

Trace-element fractionation processes between carbonates and silicates at mantle conditions

N.BIEDERMANN^{1,2}, K.APPEL¹, G. SPIEKERMANN², W.
MORGENROTH¹, A. PAKHOMOVA⁴, RICHARD WIRTH⁵
AND M. WILKE²

¹European XFEL, Schenefeld, Germany

²Institute of Earth and Environmental Science, Potsdam
University, Potsdam, Germany,

³Institute of Geosciences, Goethe University Frankfurt,
Frankfurt, Germany

⁴Deutsches Elektronen-Synchrotron DESY, Photon Science,
Hamburg, Germany

⁵GFZ German Research Centre for Geosciences, Potsdam,
Germany

Understanding the processes within the Earth's lower mantle and transition zone and the physical properties as well as compositional variations is one of the grand challenges in modern geoscience. Volatile components, such as CO₂, reintroduced to the Earth's mantle as carbonate phase in subducted oceanic crust, may enhance its heterogeneity and can have a significant impact on mantle processes, e.g. melting. While the stability of carbonates has been a subject of many studies in the last decade, we want to focus on fractionation processes between carbonates and mantle silicates at relevant P-T-conditions. To achieve the aim of this project, we performed *in-situ* experiments at pressures up to 30 GPa and temperatures up to 2000 K using laser-heated diamond anvil cells. In a first set of experiments, we studied reactions between Sr- and REE-containing CaCO₃ and mantle silicates (olivine, enstatite, wadsleyite and perovskite) by spatially resolved XRD and XRF measurements at PETRA III beamline P02.2. We performed XRD mapping of the silicate single crystal in contact with carbonate powder before and after heating, and XRD patterns on single spots during heating. Our data show a transformation of the starting silicates into bridgmanite (+ MgO in case of olivine and wadsleyite starting materials). A comparison of the XRF intensity maps before and after heating indicates a change in the elemental distribution of Sr, REE and Fe. Additional TEM analyses of the recovered sample material allowed us to document decomposition of the carbonates and enrichment of Sr among the newly formed perovskite phase. We can conclude that redistribution of the trace elements has occurred upon breakdown of the carbonates. Our observations indicate that carbonates may have an effect on the trace element contents of mantle phases, but rather by breakdown and redistribution than by simple fractionation between carbonates and silicates.