The anisotropic compression of norbergite and relation to its crystal structure

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Nobergite, Mg3SiO6(OH,F)2, is belong to the humite minerals. The chemical formula and crystal structure are similar to those of olivine. The structural relationship between olivine and the humite minerals have been discussed by many papers such as Talor and West (1928, 1929), Ribbe et al. (1969), Fujino and Takeuchi (1978) and Thompson (1978). We reported the isothermal bulk modulus, the linear compressibility and crystal structure of norbergite under high-pressure conditions in the last this meeting. These results showed a notable point, which is the compression of the stacking direction of anion. Our preliminary results showed that although the a-axial length of norbergite is shorter than that of forsterite, the linear compressibility of a-axis of norbergite is greater than that of forsterite. In this report, we would like to discuss about the anisotropic compression of norbergite, especially for a- and c- axis direction, and relation to its crystal structure. Single crystal X-ray diffraction experiences on natural norbergite, Mg2.98Fe0.01Ti0.01Si0.99O6(OH0.31F1.69), were performed using an automated four-circle X-ray diffractometer installed at the beam line BL-10A in Photon Factory, KEK, Japan. Crystal structures of norbergite under high-pressure conditions were refined at 3 points. The R values were 4.6% for 4.7 GPa, 5.3% for 6.3 GPa and 5.3% for 8.2 GPa. The 4:1 fluid mixture of methanol and ethanol was used for the pressure medium. The induced pressures were determined by the ruby fluorescence methods (Piermarini et al., 1975). From the results of structural refinements, in tetrahedron, the T-O1 distance, which is paralleled to the a-axis, was most compressible among the other T-O distances. T-O distances were changed as follows; for T-O1, 1.608(2)Å to 1.592(3)Å; for T-O2, 1.638(1)Å to 1.627(2)Å; for T-O3, 1.635(2)Å to 1.624(2)Å. This is consistent to the result that the linear compressibility of a-axis has larger value. For any other variations in each polyhedron, we need more consideration.