Deciphering the geochemistry of lithospheric mantle in the melt source of the Payenia volcanic province, Argentina

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The Payenia volcanic province (central Argentina, 34.5-38° S) comprises a region of voluminous Plio-Quarternary back-arc basaltic volcanism, a substantial portion of which bears an intraplate geochemical signature. Some previous workers have attributed this signature to convecting asthenosphere [1,2], while others suggested the involvement of the subcontinental lithospheric mantle (SCLM) [3,4,5]. To better resolve the mantle source of Payenia volcanism, we report whole rock major and trace element concentrations and Sr-, Nd-, Hf-, and Pb-isotope ratios and high-precision oxygen-isotope ratios of olivine phenocrysts in a set of 35 Payenia back arc basalts and basaltic andesites. The $\delta^{18}O_{VSMOW}$ values of olivine phenocrysts from Payenia basalts vary from 4.84 to 5.39‰, a range that covers and extends below the range of normal mantle $\delta^{18}O_{ol}$ values (5.0-5.4‰) [5,6]. A subset of Payenia lavas with an intraplate signature have $\delta^{18}O_{ol} \approx 5.0$‰ and exhibit Hf and Nd isotope ratios that diverge from the Hf-Nd mantle array (i.e., $\Delta\varepsilon_{Hf}$ values reaching -2.8). The low $\delta^{18}O_{ol}$ and the trace element composition of these lavas preclude contribution from the continental crust. Instead, we suggest such isotopic fractionation may occur during metasomatism of the SCLM. We developed a simple forward model of melting magmatic cumulates within the SCLM, which predicts the isotopic variations and trace element compositions observed in the erupted melts. Model results represent the first quantitative indication of a SCLM-derived melt source in Payenia.

[1] Søager *et al.* (2013) *Chem. Geol.* **349-350**, 36-53. [2] Søager and Holm (2013) *Chem. Geol.* **360-361**, 204-219. [3] Stern *et al.* (1990) *CMP.* **104**, 294-308 Kay *et al.* (2013) *CMP,* **166**, 165-192. [4] Jacques *et al.* (2013) *GCA* **123**, 218-243. [5] Mattey *et al.* (1994) *EPSL* **128**, 231-241. [6] Eiler (2001) *Rev. Min. Geochem.* **43**, 319-364.