5.3.P06

Mantle modification and diamond genesis during continental accretion

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The Bellsbank Group kimberlite (120 Ma, group II kimberlite), Kaapvaal craton, lies ca. 200km west of the Colesberg Lineament, the proposed suture between the eastern and western Kaapvaal, where the eastern Kaapvaal was subducted against the western Kaapvaal during a period of craton accretion between 2.94 and 2.88 Ga [1]. The proximity of Bellsbank to this suture makes it an ideal locality in which to evaluate modification of the subcontinental lithospheric mantle (SCLM) during accretion and diamond genesis.

Bellsbank peridotites are split into three groups based on petrography/mineral chemistry and Re-Os systematics 1) spinel peridotites (n=19) 2) garnet peridotites (n=6) 3) necklace textured garnet peridotites (n=3). Garnet bearing peridotites show more scatter in ages caused by post formation metasomatic events, in direct contrast to the shallower spinel peridotites that show consistent age systematics (T_{RD} = 2.85 Ga ± 0.06, T_{MA} = 3.01 Ga ± 0.09) and overlap with the age of accretion. Three peridotites give T_{RD} ages >3.2Ga. As T_{RD} ages are typically lowered by multiple depletion or metasomatic events, this supports the presence and subsequent modification of older SCLM in this region.

Bellsbank eclogite (Group A, Group B & Group C) Re-Os concentrations suggest that Group B & C represent parts (residues?) of a subducted slab which has undergone partial melting. Their Re-Os ages cluster around a 2.9Ga isochron suggesting that they formed just prior to or during craton accretion. Group A eclogites are websteritic and may have formed by slab derived melt interaction within the overlying mantle wedge.

Re-Os systematics for syngenetic eclogitic sulfide diamond inclusions give a ca. 2.9 Ga age. Their age and basaltic affinity support the subduction accretion model. Bellsbank is significant as the only locality so far where three lithospheric components (peridotites, eclogites, and diamonds) have been studied.

Reference

[1] Schmitz et al, *ESPL* (in press)

5.3.P07

Os isotopic systematics in peridotite xenoliths from the SW Japan arc

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Noyamadake volcano in the southwest Japan arc, has transported a varied suite of mantle-derived xenoliths to the surface, including residual peridotite and a range of cummulate rocks, providing direct samples of the mantle wedge. Mantle wedge-derived xenoliths can provide valuable insights into Os and other chalcophile element recycling through subduction zones, as well as constraining the composition and evolution of the mantle wedge. In particular, they have the advantage that they bypass potentially complicating crustal processes that are likely to effect arc lavas, such as crustal contamination and fractionation.

Noyamadake is a 6-7.3 Ma [1] basanitic volcano that has sampled the backarc-side of the southwest Japan volcanic arc. The Noyamadake peridotite suite represents a hotter and less metasomatised mantle wedge [2] than previously reported arc xenoliths, including those from Ichinomegata in the northeast Japan arc [e.g. 3].

The peridotite xenolith suite comprises spinel bearing peridotites ranging from fertile lherzolite (23 vol% clinopyroxene) to highly depleted harzburgite (0.1 vol% clinopyroxene)[2]. These protogranular to porphyroclastic xenoliths record very high equilibration temperatures (1100-1250ºC)[2]. Secondary volatile-bearing phases, such as pargasite, are absent. The peridotites range from LREE-depleted to LREE-enriched, and trace element systematics suggest that the samples have interacted with two types of metasomatic agents: a hydrated silicate melt or hydrous fluid, and a more rare carbonate-rich melt or CO_2-rich fluid [2].

We will present Re-Os isotopic data for fertile to depleted peridotites from Noyamadake to constrain the Re-Os isotopic composition of the sampled sub-arc mantle, and to investigate the behaviour of Re and Os in a high temperature, relatively dry region of the mantle wedge.

References

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[3] Brandon, A.D, Creaser, R.A. Shirey, S.B. and Carlson, R.W. (1996) *Science* **272,** 861-864.