Evidence for deep metasomatic enrichment in oceanic lithospheric mantle

S. PILET[1], L. ROCHAT[2], N. ABE[3], M.-A. KACZMAREK[4] AND O. MUNTENER[5]

[1]Sebastien.Pilet@unil.ch
[2]Laetitia.Rochat@unil.ch
[3]abenatsu@jamstec.go.jp
[4]mary-alix.kaczmarek@unil.ch
[5]Othmar.Muntener@unil.ch

Oceanic lithosphere is generally interpreted as mantle residue after MORB extraction. Niu and O'Hara [1] have suggested, however, that metasomatic processes could refertilize oceanic lithospheric mantle. To test and refine this idea it is fundamental to understand the isotopic evolution of the Earth mantle, since domains of metasomatically enriched lithospheric could generate some of the small scale isotopic heterogeneities observed in the source of MORBs or OIBs, after recycling into the convecting mantle. Direct evidence for refertilization of the deep oceanic lithosphere, however, at global scale is missing.

Here, we report mantle xenoliths and xenocrysts with metasomatic imprint in *petit-spot* lavas that provide the first direct evidence that the deep oceanic lithosphere is affected by metasomatic processes unrelated to plume activity. Cpx from two peridotite xenoliths from Japanese *petit-spot* show compositions that differ significantly from the composition predicted for cpx in equilibrium with peridotite depleted by melt extraction. These cpx display high contents of incompatible trace elements, while variable LREE/HREE ratios suggest equlibration close to Grt/Spl transition zone. These trace elements "signatures" are unknown in oceanic settings but are similar to those observed in melt-metasomatized Spl and Grt peridotite xenolith sampled by intracontinental basalts and kimberlites. Additional evidence of deep metasomatic cumulates in oceanic lithosphere is preserved in cpx xenocrysts from accreted *petit-spot* lavas in northern Costa Rica [2], with compositions similar to cpx observed in metasomatic veins worldwide. We suggest that plate flexure does not only produce *petit-spot* lavas at the surface, but allows low degree melts from the LVZ to percolate and differentiate across the oceanic lithospheric mantle producing metasomatic enrichment in peridotite and metasomatic cumulates. Since plate flexure represents a global mechanism in subduction zone, a significant portion of oceanic lithospheric mantle is likely to be metasomatized prior to subduction.

[1] Niu and O'Hara 2003, *JGR*, [2] Buchs et al. 2013 *G3*.