Insights on the evolution of the lithospheric mantle underneath the Gibeon Kimberlite field, Namibia

TIMO LUCHS*, GERHARD BREY AND AXEL GERDES

Institut für Geowissenschaften, Goethe Universität, Frankfurt am Main (*correspondence: luchs@em.uni-frankfurt.de)

The kimberlitic volcanism in the Gibeon Province in Namibia about 70 - 80 Ma ago brought garnet peridotite xenoliths, clinopyroxene and garnet megacrysts and occasionally crustal xenoliths to the surface (e.g. [1]). The province is situated within the Namaqua-Natal belt in the Rehoboth terrane which gives mixed ages between 0.9 – 2.0 Ga. Re-Os isotope measurements on the garnet peridotites range up to only 2.5 Ga [3], indicating a Proterozoic mantle age. However, on the basis of high modal abundances of orthopyroxene in some of the Gibeon xenoliths, similar to those known from the Archaean Kaapvaal craton, Franz *et al*. (1996) suggested that they represent slivers of the subcontinental lower lithosphere of the Kaapvaal Craton which were transported underneath the Namaqua-Natal belt during jurassic and cretaceous continental breakup.

In order to constrain the nature of depletion and possible enrichment processes, we determined trace elements of the constituent minerals of 19 garnet peridotite xenoliths from several localities in the Gibeon province by laser ablation single collector ICP MS.

The REE patterns in most garnets are LREE depleted as it is typical for mantle xenoliths from off craton (Proterozoic) areas and in cratonic mantle that has been melt-modified. In contrast, two garnets show sigmoidal patterns characteristic for garnet peridotites from Archean cratons. Hence, these samples may represent relic cratonic areas, in accord with the findings of Franz *et al*. (1996), whereas most of the mantle beneath Gibeon is younger or has later been refertilised.

Analysis of the Sm-Nd- and Lu-Hf-isotope systematics by solution multicollector ICP MS is in progress. We anticipate that the Sm-Nd isotope system will reflect LREE-enrichment accompanying younger mantle metasomatism whereas the Lu-Hf system may yield actual formation ages.

[1] Davies & Spriggs *et al*. (2001) *Journal of Petrology* **42**(1), 159–172. [2] Franz & Brey *et al*. (1996) *Contributions to Mineralogy & Petrology* **126**(1-2), 181–198. [3] Pearson, Carlson, Shirey, Boyd & Nixon (1995) *Earth & Planetary Science Letters* **134**, 341–357.

Carbon isotopic and noble gas compositions of quartz-hosted gas-rich fluid inclusions from the Lower Saxony Basin (Germany)

V, LÜDERS, B. PLESSEN AND S. NIEDERMANN

Helmholtz Centre Potsdam GFZ, Telegrafenberg, 14473 Potsdam, Germany (volue@gfz-potsdam.de)

The southern part of the Lower Saxony Basin (LSB) in NW Germany is characterized by local magnetic and positive gravity anomalies as well as high maturity of organic matter in sedimentary rocks (up to 6% Rr). The origin of these thermal anomalies is discussed controversially. It is either attributed to deep-seated intrusions of igneous rocks in Early Createceous times or by an increased amount of burial with subsequent tectonic inversion. However, the presence of abundant quartz veins and fracture-fills in Upper Carboniferous to Lower Cretaceous host rocks reveals evidence for high fluid-flow in this part of the LSB.

The salinity in the range between 0.5 and 25 wt.% NaCl eq. and homogenization temperatures between 130 and 265°C of quartz-hosted inclusions are highly variable. Migration of CH_4-CO_2 ($\pm N_2$) gas mixtures along fissures and veins occurred along with the migration of fluids as indicated by abundant gas-rich inclusions in quartz. The carbon isotopic compositions of gas inclusions in quartz differ significantly: inclusions in quartz from fracture-fills hosted by Upper Carboniferous rocks show $\delta^{13}C$ of about -30‰ for CH_4 and -10‰ for CO_2. This gas is most likely derived from coal seams within the Upper Carboniferous strata. In the eastern part of the study area CH_4 inclusions in quartz hosted by Mesozoic rocks show considerably lower $\delta^{13}C$ values of about -42‰ suggesting marine shales as most likely source rocks.

Fluid inclusions show general noble gas signatures indicative of typical crustal fluids, such as radiogenic He ($^3He/^4He < 3\times10^{-8}$), moderately nucleogenic Ne ($^{20}Ne/^{22}Ne$ close to atmospheric, $^{21}Ne/^{22}Ne < 0.07$) and radiogenic Ar ($^{40}Ar/^{36}Ar < 1300$). Only a few samples show increased $^3He/^4He$ ratios in the range of several 10^{-7} up to a maximum of $(4.1\pm2.0)\times10^{-6}$, or 2.9 times the atmospheric value of 1.4×10^{-6}. Such high ratios can only be explained by a contribution from mantle-derived fluids, which is also supported by a slightly higher-than-atmospheric $^{20}Ne/^{22}Ne$ ratio (10.08 ± 0.07) in one sample. In addition, those samples showing mantle influence are also characterized by the highest $^{40}Ar/^{36}Ar$ ratios found in the sample suite (up to 6100). This mantle input may be related to supposed magmatic intrusion (s) in Lower Cretaceous times.