Petrological diversity of abyssal peridotites from the ultraslow-spreading Gakkel Ridge, Arctic Ocean

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The Gakkel Ridge is the world's slowest-spreading mid-ocean ridge varying from about 14 mm/year to 8 mm/year in full spreading rate (Cochran et al., 2003 JGR). It is widely accepted that the ultraslow-spreading ridge limits melting, leading to an idea that peridotites beneath the ultra-slow spreading ridges are relatively fertile in melt components. The ultraslow-spreading ridges, therefore, provide us unique opportunity to insight into original mantle heterogeneity before partial melting beneath the ocean ridge. Peridotite samples were recovered from the Gakkel Ridge during the international Arctic Mid-Ocean Ridge Expedition (AMORE) (Micael et al., 2003 Nature). Recently, D’ Errico et al. (2016 GCA) reported a variety of peridotites corrected by the expedition. We also examined petrology and mineralogy of 12 abyssal peridotites from the Sparsely Magmatic Zones of the Gakkel Ridge. Our samples show a wide range of textures from protgranular to mylonitic textures. Based on trace element pattern of clinopyroxene, peridotites can be classified into three types: (Type-1: simple residue) systematic depletions in light rare earth elements (LREEs) from Heavy REEs (HREEs), (Type-2: residue after influx melting) concave-down REE pattern with highly enriched LREE, and (Type-3: unusual mantle) systematic depletions in LREEs from HREEs with no Zr negative anomaly. Type-1 peridotite can be explained as residue after partial melting and melt extraction, and are similar to other abyssal peridotites recovered from other mid-ocean ridges. Trace element pattern of clinopyroxene in Type-2 peridotite is similar trend to that in harzburgie sample of D’ Errico et al. (2016). Type-2 peridotite can be explained as residue after influx melting in the melting column beneath the ridge. Type-3 peridotite has not been reported yet. We need further investing on origin of this sample: either reaction/influx melting with a Zr-rich fluid/melt or originally Zr-rich mantle source.

Keywords: Mantle beneath the ultraslow-spreading ridge, Mantle heterogeneity, Peridotite

