Abstract No. matr28

Organic Matter Measurements in Antarctic Micrometeorites

G. Matrajt (Orsay U.), G. Flynn (SUNY, Plattsburgh) and S. Wirick (SUNY, Stony Brook)

Beamline(s): X1A

Giant micrometeorites with sizes from 25-400 μm have been collected on the Greenland and Antarctica ice sheets. The most uncontaminated samples were collected in the blue ice fields of Cap-Prudhomme in 1991 and 1994 by filtering huge amounts of melt ice water through stacks with different openings (25, 50, 100 and 400 μm (Engrand and Maurette, 1998).

These antarctic micrometeorites (AMMs) are large interplanetary dust particles, mostly fine-grained carbonaceous objects, related to a primitive class of meteorites called carbonaceous chondrites.

Analyses of these grains with different techniques like Electron Energy Loss Spectroscopy (EELS) (Engrand and Maurette, 1997) and stepped combustion-static mass spectrometry (Wright et al., 1997) yielded high concentrations of carbonaceous material (~2%) (Engrand and Maurettes, 1997).

Complex organic molecules such as polycyclic aromatic hydrocarbons (PAHs) have also been identified in AMMs (Clemett et al., 1998).

Because these particles seem to be rich in carbon, it is clear that during the heavy bombardment period (between 4.2 and 3.9 billion years ago) they probably had played an important role bringing to the early Earth some of the building blocks important for the origin of life (Anders, 1989).

Last year we determined the abundance and the carbon functional groups using Scanning Transmission X-ray Microscope after have used the FTIR (U10B line) instrument on two non melted (least thermally altered) antarctic micrometeorites, one from the collection in 1994 called 99-11-73, and one from the collection in 2000 called Du-1-00, as well as on a piece of the carbonaceous chondrite Murchison and on a terrestrial grain collected and curated in the same manner as the grain 99-11-73. Because the success of the measurements, this year we analysed two new particles, 99-11-21 and 99-11-55 which are fine grained and have been less heated than the scoriaceous one (thus should be richer in organic carbon). We also analysed a new terrestrial particle, 99-11-54T. Preliminary results showed similar C-XANES spectra in the particles 99-11-73, 99-11-21 and Murchison sample with pics at 285 eV and 288 eV. No carbon was detected in the region studied in the sample 99-11-55. Since this kind of analyses have been made on interplanetary dust particles (IDPs) ~10 micrometers in size that are collected by NASA in the stratosphere, we compared our C-XANES spectrum of AMM 99-11-73 and 99-11-21 to the spectra of IDPs and we noticed they are also similar. This suggests that the dominant type of organic matter in Murchison, in IDPs and in the Antarctic micrometeorites are very similar, possibly indicating the existence of a common process operating in the solar nebula that produced the bulk of the organic matter in interplanetary materials.

The terrestrial particle of last year didn't show any signature of organics above the noise. However, the particle 99-11-54T did show a region with organic carbon, which is not similar to the carbon seen in the extraterrestrial particles. In order to be sure that the organics observed in the micrometeorite 99-11-73 and 99-11-21 are indigenous and that the carbon seen in this terrestrial particle is coming from the curation and/or extraction process, some extra analyses are required. It is important to continue to make these analyses on other AMMs and terrestrial particles from the Antarctic collections in order to determine if the presence of organic carbon in micrometeorites is indigenous and common.

References:

1) C. Engrand and M. Maurette, "Carbonaceous micrometeorites from Antarctica," Meteoritics and Planetary Science, **33**, 1998.
2) C. Engrand and M. Maurette, "Antarctic micrometeorites: High carbon contents from high C/O atomic ratios-the controversy," (abstract). Meteoritics and Planetary Science **31 (Suppl.)**, A39, 1997.
3) I.P Wright, P. Yates, R. Hutchison and C.T. Pillinger, "The content and stable isotopic composition of carbon in individual micrometeorites from Greenland and Antarctica," Meteoritics and Planetary Science, **32**, 1997.
4) S.J. Clemett, X.D.F. Chillier, S. Gillette, R.N. Zare, M. Maurette, C. Engrand and G. Kurat, "Search for polycyclic aromatic hydrocarbons in « giant » carbonaceous Antarctic micrometeorites," Orig. Life Evol. Biosphere**, 28**, 1998.
5) E. Anders, "Pre-biotic matter from comets and asteroids," Nature **342**, 1989.