Experimental investigation of the effect of oxygen fugacity on diamond versus carbonate in carbon-bearing eclogites during deep subduction

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Subduction of relatively oxidized carbonate eclogite into the deep upper mantle may cause redox heterogeneity in the mantle, as a result of juxtapositioning of oxidized subducted domains and relatively reduced ambient mantle [1]. Therefore determination of phase relations of subducting carbon-bearing eclogite and the oxidation state of carbon in it may be critical for understanding redox state of the Earth's mantle through geological time.

The stability limit of carbonate relative to diamond in deeply subducted altered oceanic crust may be described by the reaction: $CaMg(CO_3)_2 + 2SiO_2 = CaMgSi_2O_6 + 2C + 2O_2$ [2]. A series of piston-cylinder experiments were conducted using natural complex compositions to constrain the stability of carbonate vs. diamond reaction as a function of pressure (P=3.5-6 GPa), temperature (T=900-1300ºC) and oxygen fugacity.

The determination of oxygen fugacity in experiments is based on use of noble metals as redox sensors[3] and quantitative *in situ* XANES measurements of $Fe^{3+}/\Sigma Fe$ in garnet [4].

The use of palladium metal as an accurate redox sensor in high-pressure experiments, the estimation of thermodynamic properties of its redox reaction and the development of an oxybarometer applicable to eclogite assemblages based on XANES measurements are among the principal outcomes of this research.

[1] Frost & McCammon (2008) *EPSL* **36(1)**, 389-420 [2] Luth (1993) *Science* **261**, 66-68 [3] Woodland & O'Neill (1997) *GCA*, **61(20)**, 4359-4366 [4] Berry *et al* (2010) *Chem.Geol.* **278**, 31-37