GEOLOGICAL STRUCTURE OF THE MYRTOON BASIN (AEGEAN SEA) BASED ON SWATH BATHYMETRY

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Abstract

A novel structure of the sea-bed has been revealed in the junction point among the Myrtoon basin, Cretan basin, volcanic arc and the south-western border of the Cycladic plateau. The bathymetric map, resulted by recently acquired multibeam data permitted the distinction of: a) a deep basin at the west which represents an asymmetric tectonic graben with very steep slopes and with a maximum subsidence of –1080m; b) a canyon type feature at the north-east which runs through the western Cycladic plateau producing an arcuate depression of about 300m deep, for a length of approximately 20 Km; c) a rough area with an irregular small scale relief at the south-east which is interpreted as the submarine prolongation of the Antimilos volcano. The tectonic regime is outlined by two major fault zones: one of WNW-ESE, direction which constitutes the southern marginal fault of the Myrtoon basin separating it from the Cretan basin by the Falkonera-Antimilos tectonic horst and the second of WNW-ESE direction which represents the northern margin of the Myrtoon basin but with much less subsidence. A secondary fault set of NNW-SSE direction subdivides the regional structure in smaller neotectonic blocks.

Keywords: Swath mapping, tectonics, Aegean Sea, Cretan Sea

Swath bathymetry

SEABEAM 2120 is a new swath system that has been specifically designed to accommodate users with survey requirements exceeding 6000m water depth accomplishing a satisfactory resolution without mounting a very large array. The first installation of this type with 1.80 beam width, has been completed during 2000 on the Hellenic vessel R/V *Aegaio*. It has an angular coverage sector of 150 degrees with 149 beams, covering a swath width from 7.5 to 1.15 times the water depth for depths 1000m to 5000m respectively, with a maximum swath coverage of about 9 Km, operating with vessel's speed up to 11 Knots. The above system was used during November 2000 with an average ship's speed of 6 Knots in order to achieve better along track resolution. A total track length of 495 Km have been surveyed resulting to a coverage of about 1084 Km^2, between the small islets Falkonera and Antimilos. The processed detailed bathymetric map is presented on Figure 1, as gray-tone coded bathymetry with a contour interval of 10m, in reduction from the colored original map of 1:25000 scale. The maximum depth 1180m coincides with the deep basin at the western edge of the map to the north of Falkonera islet, while the shallowest depth 83m stands on the top of the southern side of this basin east of Falkonera. The maximum slopes (30-50%) are observed to the south, close to Falkonera and delineate the southern border of the basin. The sea-bottom relief presents a high heterogeneity at various scales of topographical variations which permit the distinction of discrete physiographic units that may represent different geological basement.

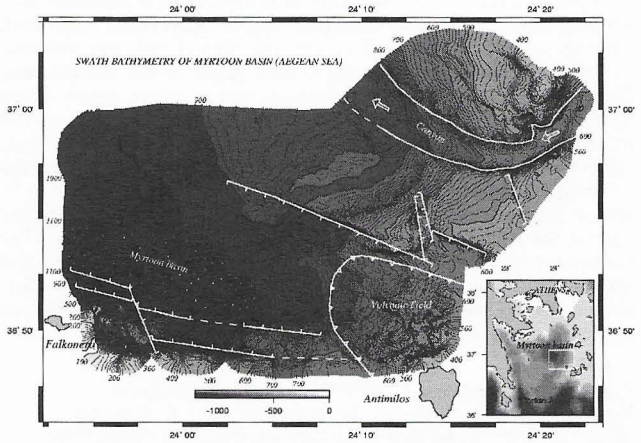

Figure 1. Bathymetric map

Interpretation of geological structures

The surveyed area, as can be seen in the inset map of Figure 1, is located in Myrtoon sea, at the junction between the Myrtoon basin, Cretan basin, volcanic arc and the south-western border of the Cycladic plateau. The overall neotectonic structure of the studied area is defined by three prominent features: a deep basin at the west, a canyon type feature at the north-east and an area of rough relief at the south-east north of Antimilos. The basin is developed in an approximately WNW-ESE direction as an elongated asymmetric tectonic graben with a length more than 8.5 Km and a width less that 3.5 Km (Fig. 2a1). It exhibits very steep slopes to the north of Falkonera and abruptly passes to a planar morphology slightly plunging to the south with slopes of 1-2% (Fig. 2a2). The submarine canyon is a semicircular channel that flows from the NE through the south-

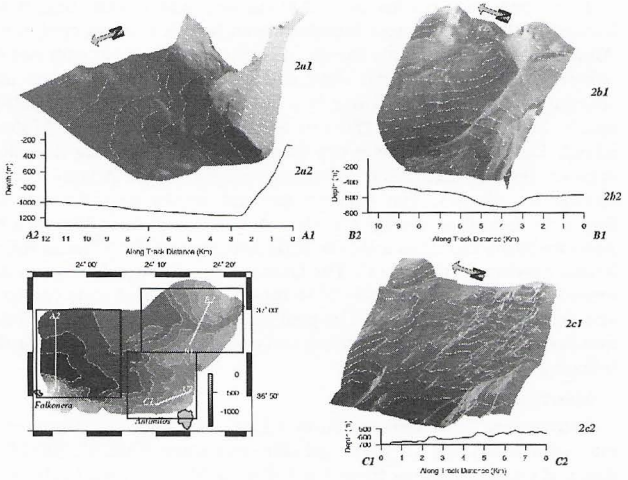

Figure 2. Perspectives images and bathymetric profiles of Myrtoon basin (a), Canyon (b), volcanic field. (c)

ern margin of the Cycladic plateau and discharges at almost right angle (Fig. 2b2). It is 200-300m deep, with a length of approximately 20 Km and a width from 1Km to 3Km (Fig. 2b2). The morphology of this canyon is most lightly inherited from older geological period when the Cycladic plateau was emerged and the present-day Cycladic islands were the summits of the mountain ranges. The peculiar rough relief exposed NW of Antimilos is presented by small undulations circular and oblong with a diameter of about 200-400m and highs of the order of 50m (Fig. 2c1, 2c2). This special relief has a distinctive signature also on the amplitude of the backscattered signal. The above signature may reflect a volcanic field in the northern prolongation of Antimilos volcano. The special morphological features may represent submarine volcanic debris, flows, submarine domes, necks and dikes. It is worth noted that, based on the dip of the volcanic formations on the northern part of Antimilos, Marinos (1) has suggested the existence of another volcanic center north of Antimilos.

The morphostructural regime revealed by the detailed analysis of the bathymetry pointed out the existence of two major fault zones of WNW-ESE direction, which form an asymmetric tectonic graben. The planar part of Myrtoon basin, previously described, occupies the central part of this tectonic graben and is developed, mainly, along the southern marginal fault zone which exhibits a vertical fault throw of more than 1 Km, in contrast to the fault throw of the northern margin which is only a few hundred meters. This general tectonic trend follows the regional trend of the Aegean volcanic arc and indicates a horizontal extension in NNE-SSW direction (2). The Falkonera-Antimilos ridge developed to the south of the southern marginal fault constitutes a WNW-ESE tectonic horst that separates the tectonic graben of Myrtoon basin from the major structure of the Cretan back-arc basin. A secondary fault system of NNW-SSE direction intersects the previous major fault structure creating smaller neotectonic blocks, as the blocks between the canyon and the volcanic field.

References

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