# 室内実験および熱力学計算に基づいた還元的環境下におけるコンドライトの水変成プロセスの解明

# A coupled experimental and thermodynamic study of chondrite-water interaction under anoxic condition

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The presence of hydrous minerals in chondrites have been considered as an important evidence for the former presence of liquid water in parent bodies. However, the detailed evolutionary history of parent bodies (e.g., temperature fluid composition and water/rock ratio) are still poorly constrained, because the alteration processes of chondritic rock are not well defined and very few relevant experimental data are available. Here we investigate alteration process of chondrites by experiments simulating reactions between synthetic chondrite (mixtures of olivine, pyroxene, glass, $Fe_{metal}$, and troilite) and $NH_3$-containing solutions at 25 and 80 ˚C under anoxic conditions. We also compared the experimental results with those predicted from thermodynamic calculations to understand the equilibrium and kinetic conditions of chondrite-water interaction.
The experiments up to 7 months showed that the water-rock reactions caused a series of mineral alterations and production of $H_2$(aq), especially at 80 ˚C. X-ray diffraction analysis revealed that the formation of pyrrhotite was notable during the first few days in the experiment, which was likely resulted from the dissolution of troilite. In contrast, precipitation of saponite was evident after 100 days in the experiment, which was probably caused by the dissolution of Si-rich glass in the synthetic chondrites. Transmission electron microscope observation revealed that the saponite and secondary Si-rich amorphous phases densely covered the surface of the original olivine, glass, pyroxene, and troilite. These results imply that amorphous silica precipitated after the formation of pyrrhotite, followed by the precipitation of saponite. A part of these mineral assemblages obtained from our experiment was inconsistent with those predicted from the thermodynamic equilibrium calculations, suggesting that some metastable alteration minerals occur in the chondrite-water system before the complete equilibrium is achieved.

キーワード：コンドライト、サポナイト、ピロータイト
Keywords: chondrite, saponite, pyrrhotite

 