The origin of Alpine-Himalayan orogenic K-rich lavas: an integrated experimental and geochemical approach

DEJAN PRELEVIĆ[1, 2], STEPHAN BUHRE[2], MICHAEL W. FÖRSTER[3]
[1]Faculty of Mining and Geology, University Belgrade, Serbia
[2]Inst. für Geowissenschaften, Universität Mainz, Germany
[3]ARC Centre of Excellence CCFS, Macquarie University, Australia

K-rich mantle-derived magmatism occurring within Alpine-Himalayan orogenic belt (AHOB) is characterized by the close association of different petrological members including high-K calk-alkaline, shoshonitic and lamproitic lavas [1]. Rather than homogeneous peridotite, their source is heterogeneously metasomatised with the metasomatic assemblages situated in the veins within peridotitic wall-rock, originated through the melt-mantle interaction at the plate boundaries during the previous subduction.

In our 2GPa experiments, we simulate the melting processes within the mantle source of AHOB magmas aiming to resolve the perplexing issue of mutual occurrence of different K-rich lavas. We combine phlogopite-clinopyroxenites (metasome) with either harzburgite or lherzolite, in which these rock types make up two halves each capsule, in order to observe the role of wall-rock fertility on major and trace element compositions of the final melt. There is a number of general observations relevant to the origin of AHOB magmatism:

1. Two distinctive melt compositions are produced: the metasome-melt has lower SiO_2, higher MgO and similar K_2O contents compared with the infiltration-melt produced within peridotitic part by melt-mantle interaction due to the assimilation of Opx and Ol crystallization that increases the Ol/Opx ratio.
2. The infiltration melt from harzburgite compositionally resembles lamproites with high K_2O (9 wt.%), high K_2O/Na_2O >>2, with relatively low Al_2O_3 (<10 wt.%). The spinel with Cr# 83 and olivine with Mg# 93 also resemble typical features of AHOB lamproites.
3. When lherzolite is involved, the resulting infiltration-melts are silica-rich (up to 55 wt.% SiO_2), with high Al_2O_3 (up to 17 wt.%) and with the lower K_2O/Na_2O ~1, resembling AHOB high-K calk-alkaline and shoshonitic lavas.

These experiments allow clarification of the role of the mantle fertility on the composition of diverse K-rich melts. They also illustrate that melting of mixed source regions is not simply a question of producing and mixing two melt types; rather, the melt produced in the rock with the lower melting temperature react with the second rock, changing its mineralogy and taking up some of its components.

1.Conticelli, S., et al., Lithos, 2009. **107**(1-2): p. 68-92.