

ACTIVE TECTONICS IN THE CENTRAL PART OF THE HELLENIC VOLCANIC ARC, SOUTH AEGEAN SEA.

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Abstract

Santorini volcanic group is part of the Aegean Volcanic Arc and comprises of three distinct, NE-SW aligned, volcanic centers: Christiana Islets to the southwest, Santorini-Kameni in the middle and Kolombo volcanic chain to the northeast. Old, analogue seismic profiles, acquired between 1986-1992, recent seismic profiles, acquired in 2006, and swath bathymetry data, have been used to study the tectonic and volcano-sedimentary processes, unravel the geodynamic evolution of the central Aegean Volcanic Arc and understand if and how active tectonics controls the spatial distribution of volcanism in the Santorini volcanic province.

Keywords: Tectonics, Sedimentation, Back-arc, Geophysics, Hellenic Arc

Christiana and Anhydros Basins are the two adjoining basins of Santorini Island. Christiana Basin is located west of Santorini, east of Milos Island and north of the Cretan Basin, while Anhydros Basin is located NE of Santorini, between Ios (north) and Anhydros and Amorgos islands (south). The interpretation of the acquired seismic data that cover those two basins, gives us the opportunity to examine the prevailing geological and sedimentological regime in each basin separately and then to correlate the obtained results in order to draw conclusions for the main tectonic processes that dominate and affect the whole Santorini volcanic province.

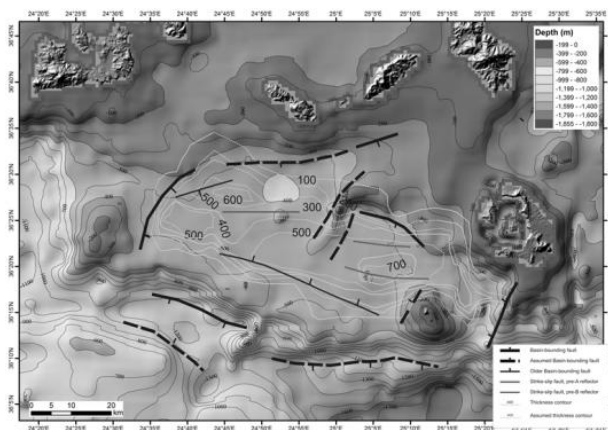


Fig. 1. Tectonic map of the Christiana Basin with major faults and fault zones and the thickness contours that define the sediments' thickness above the alpine basement

Christiana Basin is a W-E elongated basin. Extensional and strike-slip faulting, has played a dominant role in the formation of the basin during Plio-Quaternary. The western and northern boundaries of the basin are defined by apparently normal faults while the southern boundary has been controlled by a series of older blind faults. The eastern margin of the basin and the formation of Christiana volcanic center are controlled by NE-SW trending, active normal faults. The fault network with the older inactive faults and the active, apparently normal faults indicate that the post-Miocene evolution of the basin displays two main stages: A first stage which lasts until the Lower or Middle Pleistocene with three distinct depocenters and a second stagewhere older faults are deactivated, new faults shift the northern and western margins north- and westwards respectively, and the basin becomes unified.

The stratigraphy of Christiana Basin holds evidence for the activity of Santorini volcanic center. At least three different pyroclastic flows have been recognized within the basin's sedimentary infill. Volcanic material related to the Minoan eruption has been deposited on the sea floor of Christiana Basin covering a distance of more than 50 km². A second, older pyroclastic flow, probably related with Peristeria volcano, has been mapped 50 msec below the seafloor and can be indirectly dated to about 0,42 Ma while a third, up to 90 msec thick pyroclastic flow has been mapped in the central and eastern part of

Christiana Basin. Its age, estimated between 0,42 and 1,25 Ma, strongly suggests that it is generated from one of the early eruptive centers of Santorini.

Anhydros basin is a N45°E trending, elongate basin [1]. More than 20 volcanic cones, with Kolombo being the largest among them, have been mapped on the basin's seafloor [2], aligned on a N30°E trending zone. The Santorini-Amorgos zone is presently in the state of right-lateral transtension while the seismicity observed underneath Kolombo is associated with the Kameni – Kolombo Fracture Zone, which corresponds to the western termination of the major ENE-WSW Santorini – Amorgos Fault Zone ([3], [4], and [1]).

The interpretation of seismic profiles across Anhydros Basin shows that the latter has developed between the Ios (to the north) and Anhydros (to the south) fault zones. They diverge towards SW and display normal to dextral oblique slip character as postulated by the intra-basin deformation and the linear distribution of the volcanic cones along vertical to high-angle faults within the basin. Hemipelagic sediments alternating with volcanic material constitute the infill of the basin. A pyroclastic flow with an average thickness of 50 msec, probably related with the Minoan and Kolombo eruptions, lies on the seafloor. A thicker pyroclastic flow has been recognized at about 800 msec depth and is probably equivalent to the thick (third) pyroclastic flow mapped in Christiana Basin.

Preliminary results of our ongoing research indicate that the NE-SW linear distribution of the volcanic centers of Santorini volcanic province (Christiana, Kameni and Kolombo chain) in the Anhydros basin derives from the transtensional regime developed between the dextral oblique Ios and Anhydros fault zones. The WNW-ESE trending Christiana Basin, located at the southwestern end of Anhydros Basin may have developed as an extensional feature at the termination of the major Santorini – Amorgos Fault Zone.

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