Inorganic and organic sulfur in Murchison and other chondrites carry isotope anomalies

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We have investigated the quadruple isotopic composition of organic and inorganic sulfur-bearing phases from Murchison and 12 others carbonaceous chondrites of CM type. We have also extraced sulfur out of 3 splits of insoluble organic matter (IOM) from the Murchison chondrite (from the USNM).

On average for CMs, we recover a bulk S content of 2.11±0.39 wt.% S (1σ). The recovered sulfate, S^0 and sulfide contents represent 25±12%, 10±7% and 65±15 % of the bulk S, respectively (all 1 σ). We recover a variable S content in the Murchison IOM, with a S content between 3100 and 6150 ppm S (±300 ppm S).

We report a range of $\Delta^{33}S$ and $\Delta^{36}S$ values in CMs significantly larger than previously observed. In the inorganic fraction, the largest variations are captured by S^0, with $\Delta^{33}S$ values ranging between -0.104±0.012‰ and +0.256±0.018‰ (2 σ). In the organic fraction, the low amount of extracted S allowed the determination of $\Delta^{33}S$ with a larger uncertainty. However, we observe a clear mass-independent signature in one of the three splits, with a $\Delta^{33}S$ value of +0.74±0.08‰. The two other splits have a $\Delta^{33}S$ value indistinguishable from the Canyon Diablo Troilite standard at a 0.02‰ level.

We suggest that these mass independent S isotopic compositions record H_2S photodissociation at the surface of the solar nebula. Mass independent $\Delta^{33}S$ values in the Murchison IOM has implication for the origin of S-bearing organics, as it links them with H_2S photodissociation. On the basis of experimental litterature we suggest that the photo-processing of H_2S, during ice transport, could have contributed to the presence of elemental S and S-bearing organics observed in the meteorites.