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Volatile composition of Cosmic Spherules

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To quantify the contribution of micrometeorites to Earth's volatile content, noble gas- (He to Xe) and high resolution SIMS-measurements (H, C, N, O) are planned on particles, including cosmic spherules (CS), unmelted micrometeorites and IDPs.

Upon atmospheric entry, particles with >50µm can suffer peak temperature heating that causes partial or complete melting. Completely melted CS experience a volatile loss of up to 95%. Though generally gas-poor, CS may still contain measurable amounts of noble gases [1], as shown for samples collected from the Transantarctic Mountains (TAM) [2].

Using SEM and electron microprobe, 300-700 µm-sized cosmic spherules are classified as S-type glassy to cryptocrystalline (CC), barred olivine (BO) and iron-particle (I) [3]. Chemical variations are observed in inversely correlated Mg and Fe abundance and Fe/Si ratios that were fractionated during atmospheric entry.

[1] Baecker, B. (2012) Primordial and other Noble Gases in Micrometeorites (Diss.), 326 pp. [2] Rochette, P. et al. (2008) Proc Natl Acad Sci U S A 105, 18206–18211. [3] Genge, M.J. et al. (2008) Meteoritics & Planetary Science 43, 497–515.–567.

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