GRAVITY AND MAGNETIC DATA OF THE ANAXIMANDER MOUNTAINS

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Abstract

The Anaximander Mountains lie at the junction between the Hellenic Arc and the Cyprus Arc where the Mediterranean Ridge meets the Florence Rise. Results from the ANAXIPROBE project indicate that these mountains are a southward-rifted and foundered continuation of the southwestern Turkish Tauride mountains to the north. The mountains are separated by faults and are undergoing independent movements and deformations. Free air gravity anomalies indicate a crustal discontinuity running directly through the middle of the mountains. Free-air gravity anomalies decrease towards the Rhodes basin (northwest), the Finike basin (north) and the south side at the eastern mountains. These are partly correlable with water depths. The Rhodes Abyssal Plain has a depth of approximately 4000 m and a Bouguer gravity high of nearly 180 mGal. On the other hand, the Anaximander Mountains are marked by a gravity low only 0 to 20 mGal. It seems however, that changing sediment thicknesses and density alone can not explain the rapid change in gravity. In addition crustal thickening and a change from continental to oceanic type crust must be involved. The magnetic data of the region are rather patchy thus suggesting a complex block structure.

Key-words : crust structure, tectonics, Mediterranean Ridge

Introduction

The Anaximander Mountains lie at the junction between the Hellenic Arc and the Cyprus Arc where the Mediterranean Ridge meets the Florence Rise. The three principal mountains in the complex rise from depths of around 2000 to 2500 m to peaks at about 700 m (Western Mountain), 900 m (Southern Mountain), and 1200 m (Eastern Mountain). However surrounding depths can reach more than 4000 m to the west (Rhodes Basin) and 3000 m to the north (Finike Basin). Each mountain in the group has a different shape the others: Anaximenes is a curved ridge of moderately dipping (about 250) sedimentary strata, Anaximander is a north tilted (at about 40) tabular block, and Anaxagoras comprises a broken NW-SE ridge on a broader plateau of rough relief (1).

The boundary between the African and Eurasian plates is delineated by the Hellenic arc and Pliny-Strabo trench to the west and the Cyprus arc to the east. The complex geomorphology of the Mediterranean Ridge and Florence Rise around the Anaximander Mountains makes it difficult to distinguish true neotectonic deformation resulting from the regional plate interactions from local effects which may be caused by karstic processes, mud diapirism, or halokinesis (2). The mountains are separated by faults and are undergoing independent movement and deformation. They are caught up in the relative northeastward movement of the African plate with respect to the Aegean and Anatolian microplates, resulting on the one hand in transpression along the Pliny trench and the extension of this transform boundary into southwestern Turkey and, on the other hand, in the compression of the Mediterranean Ridge against the Florence Rise (3).

In order to determine the origin of the Anaximander Mountains and the current neotectonic deformations, three marine geophysical expeditions were carried out in the region within the framework of UNESCO/TREDMAR "Training-Through-Research (TTR)" program and the ANAXIPROBE Project during 1991, 1995 and 1996.

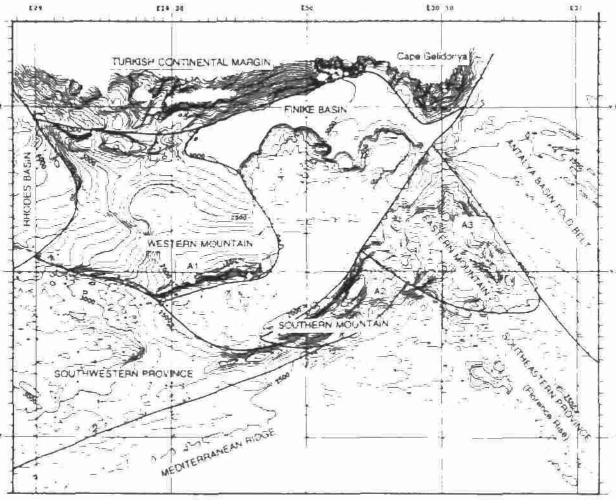

Fig.1: Bathymetry of the Anaximander Mountains and the different geographical regions (1).

The gravity measurements during the ANAXIPROBE Project cruise of 1995, were made by the gyro-stabilised marine gravimeter KSS 30 designed by Bodenseework Geosystem which has three main subsystems : (I) GSS 30 gravity sensor subsystem; (ii) KT 30 stabilisation subsystem; (iii) data handling subsystem. All the necessary corrections were operated on the raw data in the office of IFREMER in Brest in the same way as for the magnetic data. The magnetic data were collected by a M-244 Recording Proton Precession Magnetometer from Barringer. The sensitiviy of the magnetometer was 0.1 nT and towed 250-300 m behind the ship.

Results and discussion

Multibeam bathymetric data indicate five different morphological provinces in the Anaximander Mountains area, which are as follows : (i) the steep margin of southern Turkey with canyons, slumps, and cross-slope faulting; (ii) the consistent western mountain with a relative flat but northward dipping northern slope and steep southern escarpment; (iii) the relatively flat areas of the Finike Basin and the region between the western and the southern mountains; (iv) the rough and irregular eastern mountains; and (v) the irregular low relief of the region southwest of the mountains. A large tongue of sediment seems to extend over the Finike basin between the western and southern mountains. The impression is that the southern mountain is being pushed northward and squeezing the sediments lying between it and the western mountain outward to the north. The northern edge of the tongue of sediments has almost semicircular lobes with, in some cases there are spots of high reflectivity near their centres. Differential tectonic movements are thought to be responsible for both the elevations of the Anaximander Mountains and for the subsidence of the Finike and Antalya basins to the north and northeast of the Anaximander Mountains, respectively (2). Both the Antalya and Finike basins appear to have been tilted northeast and northwest, respectively, effects which seem to be connected with the development of the Hellenic Arc in the case of the Finike basin and with the development of the Cyprus Arc in the case of the Antalya basin.

Gravity results (free-air and Bouguer gravity anomaly maps are given by Figs. 2 and 3) indicate that there is a major crustal disconti-

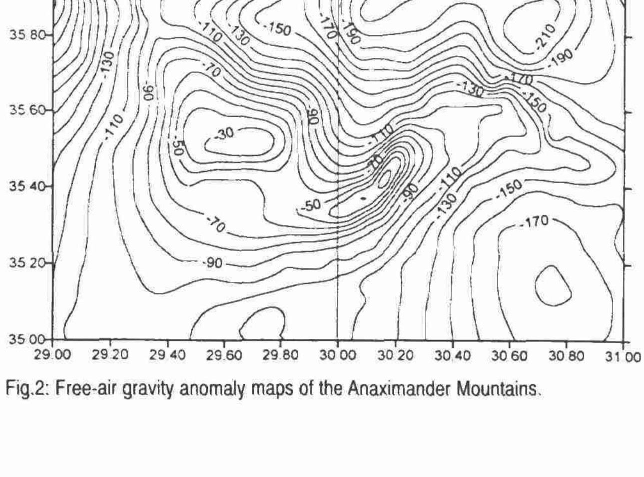

Fig.2: Free-air gravity anomaly maps of the Anaximander Mountains.