88	0800	Arr: Mormugao at the end of the cruise

5.0 ACQUISITION OF UNDERWAY DATA

5.1 Navigation :

During the cruise the navigation along the tracks was carried out using the MAGNAVOX series 5000 Integrated Navigation System (INS). This INS System uses a MAGNAVOX (Model 1107) dual channel Satellite navigator for primary position control. It further obtains the speed of tje vessel from a doppler sonar

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(KRUPP ATLAS DOLOG) and the course from the ship's gyrocompass. The INS system integrates all the above mentioned navigational data and gives 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 along the track. In order to find out, the cumulative bias of individual subsystem, calibration line was run. The computed bias parameters were provided to the INS system computer which in turn provided better navigation. The ships officers observed irregular behaviour of the ships gyro compass. This problem was attended by onshore engineer at Mormugao and Bombay. However, the problem continued throughout the survey, although with varying degree of severity. A system was improvised according to which, ships officer obtained the gyro compass deviation values at regular interval (i.e. 15 or 30 minutes) by following their standard astronomical method. These deviation values were immediately supplied to the INS system computer for correcting the dead reckoning positions. Following this method, the navigation could be maintained within acceptable limit of accuracy.

5.2 Echosounding:

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 electrastatic paper.

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 test and ball calibration tests were carried out and the subsystem of the gravitymeter were adjusted as per procedure. The gravity data were logged on a telytype at every 60 secs whereas on the INS 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 Onboard data processing:

During the cruise the navigation was carried out in a shot point mode with a shot point interval of every 125 meters. Various data (such as Navigational, bathymetric and gravimetric) were continously logged on the INS system data logger. The data is stored in half inch magnetic tape at 800 BPI in free format. During the cruise each raw data tape were read using the onboard general purpose computer. After the upgradation of the INS system onboard ORV Sagar Kanya the data recording formats were changed by the manufacturer. This change made the available underway geophysical data processing package inoperative. During an earlier cruise a software to read the INS data tapes were developed. During this cruise this software was successfully utilised to read various types of data recorded in the tapes. The preliminary onboard processing of the data included the following:

i) Extraction of all the satellite update informations.

ii) Extraction of all shot point data along survey tracks.

iii) Extraction of all 6 second gravity measurements.

iv) Conversion of all these data into ASCII.

v) Computation of preliminary free air anomaly and bouguer anomaly values at shot points along the lines.

These jobs were completed for the data collected for entire survey period.

6.0 PRELIMINARY RESULTS

6.1 BATHYMETRY:

A minimum of about 25 m depth towards the northeastern boundary and a maximum depth of about 90 m was encountered towards the southwestern boundary of the study area. 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 (ref. Figure III).

a) Area with smooth topography: This zone covers extensively the northern portion of the study area (i.e. about north of 19° 30' N and east of 71° 00' E).

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 waterdepth varies from 65 meters in the east to about 90 m towards the west.

Apart from the three distinct zones mentioned, the other prominent topographic feature observed was a ridge. This ridge like feature was observed around 19° 00' N and 71° 45' E. This feature trends approximately NW-SE and have a relief of about 10 meters. This feature could be identified in about 6 parallel lines which indicate its extension from 18° 40' to 19° 00' N. However, its relief gradually decreases towards south.

6.2 Gravimetry:

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

a) 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 restricted Bombay High oil field zone which could not be surveyed. The gradient of the anomaly is relatively high with the gravity field rising continuously towards the west beyond the study area.

b) 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. One such low closure could be found near the northeastern corner of the study area.

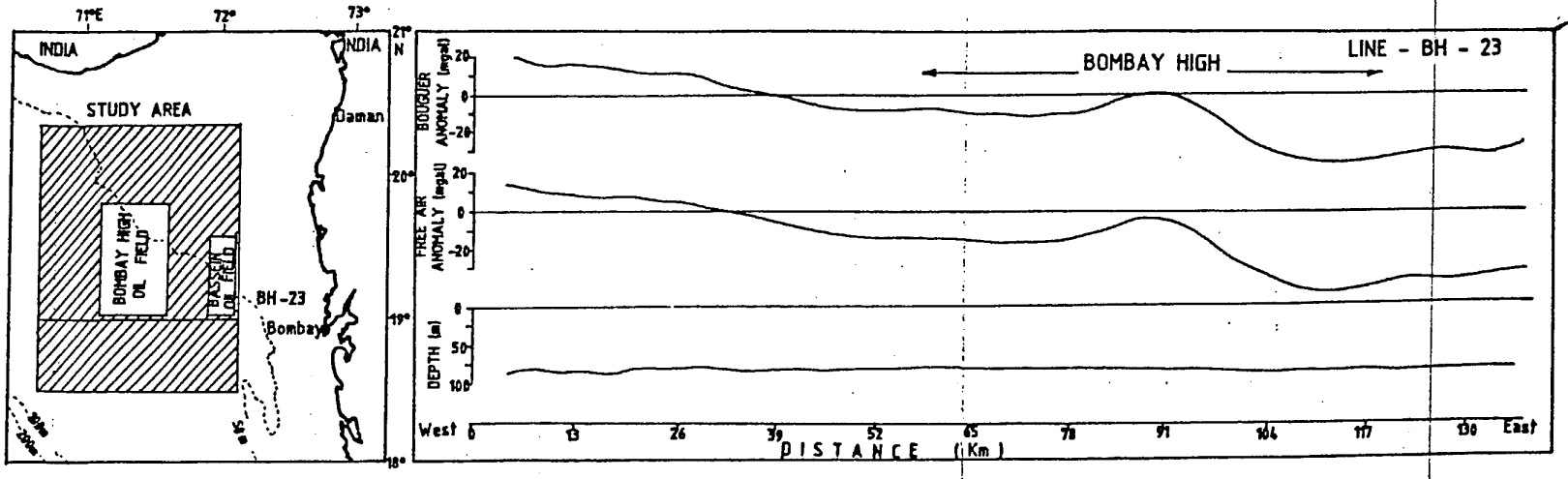
c) In the area immediately south of Bombay High field an important gravity anomaly was observed. (see Figure II). This gravity anomaly is of the order of 35 mgal and approximately coincides with the postulated basement fault line which marks the eastern boundary of the Bombay High structure.

The general trend of the gravity field indicates a gradual rise of the field from the eastern boundary towards the western limit of study area.

7.0 ACKNOWLEDGEMENTS

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

ACQUISITION OF GRAVITY DATA ON THE BOMBAY HIGH AREA (PROJECT SPONSORED BY OIL AND NATURAL GAS COMMISSION)



AREA OF OPERATION (5 Km grid)

PROFILE SHOWING THE IMPORTANT GRAVITY ANOMALY ALONG WITH BATHYMETRY IDENTIFIED DURING THE SURVEY

Figure II

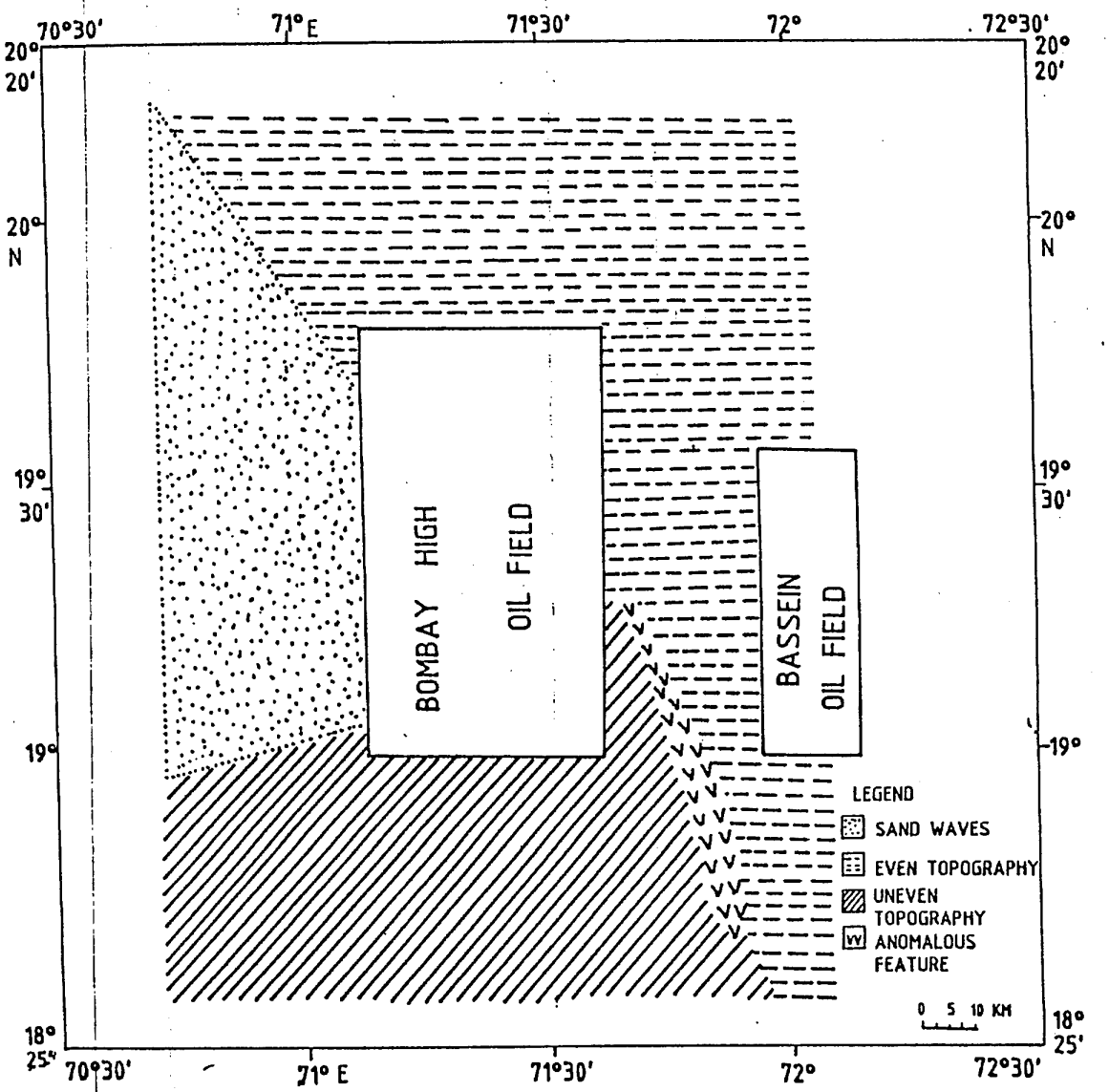


Fig. III Preliminary geomorphology of the seafloor

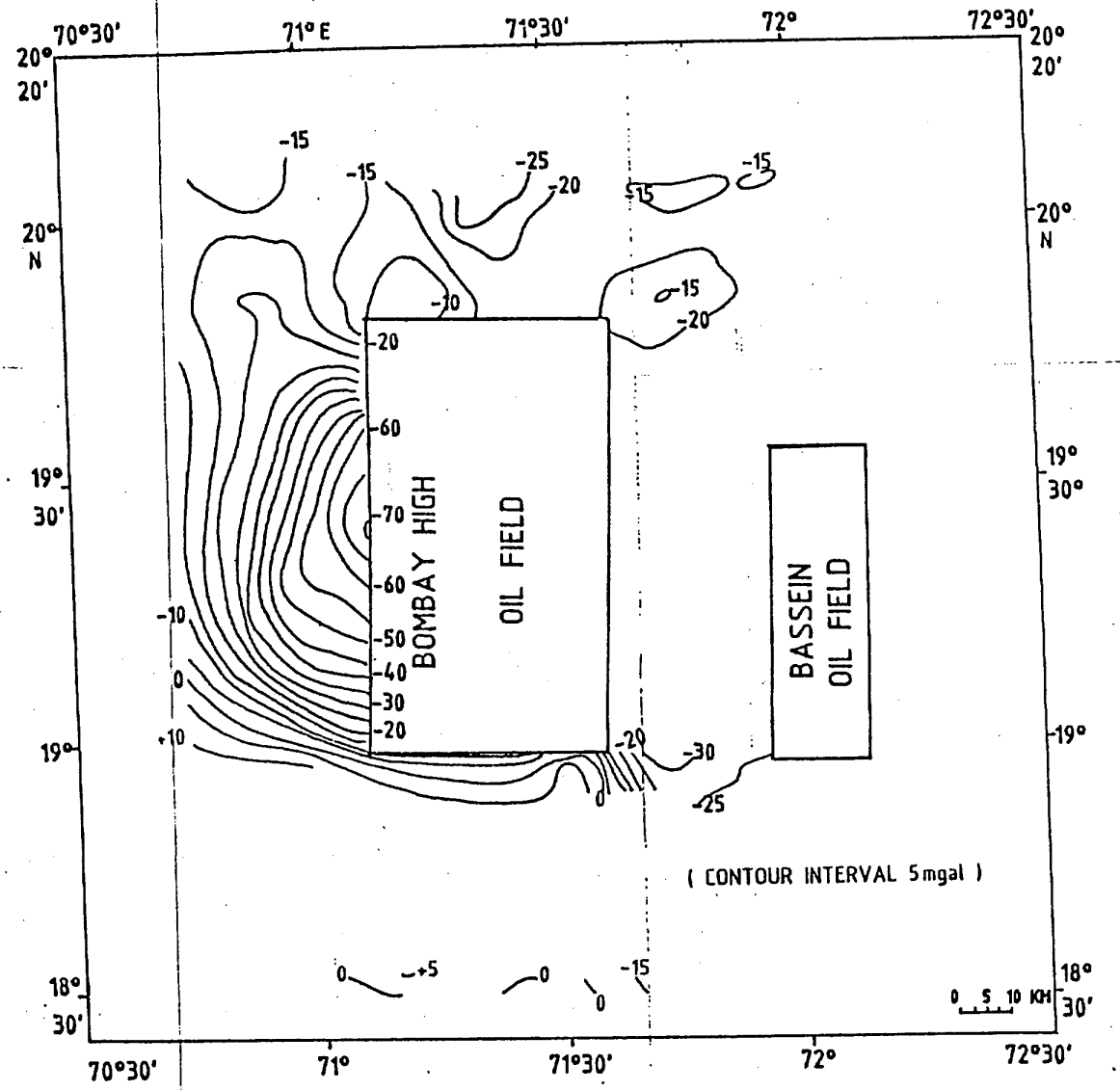


Fig. IV Preliminary free air gravity anomaly map of the survey area