



## Morphological evolution of the Hunga Tonga–Hunga Haʻapai submarine volcano after the explosive eruption

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Submarine eruptions dominate volcanism on Earth, but the recent eruption of Hunga Tonga–Hunga Haʻapai volcano in January 2022 was one of the most explosive eruptions ever recorded. Many large calderas collapse during eruptions and the resulting morphology provides unvaluable information for understanding the processes during highly unpredictable eruptions.

Here we present a detailed analyses of the post-eruption morphology of the caldera of the Hunga Tonga–Hunga Haʻapai submarine volcano. We use the first multibeam bathymetry of the caldera, acquired only 5 months after the eruption on the MV Pacific Horizon, in May 2022.

The multibeam data shows landslides with 0.5-1 km wide scars, mainly on the southern rim, with the deposits extending to the central part of the caldera. However, the flat inner caldera suggests that most of the material was deposited simultaneously to the caldera drop following the eruption, on the order of 800 m. Sediment cores collected inside the caldera show repeated turbidity current sedimentation pointing to ongoing mass wasting, which could have potentially led to eventual breaching of the rim on the north and east side. Submarine ridges were preserved on these sites, separating the inner caldera and two erosional channels on the outer part, which point to the main debris transport paths during the eruption. More than 50 active gas plumes are observed on the eastern side, located following a straight W-E transect, and on the northern side, where the vents are covering the collapse walls close to the eastern Hunga Tonga–Hunga Haʻapai island. The presence of these vents and their distribution related to the morphology of the caldera, indicate the most energetic parts of the volcano, which can potentially still be hazardous. Our morphological analyses provide new insights of transport and depositional processes following highly energetic submarine eruptions.