

Report on experiment ES25 : In situ study of the sharp change in melting curve in the CO₂-SiO₂-CaO-MgO system at high pressure

We aim at determining the melting properties of a silicate + CO₂ system at high pressure and temperature. Classical studies have only investigated melting upon heating, using the quench method. However, peculiarities of the silicate + CO₂ phase diagram have been reported, which seem to point out a transition from supercritical CO₂-fluid to carbonatitic-melt as pressure is increased. We propose to bracket the fluid / melt transition in order to better constrain the topology of the silicate + CO₂ melting diagram and better refine the consequences for melting processes in the Earth's mantle as well as carbon emission from the deep mantle.

During the 17 shift time period, we have performed 7 successful high pressure runs. The first two runs allowed us to define the best sample container. For MgO container, we noted reaction with the sample. From run 3 on, we therefore only used graphite.

We were able to perform the first in-situ detection of the dolomite decarbonation boundary [dolomite + SiO₂ = diopside] upon heating at low pressure (<2.5 GPa) in the peridotitic system. Next, we detected melting at $P > 3.9$ GPa. We performed several runs to closely bracket the phase relationships. In one instance, we were able to evidence carbonate melt degassing upon decompression.

In conclusion, we have refined the peridotite + CO₂ phase relationships using high pressure, in situ X-ray diffraction. We have demonstrated CO₂ degassing. A manuscript is currently being written.