

RV SONNE cruise SO311

2nd Weekly Report (31.03. – 06.04.2025)

The *Brothers* volcano continued to be the focus of our investigations during the second week. The video-guided grab was used to take samples of the volcanic subsurface of *Brothers* and other volcanic structures in the immediate vicinity. In addition, the water column above the volcano was repeatedly sampled to track the dispersion of chemical substances escaping from the hydrothermal vents and spreading into the ocean. In the south-eastern part of the *Brothers* caldera (a large crater), the first boreholes were drilled with the MeBo200 seabed drilling rig. Here the seafloor beneath the steep crater wall is relatively flat, which is ideal for MeBo deployment. Geophysical measurements by our colleagues from the Geological and Nuclear Sciences (GNS) Institute of New Zealand indicate that the subsurface at the drilling location must be hydrothermally altered.

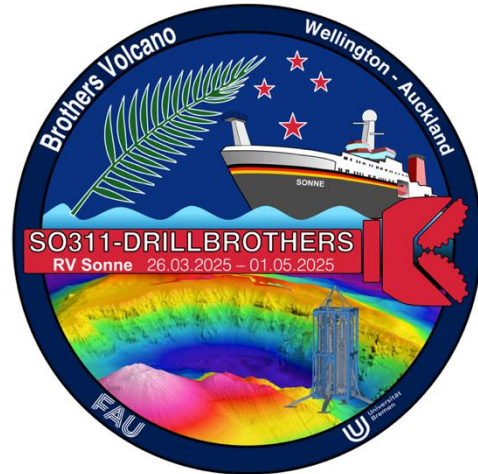


Fig. 1: The video-guided grab retrieved samples of the volcanic basement of Brothers and several volcanic structures in the region. Photo: Fabian Hampel

In order to reach these layers of interest to us, MeBo had to drill through the overlying layer of slope debris. This was actually successful at the second attempt. Several meters of drill core from a depth of 15 to 25 m were recovered and show the hoped-for hydrothermal transformations. Beautiful crystals of sulphate and sulphide minerals can be recognized and described with a magnifying glass and under a microscope. The volcanic rock in which these crystals are found also indicates changes due to interactions with rising hydrothermal solutions through striking discolorations.

Unfortunately, further deepening of the borehole was not possible at this point as the borehole wall became unstable and blocked the drill pipe. The drilling had to be abandoned, but an initial success was achieved.

In the second half of the week, the fine weather temporarily came to an end and we spent this period of stormy seas surveying the seabed with the SONNE's modern echo sounder. The wider area around *Brothers*, including a volcano to the north-east called *Kibblewhite*, was mapped.

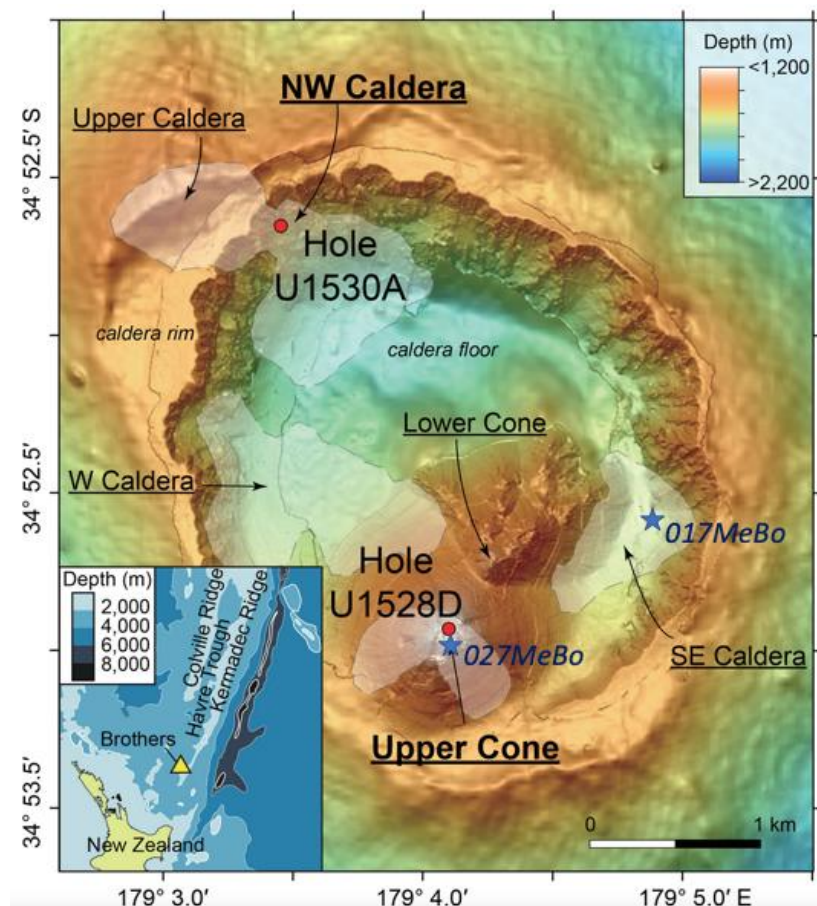


Fig. 2: The Brothers volcano has a 3-km wide caldera, in the southern part of which two cones are growing. One of these is currently being drilled (027). An earlier borehole was drilled in the south-eastern part of the caldera (017). The international research drilling program IODP already drilled several boreholes in 2018, which went down to a depth of 450 m, but could only sparsely sample the shallow subsurface. MeBo will now provide these missing samples. Bright areas in the map indicate magnetic anomalies that are due to hydrothermal overprints of the volcanic rocks. (Map from Lee et al., 2023, *Econ. Geol.* 118, 1741-1760)

The storm moved through quickly and MeBo200 was deployed again on Sunday morning. The target of the current drilling operation is the Upper Cone, the larger of the two young volcanic cones growing on the caldera floor in the southern part of *Brothers*. As these lines are being written, MeBo's diamond-studded and therefore extremely hard drill bit is eating its way meter by meter into the rocky foundations of *Brothers* at a water depth of over 1200 meters. Here, in the summit region of the cone, there is no slope debris that could cause trouble. But drilling is not easy at this location either, as we are in the immediate vicinity of hot and very acidic springs.

The atmosphere on board is excellent and the cooperation between the bridge, engine, deck and scientists is going very well.

Best regards, also on behalf of all those on board,

Wolfgang Bach



Fig. 3: Full of anticipation and in visibly high spirits, the first cores of the MeBo200 seabed drilling rig were taken from the core tubes on the working deck of the SONNE. Photo: Fabian Hampel