Are cratonic roots forever? Erosion and renewal of Siberian cratonic mantle

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The stability and longevity of cratonic lithosphere is often attributed to the strength and buoyancy of its refractory keels, which are assumed to have formed in the Archean, i.e. be roughly coeval with the oldest overlying crust. This might be the case for some cratons, but does not appear to be consistent with recent data on the age and composition of the Siberian cratonic mantle (and lower crust). Peridotite xenoliths appropriate for petro-geochemical studies in the areas with exposed or presumed Archean crust on the Siberian craton are available in two kimberlite pipes, Udachnaya in its center and Obnazhennaya in its NE part as well as in the Tok basaltic field in its SE corner. Re-Os dating of refractory, melt-depleted peridotites yield T_{RD} ages of ~2.8 Ga and ~2 Ga for Obnazhennaya [1] and ≤2.0-2.2 Ga for Udachnaya and Tok [2,3], the latter are younger than the oldest crust in each area.

We argue that a significant part of the lithospheric mantle beneath the NE craton and nearly all mantle lithosphere in the central and SE craton were eroded and replaced with new melting residues at ~2 Ga. Further, the cratonic keel beneath the Tok area was delaminated and the remaining spinel facies mantle re-worked in the Phanerozoic by percolating basaltic melts [4], like in the North China craton [5]. We present new data on metasomatism, in particular by carbonate-rich melts in the Siberian peridotites. Melt-reacted peridotites with relatively low Mg# and/or high CaO and incompatible minor elements appear to be more common than pristine refractory peridotites [1-4, 6]. Overall, erosion and renewal of cratonic roots is widespread in cratonic mantle worldwide.

[1] Ionov *et al*. (2015a) *EPSL* **428**, 108-119. [2] Ionov *et al*. (2015b) *GCA* **165,** 466-483. [3] Ionov *et al*. (2006a) *EPSL,* **241**, 47-64. [4] Ionov *et al*. (2006b) *GCA,* **70**, 1231-1269. [5] Gao *et al*. (2002) *EPSL,* **198**, 307-322. [6] Ionov *et al*. (2010) *J.Petrol*. **51**, 2177-2210.