

Magnetic Anomalies at the Mouth of the Gulf of Kutch

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Total magnetic intensity data collected along 3 profiles at the mouth of the Gulf of Kutch during 2nd cruise of *RV Gaveshani* were analysed. The observed anomalies indicated the trend of the magnetic layer in this area as NNE-SSW. The sources causing the anomalies are at shallow depths which were attributed to structures within the traps.

MMAGNETIC measurements were carried out along 3 profiles totalling about 43 line km at the mouth of the Gulf of Kutch during the 2nd cruise of *RV Gaveshani* (Fig. 1). A Barringer marine proton precession magnetometer was towed behind the vessel and echosounding was carried out by a Kelvin Hughes MS-45 echosounder.

The observed total magnetic intensity values along the tracks were corrected to the International Geomagnetic Reference Field for the Year 1975 and the anomalies were computed. The 3 magnetic profiles, the computed depths to causative sources along the tracks and the bottom topography of the gulf is shown in Fig. 2. The important anomalies on the profiles are numbered and interpreted quantitatively equating the sources causing the anomalies to dykes, tabular bodies and semi-infinite slabs. In estimating the depths the methods of Koulomzine *et al.*¹ for dyke model and of Bean² for tabular body and semi-infinite slab models were used. The interpreted models, their widths and the depths are given in Table 1.

Anomalies as high as 240, 140 and 180 gammas, peak to peak amplitude are noticed on the profiles 1, 2 and 3 respectively. The magnetic anomalies along the profiles 2 and 3 (Fig. 2) show the following similarities: (i) a band of low amplitude anomalies between 0 and 3 km on profile 2 is similar to the anomalies between 4.5 and 7.5 km on profile 3; (ii) the high amplitude low frequency anomaly with a peak to peak amplitude of around 140 gammas between 4 and 6.5 km along profile 2 is similar to the anomaly observed along profile 3 between 0

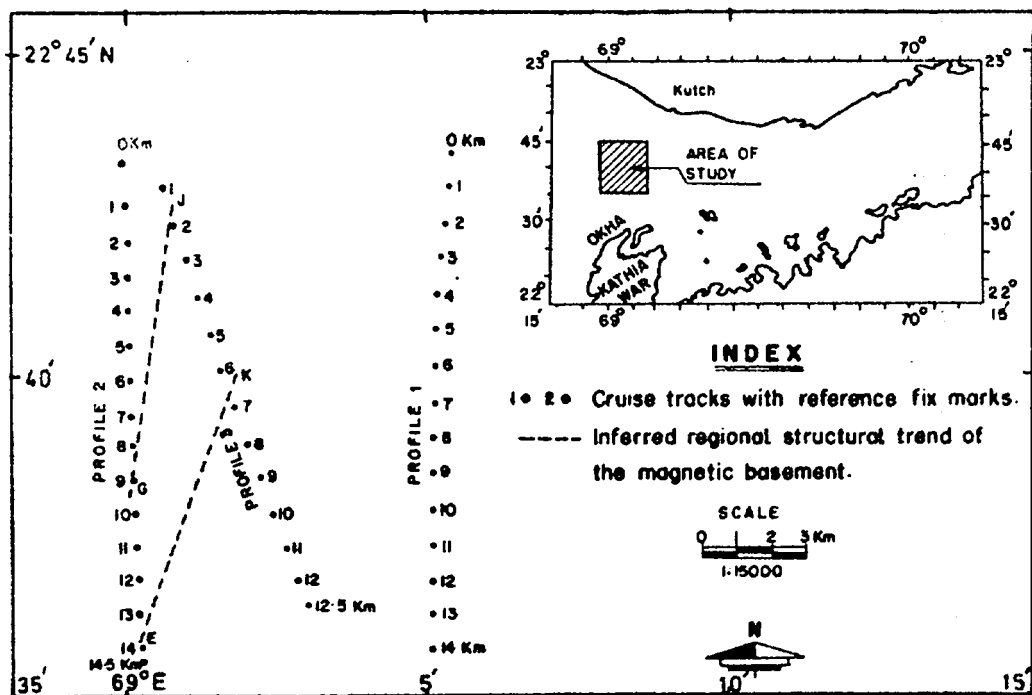


Fig. 1 — Cruise tracks with fixes and inferred regional structural trend of magnetic basement

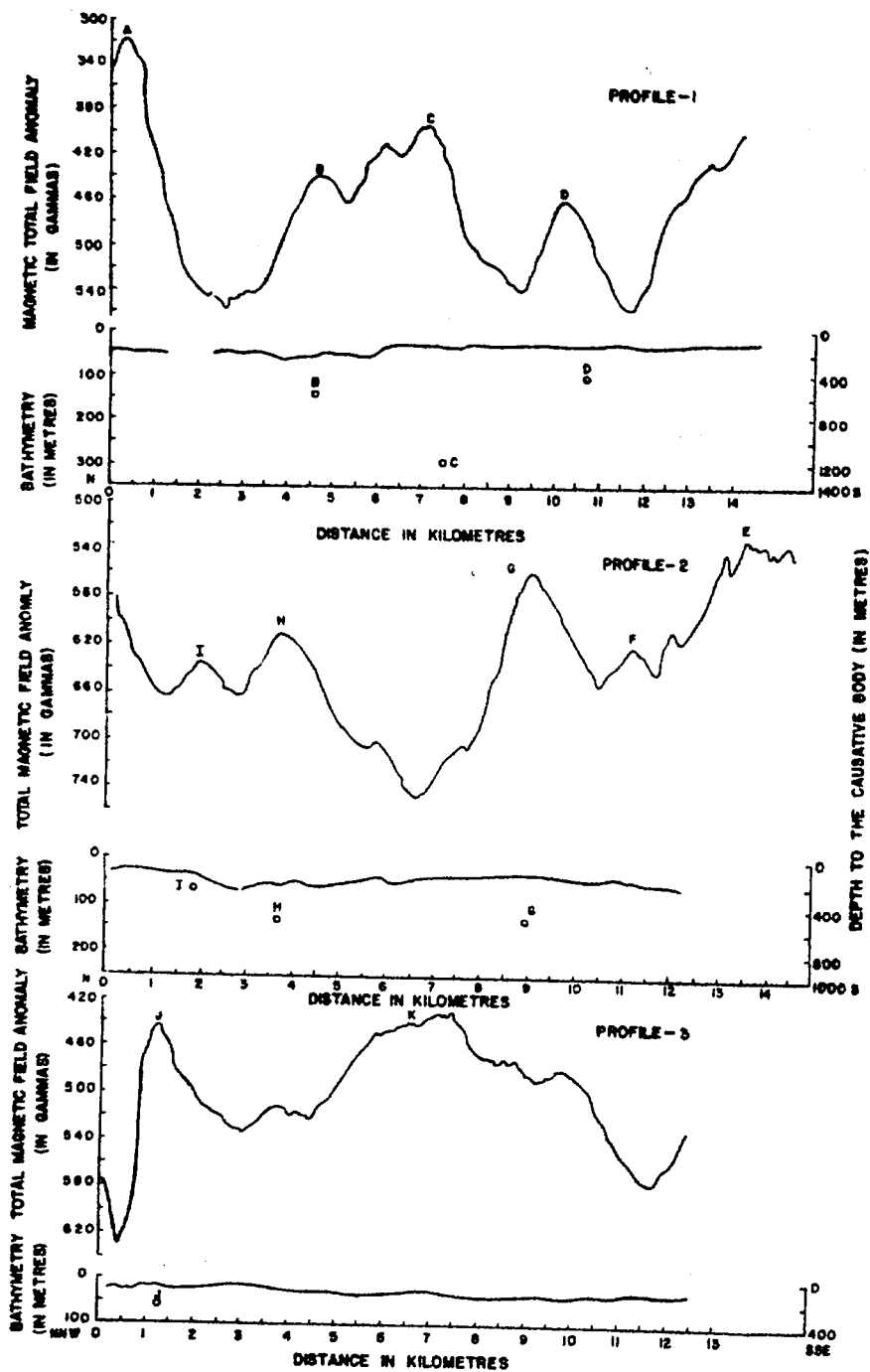


Fig. 2 — Bathymetry and magnetic anomalies along the profiles and depth to the causative bodies

TABLE 1 — ESTIMATED DEPTH AND WIDTH VALUES

Anomaly	Accepted model	Depth km	Width km
PROFILE 1			
B	Semi-infinite slab	0.5	—
C	Semi-infinite slab	1.2	—
D	Dyke	0.3	3.8
PROFILE 2			
G	Dyke	0.5	0.5
H	Dyke	0.5	0.6
I	Dyke	0.2	0.3
PROFILE 3			
J	Dyke/Tabular body	0.3	—

and 2.5 km. By joining the positions of similar anomalies on their respective profiles, it can be seen that the anomalies have a north-north-east-south-south-west trend. Similar anomalies are not observed on profile 1, perhaps due to the shorter length of the profile. It is seen that the physiography of the sea in the study area is not reflected in the magnetic anomalies. The depths and widths computed from these anomalies range from 0.3 to 1.2 km and 0.3 to 4 km respectively. Since the profile directions are not exactly perpendicular to the lineations of the anomalies, the observed parameters are apparent.

A study of the structure, tectonics and geology of the land areas to the north and south of the Gulf of Kutch²⁻⁴ shows that (i) a NNE-SSW trending median high extends into the offshore regions off the Gulf of Kutch; (ii) strong positive gravity anomalies exist off south of Okha which are attributed to thick traps⁷; (iii) the Deccan traps are exposed along the western and southern coasts of Kutch and Kathiawar coast, and a few volcanic plugs comprising alkali olivine basalts occur along the coast of Kutch; and (iv) the structure of Kutch is controlled by WNW-SSE trending and NNE-SSW trending faults. The structures of Kutch were

developed mostly within the Mesozoic rocks in the pre-Deccan trap time and the traps flows rest disconformably over eroded or depressed parts of folded Mesozoic rocks^{8,9}.

The observed NNE-SSW trends of the magnetic anomalies in the Gulf of Kutch represent structural trend indicating that the onshore trend in Kutch extends into the gulf also. The observed depths and widths indicate that the sources causing the anomalies are at shallow depths and that they are narrow. However, mention may be made here that some other anomalies such as at A, E, F and K are also discernible from the data analysed. Since they do not appear to be well resolved (might be due to the interference by the adjacent bodies effect) or incomplete they were not used for depth computations. However, they have been made use of in deciphering the trends of the anomalies. The data indicate that the thickness of sediments overlying the basalt may be of the order of 500 m and may be rarely more. Based on the available geological data and the shallow magnetic source causing the anomalies it is suggested that the observed anomalies are related to the structures within Deccan traps which are located at shallow depths. A detailed geophysical survey with a shallow draught vessel will indicate more clearly the structure and tectonics of the Gulf of Kutch.

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