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Mafic volcanism of Neogene to Quaternary age in the northern Chilean Andes (21º10'-22º50'S)

Osvaldo González-Maurel (1,2), Petrus le Roux (2), Beningo Godoy (3), Frances Deegan (4), Valentin Troll (4), Andrew Menzies (1), and Marina Vargas (5)

(1) Departamento de Ciencias Geológicas, Universidad Católica del Norte, Avda. Angamos 0610, Antofagasta, Chile (ogm004@alumnos.ucn.cl), (2) Department of Geological Sciences, University of Cape Town, Rondebosch 7701, South Africa, (3) Centro de Excelencia en Geotermia de los Andes (CEGA), Departamento de Geología, Facultad de Ciencias Físicas y Matemáticas, Universidad de Chile, Plaza Ercilla 803, Santiago, Chile, (4) Department of Earth Sciences, Section for Mineralogy, Petrology, and Tectonics (MPT), Uppsala University, SE-75236 Uppsala, Sweden (frances.deegan@geo.uu.se), (5) Maini, Unidad de Equipamiento Científico, Universidad Católica del Norte, Antofagasta, Chile.

The Neogene-Quaternary magmatic arc of the Central Andes formed on continental crust some 70-74 km thick. Parental magma compositions for this arc are difficult to determine due to the scarcity of basaltic eruptives, likely due to differentiation of mantle-derived magma during ascent through the thickened crust. However, a rare concentration of mafic eruptives is located in the Western Cordillera of northern Chile between 21°10'S to 22°50'S, marginal to the highly evolved Altiplano Puna Magma Body (APMB). To unravel the relationship between mafic magmatism and the APMB, we present automated mineralogical analyses, major and trace element data, and Sr and Nd isotope ratios on a suite of porphyritic mafic samples. Whole-rock geochemical and Sr and Nd isotope data reveal a large degree of compositional heterogeneity, e.g., 52.5 to 64.8 wt% SiO_2, 1.76 to 6.33 wt% MgO, 2 to 382 ppm Cr, 3 to 80 ppm Ni, 87Sr/86Sr = 0.705541 to 0.708746, and 143Nd/144Nd = 0.512208 to 0.512513. The combined dataset points to magma compositional changes over time, which we interpret as the result of inter-linked processes such as fractional crystallization, magma mixing, crustal assimilation, and assimilation during turbulent ascent (ATA). Remarkably, the studied mafic volcanoes cluster at the border of the APMB partial melt anomaly, where the vertical mush thickness is thought to be at a minimum. We thus suggest that the scarce mafic eruptives in the Central Andes were sourced from basaltic melt injections underplating the APMB at depth, and subsequently modified during storage and ascent through the crust.