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Shield vs post-erosional volcanism in Juan Fernandez Ridge (Nazca plate): insights for magma transport and storage

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Robinson Crusoe island corresponds to the main remnant of volcanic structures in the Juan Fernández Ridge, a ~750km-long aseismic ridge located on the Nazca plate in the southeastern Pacific. Two different volcanic units show the existence of a period of shield volcanism (ca. 3.80 to 3.40Ma), and after a subsequent erosional event, a final stage of post-erosional volcanism (ca. 1.38 to 0.77 Ma) that filled the paleo-relief depressions. The conditions of magmatic transport and storage of each unit are studied by modeling the flexural stress fields generated by vertical movements (mechanical model calculation of isostatic variations in each stage), and the estimation of P-T conditions of crystallization from EPMA data in olivine (temperature estimates from Herzberg and O'Hara [2002]) and clinopyroxene (pressure estimates from Nimis and Ulmer [1998]).

Primary results of the isostatic model show a central field of extensive stress during the shield stage volcanism due to growth of the volcano and its consequent subsidence. Furthermore, geothermobarometry yields pressure of 0-3.2kbar and crystallization temperatures of 1166-1197°C. These data suggest the existence of shallow magmatic reservoirs during the shield volcanism period that allowed differentiation by fractional crystallization and a decrease in temperature.

The 'erosive' uplift after the extinction of shield volcanism changed the stress conditions and generated variations in the transport style for the post-erosional magmatism restoring direct ascent pathways for the new intrusions. These changes are reflected in pressures of pyroxene formation of 0-10.2kbar and temperature conditions grouped into two sets. A

group of low-T, characterized by olivine with zoned rims, crystallized at 1271-1306°C; and a high-T, between 1332-1368°C, and olivine Fo89-91 content that correspond to primitive magmas in equilibrium with the mantle. These data allow us to interpret magmatic direct transport, facilitated by tectonic stress conditions, with possible development of small surface reservoirs for the group of low-T.