



A review on past and future experimental fractionation of carbon isotopes at high P and high T during diamond growth. Implications for the Earth's geodynamic carbon cycle.

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Several studies have investigated the solubility of carbon in abundant mantle minerals such as Olivine (Keppler et al., 2003; Shcheka et al., 2006) and enstanite, diopside, pyrope, MgAl_2O_4 spinel, wadsleyite, ringwoodite, MgSiO_3 -ilmenite and MgSiO_3 -perovskite (Shcheka et al., 2006) as a means of calculating the concentration of carbon in the deep earth. Other studies have focused on carbon bearing minerals and their stability in the deep earth to discuss the geodynamic carbon cycle (Brenker et al., 2007; Oganov et al., 2008).

Mantle materials display an interesting bimodality in carbon isotopes (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).

Therefore to assess the source of carbon in the Earth's mantle a useful tool is the isotopic ratio of carbon in diamond. This makes it possible to trace the history of the carbon using one of the most important reservoirs for deep carbon in the interior of the Earth (diamond). Diamond is stable from the lower lithosphere to the core (150 to 2890 km), and can retain ancient geochemical information about the deep Earth as microscopic mineral inclusions in mantle diamonds can be >3Ga (McCammon, 2001). Therefore the fractionation of carbon isotopes between solid and fluid phases at HP and HT is of great importance when attempting to understand the deep carbon cycle and the source of the isotopic variation observed in diamonds and other mantle carbon reservoirs such as graphite, carbide, carbonate and associated fluids (Cartigny, 2001).

References:

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