IN-SITU OBSERVATION OF D-RICH CARBONACEOUS MATTERS EMBEDDED IN NWA 801 CR2 CHONDRITE

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Introduction: Insoluble organic matter (IOM) extracted from carbonaceous chondrites is considered to have formed in cold molecular clouds and/or outer solar nebula, because of its enrichment of D and ^{15}N [e.g. 1]. However, occurrences of IOM in chondrite are poorly understood. This is because most of the previous studies for meteoritic organic matters used extracted-IOM. In this study, we observed organic matters in chondrite by *in-situ* hydrogen isotopic analysis to reveal their morphologies and occurrences.

Methods: The sample used in this study is a polished thin section of NWA 801 CR2 chondrite. Hydrogen isotope imaging (isotopography) was performed by a Hokudai isotope microscope system (Cameca ims 1270 equipped with SCAPS) [2]. We obtained $^{1}H^{-}$, $^{2}D^{-}$ and $^{12}C^{-}$ images from 65 areas of ~ 50 μm in diameter in the NWA 801 matrix. Hydrogen isotopic composition of the matrix was normalized to a reported value of phyllosilicate of Renazzo CR2, which is estimated to be +730‰ [3]. Morphologies of carbonaceous matters identified by isotopography were observed by FE-SEM-EDS (JSM-7000F, Oxford INCA Energy) system.

Results and Discussion: D-rich spots with high C secondary ion signals were found in isotopography in the 33 areas of 65 areas. Total numbers of the D-rich carbonaceous spots were 84. δD values of the carbonaceous spots are ranged over 1700-9600‰. These carbonaceous spots are not distributed randomly in the NWA 801 matrix. We identified the morphologies of 48 D-rich carbonaceous spots. The other 36 spots have been failed to determine the locations by the SEM-EDS because of too small X-ray intensities of carbon. The 48 D-rich carbonaceous spots are composed of carbonaceous matters which morphologies are basically globular. Morphologies of the D-rich carbonaceous globules were classified into 4 groups; round globules, irregular-shaped globules, globule aggregates and ring globules. Round and irregular-shaped globules consist of a separated globule embedded in silicate matrix, which sizes distribute 0.2-1.0 μm. The globule aggregate consists of an aggregate of carbonaceous globules with silicates. The aggregate sizes are 0.3-2.6 μm. Ring globules are ring shaped carbonaceous globules with sizes of 0.3-0.8 μm that include silicate or void in their interior. The ring globules including a void are similar in morphology to organic globules observed in Tagish Lake meteorite [4]. Numbers of Round globules, Irregular-shaped globules, Globule aggregates and Ring globules are 6, 9, 26 and 7, respectively.

The carbonaceous matters with H isotope anomaly found in this study are mainly composed of H and C, and are enriched in D. These characteristics indicate that these matters correspond to organic matters formed in molecular clouds and/or outer solar nebula. Formation processes of these morphorogies can be explained by a formation model of organic matters in molecular clouds [e.g. 5].

References: [1] Busemann H. et al. 2006. Science, 312:727-730 [2] Yurimoto H. et al., 2003. Appl. Surf. Sci., 203-204:793-797 [3] Deloule E. and Robert F. 1995 Geochim. Cosmochim. Acta, 59:4695-4706. [4] Nakamura-Messenger et al. 2006. Science, 314, 1439-1442. [5] Greenberg J. M. 1998 Astron. Astrophys. 330:375-380.