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The nebular snow line recorded by photochemical sulfur in iron meteorites

Peters*, S.T.M., Chakraborty, S., Jackson, T., Almeida, N. Thiemens, M.H.
*University of California San Diego, 9500 Gilman Dr. 92093 La Jolla, USA; speters@geo.uni-goettingen.de.

Mass-independent sulfur (S) isotope variations in meteoritic materials likely reflect gas-phase photochemical reactions in the nebula (e.g., [1]). We present the first extensive S isotope dataset for sulfide inclusions in irons from "carbonaceous" (CC) groups, and new S isotope data for sulfide inclusions in irons from "non-carbonaceous" (NC) groups [2]. Whereas NC irons show uniform and mildly positive $\Delta^{33}S$ relative to CDT (~ +15 ppm), i.e., in good agreement with [3], CC irons show variable and negative $\Delta^{33}S$ down to -40 ppm. The $\Delta^{36}S$ of both NC and CC irons is uniform and is identical to CDT within <40 ppm. We show that the combined $\Delta^{33}S$ and $\Delta^{36}S$ data are potentially explained if CC irons inherited S that had formed by Lymann-α (121.6 nm) photolysis of H_2S on icy dust grains [4]. This conclusion suggests that CC irons may have formed beyond the position of the ancient snow line.

[1] Rai et al. 2005 *Science* **309** 1062-1065 [2] Kruijer et al. 2017 *PNAS* **114** 6712-6716 [3] Antonelli et al. 2014 *PNAS* **111** 17749-17754 [4] Chakraborty et al. 2012 *PNAS* **110** 17650-17655

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