Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

PPS009-10 Room: 301A Time: May 27 14:11-14:24

Hydrothermal alteration experiments of amorphous silicates: dependence of water/rock ratio.

Ryo Noguchi[1*], Akira Tsuchiyama[1], Takaaki Noguchi[2], Guy Libourel[3]

[1]Earth and Space Sci., Osaka Univ., [2]College of Science, Ibaraki University, [3]CRPG, CNRS

Carbonaceous chondrites, such as CI, CM, CR, CV and Tagish Lake (TL) chondrite, have primitive chemical compositions, but have experienced strong aqueous alteration in their parent bodies. In order to examine the aqueous alteration process, many hydrothermal experiments using silicate crystals and natural samples, such as chondrites and IDPs, have been performed (e.g., Ohnishi and Tomeoka, 2007). In contrast, circumstellar silicate dusts around young stars are mixture of amorphous and crystalline silicates based on infrared astronomical observations (e.g., Honda et al., 2003). In addition, unique primitive carbonaceous chondrites, such as Acfer 094, have partly crystallized amorphous silicates as abundant component in matrix (Greshake, 1997). Therefore it is important to investigate aqueous alteration of amorphous silicate as well as crystalline silicates. Based on the above consideration, we have performed hydrothermal alteration experiments of the mixture of amorphous silicates and crystalline silicates at 100-200°C (Noguchi et al., 2009). In these experiments, we showed that saponite, serpentine, calcite and magnetite, which are found in aqueously altered chondrites, formed by alteration in the de-ionized water and the mineral assemblage obtained in the later stage of the alteration resembles to that of CM chondrite. In a series of the experiments, water to rock mass ratio (W/R ratio) was 332, although W/R ratio of aqueous alteration in chondrites is estimated to be lower (e.g., Crayton and Mayeda, 1999).
In order to understand the effect of W/R ratio on aqueous alteration, we have carried out new hydrothermal alteration experiments using Fe-free amorphous silicates. We synthesized glass of the system, SiO_2-MgO-Al_2O_3-CaO-NiO-Na_2O, with the CI ratios by quenching method. Two major elements, Fe and S, were excluded from the system for simplicity to avoid problems of controlling their redox states. The starting materials were ground to make powders and were heated in de-ionized water at 150°C for 504 hours with different W/R ratios ranging from 0.1 to 332 under water saturated vapor pressures (approximately 3.0 bars) in Teflon vessels. Run products were analyzed with XRD and observation with FE-SEM/EDX and TEM. Serpentine was formed at higher W/R ratio (332) while saponite and chlorite were formed at lower W/R ratio (2.46) as a preliminary result.

Keywords: hydrothermal experiment, amorphous silicate, chondrite, aqueous alteration