

SOLVING THE PARENT BODIES OF MICROMETEORITES WITH HIGH-PRECISION OXYGEN ISOTOPE RATIOS.

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Introduction: Previous petrographic and ion probe studies [1] have concluded that 99% of small (150–250 μm) micrometeorites should come from carbonaceous, possibly cometary parent bodies. We measured oxygen isotope ratios of 33 large (>500 μm) silicate type cosmic spherules (CS) from the Transantarctic Mountains collection [2] with different textures (23 barred olivine (BO), 3 porphyritic olivine (PO) and 7 glassy) using IR-laser fluorination/mass spectrometry.

Results: As CS melt during atmospheric entry, their oxygen isotopic composition is a mixture between primary extraterrestrial components and high altitude atmosphere interaction. Most BO CS (16/23) have $\Delta^{17}\text{O} \approx -3$ to -5‰ and $\delta^{18}\text{O}$ in the 10–30‰ range, which could correspond to the atmospheric contamination of a parent material with ratios on the carbonaceous chondrite anhydrous minerals line, e.g. typical of CO/CV carbonaceous chondrites. Five BO CS and 2 glassy CS have $\Delta^{17}\text{O}$ around -1‰ and $\delta^{18}\text{O}$ in the 15–35‰ range, which could correspond to atmospheric contamination of hydrothermally processed carbonaceous material, e.g. CM/CR parent material. Two BO, all 3 PO, and 3 glassy CS have $\Delta^{17}\text{O} \approx 0.4$ to 0.8‰ and $\delta^{18}\text{O}$ in the 10–20‰ range, which could correspond to atmospheric contamination of ordinary chondrite parent material. It is the first time that any evidence has been uncovered for ordinary chondrite parent material for CS. Two glassy CS have $\Delta^{17}\text{O} \approx +1.8\text{‰}$ and $\delta^{18}\text{O} \approx 41\text{‰}$. The only known parent material could be an R chondrite, or the high $\Delta^{17}\text{O}$ component observed in the magnetites [3] and the mesostasis of unequilibrated ordinary chondrites [4].

Conclusions: Our finding of 30% of spherules above the terrestrial fractionation line (TFL), while previous studies by ion probe found none [1,5] (or 6% [6]), may be related to the lower precision of the ion probe, and/or to a higher proportion of ordinary chondrite related material in our large (>500 μm) spherules, that may show an intermediate proportion between meteorites (80% above TFL) and small micrometeorites (0–6% above TFL).

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