Geophysical Research Abstracts,
Vol. 11, EGU2009-13713, 2009
EGU General Assembly 2009

Are light 13C diamonds derived from preserved primordial heterogeneity or subducted organic carbon? Using numerical modelling of multi-component mass balanced mixing of stable isotopes

S. Mikhail, AP Jones, S. Robinson, HJ Milledge, and AB Verchovsky
Department of Earth Sciences, UCL, Gower Street, London, WC1E 6BT, UK

During the subduction of oceanic crust light volatile elements such as S, C and H are recycled into the upper mantle wedge via slab dehydration and partial melting of oceanic lithosphere. This is evident as arc magmas have higher concentrations of SO2, CO2 and H2O than mid-ocean ridge basalts (Wallace, 2005). It is also calculated that 50% of the carbon and >70% of the sulphur subducted is returned to the earth's deep mantle (Wallace, 2005).

This work is testing the notion that the subducted organic carbon is a possible source of growth medium for diamonds. Mantle materials display an interesting bimodality in carbon isotopes with a large peak demonstrating the mean mantle value of ∼ -5 %■ and a smaller peak consistent with organic carbon at ∼ -25%■ (Deines, 2001). The source of the bimodality remains unresolved with the main theories being; subducted organic carbon, preserved primordial heterogeneity and the existence of a HPHT fractionation process (for a review see Cartigny, 2005).

To test the idea that such organic values of d13C in diamond (ranging from -11 to -37%■) are derived from subducted organic carbon it is essential to compare the d13C values in diamond to other isotopic systems, such as the values for d15N in diamond, as well as values for d34S and d18O in associated syngenic mineral inclusions.

We have calculated the percentage of organic C-O-N-S in sediments relative to mean mantle values for d13C, d15N, d34S and d18O required to produce the observed isotopic ratios found in natural diamonds and syngenic mineral inclusions. This was done by way of multi-component mass balanced mixing of stable isotopes between sedimentary, organic and mantle materials of varying measured isotope compositions.

References:
Cartigny, P .2005. Elements 1, 79-84
Deines, P. 2001. Earth Science Reviews 58, 247-278
Wallace, P.J. 2005. Journal of Volcanology and Geothermal Research 140, 217– 240