RV SONNE cruise SO311

3rd Weekly Report (07. – 13.04.2025)

The MeBo drilling into the summit area of the Upper Cone, the larger of the two young volcanic cones in the southern part of the Brothers caldera, initially went very well. After about 36 hours, however, drilling had to be abandoned because the drill pipe had become stuck. But when the drill cores were removed on board the *Sonne*, it became clear that the drilling had been very successful. The volcanic rock was cored almost completely over a distance of several meters. These



cores represent unconsolidated volcanic materials that were literally cemented by rising hydrothermal solutions. The rock was transformed into clay minerals and former cavities between the rock fragments were filled with sulfate minerals and elemental sulfur.



Fig. 1: The MeBo cores from the upper cone of the Brothers volcano impress with their almost perfect preservation and great variety of details. Photo: Fabian Hampel

A nighttime reconnaissance survey with the multibeam echo sounder took us to the Kibblewhite volcano 35 km northeast of Brothers. Kibblewhite is considered to be hydrothermally active; however, a CTD survey and two TV grab deployments did not reveal any evidence of hydrothermal activity. Back at Brothers Volcano, we deployed the TV-guided grab on Wednesday to sample hydrothermally mineralized basement on the northwest caldera wall. We had discovered these deposits in 2016 during cruise SO253 with the remotely operated vehicle MARUM Quest 4000m. The grab samples that have now been recovered show spectacular veins with iron, zinc and copper sulfides that have permeated volcanic ash like a network. These types of formations are known as "stockwork zones" to geologists studying hydrothermal deposits, and they are located directly below the sulfide accumulations on the sea floor. As we cannot drill with MeBo in the steep caldera wall, we are now using the TV-guided grab to sample rocks from the subsurface on near-vertical slopes that have been exposed by rockfalls. This seems to work very well and we will repeat this type of sampling in other parts of the caldera wall.

The next deployment of MeBo200 took place on the northern edge of the caldera, where a hydrothermal field was discovered and mapped with high precision during a US research



Fig. 2: Impressive examples of stockwork mineralization could be retrieved from the steep caldera walls of Brothers. Photo: Fabian Hampel

expedition in 2018. With the excellent map material, we were able to place MeBo directly next to the active smoker field on an ash-covered area and drill a well. We hoped to be able to sample the ascent paths of the hydrothermal solutions when drilling the borehole directly next to the hydrothermal field. Unfortunately, this expectation was not confirmed. At the drilling location, the subsurface consists only of unconsolidated ash and fresh lava rock down to a depth of approximately 35 m.

Towards the end of the week, we were caught in a low-pressure trough and were unable to use MeBo due to the stormy weather. The TV grab was also temporarily out of order. We used this time to survey two large submarine volcanoes located about 40 km west of Brothers and to investigate hydrothermal activity using hydroacoustic methods and CTD. However, neither *Rapuhia* nor *Giljanes* showed any evidence of hydrothermal venting.

Today, Sunday, we deployed the chain bag dredge to sample rocks from volcanic spreading ridges near the Brothers and Healy volcanoes. Tomorrow, MeBo will be deployed at Healy Volcano to sample young volcanic cones associated with hydrothermal activity.

The atmosphere on board remains excellent and we are looking forward to the exciting work during the second half of the expedition.

Best regards, also on behalf of all those taking part in the expedition,

Wolfgang Bach



Fig. 3: The contents of a chain bag dredge are inspected anxiously by researchers from FAU Erlangen-Nürnberg. Such samples of the volcanoes' wider surroundings allow conclusions to be drawn about the origin and development of magma in the region. Photo: Fabian Hampel