

DISCOVERY OF ANTARCTIC MICROMETEORITES CONTAINING GEMS AND ENSTATITE WHISKERS

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Introduction: About a half of interplanetary dust particles (IDPs) collected in the stratosphere is quite porous and has chondritic compositions and anhydrous mineralogy. It has been thought that at least a part of them were derived from comets [1]. Such chondritic porous IDPs (CP IDPs) are characterized by the presence of GEMS (glass with embedded metal and sulfides) and enstatite whisker [1, 2]. However, CP IDPs have not been discovered among Antarctic micrometeorites (AMMs) to date. Discovery of AMMs containing these components are quite important to testify that CP IDPs could reach the surface of the earth in the past. Here we report the first discovery of AMMs that contain GEMS and enstatite whiskers.

Samples and Methods: We have been identified >3000 AMMs among fine-grained particles collected at Tottuki Point, Antarctica, in 2000. Synchrotron radiation X-ray diffraction was performed to obtain bulk mineralogy of each AMM. We selected three porous AMMs, To440020, TT54C394, and T5BB2066, containing primary pyroxene. A TEM sample of a rod-shaped object (0.2 $\mu\text{m} \times 2 \mu\text{m}$) on the surface of To440020 was prepared by focused ion beam (FIB) technique. Ultrathin sections of all samples and a highly carbonaceous AMM (TT54B397) investigated by [3] were prepared for detailed TEM study.

Results and Discussion: Selected area electron diffraction patterns and TEM photographs of the rod-shaped object display that it is a unit-scale mixture of clino- and ortho-enstatite with many stacking disorders parallel to (100) and elongated along a-axis. The features are common to those of enstatite whiskers in CP IDPs. We also identified enstatite whiskers from the interiors of To440020 and TT54C394. All the AMMs contain 100- to 400-nm across spheroidal objects, containing Fe-Ni metal and Fe-bearing sulfide. Their chemical composition overlaps with those of GEMS in CP IDPs. In addition, they have features uncommon among CP IDPs. To440020 and TT54C394 contain organic globules found among hydrated carbonaceous chondrites [4, 5]. TT54C394 and T5BB2066 contain Mg-bearing Fe oxide, which was probably Mg-rich siderite before entering earth's atmosphere. Mg-rich siderite is common among carbonaceous chondrites such as Tagish Lake [6]. It is obvious that the AMMs are past CP IDPs containing GEMS and enstatite whiskers. They can also serve to understand parent body processes of very primitive small bodies.

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