NanoSIMS triple-oxygen isotope analyses of glass-type cosmic spherules from the Sør Rondane Mountains, East Antarctica

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We report new triple-oxygen isotope data for glass-type cosmic spherules from the Sør Rondane Mountains, East Antarctica in the size range of 478-828 μm. Measurements were performed with a Cameca NanoSIMS 50L instrument at the Open University, Milton Keynes (United Kingdom).

Following the classification scheme for glass-type spherules by [1-2], 8 samples were classified as 'normal', while the 4 remaining samples belong to the 'CAT' (A10, A48) or 'High Ca-Al' groups (A01, A20), based on LA-ICP-MS data and defining a possible evaporation sequence. If this model is valid, sample A01 must have experienced extreme degrees of evaporation, as suggested by the strong fractionation trends in major and trace element diagrams (e.g., $CaO+Al_2O_3 \approx 50\%$, Average $REE_N \approx 24$).

Results suggest that the majority (7/12) of glass-type cosmic spherules are related to carbonaceous chondrite precursors. Three samples lie close to the terrestrial fractionation line (TFL) and are consequently classified as 'ambiguous' [3]. Sample A21 plots in between the ordinary and Rumuruti chondrite fields, while sample A01 lies unexpectedly close to the ordinary chondrite fields. The latter is contradictory to the strongly vapor fractionated major and trace element patterns mentioned earlier. Indeed, 'CAT' and 'High Ca-Al' spherules do not seem to have experienced high degrees of atmospheric entry processing (i.e., atmospheric oxygen contamination and mass-dependent fractionation) based on triple-oxygen isotope data solely. In light of these results, both oxygen isotope and elemental data are essential to fully comprehend the nature of strongly evaporated glass-type spherules with refractory compositions.

References: [1] Taylor et al. (2005). *Geochim. Cosmochim. Acta*, 69, 10, 2647-2662. [2] Cordier et al. (2011). *Geochim. Cosmochim. Acta*, 75, 5203-5218. [3] Suavet et al. (2010). *Earth Planet. Sci. Lett.*, 293, 313-320.