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Comparative study between anhydrous and hydrous orthoenstatite by high-pressure single-crystal X-ray diffraction

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The crystallographic information under pressure is essential to interpret the physical property of mineral phases in the upper mantle. The physical properties of mantle minerals can be affected by water incorporation into their structure. The previous studies from xenoliths indicate that pyroxene can contain more water than olivine and garnet. In this study, we investigated how the water-incorporated in enstatites affect the compression behaviour.

Orthoenstatites (OEN) with various water-content were synthesized under pressure from 5 to 7 GPa and temperature of 1100 to 1400°. The SIMs measurements indicated the water concentration in OEN and Al-bearing OEN from 500 to 1000 ppm, depending the composition and synthesis P-T conditions. Single-crystal X-ray diffraction was performed at ambient conditions and under high pressure.

At ambient conditions, up to 500 ppm water-content, we did not find any significant change in the cell unit volume between anhydrous and hydrous OEN but did note a minor decrease in Al-bearing OEN with a bit higher water-content in the structure. The high-pressure data showed the compression behaviour between the anhydrous and hydrous OEN being similar when the water content below 500 ppm in our specimens. As for the hydrous Al-bearing OEN, the compression behaviour along a-axis presented a minor departure from those of anhydrous and hydrous OEN.

The preliminary structure refinement did not show dramatical difference among studied OENs. However, we did observe an obvious reduction in transport property measurement performed on the specimen with $\sim$1000 ppm water-content in pyroxene structure related to those with lower water-content. In this meeting, we will present the comparison of the structure between hydrous and anhydrous OEN in details.