Melt inclusions in mafic-ultramafic potassic volcanic rocks in British Columbia, Canada: A record of the transfer of PGE from mantle to crust in porphyry settings

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Mafic-ultramafic subvolcanic intrusions composed of alkalic basalt are spatially/temporally associated with many alkalic Cu-Au deposits in the Canadian Cordillera that contain resources of platinum-group elements (PGE). In the Afton porphyry deposit, we have investigated melt inclusions preserved within leucite-clinopyroxene-olivine(>Fo_{90})-rich basalts (18-22 wt% MgO) in order to understand their relationship to porphyry evolution/metal tenor.

Olivine-melt and melt inclusion microthermometry for primary inclusions in growth zones in clinopyroxene primocrysts constrain the liquidus T of the basalt between 1370-1520ºC. However more evolved liquids, trapped as secondary inclusions in pyroxene, were likely trapped as low as ~900ºC and at low pressure. Shallow depths of emplacement for the basalt sills and dykes are confirmed by pepperite textures indicating interaction of the magma bodies with wet volcanic sediments, sandstones, and mudstones. The Cr content of early melt inclusions (Cr-in-melt oxybarometry[1]), determined by laser ablation ICP-MS, and chromian spinel-olivine oxybarometry indicate that the liquids were relatively oxidized (~FMQ+1.5).

Melt inclusion analysis is essential to characterize the trace element chemistry of the basalts because the intrusions are cumulates containing non-cotectic proportions of olivine and pyroxene, and the groundmass was extensively hydrothermally altered by the adjacent porphyry stock. Early melts are most similar to high Ca-Mg, high K_2O, silica-undersaturated arc ankaramites and their differentiates, formed by partial melting of amphibole or clinopyroxene-rich cumulates in sub-arc lithospheric mantle or lower crust.

heTearly melt inclusions are highly enriched in PGE, containing up to ~480 ppb Pd and a high Pd/Pt ratio (~10-20), identical to that of porphyry-stage ore in the deposit. The exact mechanism by which this high Pd/Pt was inherited by the porphyry magma (i.e., fractional crystallization, mixing with/contamination by crustal rocks/melts) is being evaluated.

[1] J.Brenan (2012) personal communication

Sr isotope anomalies in meteorites: Uniform distribution of *s*- and *r*-process Sr at the planetary scale

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Planetary-scale nucleosynthetic anomalies have been identified for various refractory elements, indicating that the protoplanetary disk was not entirely mixed with respect to stellar sources or that thermal processing of solid material was uneven. In this study we re-address the presence of planetary-scale $^{84}Sr/^{86}Sr$ anomalies. Several bulk chondrites, eucrites, angrites as well as Ca-Al-rich inclusions (CAI) from the CV3 chondrite Allende were analyzed using the Thermo Triton TIMS at ETH Zürich in a dynamic acquisition mode. In contrast to static measurements (as used in previous studies [1]) no difference in $^{84}Sr/^{86}Sr$ ratios between the NBS987 standard and terrestrial rock standards was found. Furthermore, with the exception of CV and CM chondrites all bulk meteorites show within uncertainty a uniform and terrestrial $^{84}Sr/^{86}Sr$. The anomaly in the CM chondrite could be due to incomplete dissolution of presolar SiC grains, while the anomalies in Allende can be attributed to the high abundance of CAI which show $^{84}Sr/^{86}Sr$ anomalies of up to 1.3ε, most likely due to an excess in r-process Sr. Thus, our results do not confirm the planetary-scale Sr isotope heterogeneity reported in an earlier study. Instead they indicate that overall, the Sr isotope composition of the solar nebula prior to planetary accretion was rather homogeneous, which is essential to establish the Rb-Sr chronology of volatile element depletion in the early solar system.

[1] Moynier *et al*, *Astrophys. J.*. **758**:45 ,(2012)

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