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R290
no.76-545

U.S. GEOLOGICAL SURVEY
[Reports - Open file series]

OPEN FILE REPORT

76-545

Marine Magnetometer Measurements

Gulf of Almeria, Spain

by

U.S. GEOLOGICAL SURVEY
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Release: 8-7-76

June 1976

This report is preliminary and has not been edited or reviewed for conformity with Geological Survey standards and nomenclature.

Marine Magnetometer Measurements
Gulf of Almeria, Spain

ADARO-USGS Project, 1974

Summary

Total field magnetic intensity measurements and concurrent seismic reflection profiles were collected in May 1974 aboard the B.H. Pollux, of the Instituto Hydrografico de la Marina, in the Gulf of Almeria, Spain, as a cooperative project between the U.S. Geological Survey and the Empresa Nacional ADARO de Investigaciones Mineras, S.A. (ENADIMSA). This report presents the magnetometer data in the form of a contoured map and two sets of profiles.

The magnetometer data show that in general the grain of the magnetic field trends southwest, conforming with the geologic structure as interpreted from seismic reflection profiles. A southwesterly trending set of anomalies marks the location of a fault zone (identified as Almeria fault zone A by J.C. Lucena and H.G. Greene, unpublished data, 1974) which extends onshore northwest of Cabo de Gata. Anomalies greater than 200 gammas in amplitude which occur south and southwest of the Cabo de Gata and greater than 150 gammas southwest of the Campo de Dalias probably result from underlying volcanic rocks.

Magnetic storms during the period of ship operations decreased the possible precision of the magnetometer data. Attempts to correct for temporal variation by comparing the marine magnetometer data with station magnetometer data from the Observatorio Geofisico de Almeria were not entirely successful. We have been unable to contour most of the area at

less than a 50 gamma contour interval.

Collection and Processing of the Magnetometer Data

The survey was made aboard the B.H. Pollux in the Gulf of Almeria during the period of 4 to 20 May, 1974. Marine proton precession magnetometer readings to one gamma accuracy were recorded at 6 second intervals in analog form on a paper strip chart and digitally on magnetic tape. Processing was done by computer from the data on magnetic tape. The magnetometer data were merged with navigation data (15 minute Raydist fixes) to provide geographic coordinates for each measurement so that the International Geomagnetic Reference Field could be removed. A constant 175 gammas had to be subtracted to bring the general residual level closer to zero. A "gradient" filter was used to attempt to eliminate periodic sequences of noise that had been introduced by simultaneous operation of the magnetometer with a 30 kj sparker. This filter rejected points which would create a magnetic gradient greater than 2000 gammas/km in high gradient areas, and 600 gammas/km elsewhere. These values exceed reasonable maximum gradients for the data. This procedure reduced the number of bad points, but a few data intervals had to be deleted altogether. Data resulting from this processing step are shown as "Shipboard Data" on the profiles of magnetic data which accompany this report (Figure 2). Plots of these data show a mean error of 18 gammas at track crossings. Inspection of records from the Observatorio Geofisico de Almeria at Lma. de la Molineta for May, 1974, revealed large magnetic storm disturbances. These station magnetometer records, in analog form, were manually digitized at irregular intervals between 2 and 30 minutes, as closely as practicable considering the scale of the available records. Total magnetic intensity calculated from the station

magnetometer records is shown on the profiles of Figure 2 as "Temporal Variation". Deviations from the mean of these station data were then used to correct the shipboard data to a common datum. The resulting corrected profiles are labeled "Corrected Data" in Figure 2.

Visual comparison of the temporal variation and corrected data suggests that the temporal variation has not been entirely removed from the shipboard data. The mean track crossing error of the corrected data is 10 gammas, with a standard deviation of 16 gammas about the mean. The greatest temporal variation seems to have occurred during the survey of the northwestern part of the area. The data from that area proved to be the most difficult to contour, although they lie closest to the land magnetometer station where the correction procedure should be most effective.

Results

The dataare presented by means of a contour map and two sets of profiles (Fig. 1, 2, 3).

The contour map (Fig. 1) shows a NNE regional trend of magnetic anomalies. The anomalies are generally less than 50 gammas in amplitude; however, areas of higher amplitude anomalies are found southwest of the Cabo de Gata (greater than 200 gammas) and southwest of the Campo de Dalias(greater than 150 gammas). Sets of linear anomalies, which lie along fault zones identified in seismic profiles by J.C. Lucena and H.G. Greene (unpublished work, 1974) are difficult to see on the contour map because of the wide contour interval, but are more apparent in the magnetic profiles (cf. Fig. 3, lines 6A, 8A, 12, 13, 14).

Profiles of all the magnetic data acquired are shown in Figure 2. Judgements of data quality on any particular line may be made by comparing

the corrected data with the shipboard data and temporal variation.

Because the ship moved at varying speeds, profiles of magnetic intensity vs. time (Fig. 2) may not show gradients which are relatively comparable. Figure 3 shows profiles of corrected magnetic data vs. distance along several lines for which there are seismic profiles interpreted by Lucena and Greene, and for which the temporal variation during collection was minimal.

We thank Alan Cooper for his helpful review of this report.

The magnetic data presented in this report (Fig. 2) will be available, after June, 1976, at cost of reproduction, on magnetic tape from the National Geophysical and Solar Terrestrial Data Center, Boulder, Colorado, U.S.A.

Accompanying Figures

Fig. 1 Map of Residual Magnetic Anomaly. Contour Interval 50 gammas. Contours dashed where uncertain. Fix points shown at 15 minute intervals along track lines of B.H. Pollux, May, 1974. Dashed tracklines indicate absence of magnetometer data. Fixes are annotated in ship time (Ship time minus 2 hr. equals GMT). Numbers and letters along tracklines are line designations. Line designations in large print show lines of magnetic profiles presented in Fig. 3.

Fig. 2 Profiles of Magnetic Intensity Data vs. Time. The six segments correspond with six consecutive periods of survey operations. Time in hours is annotated both in ship time (-2) and in GMT (z) so that the data may be compared with station magnetometer data (z) and with other shipboard data. Temporal Variation shows total magnetic intensity recorded at the Observatorio Geofisico de Almeria, relative to an arbitrary mean datum (42673 gammas). Shipboard Data shows magnetic intensity recorded on the

B.H. Pollux, with the International Geomagnetic Reference Field and a constant 175 gammas removed. Corrected Data shows shipboard data as corrected for Temporal Variation; see text.

Fig. 3 Profiles of Corrected Magnetic Intensity Data vs. Distance (km) for lines 3A, 4, 4A, 6A, 8A, 12, 13, 14. Location of these lines is shown on Figure 1. Horizontal scale is the same as Figure 1. Fix times are annotated in ship time (zone - 2) to correspond with Figure 1.