Abstract

The oceanic lithospheric mantle is generally interpreted as the mantle residue after Mid-Ocean Ridge Basalt (MORB) extraction leaving a depleted mantle. However, it has been suggested that metasomatic processes could refertilize the oceanic lithospheric mantle. We report direct evidences of refertilization of the oceanic lithospheric mantle at different step of its history with geochemical modeling for the petrogenesis of petit-spot lavas and their enclosing xenoliths and xenocrysts. Petit-spot are small-scale volcanoes discovered on the downgoing Pacific plate east of Japan. The flexure of the plate produces an extension allowing pre-existing melt from the base of the lithosphere to rise up and entrain lithospheric xenoliths and xenocrysts. First, garnet xenocryst (Py_{62}, Gr_{20}, Alm_{18}) has relatively low Mg# ($\sim$77.5) and low Cr (0.07-0.21) and Ti (0.06-0.17) content, depleted LREE, a slight positive Eu anomaly and flat HREE with primitive mantle normalized values around one. The low Mg# and Cr content exclude a peridotitic origin and the trace element content and the flat HREE exclude a magmatic origin. Therefore, it is interpreted as formed during subsolidus cooling of gabbroic cumulate into the lithospheric mantle indicating melt percolation in the periphery of mid ocean ridges. Second, clinopyroxene (cpx) in two peridotitic xenoliths show composition that differ significantly from cpx composition of abyssal peridotite which is interpreted as the mantle residue after MORB extraction. These cpx show relatively high content in very incompatible elements similar to those observed in melt-metasomatized peridotites sampled in intra-continental basalts and kimberlites. And finally geochemical modeling for the petrogenesis of sills from Costa Rica can explain the potassic ($K_2O/Na_2O > 0.8$) composition of petit-spot melts. A first hypothesis suggest that the mantle at the base of the lithosphere is K- and trace elements-enriched. Our model suggests that low-degree melt extracted from the Low-Velocity Zone (LVZ) interact with previously formed amphibole and phlogopit-rich lithologies. All these evidences call into question the formation of the oceanic lithospheric mantle as the simple residue after MORB extraction. We suggest that the oceanic lithospheric mantle undergo different stage of refertilization at different time occurring first in the periphery of mid ocean ridge and then at plate-flexure before subduction.