

**OCCURRENCE AND CHEMICAL VARIATION OF COSMIC SYMPLECTITE IN ACFER 094 CARBONACEOUS CHONDRITE.** K. Abe<sup>1</sup>, N. Sakamoto<sup>2</sup>, A. N. Krot<sup>3</sup> and H. Yurimoto<sup>1,2</sup>, <sup>1</sup>Department of Natural History Sciences, Hokkaido University, Sapporo 060-0810, JAPAN. E-mail: abeken@ep.sci.hokudai.ac.jp, <sup>2</sup>Isotope Imaging Laboratory, Creative Research Institution Sousei, Hokkaido University, Sapporo, 001-0021, JAPAN, <sup>3</sup>Hawai'i Institute of Geophysics and Planetology, School of Ocean and Earth Science and Technology, University of Hawai'i at Manoa, Honolulu, HI 96822, USA.

**Introduction:** Cosmic symplectite (COS) has been discovered from matrices of a primitive carbonaceous chondrite Acfer 094. The COS consists of nanocrystalline aggregates of iron sulfide and magnetite with a symplectic texture and the oxygen isotope composition is extremely enriched in <sup>17</sup>, <sup>18</sup>O ( $\delta^{17, 18}\text{O} = +180 \text{ ‰}$ ) [1, 2]. The occurrence and chemical information of COS has limited and further study would help to characterize COSs. Therefore we performed systematic COS survey in Acfer 094 carbonaceous chondrite using X-ray elemental mapping technique in order to reveal the abundance, occurrence and chemical variation to confirm the formation process of COS previously proposed [1, 2].

**Results and Discussion:** We have studied 314 COS grains from two thin sections of Acfer 094 using X-ray elemental mapping technique described in [7]. COS grains were scattered ubiquitously in the Acfer 094 matrix with a 611 ppm volume abundance. COSs can be classified into five categories: (1) symplectic structure composed of column-shaped magnetite (10–30 nm in diameter and 100–200 nm in length) and worm-shaped iron sulfide (100–300 nm in size) [2], (2) wormy grain (about 200 nm in diameter) having the symplectite inner structure, (3) irregular rope-like grain (few microns in width) consisting of the wormy grains, (4) bundle of the entangled rope-like grain (few tens of micron in size) and (5) aggregate of the (4) spread within the matrix area of 100×100 μm [8].

Whereas COS grains were often accompanied or surrounded by iron sulfide with a fractured structure, we have not been observed Fe,Ni-metal attached to COS grains. On the phase diagram calculated by [1], Fe-metals disappeared from the system when precursor metals or sulfides were oxidized to magnetites by water vapor below ~360 K. Our observations are consistent with the process.

All COS grains analyzed in this study have almost same atomic ratio of Fe,Ni : O : S = 4 : 4 : 1, which means (Fe,Ni)S : Fe<sub>3</sub>O<sub>4</sub> = 1 : 1. Ni contents in COS grains show wide variation ranging from 0 to 0.4 as atomic ratio of Ni/(Fe+Ni). If COS grains were formed by the formation process proposed by [2] that iron sulfides except for pentlandite were completely oxidized to magnetites, the (Fe,Ni)S/Fe<sub>3</sub>O<sub>4</sub> ratio of the COS grains should increase with increasing the Ni content. Therefore new mechanism of COS formation is needed.

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**PETROGRAPHY OF A LARGE PERFECT SHAPED TYPE A/B CAI FORMED BY MULTIPLE HEATING.** S. Yoneyama<sup>1</sup> and S. Itoh<sup>1</sup>, <sup>1</sup>Dept. Earth Planet. Sci., Kyoto University, Kitashirakawa oiwakecho sakyoku, Kyoto, 606-8502, JAPAN. Email:yoneyama.shun.23n@st.kyoto-u.ac.jp.

Calcium-aluminum-rich inclusions (CAIs) are the oldest solid materials in the early solar system [1]. Coarse-grained CAIs are divided into three groups, type A, type B and type C by the petrography and the bulk chemical composition [2]. All type of CAIs has partially melted more than once [e.g., 3, 4, 5]. However, the petrography and isotopography about multiple heating process are limited.

A large (about 8mm in diameter) perfect rounded shaped CAI, named KU-N-01, has a bulk chemical composition between type A and type B was used in this study. The petrography of a CAI is studied with FE-SEM-EDS at Kyoto University (KU). This CAI has some spinel-rich areas enclosed by fassaite in the mantle, likely Type B CAIs. The core mostly consists of melilite (åk<sub>30-50</sub>), likely Type A CAIs. In particular, this CAI has a unique structure with some domains divided by spinel layers (Fig. 1). Three domains are existed. The rim is surrounded by Wark-Lovering rim. In addition, this CAI has a double-layered structure divided by spinel layer in the rim. These layered consists of gehlenite (Ca<sub>2</sub>Al<sub>2</sub>SiO<sub>4</sub>)-rich layer, spinel layer (~5 wt% FeO), åkermanite (Ca<sub>2</sub>MgSi<sub>2</sub>O<sub>7</sub>)-rich layer and spinel layer (~0.4 wt% FeO) from outside to inside. This suggests that at least the CAI has melted more than three times and KU-N CAI has gradually evolved by multiple heating process. In this talk, the detail petrography with a trace element mapping by LA-ICP-MS and the formation process of CAI will be discussed.

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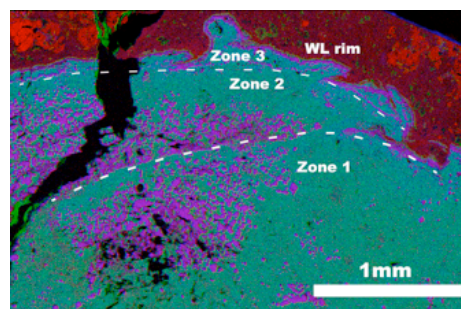


Fig. 1. X-ray map of zoned area by multiple heating. Mg=red, Ca=green, Al=blue. WL rim: Wark and Lovering rim.

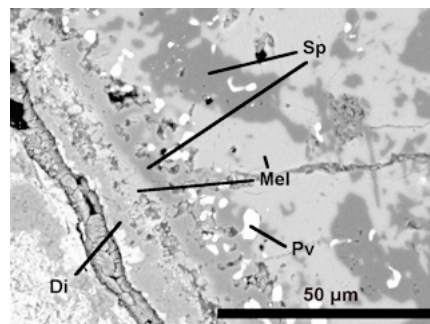


Fig. 2. WL-rim of BSE image. Sp: spinel, Mel.: Melilite, Pv: perovskite, Di:diopside.