Final depletion of the Kaapvaal cratonic root: Lu-Hf versus Re-Os dating of garnet peridotites from the Finsch mine (South Africa)

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Processes connected with the formation and modification of the sub-continental lithospheric mantle (SCLM) are recorded in the trace elements and isotopes of peridotites and their constituent minerals. The main hosts for lithophile elements are grt (harzburgites) and grt + cpx (lherzolites). The Sm-Nd system may yield information on processes and age of metasomatism whereas the Lu-Hf and the Re-Os systems may yield age information on depletion processes.

Single subcalcic garnet grains from Finsch yield a Lu-Hf isochron of 2520 ± 59 Ma with εHf inital of +28. This age is interpreted as marking the final depletion event underneath the Kaapvaal craton. The Sm-Nd system yields two error-chrones interpreted as reflecting metasomatic events 1.3 Ga and 400 Ma ago [1]. Grt-cpx pairs from lherzolites give two-point isochrones with eruption age (120 Ma) for Sm-Nd and ages from eruption age up to 500 Ma for Lu-Hf. Calculated bulk rocks (grt + cpx) form an isochron of 2550 ± 60 Ma with εHf inital of +16 [2]. The coincidence in age is strengthening the interpretation of the isochrones as depletion ages. It is broadly consistent with Re-Os depletion ages from other Kaapvaal craton localities (2.4-3.0 Ga – e.g. [3]).

Agreement or disagreement of the Lu-Hf and the Re-Os systems can be evaluated for the first time with our sample set. We have therefore analysed the Re-Os systematics in the bulk samples which yield the 2.55 Lu-Hf isochrones. A first evaluation shows that four samples have $^{187}Os/^{188}Os$ of around 0.110, i.e. a Re depletion model age of about 2.5 Ga while the others range in $^{187}Os/^{188}Os$ up to 0.120.

[1] Lazarov *et al*. (2009) *Earth Planet. Sci. Lett*. 279, 1–10. [2] Lazarov *et al*. (2008) 9IKC Extended Abstract. [3] Carlson *et al*. (1999) Proc. 7th Int. Kimb. Conf. 99–108.

The geochemical fate of Se(IV) in the Boom Clay system – XAS based solid phase speciation

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For more than 30 years the Boom Clay formation is studied as a reference host formation for methodological research concerning clay-based geological disposal of HLRW in Belgium and Europe. Boom Clay provides good sorption capacity, very low permeability and chemically reducing conditions due to the anoxic conditions and the presence of pyrite and siderite. Performance Assessment calculations have indicated Se^{79} ($t_{1/2}$ = 2.95×10^5 y) to be one of the critical radionuclides for the geological disposal of HLRW [1].

Aqueous selenite [Se (+IV)] and selenate [Se (+VI)] are the dominant species in mildly and strongly oxidizing environments. Under reducing conditions the solubility of Se is theoretically controlled by the formation of sparsely soluble selenium phases such as elemental Se or transition metal-selenide salts (e.g. FeSe or $FeSe_2$) [2, 3]. Slow kinetic reactions between the different redox states have been observed [4] and proposed to explain different redox phases observed within a single reducing environment. Se oxyanions, such as SeO_4^{2-} and SeO_3^{2-}, are generally considered as the most mobile forms of Se [5] and their migration through Boom Clay thus is considered as 'worst case scenario'. In order to assess their long-term fate it is imperative to understand the influence of different geochemical phases present in the Boom Clay matrix on selenium speciation and mobility.

A multidisciplinary approach combining long-term batch sorption experiments with linear combination XANES and ITFA-based EXAFS analysis on different fractions isolated from Boom Clay batch systems equilibrated with Se (IV), identified Se° as the dominant *in situ* solid phase speciation of Se in Boom Clay conditions.

[1] SAFIR-2, 2001. Brussels, Belgium. p. 288. [2] Breynaert, E. *et al*. *ES&T*. **42**(10), 3595. [3] Scheinost, A.C. *et al*. J. Contam. Hydrol. **102**, p.228. [4] Masscheleyn, P.H. *et al. ES&T*. **24**(1), 91. [5] Elrashidi, M.A. *et al*. *Soil Science* **144**(2), 141.