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Geomorphological Analysis of the Underwater Tagoro Volcano (Submarine Slope of El Hierro Island)

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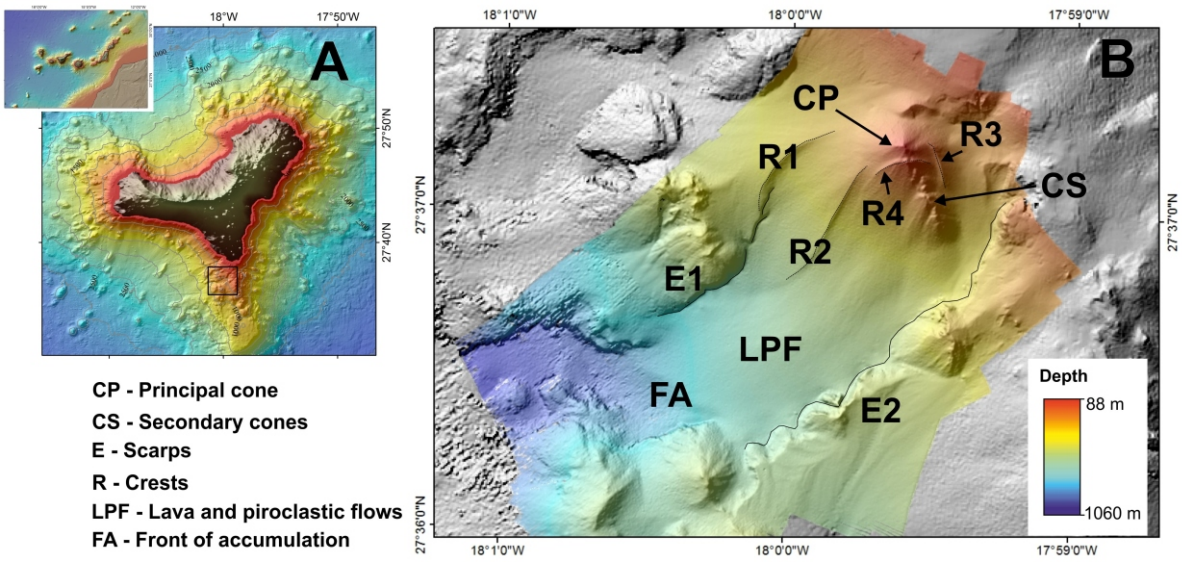
Abstract:
Between October 10th 2011 and March 5th 2012, an underwater volcanic eruption took place 1.8 km south of El Hierro Island originating the new Tagoro volcano. It was characterized by the emission of pyroclastic products, lava balloons and gases into the water column. The Spanish Institute of Oceanography carried out 21 multidisciplinary oceanographic cruises in order to monitor the evolution of the physical-chemical-biological and geological properties of the submarine eruption and its impact on the marine ecosystem. The major geomorphological features of the Tagoro volcano were achieved by using the Multibeam EM710 and parametric TOPAS PS18 echosounders data, acquired during the last 5 years of oceanographic expeditions. The eruption produced a main volcanic edifice rising from 400 to 88 m water depth (mwd) on the submarine slope with a subcircular base (1-1.3 km in diameter) and a NNW-SSE elongated top (Fig. 1). This edifice consists of a quasi-circular principal cone and at least 9 secondary cones extended towards the SSE from the main one. This distribution might indicate a fissure eruption in the last phase, probably controlled by a NNW-SSE failure. In the SW flank of the main cone, mixed lavas and pyroclastic flows were deposited along more than 5 km length and 1500 mwd. These flows were channeled throughout a pre-eruption valley and the maximum thickness front (FA) is located 2.5 km away from the base of the main edifice. Two main scarps (E1 and E2) and four crests (R1, R2, R3 and R4) have been observed. The scarps follow a relatively irregular NE-SW trend and correspond to the reworked flanks of the pre-eruption valley; especially E1 moves backwards as result of the evolution of the eruption progress. R1 has a NE-SW trend in the prolongation of E1 and its arc-like shape could be related to a gravitational scar developed during the eruption. R2 (NE-SW trend) and R3 (practically N-S) crests were probably caused by the instability of the main edifice toward the SSE, and the minor R4 (ENE-WSW trend) separates the main cone from the secondary ones. Finally, it has been observed that the pyroclastic rain has smoothed the surface of the surrounding reliefs especially to the NW of the Tagoro volcano.



CP - Principal cone
CS - Secondary cones
E - Scarps
R - Crests
LPF - Lava and piroclastic flows
FA - Front of accumulation