The transition from carbonatitic to carbonate-silicate magmas in carbonated eclogite rocks as function of pressure, temperature and oxygen fugacity

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The deep carbon cycle and the origin of carbonatitic melts into the Earth's mantle have been studied through the effect of CO_2 on phase equilibria within carbonated eclogitic assemblage in the last decades. However the effect of temperature (T), pressure (P) and oxygen fugacity (fO_2) on the melt composition remains unclear. This study aims to determine the melt composition of CO_2-rich melts at fO_2 buffered by the C/carbonate equilibrium as function of P and T. Experiments were performed using the Voggenreiter 840 t, Walker-type multi anvil press available at HP/HT Lab at National Institute of Geophysics and Volcanology (INGV) in Rome. The starting material employed for all the experiments is a mixture of synthetic omphacitic glass, quartz, dolomite and graphite representative of the Dolomite-Coesite-Diopside-Graphite buffering assemblage [DCDG; 1], doped with ilmenite and rutile and ~3 wt% iridium used as redox sensor to monitorate the oxygen fugacity during the experiment. The recovered quenched samples were polished for textural and chemical analysis of the mineral phases using Field emission scanning electron microscope and electron microprobe at the INGV. Preliminary results were combined with previous published data [2], and the determined fO_2 compared with thermodynamic predictions. The obtained data show that at 800°C run product consists of a subsolidus mineral assemblage representative of the DCDG mineral assemblage. With increasing temperature, a carbonatitic melt forms with 1-5 wt% SiO_2 at 900 °C, then evolves to a carbonate-silicate melt with 25 wt% SiO_2 at 1100 °C, and to a silicate melt with ~32 wt% SiO_2 at 1200 °C. Preliminary results demonstrate that magmas with compositions from carbonatitic to carbonate-silicate (hybrid) melts can form within less than 1 log unit of fO_2 by redox melting of elemental carbon-bearing eclogite rocks.

[1] Luth, R. W. (1993), *Science-New York then Washington*. **261**, 66-66. [2] Stagno, V., et al. (2015), *Contributions to Mineralogy and Petrology*, **169**, 1-18.