Preliminary petrologic and geochemical observations of volcanic rocks associated with an area of active surface uplift in the Lazufre region, Andean Central Volcanic Zone

Alicia D Wilder, Todd C Feeley, Gary S Michelfelder

Montana State University, United States

E-mail: alicia.wilder@msu.montana.edu

The Lazufre region is an area of active surface uplift (~25°14'S) situated between two potentially active Quaternary volcanic centers, Lastarria and Cordon del Azufre, in the Andean Central Volcanic Zone. InSAR observations show signs of unrest with an elliptical deformation area 45 by 37 km with a maximum inflation rate of ~2.5 cm/yr. The inferred depth of the magma chamber is 10 km below sea level. Given this depth, deformation and surface uplift are unlikely to be solely hydrothermal in origin and imply active pluton growth. Whole rock K-Ar dates of lavas from Cordon del Azufre place the most recent eruptions at 0.6-0.3 Ma $\pm$0.3 Ma. The most recent eruptive activity at Lastarria has been dated at ~0.5-0.1 Ma. Bombs and blocks of banded pumice are common on the surfaces of Lastarria lava flows indicating intermittent explosive and effusive eruptive activity. Eruptive products of Lazufre are primarily andesites and dacites (59-67 wt.% SiO_2) with plagioclase-pyroxene-amphibole-biotite-opaque-quartz phenocryst assemblages. Many plagioclase phenocrysts in all composition rocks possess resorption textures with finely-sieved, dusty zones near the margins of the crystals suggesting that magma mixing and mingling occurred at a late stage after the phenocrysts formed but prior to or during eruption. Trends in major and trace element concentrations suggest that crystallization-differentiation processes were also important processes in the evolution of the magmas. These trends include consistent decreases in MgO (4.0-1.5 wt.%), CaO (6.4-3.5 wt.%), TiO_2 (1.03-0.61 wt.%), and FeO (6.8-3.9 wt.%); variable increases in K_2O (2.3-4.1 wt.%), and little variation in Na_2O (2.9-3.6 wt.%) with increasing SiO_2 contents. Large ion lithophile trace elements show enrichments beyond those that can be produced by crystallization-differentiation alone (Rb=103-291 ppm and Th=18-66 ppm); while compatible trace elements are strongly depleted relative to inferred primitive mantle melts: Sr (578-294 ppm), Cr (61-10 ppm), Ni (33-14 ppm). Closed system crystallization-differentiation processes alone cannot be the only factors influencing magma compositions, however, as $^{87}Sr/^{86}Sr$ values are highly elevated (0.70651-0.70715). Collectively these data attest to a multitude of differentiation processes and magma sources including crystallization-differentiation from more mafic magmas, melting and assimilation of older crustal rocks, and magma mixing and mingling.