The effect of pressure on the structure of hydrous ferric oxides

[1]YU, S.C., [1]Lin, Y. H. and [2]HUANG, E. [1]Department of Earth Sciences, National Cheng-Kung University, Tainan, Taiwan; [2]Institute of Earth Science, Academia Sinica, Taipei, Taiwan.

Two hydrous ferric oxide minerals, goethite (α-FeOOH) and lepidocrocite (γ-FeOOH), were studied at the elevated pressure and ambient temperature conditions with the use of diamond anvil cell in conjunction with Raman spectroscopy and X-ray diffraction techniques. Similar to AlOOH (diaspore-boehmite), iron oxyhydroxides are also an important series in the study of the evolution of mantle-crust system.

The α-FeOOH samples used were natural goethite crystals, while the γ-FeOOH samples were synthetic lepidocrocite. A structural distortion in the double chain of Fe octahedra was observed for goethite at the pressure of 8 GPa as suggested by splitting of the ν_2 Raman vibrational mode. A second or higher order of phase transition was recorded for goethite at 13 GPa as indicated by the $\partial V/\partial P$ discontinuity. This transition may have been resulted from the movement of H atom in the goethite lattice. The alteration of the OH bond geometry may play a significant role in the subsequent dehydration process of goethite.

A structural phase transformation was detected for lepidocrocite at 12.5 GPa. In contrast to α-FeOOH, the high pressure phase of γ-FeOOH can be retained at ambient conditions after decompression, suggesting that it may have been a reconstructive type of phase transition.