Recovery of Pristine Micrometeorites from Antarctic Snow Filed in Central Victoria Land

JONG IK LEE[1*], KEN TAZAWA[2], TAKUYA HIROWATARI[2], CHANGKUN PARK[1], MI JUNG LEE[1], TOMOKI NAKAMURA[2], KAORI JOGO[1] AND JONGMIN BAEK[1]

[1]Korea Polar Research Institute, Incheon 21990, Korea (correspondence: jilee@kopri.re.kr)

[2] Division of Earth and Planetary Material Science, Graduate School of Science, Tohoku University, 980-8578, Japan

One hundred forty micrometeorites were identified and recovered from approximately 450kg of fresh snow samples collected at central Victoria Land in Antarctica in 2013 and 2014 by the KOREAMET antarctic expedition team. They were separated from snow using a procedure that minimizes the time of contact between snow-melted water and micrometeorites, analyzed by electron microscopy, and classified to unmelted type (30 particles), partially-melted scoriaceous type (35 particles) and totally-melted cosmic spherules (85 particles) based on the degree of frictional heating during deceleration in atmosphere. More than half of the unmelted- and scoriaceous-type micrometeorites contain sulfur-bearing phases such as pyrrhotite on their surfaces, indicating that they are experienced the least degree of alteration in Antarctica. Synchrotron X-ray diffraction analysis of individual micrometeorites indicates that major mineral phases are olivine, low-Ca pyroxene, sulfide and magnetite. Some contain phyllosilicates and carbonates. Detailed mineralogical analysis was performed on five unmelted micrometeorites that show different bulk mineralogy. Detailed mineralogical analysis was performed on five unmelted micrometeorites that show different bulk mineralogy. The results indicate that two micrometeorites have mineralogy and chemical composition similar to Tagish Lake carbonaceous chondrite, suggesting that they might come from D-type asteroids. Other one and two samples are similar to CI and CM chondrites, respectively, suggestive of C-type asteroid origin. One Tagish Lake-like sample and one CI-like sample show mineral chemistries that are different in part from Tagish Lake and Orgueil CI chondrite, respectively. This implies differences in the conditions of early aqueous alteration occurred at parent objects. Our study indicates that micrometeorites recovered from fresh snow retain ancient records of solar system owing to minimum terrestrial alteration and thus contribute to uncover the evolutional processes taken place in primitive asteoirds and comets.