

VARIATIONS IN ORGANIC FUNCTIONAL GROUPS BETWEEN HYDROUS AND ANHYDROUS ANTARCTIC MICROMETEORITES.

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Introduction: It has been reported that the chemical compositions of (not all, but most) organic molecules in types 1-2 carbonaceous chondrites have correlations with the extent of parent body aqueous alteration [e.g., 1-3]. On the other hand, chemical evolution of organics in the earlier stage of aqueous alteration have not been well studied. Therefore, in this study, variations in functional group distributions of organic materials between hydrous and anhydrous Antarctic micrometeorites were investigated through the coordinated analyses using STXM-XANES, TEM, and SIMS.

Samples and methods: Five micrometeorites (MMs) (D10IB-004, 009, 017, 163, 356) which were found from the surface snow collected in the 2010 period by the Japan Antarctic Research Expedition teams near the Dome Fuji Station, Antarctica, were studied. The collected snow was melted and filtered in a class 1000 clean room at Ibaraki Univ. MMs were identified by using SEM-EDS. The MMs were embedded in gold for the isotope imaging by Cameca ims-1270 SIMS equipped with SCAPS [4]. Afterward, a thin section was prepared by the dual beam FIB-SEM. C-, N-, and O-XANES spectra of the FIB sections were acquired using a STXM at the beamline 5.3.2.2., Advanced Light Source, Lawrence Berkeley Laboratory.

Results and discussion: Through SEM-EDS and TEM analyses, GEMS were identified from D10IB-004, 009, 356 and these MMs were classified as anhydrous MMs that were similar to CP-IDPs [5]. In particular, D10IB004 had the highest abundance of GEMS. D10IB163 was classified weakly-hydrated MM due to small abundance of Fe-rich phyllosilicates. D10IB017 was enriched in Fe-rich phyllosilicates and classified as hydrous MM. STXM Carbon maps showed that organic carbon was diffusely distributed in D10IB-004, 009, 017, and 356. In contrast, organic carbon was depleted in D10IB163. C-XANES spectra of all the MMs exhibited the peaks of aromatic C=C, aromatic ketone, and carbonyl C=O, while the relative ratios of C=O to C=C for anhydrous D10IB-009 and 356 were higher than those for hydrous D10IB017 whose spectral pattern was chondritic insoluble organic matter (IOM)-like. IOM-like organics were detected from D10IB004 also. Both C=O rich regions and C=C rich regions were locally present in the weakly-hydrated D10IB163. In D10IB163, a single organic nanoglobule was found and it was slightly aromatic rich compared to the surrounding organic area. Nitrogen was depleted in most of the MMs. Exceptionally, submicron-sized nitrogen-rich grains were detected in D10IB009 and their N-XANES spectra showed extremely developed peaks of nitrile and/or aromatic N.

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