Petrological comparison between Siberian and NW Pacific lithospheric mantle: A preliminary evaluation of the lithosphere stacking model

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Understanding nature of subcontinental lithospheric mantle (SCLM) is of considerable importance as underscored by the abundance of studies in different Solid Earth Sciences, including petrology, geochemistry, volcanology, seismology, and geodynamics. So far many researchers have endeavored to accurately visualize heterogeneity of SCLM and its evolution. One possible model to form lithologic heterogeneity is the lithosphere stacking model proposed by Helmstaedt and Schulze (1989). In order to evaluate the model, two contrasting mantle peridotites from cratonic (continental) and oceanic lithospheres were investigated. Deformed garnet peridotite xenoliths from the Udachnaya kimberlite pipe, as a representative material of SCLM, record multiple mantle processes beneath a craton. In-situ trace elements analyses of garnet and clinopyroxene of the garnet peridotite, confirmed at least two times of mantle–melt interaction and possible fluid infiltration at the latest process. Comparing petrological features of Siberian SCLM xenolith together with an oceanic lithospheric mantle xenolith (spinel peridotite) from the Miyagi offshore petit spot volcano, the lithosphere stacking model was revisited. No matter whether the model is realistic or not, this study confirmed that deep SCLM materials contain geochemical and mineralogical evidences of the presence of “water”, likely supplied from deeply subducted oceanic lithosphere.

Keywords: lithospheric mantle, mantle xenolith, lithosphere stacking, trace element, garnet

