Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.9210

Unravelling the evolution of the Late Holocene monogenetic volcano cluster, Zacapu Basin, Mexico: crystal fractionation, crustal assimilation, or mantle source heterogeneity?

NANCI REYES GUZMAN[1], ELISABETH WIDOM[1], CLAUS SIEBE[2], DR. PATRICIA LARREA, PHD[3] AND DAVID KUENTZ[1]

[1]Miami University, Oxford, OH

[2]Departamento de Vulcanologiì a, Instituto de Geofiì sica, Universidad Nacional Autoì noma de Meì xico, Ciudad Universitaria, Ciudad de Meì xico C.P. 04510, Coyoacaì n, Mexico

[3]Departamento de Geología y Centro de Excelencia en Geotermia de los Andes (CEGA), Facultad de Ciencias Físicas y Matemáticas, Universidad de Chile, Santiago, Chile

Presenting Author: nanreyguz@gmail.com

The Late Holocene Zacapu cluster (HZC), located at the western margin of the Zacapu lacustrine basin (Michoacán-Mexico), comprises four eruptions that occurred closely in space and time over a period of ~2,500 years: Infiernillo, Malpaís Las Víboras, Capaxtiro and Malpaís Prieto. The cluster started in a Strombolian style with the eruption of the Las Vigas scoria cone (SiO_2 = 57 wt.%), which also produced the Infiernillo lava flows (SiO_2 < 59 wt.%). It was followed by Malpaís Las Víboras, a thick andesitic (SiO_2 = 61-63 wt.%) lava flow with a pure effusive style. The next eruption was Capaxtiro, an andesitic (SiO_2 = 62-64 wt.%) compound lava flow field formed by 28 flow units and a dense spatter cone. Finally, the youngest volcano, Malpaís Prieto, is a thick andesitic lava flow chemically and morphologically similar to Malpaís Las Víboras. The spatial-temporal proximity and geochemical progression from a gas-rich mafic magma to a SiO_2-rich degassed magma suggest a genetic relationship. In order to test whether the cluster tapped a single progressively evolving magma reservoir, or was produced by different magma batches, we conducted Sr-Nd-Pb-Hf isotopic analyses combined with major and trace element modelling for fractional crystallization (FC) and assimilation (AFC) processes. Major element variations are consistent with closed system FC of olivine and pyroxene, with minor Fe-Ti oxides. However, La and Zr vs. SiO_2 trends are opposite to those expected for FC or AFC. Furthermore, isotopic signatures do not vary systematically with time, contrary to the expectation for progressive assimilation of continental crust. Although FC is an important process in generating the observed range in SiO_2, the eruptions are not related to one another via progressive FC or AFC, and likely require variable degrees of melting of a heterogeneous mantle source. Ongoing Os isotopic analyses and olivine diffusion profiling will provide additional constraints on the sources, processes of evolution, and magmatic timescales, to better understand the petrogenetic relationship between the magmas of the eruptive sequence.