Weekly Report POS 510 (06.03.17-12.03.17)

POS 510 is the first of four research cruises with RV Poseidon in the Southern Aegean Sea, focusing on the volcanic and tectonic activity of the Cyclades region. POS 510 aims to document the geological evolution of the Anydros Basin and adjacent Kolumbo-Santorini Volcanic Line to better understand the sequence of early arc rifting and the emergence of magmatic-hydrothermal activity in a dynamic continental margin setting. Planned operations include heat flow surveys using the 3-m GEOMAR heat probe, sidescan and multibeam mapping using the AUV Abyss and LARS system, and sampling with a 3-m gravity corer.

RV Poseidon left the port of Catania, Italy, in the morning of Monday, March 6, and arrived on station in the Anydros Basin to commence operations at 8 am on Thursday, March 9. The first day of operations focused on background temperature profiles in the Anydros Basin west of the Kolumbo Line. A specially redesigned heat flow probe (Modell FIELAX GmbH, Bremerhaven) was used, consisting of a 3-m stainless steel lance and thermistor string (22 temperature sensors) with a temperature resolution of <0.01 °C). Five (5) heat flow stations, approximately 1 nm apart, were performed in the Anydros Basin NW of Kolumbo. Background temperatures were recorded across the rift zone at all locations, but penetration was limited due to clast-rich layers, except at one station on the western side of the basin nearest the Ios Fault.

The first deployment of the AUV Abyss was in the Anydros Basin west of Kolumbo, using the 120 kHz sidescan sonar configuration. The goal was to identify seafloor traces of the buried boundary faults of the rift. The vehicle was deployed at 4 pm and recovered the next morning (March 10) at 8 am after 15 hours of uneventful operations during the night. Preliminary inspection of the unprocessed sidescan data showed large-scale volcanic depositional features, related either to mass flows or pyroclastic deposits and a number of the anticipated fault traces.

On Friday, March 10, the first sampling inside the crater of Kolumbo Seamount was conducted using the 3-m gravity corer. The goal was to determine the extent of subseafloor hydrothermal activity beyond the small area of known venting in the NE of the caldera. Six (6) short (<3 m) gravity cores were collected, encompassing an area of 300 x 300 m at the bottom of the caldera. High temperatures in the sampled sediments and hardened ("baked") layers below 1 m indicate a laterally extensive hydrothermal alteration zone around the known vents. Cores outside the 100 m diameter area of venting were notably reduced, black and locally sulfidic. Two "hot cores" from the northern part of the caldera had temperatures of 96 ° and 87 °C (measured on the deck of the ship), corresponding to a boiling temperature at or below the seafloor of at least 265 °C (about 40 °C hotter than previously measured vent temperatures). Cores were visibly degassing when opened, with CO_2 bubbles in water-saturated sediment, and one had a smell of sulfur. Coarse pumice clast-rich layers appear to have been saturated with boiling water below the seafloor, with several layers containing anhydrite and black sulfidic mud; the hottest cores stopped in hardened mud 2 m below the seafloor. These cores were still "hot to touch" hours after being recovered. After opening and logging the cores, a total of 39 pore-water samples were extracted using Rhizon samplers. 39 sediment samples alsow were collected. The pore fluids from the "hot cores" represent the highest-temperature fluids sampled at Kolumbo.

During the night of Friday, March 10, a second AUV dive was carried out in the Anydros Basin to extend the sidescan survey further to the west of Kolumbo. The vehicle was recovered in the morning of March 11, and a second heat flow survey was started in the caldera of Kolumbo. Seven (7) stations were occupied in an area of 300 x 300 m, corresponding to the locations of the gravity cores collected on March 10.

On the evening of Saturday, March 11, in anticipation of deteriorating weather at Kolumbo, operations were moved to planned targets in the caldera of Santorini. The objective here is to test the

“connection” between the Kolumbo Line and the known hydrothermal activity in the Santorini Caldera. A first 200 kHz AUV multibeam survey was conducted during the night to map the extension of the Kolumbo Fault through the NE arm of Santorini Island, encompassing the known area of hydrothermal venting in the caldera.

To date (ending 12.03.17): 3 AUV dives, 12 heat flow measurements, 6 gravity cores, 39 pore fluid and sediment samples.

On behalf of the Research Team

Mark Hannington

Photo: Pore fluid sampling in hydrothermally altered (“baked”) mud from Kolumbo crater. Pore fluids are extracted using Rhizon samplers with 4- cm long porous membrane filters (0.12-0.18 micron pore size). Pore fluids were extracted within 1-2 hours after opening of each core.