Hybridization of mantle-wedge by hydrous sediment partial melt and generation of ultra-potassic arc lavas

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Arc lavas contain geochemical signature of subducted sediments, yet the physico-chemical process of sediment incorporation into arc mantle source is poorly understood. Partial melts generated from subducting pelitic sediments are broadly rhyo-dacitic and thus are out of equilibrium with mantle-wedge peridotite. In this study, we have investigated how ultra-potassic arc basalts can be produced via hybridization of peridotite by hydrous rhyolitic sediment partial melt and the role of H_2O on such a process.

We have performed partial melting of 25% rhyolitic melt-infused fertile peridotite with bulk H_2O content of 2 wt.%, from 1050-1350 °C at 2–3 GPa. With increasing *T*, increase in melt fraction (25 to 35 wt.% from 1200 to 1300 °C at 2 GPa and 8 to 24 wt.% from 1225 to 1350 °C at 3 GPa) is accompanied by exhaustion of amphibole (at 1100 °C), garnet (at 1200 °C, 3 GPa), clinopyroxene (at 1150 °C, 2 GPa and 1225 °C, 3 GPa) and finally phlogopite (at 1250 °C, 2 GPa and 1300 °C, 3 GPa) while olivine (only at 2 GPa), and orthopyroxene are present in the residue at all temperatures.

The melts from this study are Group III (leucititic) ultra-potassic basaltic lavas[1]. They match with primary (≥8 wt.% MgO) leucitites from both inactive and active arcs in terms of TiO_2 (0.6–0.8 wt.%), Al_2O_3 (14–16 wt.%), CaO (7–12 wt.%) and K_2O/Na_2O (1.7–2.9 wt. ratio) for given SiO_2 (47–51 wt.%) concentration. Thus, leucititic primary magma can be generated by decompression melting of a previously metasomatized phlogopite-bearing mantle in a fossil-arc region as well as sediment melt hybridization in the mantle-wedge of an active subduction environment. Also, our study shows that phlogopite can be stable near the core of mantle-wedge and can thus be a potent agent for recycling volatiles, LILE and long-term stability of phlogopite in the mantle-wedge can, with time, create discrete domains in the mantle with high radiogenic-Sr. Investigation of the effect of variable H_2O on the phase equilibria of a similar hybridization process is underway.

[1] Foley *et al Earth Sci. Rev.* (1987), **24** (2), 81-134