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Synchrotron radiation X-ray diffraction analysis of micrometeorites recovered from the Antarctic surface snow

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1 Introduction

Micrometeorites (MMs) are extraterrestrial particles smaller than 1mm in size. Most MMs come from small bodies at the outer solar system such as outer asteroid belt and comets. MMs recovered from the Antarctic surface snow experienced a lower degree of terrestrial alteration than MMs from Antarctic blue ice field [1-2], thus retain primitive characteristics of asteroids and comets. In order to investigate bulk mineralogy of individual MMs, we performed synchrotron X-ray diffraction analysis on each MM.

2 Samples and analytical techniques

The surface snow was collected near the Jangbogo Antarctic Research Station by Korea Polar Research Institute in 2013. We separated particles by melting and filtering snow in a clean room. After identification of MMs, they attached to the top of carbon fibers 5μm in diameter. Individual MMs were analyzed for bulk mineralogy by synchrotron X-ray diffraction analysis at photon factory beamline 3A. After that, we embedded them in epoxy resin, and sliced with ultramicrotomy. The ultrathin sections and the cross sections were analyzed by FE-TEM/EDS and FE-SEM/EDS, respectively.

3 Results and discussion

A diffraction pattern of THP5L9 indicates that most abundant mineral is crystalline troilite and next abundant minerals are crystalline olivine and low-Ca pyroxene and poorly crystalline magnetite (Fig. 1). FE-SEM/EDS analysis revealed that THP5L9 shows a porphyritic texture consisting mainly of very small silicates (Fig. 2) and has high FeO content, suggesting that THP5L9 is a fragment of a Type II POP chondrule. Mineralogical and chemical characteristics of this MM are similar to those of Type II POP chondrules in short-period comet Wild 2 [3]. The similarity suggests that THP5L9 well preserves mineralogical and chemical features of chondrules in comets and contributes for understanding of mineralogical properties of primitive dust at the outer protoplanetary disk in the early solar system.

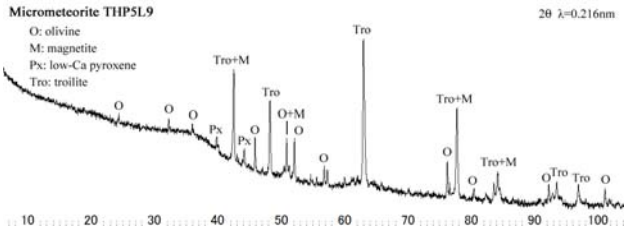

Fig. 1: A diffraction pattern of THP5L9.

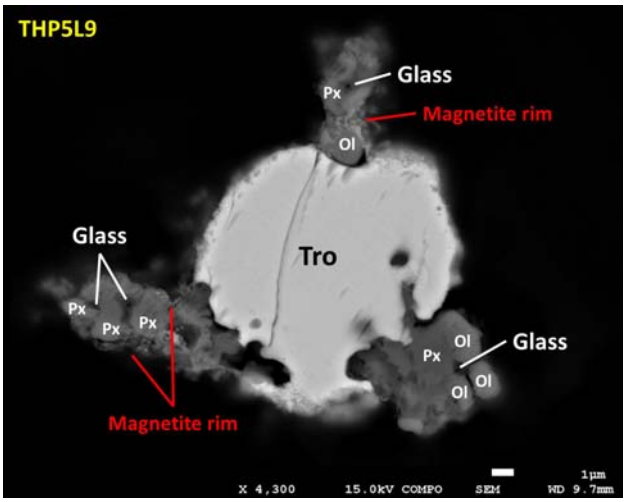

Fig. 2: Back-scattered electron image of THP5L9, consisting of low-Ca pyroxene "Px", olivine "Ol", troilite "Tro", magnetite rim, and glass.

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References

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