[JJ] Evening Poster | P (Space and Planetary Sciences) | P-PS Planetary Sciences

[P-PS09]Origin and evolution of materials in space

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Recent progresses of astronomical observations, laboratory experiments, solar-system exploration, and theoretical work have enabled us to attempt to understand the origin and evolution of materials (dust and gas) in space in the context of material science. It is thus important to link further planetary material science and astronomy for comprehensive understanding of dust and gas in space and their role in evolution of galaxies, stars, and planetary systems. In this session, based on latest results on observations, experiments, planetary missions, and theoretical studies on materials in space, we discuss next steps in science for materials in space.

[PPS09-P06]Organo-metal compounds in meteorites

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Extraterrestrial organic matter is observed from interstellar environments to asteroidal materials such as meteorites. The prebiotic synthesis of organic compounds is necessary for the origin of life in the universe. It is generally believed that organic matter was co-evolved with minerals and inorganic elements. However, few organo-metal compounds were not detected from extraterrestrial materials including meteorites. Recently magnesium-metal organics (dihydroxymagnesium carboxylates) have been reported in the solvent extract of various types of meteorites by electrospray ionization coupled with high-resolution mass spectroscopy (ESI/HRMS)(Ruf et al., 2017). The origin and formation mechanism of the CHOMg compounds, however, have not been clarified yet. Because meteoritic organic matter is very complex mixtures and metal has often several isotopes, HRMS is necessary to study the extraterrestrial organo-metal compounds. In the previous study, we found many alkylated CHN compounds in the Murchison meteorite (Naraoka et al., 2017). In this study, we examined the occurrence of organo-metal complex in the methanol extract of Murchison using high-performance liquid chromatography (HPLC)/ESI/HRMS.

Abundant ion peaks of C_nH_mN and $C_nH_mN_2$ compositions and minor CHNO peaks were observed in the methanol extract of Murchison. These CHN and CHNO compounds were present as extensively alkylated homologues (i.e. every m/z 14.0156). On the other hand, a few alkylated homologues were never assigned to organic compounds consisting only of CH, N, and/or O. These chromatographic peaks had a major ion mass peak (~70% intensity) accompanying a secondary ion peak (~30%) by difference of m/z 1.9981. Such a mass difference indicates copper-bearing species for chemical formula considering the solar abundance of elements (Anders &Grevesse, 1989). The alkylated homologues were assigned to $C_nH_mN_4{}^{63}Cu$ and $C_nH_mN_4{}^{65}Cu$ in addition to $C_nH_mN_3{}^{63}Cu$ and $C_nH_mN_3{}^{65}Cu$, in which the measured value matched with the calculated value within 1 ppm mass precision. The Cu-CHN compounds were not found in N1 and N2-bearing components but detected only in N3 and N4-bearing components, being consistent with the stability of tetraammine complex with a copper. Because reduced copper was added to the methanol extract in order to remove molecular sulfur in this study, the detected CuCHN compounds may be produced during sample preparation rather than their presence in the meteorite. Yet the meteoritic organic compounds have a potential to form organo-metal complex during the fluid activity on the meteorite parent body. The organo-metal compounds could have important roles for concentration and redistribution of metals as well as for chemical evolution in asteroids.