MAJOR, TRACE ELEMENT CONCENTRATION AND TRIPLE-OXYGEN ISOTOPE COMPOSITIONS OF G- AND I-TYPE SPHERULES FROM THE SØR RONDANE MOUNTAINS, EAST ANTARCTICA

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Introduction: Micrometeorites, extra-terrestrial dust particles between 2000-10 µm in size [1], are traditionally classified into three groups (i.e., unmelted, scoriaceous, and cosmic spherules) based on their textural properties which reflect increasing degrees of atmospheric entry heating [2]. Cosmic spherules have experienced the highest degrees of atmospheric melting and are further subdivided into silicate-rich (S-type), iron-rich (I-type) and magnetite-rich spherules containing interstitial silicate glass (G-type). While S-type spherules have been characterized in great detail by previous studies [e.g., 3-5], G- and I-type spherules have not received the same level of attention. Information on these types of materials is consequently scarce and little is known about their respective parent body precursors. However, I-type spherules appear to share strong geochemical similarities with both chondrites and iron meteorites based on elemental ratios of highly siderophile elements [6-7]. Furthermore, Genge [8] inferred that the abundance and size of I-type spherules is analoguous to the flux of Fe,Ni metal derived from ordinary chondrites. Here we present new major, trace element concentration and triple-oxygen isotope data for two G- and I-type spherules (328-409 µm) from the Sør Rondane Mountains (East Antarctica).

Methodology: Micrometeorites were collected from sediment traps on the summits of the Sør Rondane Mountains (East Antarctica), analoguous to previous French-Italian expeditions [9]. Sediments were wet-sieved, and micrometeorites were magnetically separated using a hand magnet. Major and trace element concentration data was measured using a Teledyne Cetac Technologies Analyte G2 excimer-based laser ablation system coupled to a Thermo Scientific Element XR double-focusing sector field ICP-mass spectrometer at the Dept. of Analytical Chemistry of Ghent University. Triple-oxygen isotope data were acquired with an infrared laser-assisted fluorination system, coupled to a Thermo Scientific MAT 253 dual-inlet mass spectrometer at the Open University.

Results and Discussion: Major and trace element concentration data were normalized to average CI chondrite values [10] and visualised in multi-element diagrams. Overall, major and trace element patterns for both of the G-type spherules are almost identical and fairly chondritic (average $REE_N \approx 2.5$-4x CI), except for the most volatile elements (e.g., Na, Zn ≈ 0,01x CI). I-type spherules display a similar elemental pattern compared to G-type spherules, although most major and trace elements experienced a stronger degree of fractionation (average $REE_N \approx 7.5$-9x CI). Triple-oxygen isotope data for the two I-type spherules are in line with the results obtained by previous work [e.g., 4,12], and possess similar $\Delta^{17}O$, but higher $\delta^{18}O$ values compared to atmospheric oxygen [11]. The higher $\delta^{18}O$ values are most likely the result of mass-dependent fractionation during the atmospheric entry of micrometeoroids. G-type spherules, however, plot close to the terrestrial fractionation line and appear to lie in between the I-type spherules and the ordinary chondrite fields. Given the results in literature [6-8], and the fairly chondritic elemental abundances and triple-oxygen isotope data of G- and I-type spherules presented here, we suggest that the ordinary chondrite parent bodies represent a major source of G- and I-type micrometeorites.

Conclusions: New major, trace element concentration and triple-oxygen isotope data for G- and I-type cosmic spherules suggest that ordinary chondrites may form large contributions to the flux of G- and I-type micrometeorites. Further ongoing analysis will provide a larger and more representative dataset with which to test the observations presented here, and to investigate the potential contribution of iron and stony-iron meteorites to the G- and I-type micrometeorite populations.

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