Lithospheric mantle evolution of the East Antarctic craton: Isotope evidence and PGE patterns of spinel lherzolite xenoliths

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Mantle xenoliths of lherzolite composition from Mesozoic alkaline-ultramafic diatremes of Jetty oasis represent the section of East Antarctic craton mantle to the depths of 60-80 km and evidence to the abnormally high heat flow which is connected with rifting and continental lithosphere destruction [1]. Nodule Os isotope signatures provide evidence for the beginning of lithospheric mantle formation in this region of East Antarctic craton at about 2400 Ma that coincides well with Nd isotope data [2]. The absence of traces of early Archean lithosphere could indicate partial delamination of lithosphere at convergent plate boundaries in late Archean or thermal erosion of Archean lithosphere under the influence of deep plume in Mesozoic during rift propagation. The following mantle transformations are also reflected in Re-Os isotope systematics of the mantle peridotites. Spinel-garnet lherzolite has a Re-Os isochron age of 775 Ma and demonstrate the least fractionated of platinum group elements (PGE) patterns whereas cpx-rich spinel lherzolites appear in the character of PGE distribution to be close to the primitive upper mantle model composition, but the least affected by the mantle processes are considerably depleted cpx-poor spinel lherzolites. The oldest of zircons separated from one of the lherzolite xenolith give U-Pb SHRIMP age of 2460 ± 31 Ma in good agreement with the earliest Re-depletion mantle event in the region. The other zircon-age peaks also have some analogues in Re-model ages of studied xenoliths suite but the main prominent peak is 601.6 ± 7.8 Ma which is only about 100 Ma younger than Re-depleted age and could reflect the pan-African tectono-thermal event overprinted on the vast regions of Gondwanaland.

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PGE and trace elements in veined sub-arc mantle xenoliths, Avachinsky volcano, Kamchatka

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PGE and lithophile trace elements were determined by LA-ICPMS in minerals of pyroxene-rich veins in spinel harzburgite xenoliths from the andesitic Avacha volcano in Kamchatka, Russia. Type 1 veins are quenched magmatic liquids with arc-related trace element signatures. Type 2 veins are produced by fractionation of the initial liquids and their reaction with host refractory mantle [1].

Residual sulfides in refractory harzburgites are rich in Ir and Os and depleted in P-PGE and Au (Fig. 1) [2]. Type 1 veins contain MSS globules that are either pyrrhotite (2-5% Ni) or pentlandite (~25% Ni) and have fractionated P-PGE patterns. Sulfides in Type 2 veins contain ~16% Ni (hence intermediate in Fe/Ni between the two Type-1 end-members) and a broad P-PGE vs. I-PGE fractionation range with $0.15 \leq (Rh/Pt)_N \leq 1$, $0.7 \leq (Rh/Ru)_N \leq 5.3$, $1 \leq (Os/Ir)_N \leq 3.6$ (Fig. 1). Sulfides in host peridotites next to Type 2 veins typically have negative Pt anomalies: $2.4 \leq (Rh/Pt)_N \leq 5.4$ (Fig. 1, A-B). We attribute these variations to fractionation of the initial sulfide liquid and varying degrees of its interaction with host mantle. Sulfides in amphibole selvages precipitated from host andesite show fractionated Rh/Ru ratios and negative Pt anomalies ($(Rh/Pt)_N$ up to 200). Residual harzburgites are enriched in heavy sulfur ($\delta^{34}S$ about +4‰) relative to Type 1 veins ($\delta^{34}S$ from -0.1 to +0.8‰) and average mantle.

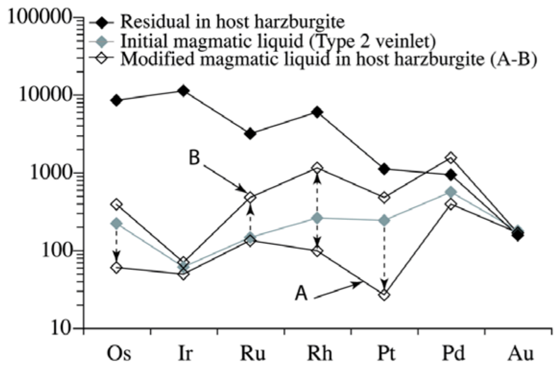

Figure 1: Primitive mantle-normalized PGE in sulfides.

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[1] Bénard & Ionov (2009) *GCA* **73**, 13 (S1) A108. [2] Pearson *et al*. (2004) *Chem. Geol*. **208**, 29–59.