

During the last days of cruise SO253 we explored our fourth working area, Rumble III, which is a large volcanic edifice that had been very active in the past decades.

Previous expeditions had shown a volcanic cone had grown on the summit of this very large volcano. New mapping showed that large parts of the cone had collapsed since it was last mapped in 2010, with only a 90 m tall lava column with some diffuse venting left standing, protruding up from the seafloor like a lighthouse. Two dives by the ROV were made at Rumble III volcano. They showed that the area where an earlier report had recovered mussels with a dredge had disappeared with most surfaces rather fresh and uninhabited by animals. Only around the diffuse venting sites at the lava column bacterial mats and some other organisms were seen. Still, the vent mussel



*Gigantidas gladius* was sampled, which had previously also been found at Macauley Caldera and Haungaroa, but not at Brothers. The individuals at Rumble III were all very small (around 1 cm, see photo), indicating that these

are young animals as part of a new population that was forming after the previous populations had been wiped out.

The diffuse fluids of about 25°C had a pH around 5 and moderate iron and sulphide concentrations at seawater chlorinity. Hydrogen concentrations were low, although methane was enriched compared to the other sites.

One CTD-tow station was carried out which detected some hydrothermal plume signals. Also one vertical CTD and one in-situ pump station were done. However, the tall lava column sticking out into the water made further water column surveys too risky. After the



second ROV dive, during which we were not able to locate the source of smoke plumes, we decided to abandon this working area and return to Brothers volcano, where we knew that there was still more to explore. During the transit we made a stop for a background CTD, trace metal rosette and in-situ pump station halfway between the two volcanoes, which later on turned out to show iron concentrations still significantly above ambient seawater at some depths. This can be taken as evidence that the whole Kermadec arc region is influenced by hydrothermal input into the water column, even at some distance from the active volcanoes.

At Brothers, we carried out two more ROV dives during which we explored more sites of the NW caldera and found and sampled new hot and diffuse vents and hydrothermal mussels.



One dive was also dedicated to the detailed sampling of a large stockwork occurrence, which is rather rare for arc volcanoes. The photos below show the stockwork cropping out on the left side and a photo of one of the samples that had been pulled out from the ore body by the manipulator arm of the ROV.



We were also the first to ever dive down to the floor of the caldera. The rather thick sediment there at about 1850 m water depth showed strong ripple marks from the current on the surface, and only some big fish and very small shrimps were seen. Closer to the caldera walls huge blocks of rocks that had fallen down from the caldera wall lay scattered in the sediment. We sampled the bottom water and the sediment and then moved up the caldera wall again and continued our exploration. Some more CTD, trace metal rosette and pump stations outside of the caldera were used to explore the far-field extension of the multiple hydrothermal plumes to the North and to the South of the volcano.

After the last ROV dive, we did some more echosounder mapping and magnetometer measurements to fill in the gaps of existing maps. On January 20, after most of the packing of boxes, lab cleaning and packing of the containers was finished, we held our second scientific meeting of the cruise to present newest results from Brothers volcano and Rumble III. Two posters presenting the cruise and first results of SO253 were also assembled, which will be presented on the ship during the Open Ship Day in Auckland on 25 January.

Cruise SO253 ends in Auckland on January 21 2017, after nearly 90 successful stations including 19 ROV dives of about 12 hours each. A large amount of on-board lab work will be followed by years of evaluating the results.

The scientific team would like to express its sincere thanks to the Captain and crew of R/V SONNE and the ROV team for their skillful operations and very pleasant working atmosphere and the Control Station and Shipping Company Briese for their continued support. At any time during the cruise we felt well taken care of and supported in our work. Funding for this cruise by the BMBF (project 03G0253) and permission to work in the Kermadec Arc by the New Zealand authorities is gratefully acknowledged.

For the last time we send our best wishes from board RV Sonne and wish the upcoming cruises as much luck, success and fun as we had during our cruise.

*Andrea Koschinsky and all participants of cruise SO253*