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Melt-rock interaction in supra-subduction mantle: evidences from veined peridotites from the Avacha volcano, Kamchatka

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Peridotite xenoliths in calc-alkaline volcanic rocks are direct samples of the sub-arc mantle. They are generally thought to have reacted with slab-derived fluids, yet many show no or minor whole-rock enrichments in incompatible elements [1]. Metasomatic veins that may cut these samples are crystallisation products of fluids and melts and give then direct informations on these latter.
New major and trace element data were obtained on eleven veined harzburgite xenoliths from the active Avacha volcano in southern Kamchatka peninsula, Russia. Two of the three vein types of mantle origin previously identified in these samples [2] are compared to late stage ones.
Type 1 veins are thin, quenched with fine-grained subhedral opx, accessory cpx, amphibole, glass and sulfides. Wall-rock olivine cut by these veins show no reaction whereas coarse opx is partly transformed to produce metasomatic cpx and amph by local fluid release. Cr_2O_3 ($< 0.1\%$ in opx), Na_2O and TiO_2 poor vein minerals (respectively $< 1.5\%$ and $\sim 0.2\%$ in am), low HREE in opx, HFSE negative anomalies, and LILE enrichment attest for an hybrid mantle source. REE enrichment in cross-cut coarse opx and LREE and LILE in isolated host rock parts (metasomatic pockets) by vein-derived fluids is identified.
Type 2 veins and veinlets are made of thin opx and empty cavities with accessory cpx and amphibole. They derive from a liquid similar to Type 1 but constantly re-equilibrating (Cr-Al enrichment trends in opx and Na and HFSE relative enrichment in am) with host minerals while fracturing them. They attest of (fluid-assisted) dissolution-precipitation reactions at rims (Fe enrichment in residual host olivine) and massive fluid-melt extraction through branching paths (LREE enrichment but low U/Th in vein-derived melt pockets and extreme veinlets-host rock interaction end-products).
Late stage quenched veins made of subhedral am ($TiO_2 \sim 1\%$ and $Na_2O \geq 2\%$) with fine opx rims are related to andesitic melt. They can also evolve into LREE enriched extreme end-products of veinlets-host rock interaction.
Comparison of melt and fluid-rock interaction at sub-moho and late stage levels allow us to establish a complete geochemical model for subduction zones primary magma evolution and impact at mantle depths.

[1] Ionov (2009) J. Petrol. 1-35. [2] Bénard and Ionov (2009) GCA, 73, Issue 13 Supplement 1, A108.