X線顕微鏡を用いたAllende隕石マトリクス中有機物のin-situ分析-その分布と起源解明をめざして-

In-situ obsevation of organic matter in the Allende meteorite matrix using X-ray microscopy

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Previous studies have reported that many kinds of carbon components are included in Allende CV3. The carbon components might be modified because they were extracted through acid treatments in the previous studies. Although the carbon components are mainly contained in the matrix of Allende CV3, their natures and occurrences have not been described in detail. *In-situ* sample extraction protocol without any chemical treatments should be applied for the characterization of the carbon components. In this study, we applied a scanning transmission X-ray microscopy (STXM) analysis combined with a focused ion beam (FIB) technique for functional group analysis and speciation.

First, Allende CV3 chip sample was cut by ISOMET under non-water and non-oil conditions. The cross section of the chip sample was coated with gold for a SEM observation. The matrix portion of the Allende CV3 was observed by a SEM. Several portions of interest selected through SEM observations were processed to ultra-thin foils using a FIB. The foils were attached to a Mo-grid. STXM analyses were conducted using STXMs at BL-13A, Photon Factory and BL-4U, UVSOR. After STXM observation, TEM observations were also conducted for textural observations.

The carbon components were found along with the grain-boundaries of fine-grained olivine crystals (diffusional). Several dense carbon components were also found in the diffusional carbon components (particulate). The constituent rates of particulate and diffusional carbons are approximately fifty-fifty. Based on C K-edge NEXAFS, the particulate carbon (aromatic-rich and carboxylic-poor) appears to be insoluble organic matter of Allende CV3 [1]. The diffusional carbon portion, on the other hand, mainly consists of aromatic-poor and carboxylic-rich carbon components. Fe L- and O K-edge NEXAFS spectra and TEM observations showed that spinel and chromite crystals are embedded in the particulate carbon. These minerals might be the fragments of CAIs, because such high temperature condensation minerals are not formed thorough thermal metamorphism occurred on the Allende parent-body. Our FIB-STXM analyses depict the existences of different two type carbon components in the Allende CV3. Based on the assumption that each carbon components had different origins, the following tow hypothesis is made. (i) The particulate carbon component might correspond to nano-globules included in carbonaceous chondrites. In some cases, silicate-minerals are surrounded by the nano-globules [2]. As same to this case, the particulate carbon component might had formed on the spinel and chromite crystals in the solar nebula, and accreted into the Allende parent-body. (ii) On the other hand, diffusional carbon component is similar to diffuse organic matter in the Orgueil and Murchison [3], except for the carbonate peak in the NEXAFS spectra. It is possible that the diffusional carbon component formed through aqueous alteration occurred on the Allende parent-body.

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