

## **Archaean crust-mantle links: Os isotopes in Witwatersrand PGM**

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The evolution of  $^{187}\text{Os}/^{188}\text{Os}$  in residual mantle effectively ceases after large-degree mantle melting events, due to almost complete depletion of Re in the residue. Thus, Os isotopes in mantle rocks can be used to constrain the timing of major mantle melting events, by comparison with a chondritic evolution curve, and to investigate the scale of such events through time [1]. Platinum-group minerals (PGM) are formed in the mantle and in mantle-derived ultramafic rocks rich in platinum-group elements (PGE). The Os isotope compositions of detrital PGM have been shown to retain a record of mantle depletion events, owing to their high Os and low Re contents and their resistance to alteration [2].

Osmium isotope analyses of over 450 PGM from the Witwatersrand supergroup, the largest recognised Archaean sedimentary basin, indicate major mantle melting in the region at around 3.0 Ga to 3.2 Ga, with some older ages up to ~3.5 Ga. Unlike Phanerozoic ophiolite-derived suites [2], the Wits PGM do not have a pronounced skew towards older ages. This either suggests a magmatic origin (komatiitic or cumulate), rather than formation in the mantle, or perhaps indicates a less heterogeneous Archaean mantle. In either case, these PGM provide a substantial record of mantle melting, and thus crust formation, in the region.

The range of Os isotope values in detrital PGM bears a strong similarity to the age record of Witwatersrand zircons and gold. This suggests a primary, detrital origin for the majority of the gold, rather than in situ hydrothermal deposition [3,4]. Furthermore, the complementary zircon and PGM records support coupled crustal growth and mantle depletion in the region, and corroborates a link between the mantle depletion record and crustal growth [2].

[1] Shirey & Walker (1998) *Ann. Rev. Earth. Planet.* 26: 423-500. [2] Pearson et al. (2007) *Nature* 449(7159): 202-205. [3] Kirk et al. (2002) *Science*, 297: 1856-1858. [4] Schaefer et al. (2010) *Chem. Geol.* 276: 88-94.