Modification of cratonic lithosphere: influence of tectono-magmatic events on Kaapvaal craton (South Africa)

M.L.A. MOREL[1], N.S.C. SIMON[2,] G.R. DAVIES[1] AND G.D. PEARSON[3]

[1] FALW, Vrije Universiteit, De Boelelaan 1085HV Amsterdam, The Netherlands; morel.melanie@falw.vu.nl
[2] PGP., University of Oslo, PO Box 1048–Blindern, 0316 Oslo, Norway, n.s.c.simon@fys.uio.no
[3] Dep. of Earth sciences, Durham University, South Road, Durham DH1 3LE, UK; d.g.pearson@durham.ac.uk

Determining the processes responsible for the formation and modification of sub-continental lithospheric mantle (SCLM) is key to understanding early crust formation and stabilisation. Studies of xenoliths from the Kaapvaal craton have provided chemical and thermal information on SCLM and together with Re-Os dating and tomographic images these data have determined the vertical and lateral variation in the age and composition of the SCLM [1]. The SCLM, as a residue from partial melting, is characterised by depletion in basaltic melt components (Al, Ca, Fe), but contains high silica and incompatible trace element contents (LREE, Ba) indicative of metasomatic enrichment. The timing and geological processes responsible for the metasomatism, however, are poorly constrained.

We report detailed studies on 2 suites of xenoliths from the Kaapvaal. Cretaceous xenoliths from Kimberley sample the seismically slowest part of the SCLM whereas Premier (eruption age 1150 Ma) samples the SCLM prior to regional flood basalt activity and Cretaceous kimberlite magmatism. The SCLM beneath Premier was strongly modified by the tectono-magmatic event that formed the Bushveld Province at 2.05 Ga.

A combination of trace element and multi-isotope studies (Sr-Nd-Hf) is used to determine the melting and enrichment processes that have produced the age and compositional distinctions in the SCLM beneath Premier and Kimberley.

Both suites are characterised by a large range in T_{RD} ages (1.6 to 3.6 Ga). The age distribution at Premier has a mode between 2 and 2.4 Ga with a tail towards older ages, clearly reflecting melt interaction or major melting associated with the Bushveld event. The most melt depleted samples are characterised by the oldest T_{RD} ages, but there is no correlation with the degree of silica enrichment. Kimberley samples have a mode at 2.8 Ga with a tail to younger ages. The most melt depleted samples are again characterised by the oldest T_{RD} ages.

References

[1] Carlson R.W., Boyd F.R., Shirey S.B. et al (2000) *GSA Today* ,**10,** 1-7.