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Measurements of Magnetic Total Field Anomalies in the Hon Graben, Libya

A. Schult

Institut für Angewandte Geophysik der Universität München,

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Abstract. The total magnetic field along four profiles (ground stations) crossing the Hon graben has been measured. The anomalies found seem to strike parallel to the graben. West of the graben positive anomalies were found indicating a shallow depth of the magnetic basement in this area or other higher magnetized bodies striking parallel to the graben. In the central and eastern part of the graben the magnetic basement seems to have a trough-like structure.

Key words: Hon Graben – Anomalies of Earth's Magnetic Field.

Introduction

The Sirte basin in Libya is characterized by several NNW striking graben systems and graben-like troughs of which the Hon graben is the most western feature. The geological situation has been reviewed by Klitzsch (1970). The Hon graben (see Fig. 1) is about 260 km long and 40—60 km wide. Topographically the margins rise 100—300 m above the depression. According to Klitzsch (1970) the top of the paleozoic basement has its maximum depression of about 1800 m in the southern part of the graben. The present structure of the graben has been formed in Early and Middle Tertiary time. Early stages of the graben date back to the Upper Cretaceous. The surface of the graben shoulders consists of Upper Cretaceous and Lower Tertiary rocks, the graben depression of Upper Tertiary and younger rocks, all of low magnetization. Southwest of the graben are the extended flood basalts of the Jebel Soda (see Fig. 1).

An aeromagnetic survey of the Hon graben area is not known to the author. Provisional field magnetic measurements in ΔZ along one profile across the Hon graben were carried out by Schult and Soffel (1971). In this paper the results of ground measurements in ΔT (total field) along four profiles crossing the graben are presented.

Measurements and Results

The location of the profiles are shown in Fig. 1. The distances between the field stations were 1 km or less. The measurements were carried out with an Askania proton magnetometer (sensitivity $\pm$ 1 γ). The values

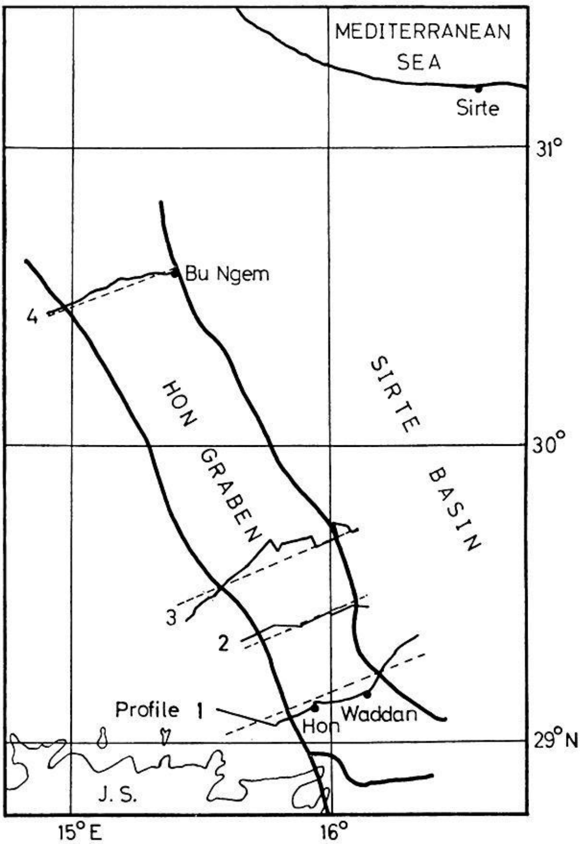

Fig. 1. Map showing the Hon graben and the location of the profiles (continous lines). For the interpretation the measured profiles were projected on straight lines (broken lines), vertical to the strike direction of the graben. J. S.: flood basalts of Jebel Soda

obtained were corrected for diurnal variation using the records of Missalat, Egypt (same magnetic latitude as the Hon graben) with a correction for the longitudinal difference. Anomalies were then calculated according to the regional field given by Leaton *et al.* (1971). Finally the measured profiles were projected on a straight profile line striking 68° from North to East (that is rectangular to the strike of the graben, see Fig. 1). The results for the projected profiles are shown in Fig. 2.

In general the shape of the anomalies on profiles 1, 2 and 3 are similar showing positive anomalies at the western graben shoulder, a broad minimum in the western part of the graben and a smooth increase in the middle and eastern part of the graben and the eastern graben shoulder.

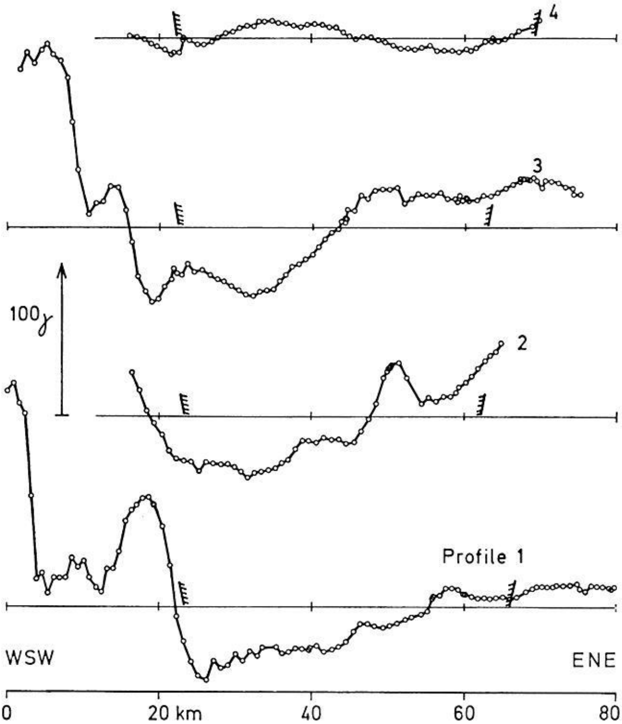

Fig. 2. Anomalies of total field along profiles normal to the strike direction of the graben. See Fig. 1

The similarity of the anomalies on the profiles 1—3 implies that the anomalies originate from magnetic bodies striking more or less parallel to the graben. — Profile 4 which is located in the most nothern part of the graben shows very small anomalies only.

Interpretation and Discussion

For a tentative interpretation it was assumed that the anomalies originate from a "magnetic basement" with a uniform magnetization of $125 \cdot 10^{-5}$ Gauss magnetized parallel to the direction of the present earth's magnetic field in that area. The results of the two-dimensional model calculation (with a strike parallel to the graben) are shown for profile 1 and 3 in Fig. 3. The assumed model of the magnetic basement at the western margin of the profiles is not realistic because the shape of the anomaly west of the measured profiles is not known. The large step of the magnetic basement at the western margin (in broken lines in Fig. 3) was introduced only to satisfy the boundary conditions.

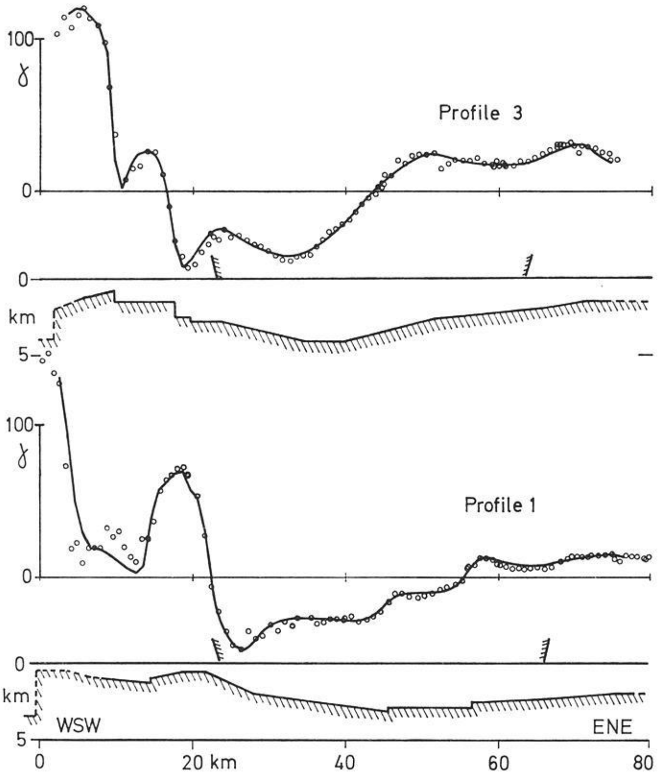

Fig. 3. Two-dimensional model calculation for profiles 1 and 3. Strike of the model is parallel to the graben. An uniformly magnetized magnetic basement (hatched area) with a magnetization of $125 \cdot 10^{-5}$ Gauss in the direction of the earth's field was assumed. Circles represent the measured anomalies, lines the model anomalies

According to the calculated models the "magnetic basement" shows relatively shallow depth at the western graben shoulder. — Gravimetric measurements in this area also indicate bodies of higher density at shallow depth (Soffel, personal communication 1973). — The depression of the magnetic basement which has its maximum depth in the middle of the graben is steeper at the western margin of the graben than in the eastern part. It should be considered however that the positive anomalies west of the graben may be also due to bodies with higher magnetization (e.g. basic intrusions) than the surrounding magnetic basements.

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Dr. A. Schult
Institut für Angewandte Geophysik
der Universität
D-8000 München 2
Theresienstr. 41
Federal Republic of Germany

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Correction

In the two papers

Long Range Profiles in Western Europe:

II. Fine Structure of the Lower Lithosphere in France (Southern Bretagne)
(A. Hirn, L. Steinmetz, R. Kind, K. Fuchs:
Z. Geophys. *39*, 363–384, 1973; paper A)

and

Long Range Propagation of Seismic Energy in the Lower Lithosphere
(R. Kind: J. Geophys. *40*, 189–202; 1974; paper B)

the time scale of one record section is in error. This record section is reproduced in the upper part of Fig. 2 and Fig. 3 (paper A), and in Fig. 1 of paper B. The time scale of this record section is labelled uncorrectly. The reduced time 30 s should read 25 s, the 5 s mark is labelled correctly. All other marks should be corrected accordingly. The time scale of the lower part of these figures is correct. The authors are grateful to E. Peterschmitt who has pointed out this mistake to them.