# Devolatilization of Planetesimals Viewed from C/S Versus C Relations

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Widespread depletions in moderately volatile elements (MVE, those that "condense" at <1400 K) observed in planets and meteorites demonstrate the importance of devolatilization during planetary evolution. Devolatilization can occur in nebular, planetesimal, and planetary stages and must have affected major volatiles (MV: H,C,N,S). Without asteroid sample return, evidence for planetesimal devolatilization comes only from achondritic meteorites, which provide vital but highly imperfect records.

Carbon-sulfur systematics are a revealing window into achondrite volatile depletion. Groups of stony achondrites plot along a linear trend in *log* C/S vs. *log* C space that is depleted compared to chondrites and to the inferred bulk Earth. However, the C and S depletions, also evident in some cases in MVEs, are largely explicable by removal of metallic or metal sulfide cores. The origin of the empirical correlation of *log* C/S vs. *log* C is not clear, as the trend includes both differentiated achondrites (HEDs, angrites, etc.), representing planetesimal crusts, and primitive achondrites (acapulcoites, winonaites), represent-ing less-degassed materials from parent body interiors.

Though C and S estimates for iron parent bodies have large uncertainties, due to complex textures and differentiation histories, they indicate depletions greater than possible from products of closed-system core formation from chondritic precursors. Open system devolatilization is required, presumably enabled by the early formation and intense heating of iron parent bodies. Strong C, S and MVE depletions in the IVB irons, isotopically linked with carbonaceous chondrites, show that planetesimal devolatilization can be profound, and are a counterpoint to ideas that devolatilization occurred chiefly in the nebular stage.

Earth's MV were likely delivered chiefly in the last ~10% of accretion, arriving in embryos from large heliocentric distance. These are usually presumed chondritic, but to have experienced core formation. Their assembly from pebbles and/or planetesimals without devolatilization is a challenge. The probability that they underwent partial devolatilization prior to terrestrial accretion complicates models of the origin of Earth's MV.