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Submarine Volcanic Morphology of Santorini Caldera, Greece

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Santorini volcanic group form the central part of the modern Aegean volcanic arc, developed within the Hellenic arc and trench system, because of the ongoing subduction of the African plate beneath the European margin throughout Cenozoic. It comprises three distinct volcanic structures occurring along a NE-SW direction: Christianna form the southwestern part of the group, Santorini occupies the middle part and Koloumbo volcanic rift zone extends towards the northeastern part. The geology of the Santorini volcano has been described by a large number of researchers with petrological as well as geochronological data. The offshore area of the Santorini volcanic field has only recently been investigated with emphasis mainly inside the Santorini caldera and the submarine volcano of Kolumbo. In September 2011, cruise NA-014 on the E/V Nautilus carried out new surveys on the submarine volcanism of the study area, investigating the seafloor morphology with high-definition video imaging.

Submarine hydrothermal vents were found on the seafloor of the northern basin of the Santorini caldera with no evidence of high temperature fluid discharges or massive sulphide formations, but only low temperature seeps characterized by meter-high mounds of bacteria-rich sediment. This vent field is located in line with the normal fault system of the Kolumbo rift, and also near the margin of a shallow intrusion that occurs within the sediments of the North Basin. Push cores have been collected and they will provide insights for their geochemical characteristics and their relationship to the active vents of the Kolumbo underwater volcano. Similar vent mounds occur in the South Basin, at shallow depths around the islets of Nea and Palaia Kameni. ROV exploration at the northern slopes of Nea Kameni revealed a fascinating underwater landscape of lava flows, lava spines and fractured lava blocks that have been formed as a result of 1707-1711 and 1925-1928 AD eruptions.

A hummocky topography at the area that lies between the town of Fira on the main island of Santorini and Nea Kammeni has been revealed. The lower slopes were covered with landslide debris which consisted of lava blocks mostly mantled with soft sediment. At the upper slopes an abrupt cliff face was exposed that was highly indurated by biologic material. At the top of a volcanic dome, a crater with its deepest part at 43m, its rim at about 34m with an approximately 8m diameter was also found. Shimmery water with temperatures as much as 25ºC above ambient was observed there but the source of venting has not yet been found.

The combination of ROV video footage and multibeam data provide new information about the main morphological characteristics of Santorini Caldera which demonstrates the intense geodynamic processes occurring at the central part of the active Hellenic volcanic arc. These results will be useful for the interpretation of understanding the offshore volcanic area and its linkage with the onshore structures.