

Report on experiment HS-2780 performed at the ID24-ID27 beamlines

Our manuscript is actually in review:

Title: Evidence for mixed Al-bearing (Mg,Fe)SiO₃ silicate phases in the lowermost Earth's mantle

Abstract:

The phase transformation from silicate perovskite (Pv) and post-perovskite (PPv) minerals is key to understand the complex structure of the D'' layer as suggested by seismology in the lowermost mantle. Still, the phase diagram for (Fe,Al)-bearing MgSiO₃ compositions remains ambiguous. Uncertainties are mainly associated to the distribution of Al³⁺, Fe²⁺ and Fe³⁺ among Pv and PPv.

Here we show that the main PPv phase is largely depleted in Fe and Al compared to the Pv. Consequently, the two silicate phases could coexist over the whole D'' region. We also expect a severe increase of the FeO activity in the D'' region, which should greatly affect the chemical exchange between mantle and core. In addition, the Pv and PPv phase fractions are expected to vary significantly with thermal and compositional mantle heterogeneities.

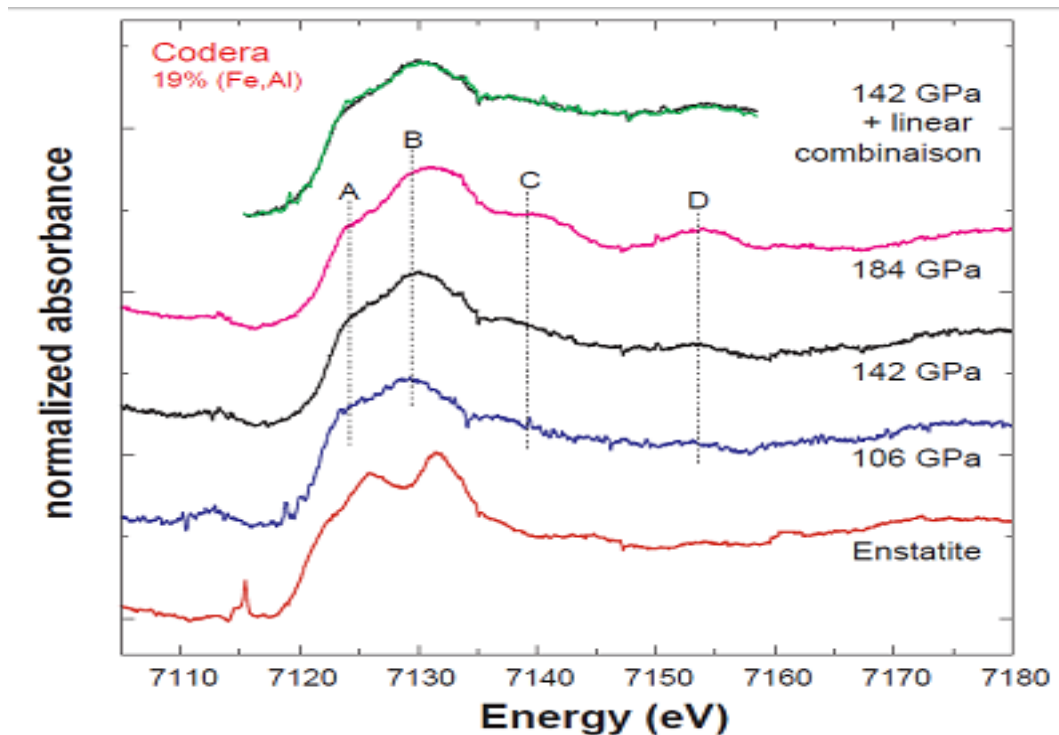


Figure : X-ray absorption spectra recorded at the Fe K-edge as a function of the synthesis pressure for the (Fe,Al)_{0.19} sample. XANES spectrum of the enstatite starting material is shown for comparison. The XANES features (A,B,C,D lines) vary significantly with pressure. This is associated to changes in the Fe local structure when Fe is progressively transferred to the PPv phase with increasing pressure from 106 to 142 GPa. In the upper part of the diagram, the XANES recorded at 142 GPa (black) is compared with a linear combination (green) of XANES patterns recorded at 106 and 184 GPa, respectively.