Effects of the lava flows associated with the eruption of the volcano at Cumbre Vieja (2021) on the insular shelf and slope of La Palma island (Canary Islands)

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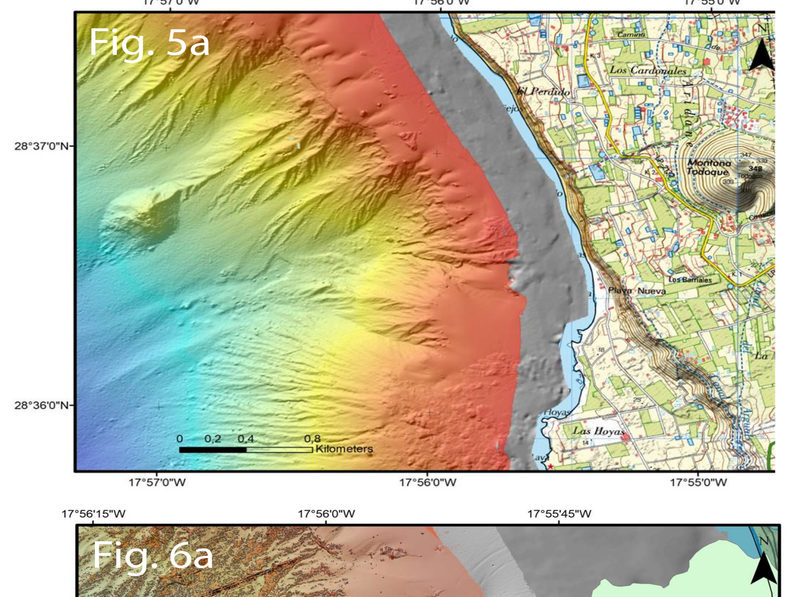
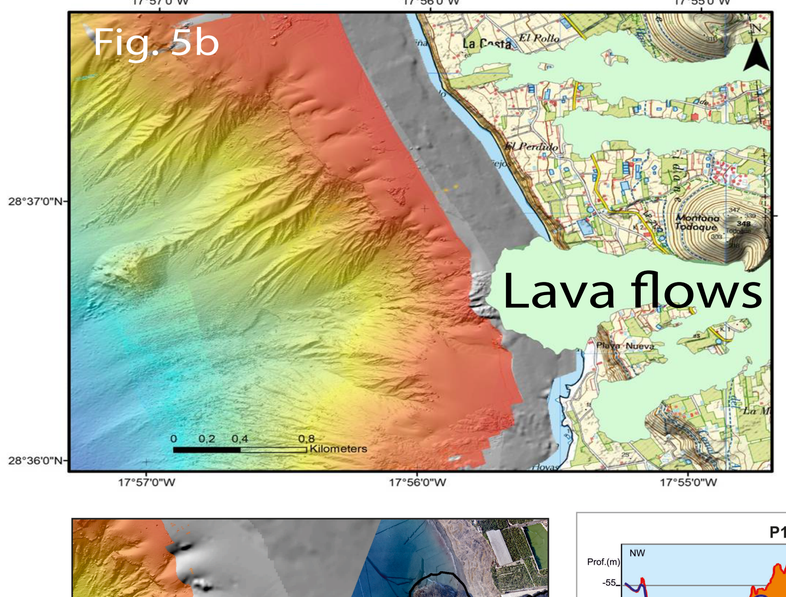
Abstract: The eruption of the volcano on the Island of La Palma (Canary Islands) began in September 2021 and flowed westward reaching the coastline 8 days later, flowing through the platform and the upper slope as blocks (aa) and pahoehoe, being conditioned by small gullies on the upper slope. Significant morphological changes have been defined in the subaerial northern and southern lava deltas (areas of 43 and 5.4 ha, respectively), and on a submarine area of ~30 ha. Volcanic material has been identified as far as 1.2 km from the original coastline at ~305 mbsl.

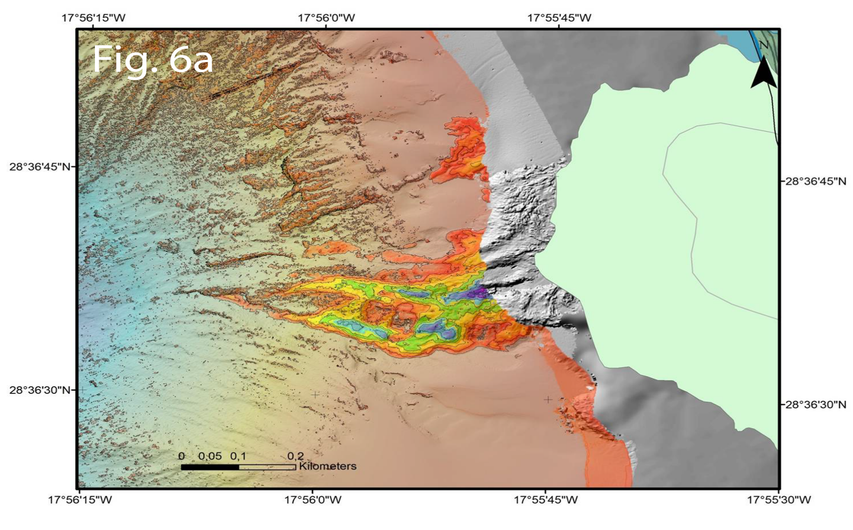
Fig. 1

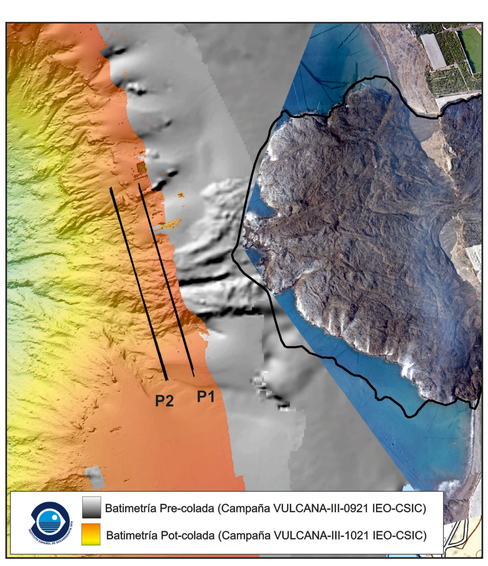
The volcano of La Palma (Canary Islands) (Fig. 1) released lava flows that reached the ocean and generated a marine lava delta one week after the eruption (Figs. 2, 3 and 4). The oceanographic research vessels Ramón Margalef and Ángeles Alvariño of the Spanish Institute of Oceanography (IEO-CSIC), carried out multidisciplinary oceanographic study of the marine area affected by the lava flows. High resolution mapping was carried out using multibeam echosounders. These maps allowed us to identify and characterize structures associated with active processes, terrain deformation and the submarine advance of the lava flows by comparing the bathymetry obtained before (Fig. 5a) and after the arrival of the lava to the coastline (Fig. 5b).

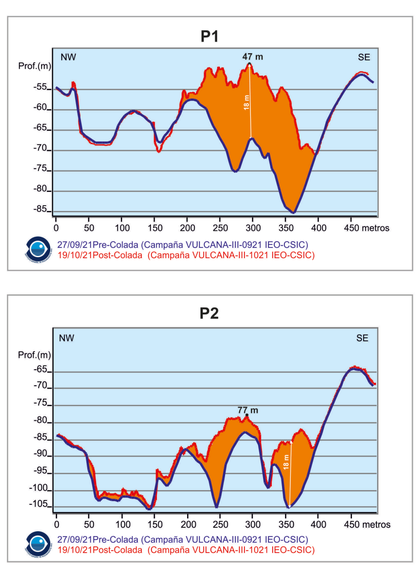




We estimate that 3Mm³ of lava was delivered under the surface of the ocean (Fig. 6a and b), with a maximum thickness of approximately 40 m. Rock and coral samples were also obtained using a Remote Operated Vehicle (ROV) (Fig. 7).

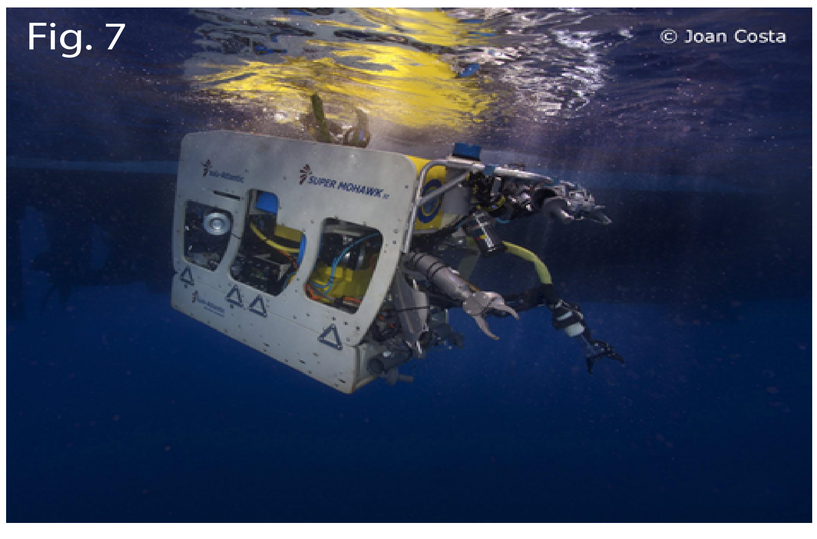






Seawater samples were collected to estimate the concentration of different chemicals elements as well as the abundance and diversity of the different components of marine plankton. Lava deltas were generated from both "aa" lavas (Fig. 8a and b) and pahoehoe lavas that produced mega-pillows (Fig. 9a and b).

This study improves the knowledge of the magmatic system at depth and its evolution into a volcanic system, and will be useful for risk management in future eruptive events.



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