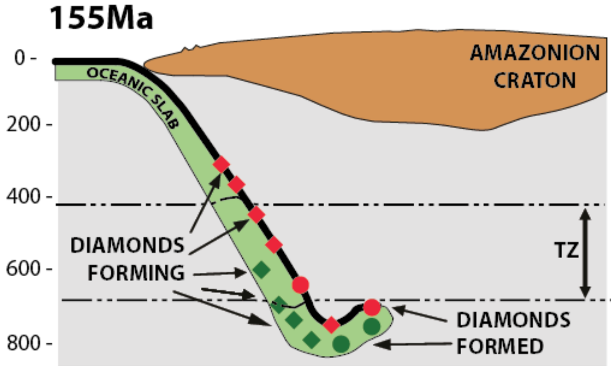
Subducted carbon in stagnant slabs: Evidence from 'deep' diamonds

BEN HARTE

Centre for Science at Extreme Conditions, School of Geosciences, University of Edinburgh, King's Buildings, Edinburgh EH9 3JW, Scotland, UK.

Evidence has been accumulating of diamonds containing mineral inclusions of unusually deep origin (250 to 800 km). In the case of 'deep' diamonds with silicate inclusions indicating basic rock protoliths, the diamonds have $\delta^{13}C$ values extending as low as -24 ‰ and suggestive of organic carbon. Other evidence of an initial ocean floor protoliths is shown by Eu anomalies in some inclusions. 'Deep' diamonds with inclusions indicating ultrabasic protoliths, commonly appear to have formed at depths of 500 to 750 km and have 'normal' mantle $\delta^{13}C$ values of -4 to -6 ‰. However, these diamonds are also believed to be derived from subducted oceanic lithosphere in the form of hydrous meta-peridotites that have undergone dehydration reactions near the Upper/Lower Mantle boundary [1]. Time constraints from diamonds and inclusions erupted in the Juina area, Brazil, suggest the subducted lithosphere to be of early Mesozoic age, with diamond formation occurring as the oceanic lithosphere descended and formed a subducted stagnant slab near the Upper/Lower Mantle boundary (see figure). The diamonds were erupted back to the surface by kimberlites during the Cretaceous.



[1] Harte (2010), *Mineralogical Magazine* **74**, 189-215.

Colloidal metals in stalagmites: Potential for palaeohydrology

ADAM HARTLAND[1], IAN. J. FAIRCHILD[2], WOLFGANG MULLER[3] AND DAVID DOMINGUEZ-VILLAR[4]

[1] University of Waikato, Hamilton, New Zealand. a.hartland@waikato.ac.nz
[2] University of Birmingham, Birmingham, B15 2TT, UK.
[3] Royal Holloway University of London, Egham, Surrey, TW20 0EX, UK.
[4] Centro Nacional de Investigación sobre la Evolución Humana, Burgos, Espana.

There is increasing recognition of the role of organic colloids and dissolved natural organic matter (NOM) in trace metal trasport in karst systems. In particular, we now know that colloid-facilitated transport of trace metals responds in a coherent way to surface infiltration patterns [1] and that this may be encoded meaningfully in speleothems [2].

This study combines measurements of aqueous colloid-metal species from dripwaters, with trace metal and organic carbon data from a conjugate hyperalkaline speleothem. Thus, for the first time the capture of the inorganic and organic components of dripwaters by speleothems is studied in a quantitative way.

Our results indicate that the partitioning of NOM-transported metals into speleothems is proportional to the strength of the aqueous NOM-metal complex. In practice, this means that some metals (e.g. Cu, Zn) more closely reflect hydrological changes (readily dissociate to bind with calcite), while other elements (e.g. Co, Br) more closely encode information on NOM capture, i.e. they less readily dissociate from aqueous complexes.

We also provide evidence for kinetic effects on NOM incorporation in the speleothem and show that the ratio of certain trace metals (e.g. Cu/Ni) in stalagmites may also reflect compositional fluctuations in the NOM, consistent with high and low molecular weight trends also seen in dripwaters.

[1] Hartland *et al* (2012) *Chem. Geol.* ***304-305***, 68-82. [2] Jo, K.N. *et al* (2010) *EPSL* **295**, 441–450.

www.minersoc.org
DOI:10.1180/minmag.2013.077.5.8