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Melt-rock interactions in south armorican peridotites

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Five mantle-derived serpentinized peridotites occurrences from South Armorica (SA: Champtoceaux, Audierne, Brittany, France) were studied using optical microscopy, EMP, ICP-OES, solution ICPMS and laser ablation-ICPMS. All but one Champtoceaux lherzolite occurrence are harzburgites which have experienced 12 to 25% partial melting ($0.57 < \text{Al}_2\text{O}_3 < 1.6$ wt.%; $\text{Sc} < 10$ ppm; $33 < \text{Cr}_{\text{spinel}} < 67$, $\text{Yb} = 1.1-0.3 \times \text{CI-chondrites}$). The lherzolites show fertile compositions ($7 < \text{Cr}_{\text{spinel}} < 15$; $\text{Al}_2\text{O}_3 = 3.0$ wt.%; $10 < \text{Sc} < 16$ ppm, $\text{Ni} < 2,000$ ppm; $\text{Yb} = 1.7$) suggesting lower degree of partial melting (5-7%). SA peridotites show overall enrichments in highly incompatible elements (HIE, Cs, Rb, Ba, Th, U, Pb, La) coupled with variable depletion in the high-field strength elements (Nb, Ta, Zr, Hf, Ti) compared to primitive-mantle estimates.

Each occurrence bears imprints of high-temperature melt/fluid - rock interaction. The most refractory harzburgites show evidence of reactive melt percolation, i.e. U-shaped REE patterns ($\text{La}/\text{Sm} = 4.4-6.3$; $\text{Sm}/\text{Yb} = 0.55$). Another Champtoceaux harzburgite occurrence has been pervasively reequilibrated with mafic melts that produced coupled increase in the Fe, Ti, Zn, Cr, V and REE contents ($83 < \text{Mg\#} < 87$; $\text{La}/\text{Sm} = 1.5-2.0$; $\text{Sm}/\text{Yb} = 1 - 2.6$). Hydrous modal metasomatism has been identified in both Champtoceaux lherzolites and Audierne harzburgites. The Champtoceaux lherzolites reacted at $P = 1.5-2$ Gpa for $T > 900^\circ\text{C}$ with HIE-enriched small-volume fluids that produced 10-15 vol. % of Ti-poor pargasite from clinopyroxene and spinel. The Audierne samples were pervasively refertilized by alkali-rich hydrous melts that precipitated K- and Cr-rich pargasite. Our new data identify SA peridotites as pieces of residual oceanic mantle that were processed to different extent with slab-derived melt/fluids in supra-subduction zone settings.