Thermal stabilities of clinohumite and chondrodite under high pressure

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Clinohumite and chondrodite are most thermally stable hydrous phases under upper mantle conditions and could be particularly important H_2O storage sites in the Earth's upper mantle. However their thermal stability limits are still unknown under high pressure. In this study, high temperature stability limits of clinohumite and chondrodite are determined under high pressure.

Starting materials were prepared by mixing SiO_2, MgO and $Mg(OH)_2$. The starting materials were sealed in welded Pt-capsules of 2 mm in outer diameter. High pressure and temperature experiments were performed with Kawai-type multi-anvil high-pressure apparatus. Experimental pressures at high temperature were calibrated using following transitions: quart-coesite, Fe_2SiO_4 alpha-gamma, and Co_2SiO_4 beta-gamma. Phase identification, textural observation, and chemical analysis of major elements for run products were performed with a Micro-focused X-ray diffraction (XRD), micro Raman spectrometer, and electron probe Micro-analyzer.

Under high pressure, chondrodite breaks down to (clinohumite + periclase + fluid) and clinohumite breaks down to (forsterite + periclase + fluid). The chondrodite breakdown reaction occurs between 1250 and 1300^{o}C at 7.4 GPa and between 1100 and 1200^{o}C at 4.3 GPa. The clinohumite breakdown reaction occurs between 1300 and 1320^{o}C at 7.4 GPa and between 1100 and 1200^{o}C at 4.3 GPa.