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On Volatiles (H, N, C) of Enstatite Meteorites and the Accretion of Earth

MABEL L GRAY[1], MICHAEL WEISBERG[2], CONEL M. O'D. ALEXANDER[3], JIANHUA WANG[3], DIONYSIS FOUSTOUKOS[4] AND DENTON S EBEL[2]

[1]The Graduate Center City University of New York

[2]American Museum of Natural History

[3]Carnegie Institution for Science

[4]Geophysical Lab / Carnegie Institution of Washington

Presenting Author: mgray1@gradcenter.cuny.edu

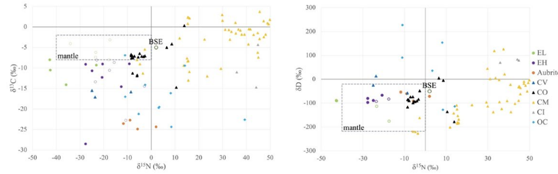

Figure 1. H, N, C isotopic compositions of ECs, aubrites, CCs, and OCs. Open symbols are *finds*, filled symbols are *falls*.

Enstatite chondrites (EC) are the primitive meteorites that most closely resemble the stable isotopic composition of the bulk silicate Earth (BSE) [e.g., 1-4], suggesting a close relationship, though some isotopes (Fe, Si) and major/minor element abundances of ECs differ from bulk Earth estimates. To better understand the distribution of volatiles in the early solar system and test the potential contribution of ECs to accretion of Earth, its oceans, and atmosphere, we analyzed bulk H, N, C abundances and isotopic compositions of a suite of ECs (EH3-6, EL3-6) and four aubrites, enstatite achondrites, and analyzed volatiles in individual phases in situ by NanoSIMS.

From C isotopes, taken at face value, and considering other isotope systems, ELs are close to estimates for BSE. BSE has heavier H and N isotopes [5] (Figure 1). Assuming precursors that were dominated by EC-like material, mixing with heavier H and N isotope-enriched materials (e.g., CC-like and/or cometary material), or isotopic fractionation processes, are required to account for Earth's isotopically heavier oceans and atmosphere [6-8].

Overlap between isotopic compositions of ECs and some CC groups suggests similarity in some of the carriers of volatiles (e.g., organics and ices) across the solar system. However, terrestrial contamination may have contributed to bulk measurements: H from H2O and organics, C and N from organics. Silicates in ECs (measured in situ) contain considerably less H than the bulk. Although primary organics are potential carriers in the least thermally altered chondrites, terrestrial contamination is a concern when measuring volatile contents of chondrites [6,9].

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