Geophysical Research Abstracts, Vol. 8, 04320, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04320

Deep structure of the lithospheric mantle under a mobile zone: the Re-Os isotope approach

A. Luguet (1), D.G. Pearson (1), A.L. Jaques (2), G.P. Bulanova (1), C.B. Smith (3), S. Roffey (4) and M.J. Rayner (5)

(1) Department of Earth Sciences, University of Durham, UK (ambre.luguet@durham.ac.uk), (2) Geoscience Australia, Canberra ACT, Australia, (3) Rio Tinto Mining and Exploration Ltd., Bristol, UK, (4) Rio Tinto Exploration Pty. Ltd., Perth, Australia, (5) Argyle Diamond Mines Ltd, West Perth, Australia.

The high-grade Argyle lamproite-hosted diamond deposit is anomalous because it lies within the Palaeoproterozoic Halls Creek orogenic belt (HCOB; NW Australia). The age of the lithospheric mantle beneath both the orogenic belt and adjacent Kimberley Craton has been a matter of debate since discovery of the deposit and resolution of this issue has important implications not only for diamond genesis and exploration models but also for our understanding of the deep lithospheric architecture beneath ìmobileî belts. We can examine the age and depth of the lithosphere beneath the HCOB by examining the mineral chemistry and Re-Os isotope plus PGE systematics of a new suite of mantle xenoliths sampled by the Argyle lamproite. Geothermobarometric estimates available for 10 of the 23 samples indicate equilibration within the diamond stability field at 150-180 km depth for both diamondiferous and non-diamondiferous xenoliths, confirming the presence of deep lithosphere in this region [1]. No primary sulfides were observed, requiring us to use a whole rock dating approach. When corrected for Re in-growth since the 1200 Ma eruption age, Re-depletion ages vary from 1 to 3.1 Ga with a peak between 2.2 –2.8 Ga, clearly indicating the presence of Archean mantle at depth beneath this region. Both the major elements and PGE systematics are also compatible with a late Archean origin. The combined platinum group element and Re-Os systematics of our samples show that the peridotites have experienced metasomatic siderophile element addition, making previous T_{MA} model ages [2] unreliable. Our data are hence the first reliable indication of Archean lithospheric mantle beneath this area. The Archean Re depletion ages are significantly older than the circa 1.8 to 1.9 Ga

crustal basement age implying that the HCOB is a shallow feature that may have been transported laterally over older cratonic lithosphere. Our data indicate that the reason for anomalously thick lithosphere beneath crust of mid-Proterozoic age is due to the underlying ancient, cold, stable Archean lithospheric mantle. This is another example of crust-mantle decoupling and indicates that we should exercise caution in estimating the extent of Archean lithosphere based on outcrops of Archean crustal rocks.

[1] A.L. Jaques et al. Contrib. Mineral. Petrol. (1990), 104: 255-276. [2] S. Graham et al. Geology (1999), 27: 431-434.