Chronological and thermal history of the lithospheric mantle underneath the Gibeon kimberlite field, Namibia

TIMO LUCHS*, GERHARD BREY AND AXEL GERDES

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

The 70 Ma kimberlite volcanism in the Gibeon Province in Namibia was triggered by the drift of the African continent over the Discovery plume [1]. It brought garnet peridotites, megacrysts and few crustal xenoliths to the surface. The volcanic field is situated in the Rehoboth province which gives crustal basement ages between 1.7 – 2.3 Ga [e.g. 2-3]. The neighbouring Namaqua-Natal belt is charactarised by ages of 0.9 to 1.3 Ga. Rhenium depletion ages of the peridotites range from less than 1 to 2.2 Ga and point towards an early proterozoic depletion event [4].

Major and trace elements of garnets and clinopyroxenes of 19 more or less altered peridotites from Hanaus and Gibeon were analysed by EPMA and LA-SF-ICPMS; the Lu/Hf and Sm/Nd isotope ratios were measured in cpx and grt mineral separates from 12 of these samples by ID-MC-ICPMS.

Garnets from 14 samples have LREE depleted patterns (with corresponding equilibrium patterns in the coexisting clinopyroxenes), five garnets show sigmoidal patterns of the type commonly observed in Archean garnets. The latter show a tendency to higher temperatures (~ 1250 °C) compared to samples with LREE depleted garnet patterns (~ 1100 °C) at same pressures (~ 40 Kbar).

Bulk rock isotopic compositions were calculated from the modal abundances and isotopic composition of the minerals. Three sigmoidal and five LREE depleted peridotites yield two separate Lu-Hf isochrones of 1.88 Ga and 933 Ma respectively. Both isochrones are interpreted as reflecting enrichment events of previously depleted mantle. Timing and extent of depletion must have been very different because the former yield $\varepsilon H = +29$, the latter +5. The younger enrichment age points to an event connected with the Namaqua orogeny, the older to processes connected with the manifestation of the Rehoboth province.

Sm-Nd whole rock isotope systematics indicate a late metasomatic overprint at around 500 Ma during the Damara orogeny.

[1] Davies, G. R. *et al*.. (2001) *J.Pet*. [2] Becker, T. *et al*. (2004) *Comm.Geol.Surv.Nam*. [3] Ziegler, U. R. F. *et al*. (1991) *Com. Geol. Surv. Nam*. [4] Hoal *et al*. (1995) *S. A. J. Geol*.

The significance of Rotliegend brines in mineralizing processes and hydrocarbon systems in the Southern Permian Basin

V. LÜDERS[1]*, B. PLESSEN[1], H.B. VONHOF[2] AND J. SCHNEIDER[3]

[1]Helmholtz Centre Potsdam GFZ, Telegrafenberg, D-14473, Potsdam, Germany (*correspondence: volue@gfz-potsdam.de, birgit.plessen@gfz-potsdam.de)

[2]Vrije Universiteit Amsterdam, De Boelelaan 1085 1081 HV Amsterdam, The Netherlands (vonh@falw.vu.nl)

[3]Badstr. 5-9, D-35792 Löhnberg, Germany (j.schneider@mineral.tu-freiberg.de)

Studies of sedimentary brines from the central part of the Southern Permian Basin (SPB) show that formation water stored in Rotliegend sandstones differs clearly in elemental abundances and isotopic composition from formation waters from the overlying Zechstein and Mesozoic units [1, 2]. The Permian depositional conditions in the central part of the SPB (Rotliegend salt lake) and subsequent Zechstein transgression which caused to the formation of huge evaporite caps led to the preservation of original Rotliegend formation waters that changed their pristine chemical character by water-rock interaction (WRI) during basin subsidence. These 'altered' Rotliegend formation waters are characterized by positive δD and $\delta^{18}O$ values due to evaporation of meteoric water of the Rotliegend salt lake and high radiogenic $^{87}Sr/^{86}Sr$ isotopic ratios due to WRI with surrounding host rocks [1]. Fluid flow of Rotliegend brines is recorded by abundant fracture-fill and vein mineralization within Rotliegend sediments and even in deeper-lying Paleozoic units. Fracture-fill anhydrite shows unusual $\delta^{34}S$ isotopic composition of about +5‰ suggesting that sulphur was derived by WRI between Rotliegend formation waters and Rotliegend sediments of magmatic origin rather than being derived from the overlying Zechstein. Furthermore, Rotliegend brines played a significant role in the formation of nitrogen-rich gas reservoirs in the central and eastern part of the SPB.

[1] Lüders *et al*. (2010) *Chem. Geol*. **276**, 198–208. [2] Möller *et al*. (2007) *Int. J. Earth Sci*. **97**, 1057–1073.