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Geodynamic features along the Christianna-Santorini-Kolumbo tectonic line (South Aegean Sea, Greece)

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Numerous oceanographic surveys have been conducted in Santorini Volcanic Group (South Aegean Sea) since 2001, revealing the spectacular morphology of the seafloor (multibeam data) and the sub-seafloor stratigraphic horizons (seismic profiles). Technological advancements in seafloor exploration such as ROVs and a submersible, enabled us to observe products of submarine volcanism that were previously inaccessible. In addition, gravity and box coring, geological and biological samples have been collected from selected areas for further analysis.

The offshore geophysical survey in Santorini shows that recent volcanism occurred along a NE-SW tectonic zone named as Christianna-Santorini-Kolumbo (CSK) line. Christiana islets and three newly discovered submarine volcanic domes, with small colonies of yellow, presumably sulfur-reducing hydrothermal bacteria, occur in the southwestern part of the line. The presently active intra caldera volcanic domes of Palea and Nea Kameni islands and the low temperature (17-24°C) vent mounds covered by yellowish bacterial mat occupy the middle part of the line. The Santorini vent field is linked with the Kolumbo normal fault onshore which is likely controlling the pathways of hydrothermal circulation within the caldera. The most prominent feature at the NE part of this zone, is Kolumbo submarine volcanic chain which is extended 20Km with several volcanic domes aligned along this direction. The Kolumbo volcano had an explosive eruption in 1650 that killed 70 people on Santorini. The hydrothermal vent field in the crater floor of Kolumbo consists dominantly of active and inactive sulfide-sulfate structures in the form of vertical spires and pinnacles, mounds and flanges along a NE-SW trend, with temperatures up to 220°C and vigorous CO_2 gas emission.

For several years, the highest frequency of earthquakes was concentrated mainly in the vicinity of Kolumbo volcano. However, during 2011-2012 both seismic and geodetic unrest began abruptly inside Santorini caldera related to a shallow magmatic intrusion indicated by inflation. Recently, several earthquakes occurred in the region south of Christianna at the SW edge of the CSK line.

This CSK line has possibly fed the post-caldera eruptions and is the main path for fluid circulation. In conclusion, the CSK tectonic line displays a special character in terms of morphology, volcanism, hydrothermal activity, seismicity and tectonic structure. It may cause important geohazards to the highly touristic Santorini island. Further seafloor investigations along this active line can provide insights into the overall geodynamic activity and aid the archipelago's hazard preparedness.