

Mineralogy of surface snow Antarctic micrometeorites.

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It has been thought that fine-grained (less than 1 mm in diameter) extraterrestrial material has been derived from asteroids and comets. We have collected and investigated micrometeorites (MMs) in the surface snow (from surface to 20 cm in depth) near Dome Fuji Station since 2005. We have already reported that porous MMs collected from the surface snow (snow MMs) contain abundant primary low-Ca pyroxene, olivine, and pyrrhotite in 2006. Their mineralogy is similar to that of chondritic porous interplanetary dust particles (CP IDPs) that were collected in the stratosphere. The CP IDPs have been thought derived from comet or comet-like bodies. In addition, coarse-grained snow MMs that are similar to coarse-grained terminal particles collected by Stardust spacecraft have been found. These results suggest that we have a possibility to collect cometary particles on the surface of the earth.

We identified snow MMs by SEM among residual particles on filters after filtering of water formed by melting the snow in a clean room at Ibaraki University. The MMs were investigated by micro-Raman spectrometry and synchrotron radiation X-ray diffraction. We discovered 77 and 89 snow MMs (larger than 10 micrometers in diameter) from about 100 kg snow collected in 2004 and 2006, respectively. Their average sizes are both 52 micrometers.

Because 5 to 15 micrometer-sized grains are the most abundant among IDPs, it is expected 10 to 15 micrometer-sized snow MMs are very similar to IDPs. A 14-micrometer-sized snow MM was ultramicrotomed and its potted butt was observed by FE-SEM at University of Tokyo. The observation revealed that it is quite porous even in the interior and that it contains tiny elongated objects (about 2 micrometer x about 0.2 micrometer). Their morphology is very similar to enstatite whisker commonly found in CP IDPs. Therefore, this MM probably contains enstatite whisker. We will perform TEM observation of this MM to identify enstatite whisker in it and to search glass embedding metal and sulfide (GEMS).

We have found the other interesting snow MMs. For example, there is a very porous MM (48 micrometers across) containing phyllosilicate and a MM (53 micrometers across) containing spinel, melilite, and hibonite. These minerals are common among CAIs. CAI-like IDPs and MMs collected from blue ice (blue ice field MMs) are rare. Especially, the abundance of CAI-like blue ice field MMs is very low (typically ~0.1 %). Our results show that we can search CP IDPs on the surface of the earth and that very rare types of fine-grained extraterrestrial material can be found among relatively small numbers of snow MMs.