ESRF	**Experiment title:** Preferred orientations and elasticity in MgO and perovskite at high pressure with monochromatic synchrotron x−rays.	**Experiment number**: HS 1210
Beamline: ID30	**Date of experiment**: from: 10 juil. 2000 to: 14 juil. 2000	**Date of report**: 25 aug. 2000
Shifts: 11	**Local contact(s)**: M. Mezouar	*Received at ESRF:*

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Report:

Polycrystalline samples were confined in a diamond anvil cell under non−hydrostatic stress conditions. Using x−ray transparent gaskets made of beryllium drilled and filled with amorphous boron, we performed diffraction with the x−ray beam perpendicular to the diamond load axis, through the gasket. We analyze the variation of the positions of the diffracted peak with the angle ψ (angle between the normal to the diffracting plane and the load axis) or α (angle between the load axis and the diffracted peaks on the diffraction pattern). Measurement were done using monochromatic beam and the fast−scan detector on ID30.

Variations of the d−spacings with the angle ψ provide information on non−hydrostatic stress and elasticity in the sample (Mao et al.1998; Singh et al. 2000; Duffy et. al 2000). Variations of the diffraction intensities allow the calculation of orientation distributions and texture analysis using Fit2d and tomographic algorithms in the Beartex package (Wenk et al. 1998; Wenk et al 2000).

Two sets of experiments were performed, with samples of $(Mg,Fe)SiO_3$ perovskite and MgO. We used ruby to calibrate the pressure when increasing load. We also used platinum as a internal standard.

The measurements on were $(Mg,Fe)SiO_3$ perovskite were successful up to a pressure of about 25 GPa and back down to P = 0. Figure 1 shows an example of the diffraction patterns we obtained (background from amorphous boron has been subtracted from this figure). Using the “cake” function in Fit2d we were able to study the variation of the d−spacing and diffraction intensity with varying azimuth angle α (cf figure 2).

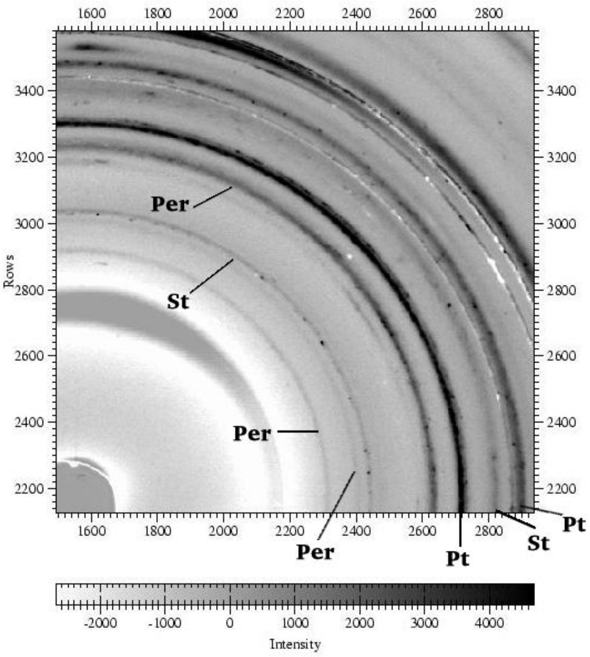

Figure 1: Diffraction pattern for perovskite experiment at P = 25 GPa. Peaks from perovskite, stishovite and platinum are shown. Background from amorphous boron was substracted for this pattern.

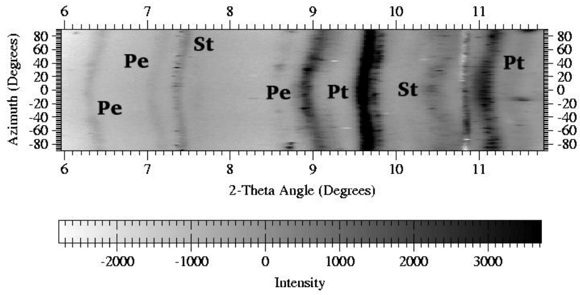

Figure 2: Cake file showing the variation of the d−spacings and intensities as a function of the azimuth angle (between −90 and 90°) for perovskite experiment at P = 25 GPa

Measurements on MgO were performed up to 8 GPa. We also observed variation of the d−spacings and diffraction intensities with varying azimuth angle (figure 3 and 4).

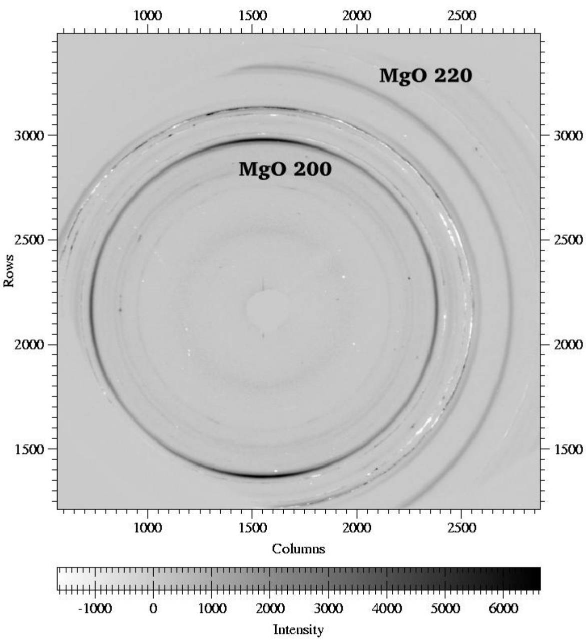

Figure 3: Diffraction pattern for MgO at 8 GPa. Background from the amorphous boron was substracted.

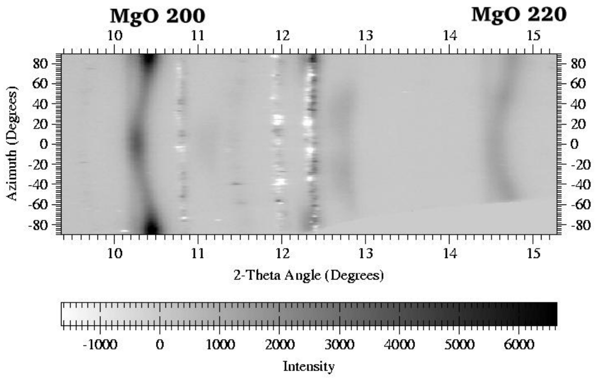

Figure 4: Cake file showing the variation of the d−spacings and intensities as a function of the azimuth angle (between –90 and 90°) for MgO at 8 GPa.

Further data analysis will be needed to draw more conclusions on the elasticity and texture of these materials under high pressure, but feasibility of the method on the ID30 beamline at ESRF was proven. Documenting the evolution of texture and elasticity under pressure will allow determination of deformation mechanisms, i.e. slip systems, and deduce polycrystals elastic properties. These studies are crucial for understanding the structure, dynamics, and evolution of planetary interiors; this information is also of great importance in condensed matter physics and materials science where texture analysis plays a central role.

They would need now to be extended to a larger range of pressures.

References

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