Post-Archean lithospheric mantle evolution – garnet peridotites from Namibian kimberlites

SHU Q.[1], BREY G.P.[2], FICHTNER C.[2], GUDELIUS D.[2]

[1]Chinese Academy of Sciences, Institute of Geochemistry, Guiyang,China, *shuqiao@mail.gyig.ac.cn*
[2]University Frankfurt, *brey@em.uni-frankfurt.de*

We studied garnet peridotite xenoliths from the Louwrensia kimberlite for their major and trace elements and the Sm-Nd and Lu-Hf isotope systems. Louwrensia is located within the ca. 75 Ma old Gibeon kimberlite field at the western edge of the Proterozoic Rehoboth Terrane in Namibia. This terrane is sandwiched between the 0.9–1.2 Ga old Namaqua-Natal belt in the west and the Kheis-Magondi belt (1.7–2.0 Ga) in the east (at the border of the Archean Kaapvaal craton). A previous isotope study on mantle xenoliths from other Gibeon kimberlites (Hanaus and Gibeon Townlands; Luchs et al., 2013) shows a temporal overlap of a 1.85 Ga old metasomatic event in the lithospheric mantle with the age of a volcano-sedimentary succession with calc-alkaline intrusions at the NW corner of the Rehoboth province resulting from arc accretion (Jacobs et al., 2008) and with the Kheis Magondi orogenesis (1.7-2.0 Ga).

The suite of mantle xenoliths from the Louwrensia kimberlite can be divided into three geochemical groups. One of them is distinct from those from the Gibeon Townlands and Hanaus kimberlites. It has whole rock fractionated HREE-MREE patterns, is depleted in HFSE (Zr-Hf ,Ti) and shows a slight enrichment in the very incompatible elements (La, Ce). These features indicate that the original residual signature of a partial melting process is largely preserved and only minor metasomatic overprint occurred. It is also distinct in the isotope data with Lu-Hf two-point cpx-grt tie-lines yielding Proterozoic ages (896 - 1044 Ma; 4 out of 5 samples) while those from other Gibeon xenoliths give 269 - 514 Ma. The group yields an isochron age of 1064 ± 83 Ma (MSWD = 1.9) with εHf (t) = +3.4. This age is interpreted as dating a metasomatic event of an already depleted mantle. It overlaps well with the age range of the Namaqua Natal orogenesis (0.9 – 1.2 Ga) in the west and south of the Rehoboth Terrane. It appears that the Post-Archean lithospheric mantle beneath the Rehoboth Terrane was modified during the final building stage of the Kalahari craton and later by circum-cratonic orogeneses.