

SEARCH FOR ANTARCTIC MICROMETEORITES IN BLUE ICE FIELD, LOMONOSOV MOUNTAINS, VOLTAT MASSIVE, QUEEN MAUD LAND, EAST ANTARCTICA

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Introduction: The Antarctic ice sheet is very clean and sterile place on the Earth and, by this, is considered as the best plachet for collecting space dust [1, 2, 3]. The objective of the studies was to search for Antarctic micrometeorites entrapped into 'old' blue ice field nearby the Voltat massif in East Antarctica not far from the coast and their SEM (elemental composition) and AFM (elasticity) characterization. Regarding SEM studies the carbonaceous chondrites were put into the focus and the EDX profiles of already characterized Antarctic micrometeorites (namely carbonaceous chondrites) were used as a reference (Jean Duprat, pers. comm.).

Material and Methods: Three samples (big blocks – 0.4-0.5 m³) of blue ice were cut off in the field and unfrozen delivered to cold and clean room laboratory facilities in France, Grenoble (IGE, CNRS, Grenoble INP, IRD, UGA). Two samples studied (no. 2 – 50 x 35 x 30 cm and no. 3 – 55 x 30 x 25 cm) originated from surface and 10m deep fault, respectively, were partly cut into segments which were cleanly treated in a cold room followed by melting and water filtering (Centripcon Plus-70 3 kDa membrane) in a clean room. The total volume of meltwater studied for samples 2 and 3 was 1.36L and 0.59L, respectively. The dust concentrated (200-700 times down) were studied by SEM (Tescan Vega 2) and AFM (Bruker's Dimension FastScan AFM system). The meltwater was also analyzed for dust content and size distribution (Beckman Coulter counter) and stable isotope contents (Picarro L-2120i analyzer).

Preliminary Results: The analyses of the sample no. 2 (surface blue ice block) represented by 5 ice segments (from the top to the bottom – 27.5cm deep) gave the following data. Dust abundance varied from 202 to 425 ppb (the upper bound has dealt with volcanic ash) with the mode of 2-3 µm and size less than 7 µm.

SEM studies: of 54 microparticles analyzed no particles were found well fitted the Duprat's carbonaceous chondrite EDX profiles while other interesting finds were discovered. Amongst them are micron-size particles of the chromic iron which could justify the background magnetic component of the cosmic dust. No cosmic spherules were observed.

AFM studies showed the particles vary widely in size (from 5nm to several µm) with the majority sized 50-80 nm. Regarding mechanical properties of the particles, a correlation of the elastic modulus with the particle size was revealed [4].

Stable isotope studies: no indication for expected old age ice was obtained.

The analyses of the sample no. 3 (10m deep blue ice block) represented by 3 ice segments (from the top to the bottom – 16.5cm deep) gave the following data. Dust abundance varied from 18 to 28 ppb (10 times down as compared with sample no. 2) with no evident mode and size less than 7 µm. SEM and AFM studies [4] are in progress.

Stable isotope studies: no indication for expected old age ice was obtained.

Conclusion: The data obtained testify that Antarctic blue ice sampled nearby Voltat massif (Queen Maud Land) not far from the East Antarctica coast is well suited for collecting dust microparticles. It contains numerous micron-size particles and their aggregates. The elasticity of material was found to correlate with the size of particles. Among 54 particles analyzed space originated carbonaceous chondrites were not revealed encountering less than 1% what presents the lowest value as compared with earlier works on Antarctic snow [5, 6, 7]. More studies are in progress in clarifying micrometeorites occurrence.

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