Archaean diamond growth beneath Venetia established by Sm-Nd systematics of individual garnet inclusions

J.M. KOORNNEEF[1], M.U. GRESS[1], J.W. HARRIS[2], G.R. DAVIES[1]

[1] VU University Amsterdam, The Netherlands (*correspondence: j.m.koornneef@vu.nl)
[2] University of Glasgow, United Kingdom

The diamondiferous Venetia Kimberlite cluster (~520 Ma) is located in the core of the Limpopo Mobile Belt, a zone of compression between the Kaapvaal and the Zimbabwe Cratons. Diamond formation beneath Venetia is likely related to major craton evolution events that led to the current regional tectonic makeup. Here we report the first Sm-Nd ages of individual peridotitic garnet inclusions in diamonds from Venetia along with major element and trace element data and carbon isotope data of the hosts.

The Sm and Nd analyses were performed on a Triton *Plus* equipped with six 10^{13} Ω amplifiers[1]. Data on an initial suite of ten garnet inclusions yield $^{143}Nd/^{144}Nd$ from 0.51020±7 to 0.51353±5. The $^{147}Sm/^{144}Nd$ vary from 0.004 to 0.305. Four samples give a T_{DM} ~3 Ga. Based on similar major (higher Mg#) and trace element data (similar HREE patterns) we group these samples to define an isochron age of 3.04±0.54 Ga, at initial $^{143}Nd/^{144}Nd$ of 0.50864 (ε_{Nd}= -0.8). A second diamond forming event at ~1.3 Ga is suggested by 2 samples with comparable HREE patterns. Diamond formation close to eruption age is recorded by one sample. Carbon isotope data of host diamonds range between -8 and -3 ‰, typical for the majority of peridotitic silicates.

Previously, a maximum age of 2.3 Ga was inferred from an isochron constructed of 4 pools of ~30 peridotitic garnet inclusions[2]. The age was suggested to represent diamond crystalisation following modification of Archaean SCLM by Bushveld type magmas. We now conclude that this 2.3 Ga age may record mixing of old and young diamonds. The ~3 Ga age for 4 out of 10 specimen suggests that earliest diamond formation probably coincided with a period of extension of the Kaapvaal Craton between 3.1-2.9 that led to formation of rift basins and a passive continental margin[3]. Additional data will be presented at the conference to further validate these findings.

[1] Koornneef et al., 2014, *ACA* 819, 49-55
[2] Richardson et al., 2009, *Lithos* 112S, 785-792
[3] de Wit et al., 1992, *Nature* 357, 553-562