Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

PPS02-P03 Room:Convention Hall Time:May 20 18:15-19:30

Hydrothermal alteration experiments representing the early Ceres

Koyo Horiguchi[1*], Hiroshi Isobe[1]

[1]Grad. Sch. Sci. Tech., Kumamoto Univ

Variations of asteroids correspond to meteorite parent bodies. Meteorites show wide range of variations from the primitive chondrites to the fractionated meteorites. Carbonaceous chondrites, the most primitive meteorites, include low-temperature aqueous alteration products. Aqueous alteration processes depend on the size and thermal history of involving the parent bodies. The Ceres, the dwarf planet, is the subject to convection of hydrothermal fluid in its early formation history (Mccord and Sotin, 2005). The infrared spectrum of the Ceres correspond to approximately 14% of phyllosilicate and 6% of carbonate such as siderite, and about 80% of carbonaceous chondrite (Rivkin, 2006). In this study, hydrothermal experiments representing the alteration process occurred in the early Ceres were carried out.

Experimental fluid is presumed based on Mousis and Alibert (2005) for H_2O 49.14% ,CO_2. 44.23%, CH_4 4.42% and H_2S 2.21%. For the experiment, CH_3OH 18.6% solution and appropriate mass of silver oxalate are used to provide hydrocarbon and CO_2, respectively. The starting material is powdered Allende meteorite, which is typical unhydrous carbonaceous chondrite. The ratio of a solid and a liquid is 1:1.8. Experimental temperature and durations are as follows; 100, 200 and 300 degree C; 3, 6 and 12weeks, 400 and 450 degree C; 1, 2 and 3weeks, respectively.

Main products phases are phyllosilicate and carbonate. In the run products of 100 degree C, magnesite-siderite crystals with various grain size and compositions occur. The Mg/Fe ratio in carbonate increases with run durations depending on dissolution of Mg-rich olivine. Over 200 degree C, Fe-poor carbonate occur. In 200 degree C, main carbonate phase is dolomite, and over 300 degree C, main phase is calcite.

Mg and Fe may be consumed by phyllosicate over 200 degree C. Phyllosilicate is most abundant at 300 degree C. Mg/Fe composition of phyllosilicate varies to Fe-rich field. This suggests that the phyllosilicate composition may be affected by the reduced alteration condition in this study.

The infrared signature of siderite and phyllosilicate is reported from the Ceres (Rivkin, 2006). Siderite on the surface of the Ceres may suggest that the alteration temperature of the Ceres did not exceed 200 degree C. Abundance of phyllosilicate also suggests that alteration temperature was below 300 degree C. The infrared spectrum of the run products may be comparable to those of dwarf planets or meteorite parent bodies to understand early evolution processes including aqueous alteration with reducing conditions.

Keywords: Asteroids, Ceres, Hydrothermal alteration, carbonate, phyllosilicate