Geophysical Research Abstracts
Vol. 15, EGU2013-8923, 2013
EGU General Assembly 2013

Tracking Crust-Mantle Recycling through Superdeep Diamonds and their Mineral Inclusions

Michael Walter, Galina Bulanova, Chris Smith, Andrew Thomson, Simon Kohn, and Antony Burnham
University of Bristol, Earth Sciences, United Kingdom (m.j.walter@bristol.ac.uk)

Sublithospheric, or 'superdeep' diamonds, originate in the deep upper mantle, transition zone, and at least as deep as the shallow lower mantle. When diamonds crystallize in the mantle from fluids or melts they occasionally entrap coexisting mineral phases. Because of their great physical resiliency, diamonds can potentially preserve information over long distance- and time-scales, revealing important information about the petrologic, tectonic and geodynamic environment in which the diamonds grew and were transported. Superdeep diamonds and their inclusions have proven especially powerful for probing processes related to subduction of slabs into the deep mantle [1-3]. In contrast to lithospheric diamonds that are effectively frozen-in geodynamically, mineral inclusions in superdeep diamonds often record hundreds of kilometers of uplift in the convecting mantle from their original depth of origin [3-5]. The phase equilibria of unmixing of original deep mantle phases such as Ca- and Mg-perovskite, NAL-phase, CF-phase, CAS-phase, and majorite provide a means to establish amounts of uplift. The few available age constraints indicate superdeep diamond growth from the Proterozoic to the Cretaceous, and further dating can potentially lead to constraining mantle upwelling rates [4]. Here we will provide several examples showing how superdeep diamonds and their inclusions record processes of subduction and slab foundering, and ultimately recycling of slab material from the transition zone and lower mantle into the shallow upper mantle.

1. Harte, B., Mineralogical Magazine, 2010. 74: p. 189-215.
2. Tappert, R., et al., Geology, 2005. 33: p. 565-568.
3. Walter, M.J., et al., Science, 2011. 333: p. 54-57.
4. Bulanova, G.P., et al., Contributions to Mineralogy and Petrology, 2010. 160: p. 489-510.
5. Harte, B. and N. Cayzer, Physics and Chemistry of Minerals, 2007.