Asthenospheric versus lithospheric sources of the Payenia basalts (Argentina): Constraints from Al-in-olivine thermometry and melt inclusions

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Crystallisation temperatures (T) for the EM1-like intraplate basalts in Payenia, Argentina, have been calculated using the Al-in-olivine geothermometer of Wan et al. [1]. The temperatures (1200-1260 °C) fall in the upper range determined for MORB [2] suggesting that the magmas originate from an asthenospheric mantle source with T similar to normal upper mantle. However, one sample representing a group with relatively low Nb/U has a larger range in T indicating mixing with a low-T mafic magma, which is interpreted to have a lithospheric origin. The studied low- and high-Nb/U samples were found to have similar fO_2 (ΔQFM ~0) in contrast to samples affected by slab fluids and melts which crystallized at higher fO_2 (ΔQFM +1.3).

Melt inclusions in two high Nb/U samples and one low Nb/U sample form common trends towards a component with higher K_2O, TiO_2, P_2O_5 and Cl and lower SiO_2. Some inclusions from the low Nb/U sample deviate from this trend and have lower TiO_2 and CaO and higher SiO_2 like the whole rock compositions of the low Nb/U group. Laser ablation-ICP-MS analyses of the inclusions show that the K-enrichment is accompanied by a strong enrichment in Cs, Rb, Th, U and Pb, also the elements with strongest enrichment in lamproites [3]. Compared to high-Nb/U melts, low Nb/U melts are also enriched in Ba, Sr and the HFSEs (Nb, Ta, Zr and Hf). Since the isotopic compositions of the high and low Nb/U lavas are completely overlapping, the lithospheric source of the low Nb/U melts could have been metasomatized shortly before melting by fluids and low-degree melts from the upwelling asthenosphere.

[1] Wan *et al*. (2008) *Am. Mineral*. **93**, 1142-1147. [2] Coogan et al. (2014) *Chem. Geol*. **368**, 1-10. [3] Prelević et al. (2008) *Geochim. Cosmochim. Acta* **72**, 2125-2156.