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

PPS009-09 Room: 301A Time: May 27 13:58-14:11

CI-like clasts found in three CM chondrites: Implications for heterogeneous redox condition in the CM parent bodies

Makoto Maeda[1*], Kazushige Tomeoka[2], Yusuke Seto[2]

[1]Science, Kobe Univ., [2]Dept. Earth and Planetary Sciences, Kobe

CM carbonaceous chondrites have undergone extensive aqueous alteration on their parent bodies and contain abundant hydrous minerals, mostly serpentine and tochilinite. Based on secondary minerals produced by aqueous alteration, the CM chondrites are considered to have experienced aqueous alteration under relatively reduced conditions. In our extensive study of seven CM chondrites, we discovered 16 unusual clasts (0.02?1 mm in size) from three CM chondrites, QUE9 7990 (one clast), Murchison (nine clasts), and Cold Bokkeveld (six clasts). Those clasts are mineralogically different in many respects from their host meteorites. Here we report the results of our detailed petrographic and mineralogical investigation of those clasts using SEM-EDS and TEM-EDS.

We found that all clasts in the three CM chondrites have common characteristics irrespective of their host chondrites. Most of the clasts contain chondrules embedded in phyllosilicate-rich matrices, having an appearance similar to the host chondrites. However, the clasts contain distinctly higher abundances of magnetite than the host chondrites. The magnetite commonly occurs in framboidal aggregates. Chondrule phenocrysts in the clasts were more highly altered than those in the host chondrites. Tochilinite, which is characteristic of CM chondrites, is absent in the clasts. EDS chemical analyses and TEM observations revealed that the phyllosilicates in the clast matrices are fine-grained intergrowths of serpentine and saponite.

Our observations indicate that the clasts are mineralogically similar to CI carbonaceous chondrites. In CI chondrites, magnetite is abundant and commonly occurs in framboidal aggregates, and their matrices mainly consist of unit cell-scale intergrowths of serpentine and saponite. Based on the abundance of magnetite and other secondary minerals, the CI chondrites are considered to have experienced aqueous alteration under relatively oxidizing conditions. Therefore, our results suggest that relatively oxidizing conditions existed locally in the reduced environments on the CM parent bodies; thus, the CM parent bodies may have been heterogeneous in the redox condition. The results further raise the possibility that the CI and CM chondrites may have constituted common parent bodies.

Keywords: Carbonaceous chondrites, CM chondrites, CI chondrites, aqueous alteration, redox condition, magnetite