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OH and CO2 diffusion profiles in garnets around two dimensional defect structures from eclogitic xenoliths from the Rovic diamond mine, South Africa

Jessika Potgieter (1), Holger Sommer (1), Klaus Regenauer-Lieb (2,3), and Biliana Gasharova (4)

(1) Department od Geology, University of the Free State, POBox 339, Bloemfontein 9301, South Africa, (2) School of Earth & Enviroment, The University of Western Australia, Perth, Western Australia 6009, Australia, (3) CSIRO Earth's Sciences and Recourse Engineering, PO Box 1130, Bentley, WA 6102, Australia, (4) ANKA/Inst. Synchrotron Radiation, Forschungszentrum Karlsruhe Gmbh, Hermann-von-Helmholtz-Platz 1, Eggenstein

The mechanism of kimberlite eruptions plays a significant role in diamond exploration. The composition of the kimberlitic melt is a major physical aspect in understanding the eruption dynamics of kimberlites and therein diamond resorption due to changes in fO2. In the studied eclogites, water and CO2 is commonly dissolved in nominally water free minerals (NAMS) as OH and CO2 around defect structures. The enrichment of volatiles is caused by mantle metasomatism and affected the outermost rims of the studied eclogites. The eruption of the kimberlite causes water to partition prefentially into the kimberlitic melt due to the higher solubility of water in the melt compared to NAMS. The concentration of OH and CO2 around defect structures in garnets can thus be used, to quantify the composition of the kimberlitic melt. For the first time high resolution FT-IR based synchrotron measurements of OH and CO2 concentrations in eclogitic garnets from the Rovic Diamond Mine in South Africa is presented. Hydrogen and CO2 profiles, has been measured towards totally embedded microcracks in the garnet crystals. These measurements show a strong variation in OH and CO2 concentrations, which demonstrate that the amount of water and carbondioxide stored in diamond bearing layers has been underestimated for a long time due to the loss of water and carbondioxide during the uplift of the kimberlite.