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A Magnetic Anomaly Map of the Area
 $51^{\circ}-55^{\circ}$ N, $10^{\circ}-16^{\circ}$ W

by
Robin P. Riddihough

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by

Robin S. Kidd

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A MAGNETIC ANOMALY MAP OF THE AREA $51^{\circ} - 55^{\circ}$ N, $10^{\circ} - 16^{\circ}$ W.¹

R. P. Riddihough

INTRODUCTION

Although aeromagnetic surveys have been flown over much of the continental margin west of Ireland as part of a programme of commercial hydrocarbon exploration, the results of these surveys are not yet freely available. Until recently the only major marine magnetic surveys that were available for the region were those carried out by the University College of North Wales in conjunction with the Dublin Institute for Advanced Studies (Young and Bailey, 1973, Bailey et al. 1975) and the Hydrographic Dept. of the Royal Navy in conjunction with Imperial College, London (Riddihough, 1968). The release in 1974 to the Geological Survey of Ireland of the magnetic data collected during a survey in 1967 by the United States Naval Oceanographic Office has now made possible the production of a comprehensive magnetic map of a large part of this region. Vogt and Avery (1974) have discussed many of the broader tectonic implications of the US magnetic data and a map of the total magnetic field at a scale of 1:650 000 over the area $51^{\circ} - 55^{\circ}$ N, $10^{\circ} - 20^{\circ}$ W has been published (Riddihough, 1975).

Nevertheless, because of considerable interest in the Irish continental margin, both on account of its hydrocarbon potential and of its tectonic and structural relation to the land area of Ireland, it was thought valuable to make the US Naval Oceanographic Office data as widely available as possible in the most useful form for geophysical and geological interpretation. The present Bulletin therefore presents a magnetic anomaly map (relative to IGRF) in two sheets which includes the Irish continental shelf, the Porcupine Sea-Bight, Porcupine Bank and the adjacent portion of Rockall Trough at a scale of approximately 1:320 000 or $1'' = 4.5$ n. miles.

DATA, REDUCTION AND CONTOURING

The data on which the contour anomaly map is based are lodged on open file with the Geological Survey of Ireland and were obtained by USNS SHOUP during June and July 1967. The data take the form of observed total field values at 50 gamma intervals and any intervening maxima or minima, plotted along ship's tracks drawn at a scale of approximately 1:320 000. Navigation was by Loran C.

Although sufficient information is given on the data sheets for magnetic diurnal corrections to be made, the uncertainty of predicting the diurnal variation in the survey area from the nearest land observatory at Valentia makes such a correction of doubtful value. The increase in amplitude of daily magnetic variation towards the edge of the continental shelf (e.g. Roden, 1964, Riddihough, 1969) suggest that a daily variation of at least 60 gammas may be recorded in the data. At the average ship speed of the survey (10 knots) such a variation will be spread along a single track over a distance of the order of 100 kms. However, values on adjacent tracks observed many hours apart, could differ by amounts of this magnitude and contour 'zig-zag' of greater than 50 gammas can therefore be expected.

To remove the effect of the earth's main field, values of the International Geomagnetic Reference Field for epoch 1967.5 were derived from Barraclough and Malin (1971) and contoured on transparent overlays at the same scale as the original data. IGRF values were then subtracted from each given field value. Because of the inherent diurnal error, subtracting was carried out only in 20 gamma 'zones' resulting in an error of ± 10 gamma from this source.

The resultant anomaly values were hand contoured at 100 gamma intervals. Intervening 50 gamma contours are shown dashed in areas where they appear to usefully define the shape of the anomaly surface. Ship's tracks are shown on the final maps so that the extent of interpolation from track to track can be appreciated. In general, the trends of anomalies shown on only one track have been drawn in conformity with the nearest definite and determinable trend. In cases where two strong trends exist and contouring could be drawn in conformity with either, an attempt has been made to reflect both trends. One of the most important examples of this is seen in the area of $52^{\circ} 30' \text{ N}$, $14^{\circ} 20' \text{ W}$ where the uncertainty due to track spacing could allow either a NE-SW magnetic 'high' continuation or an E-W magnetic 'low' continuation.

Although diurnal corrections have not been applied to either survey, comparison between the US Naval Oceanographic magnetic data and that of Young and Bailey (1973) suggest that in detail relative positions between the two surveys may differ by up to 10 km.

MAGNETIC FEATURES

Many of the main features shown by the anomaly map have already been commented upon by Young and Bailey (1974). These include the broad N-S oriented magnetic 'low' over the Porcupine Sea-Bight, the flanking magnetic 'highs', the strong E-W magnetic 'high' at 53° 10' N between 12° and 14° W and the complimentary 'low' to its north. While a detailed synthesis of the structural and tectonic significance of the magnetic features is not possible here, the following new features on the present map seem worthy of comment.

1. Feature centered on 53° 00', 11° 20' W. A complex feature about 50 km in diameter, cut by a number of sharp, linear N-S anomalies. From dyke orientations in Connemara and comparisons with magnetic anomalies elsewhere, this seems likely to indicate a large intrusive complex of probably Tertiary age.

2. Small linear anomalies in the region 51° 00' - 51° 30' N between 10° - 12° W. The work of Morris (1974) suggests that these may be due to Tertiary dykes, perhaps associated with 1 above.

3. N-S oriented linear anomalies in the region 53° 20' - 54° N, 12° 00' - 12° 30' W. These may also be due to Tertiary dykes.

4. E-W magnetic 'low' centered on 53° 30' N, 10° 45' W. This significant non-Caledonoid trend is also seen in the main 53° 10' magnetic 'ridge' to the west.

5. E-W to ESE oriented magnetic 'low' at 52° 30' N extending from 15° 30' W to 13° 30' W. This appears to be a major discontinuity across the 'Porcupine Ridge' which stretches southwards from Porcupine Bank.

6. Discontinuous linear feature running from 51° 10' N, 14° W to 52° 10' N, 13° 20' W. This could be the magnetic expression of a fault bounding the western margin of the Porcupine Sea-Bight basin.

7. NE-SW trending series of alternatively positive and negative anomalies in the region 54° - 55° N, 14° - 16° W. These are over Rockall Trough and seem to indicate a sea-floor spreading system based on a NE-SW oriented axis. The large anomaly at 54° 40' N, 14° 35' W may indicate the presence of a volcanic centre.

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October, 1975.

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55°N

16°W

TOTAL FIELD MAGNETIC ANOMALY MAP
IRISH CONTINENTAL MARGIN — SHEET 1

IGRF removed. Ships tracks shown.
Contours at 50 and 100 gamma intervals.
Mercator projection. Scale 1 : 320,000 approx.

15°W

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TOTAL FIELD MAGNETIC ANOMALY MAP
IRISH CONTINENTAL MARGIN — SHEET 1

100° revised. Ship tracks shown.
Contours at 50 and 100 gamma intervals.
Magnetic projection. Scale 1 : 500,000 approx.



