POST HYDROTHERMAL ALTERATION PROCESS BEFORE ACCRETION PROCESS: TRACE ELEMENT DISTRIBUTION IN MATRIX FROM A REDUCED CV CHONDRITE

S. Itoh[1] [1]Dept. Earth and Planetary Sciences, Kyoto University (sitoh@kueps.kyoto-u.ac.jp)

Introduction: Carbonaceous chondrites are composed of chondrules, refractory inclusions (Ca-Al-rich inclusions (CAIs), amoeboid olivine aggregates (AOAs)) and matrix. These constituents are believed to preserve information at the time of formation without melting even once after accumulation of the parent body. However, various kinds of carbonaceous chondrites have experienced various hydrothermal alteration effects, although there is a difference in degree before and after accumulation of parent body, and the information at the time of formation has been lost (e.g., [1]). Among them, the matrix, which is one of the major constituents of chondrites, consists of a mixture of fine-grained silicates, metals and oxides filling in between chondrules and CAIs. These matrix particles are small in size and highly porous and highly permeable, so that they are susceptible to alteration process such as water. However, there is no indicator for evaluating the presence or absence of alteration before and after accumulation of the parent body in the whole chondrites. In general, it has been believed that chonderites are brecciated rock but there are no way to estimate the clear boundary for the unit of brecciated crusts. In addition, it is unclear whether the constituent unit of the crust before accumulation is independent of chondrule and CAIs, or composed of chondrules, CAIs and a matrix including matrices. Therefore, in order to estimate the presence or absence of alteration and the constituent size of crust in the matrix of reduced NWA 7865 CV3 chondrite, which is hardly affected by hydrothermal alteration, petrographic studies including major element distribution and trace element distribution were applied.

Experimental procedure: The petrological features were evaluated by combining the main element map by SEM-EDS and trace element maps of LA-ICPMS of ^{25}Mg, ^{27}Al, ^{44}Ca, ^{51}V, ^{52}Cr, ^{57}Fe, ^{60}Ni, ^{88}Sr, ^{140}Ce, ^{208}Pb and ^{238}U.

Results and discussion: We focused on two regions with different Mg-Fe contents in olivine in the matrix. From the comparison of trace element maps, ^{238}U was distributed over a wide range in the Fe-poor region. Phosphate and sulfide were distributed in the Fe-poor matrix. Particularly in the concentrated part of ^{238}U, there were submicron phosphate and ring-shaped hedenbergite of tens of microns. On the other hand, these minerals were absent in the ^{238}U depleted area.

Sulfide and phosphate are distributed in Fe-poor matrix where Uranium is widely distributed, suggesting that the matrix has been experienced aqueous alteration process accompanied by fluid (e.g., [2]). In addition, since the boundary among these two matrices containing uranium and no uranium is clear, it was suggested that the aqueous alteration process accompanying this fluid is before the accumulation of the parent body. Furthermore, the constituent unit of the crust containing the matrix in which Uranium is widely distributed contains chondrules and CAIs, suggesting that it was a few mm crust before accumulation of the parent body. Such post hydrothermal alteration process in chondrites has been also suggested by previous studies (e.g., [3]).

Acknowledgement: The author appreciates Mr. Masumoto and the lab members in kyoto LPS for the contribution of this study.

References: [1] Scott E. R. D. and Krot A. N. (2014) Chondrites and their components. In Meteorites and Cosmochemical Processes (ed. A. M. Davis) Vol. 1, Treatise on Geochemistry Second edition, pp. 65-137. Elsevier, Oxford. [2] Brearley A. J. and Krot A. N. (2013) Metasomatism in the early solar system: the record from chondritic meteorites, in Metasomatism and the Chemical Transformation of Rock, Springer, 659-789. [3] Tomeoka K. and Ohnishi I. (2015) Redistribution of chondrules in a carbonaceous chondrite parent body: A model, Geochimica et Cosmochimica Acta, 164, 543-555.