HYDROUS ALTERATION EXPERIMENTS OF Mg AMORPHOUS SILICATE NANOPARTICLES.

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Introduction: Many hydrous alteration experiments have been made using meteorites or crystalline silicates (e.g., [1, 2]). Amorphous silicates is also important because interstellar dust is amorphous [3] and primitive amorphous silicates are present in cometary dust as GEMS (e.g., [4]) and some carbonaceous chondrites (e.g., [5]). In this context, experiments with amorphous silicates were carried out as well using GEMS [6] and synthetic materials with CI composition [7]. In this study, hydrous alteration experiments of amorphous silicates in the simple system MgO-SiO_2-H_2O were carried out to understand basic features of hydrous layer silicate formation.

Experiments: Nanoparticles of Mg amorphous silicates ~10 nm in size with different Mg/Si ratios (1.15, 1.25, 1.5, 1.75 and 2.02) were prepared as starting materials. Three types of experiments were made. (1) Quench experiments: Starting materials and pure water (water/rock ratio: 5.0) were heated at 50, 100, 150 and 200^{o}C and quenched or held at room temperature for 0 to 1344 hrs. The run products were dried in vacuum and examined by XRD and SEM/EDX. (2) In-site experiments: The same starting materials of (1) were exposed in water-saturated atmosphere at 60^{o}C and measured at ceitain intervals by in-situ XRD (total duration: 9-292.5 hrs.). The final run products were dried in vacuum and examined by XRD. (3) Swelling experiments: Dried run products of (1) were immersed in ethylene glycol, glycerol or water and examined by XRD.

Results: Layer silicates always formed even at room temperature. Brucite and sometimes magnesite formed in the Mg-rich composition. The XRD peaks are week and broad particularly for 001 reflection indicatig low crystallinity. The (001) lattice spacing and the chemical compositions together with swelling experimental results indicate that the layer silicates are disordered mixed layer minerals of stevensite (Mg-smectite) or vermiculite, serpentine and talc. The crystallinity and the degree of mixing order increase with increasing run duration or temperature. They also changed by the drying process.

Discussion: The disordered mixed layer minerals metastably formed from aqueous solutions highly supersaturated with respect to layer silicates, which were formed by instantaneous dissolution of metastable amorphous silicate nanoparticles of high reactivity. The presence of disordered mixed layer minerals in some carbonaceous chondrites, such as in CI [8], indicates that they formed from supersaturated aqueous solutions, which might originate from amorphous silicates. The features of layer silicate minerals in meteorites could be changed from those during hydrothermal alteration by drying process.

[1] Jones R. H. and Brearley A. J. 2006. *Geochimica et Cosmochimica Acta* 70:1040. [2] Ohnishi I. and Tomeoka K. 2007. *Meteoritics & Planetary Science* 42:49. [3] Kemper F. et al. 2004. *The Astrophysical Journal* 609:826. [4] Bradley J. et al. 1994. *Geochimica et Cosmochimica Acta* 58:2123. [5] Greshake B. 1997. *Geochimica et Cosmochimica Acta* 61:437. [6] Nakamura K. et al. 2005. *Meteoritics & Planetary Science* 40:A110. [7] Noguchi R. et al. 2008 *Meteoritics & Planetary Science* 43:A177. [8] Tomeoka K. and Buseck P. R. 1988. *Geochimica et Cosmochimica Acta* 52:1627.