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Investigating combined arc and OIB signatures at a post-collisional subduction setting by geochemical and boron isotope analyses of melt inclusions from Vulture, Italy

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Recent post-collisional magmatism in central-southern Italy is unique as it is strongly influenced by sediment subduction but also has an intra-plate signature. The composition of the potassium-rich magmatic products covers a wide range of compositions, from subalkaline to strongly alkaline, and from mafic to felsic. The Vulture volcanic centre, located east of the main volcanic front, is considered "anomalous" compared to the other major Quaternary volcanoes, as it shows the eruption of silica-rich and carbonatite lavas, and a magma source with both arc- and OIB-type signatures.

To investigate the unique nature of this anomalous magmatism, we analysed 107 Vulture melt inclusions (MIs) trapped in high-forsterite olivine (~87-90 mol% Fo) for major and trace element composition. A subset of 27 MIs was selected for boron isotope and concentration analysis. Based on relative major and trace element enrichment we distinguish two groups of inclusions: Group 1: High CaO (10-16wt.%), TiO_2 (1-3 wt.%), Na_2O (~ 3wt.%), MgO (4-9 wt.%; n = 80), lower HFSE/HREE and lower LILE/LREE (n = 44); Group 2: Low CaO (6-7 wt.%), TiO_2 (0.8-1.5 wt.%), high SiO_2 (45-48 wt.%), Al_2O_3 (18-20 wt.%), K_2O (5-7 wt.%; n = 27) and higher LILE/HREE and HFSE/LREE (n = 24). Group 1 MIs have more negative $\delta^{11}B$ values ($\delta^{11}B_{av}$ = -20 ‰; n = 23) and lower B concentration ($[B]_{av}$ = 20 ppm; n = 23) compared to Group 2 ($\delta^{11}B_{av}$ = -17 ‰; $[B]_{av}$ = 36 ppm; n = 4).

The geochemical distinction between the two groups indicates the involvement of two melt sources with diverse mineralogies. Combining major and trace elements with a more negative $\delta^{11}B$ signature of Group 1, suggests a possible additional input of marly sediments to this group.

Geophysical data confirm the presence of a slab detachment and mantle inflow under the Vulture volcanic centre, likely responsible for the OIB signature. The geochemistry of the MIs indicates that the OIB signature for this volcano is possibly derived from melts formed due to slab detachment that mix with melts from a sediment metasomatised source.