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High precision S isotopes in carbonaceous chondrites

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Chondrites are primitive and undifferentiated meteorites. These objects have a composition that has remained largely unchanged since the early stages of the solar system formation. They are therefore extensively studied to understand planetary formation, particularly that of Earth, including the origin of its volatiles.
Sulfur has four stable isotopes, allowing for the measurement of mass-independent isotopic signatures. Meteorites show a range of 33S and 36S mass-independent anomalies of ~0.5‰, although the precision on 36S has remained typically larger than 0.25‰. We make use of these anomalies in chondrites to evaluate the parent bodies of Earth.
So far, no high-precision data has been acquired for CI chondrites, although they have been invoked as a potential carrier of volatiles to planets. We developped a higher-precision analytical method for the measurement of 33S but also 36S in natural samples. By increasing the counting time, we were able to divide the uncertainty on 36S by a factor of ⊠4, i.e., from ~0.25‰ down to ⊠0,06‰ (95% confidence interval).
We applied our analytical approach to the Orgueil meteorite (CI). We sequentially extracted sulfates, elemental sulfur, and sulfides. We find that various splits of the Orgueil chondrite all show substantial amounts of oxidized sulfur. We determined their S isotope composition and find that they are no match with Earth.
The oxidation pattern on this CI chondrite is not fully understood yet. We anticipate that a comparison with Ryugu split will provide constraints on the origins of oxidized sulfure on CI. In the meantime, we tentatively conclude that the S isotopic data do not seem to support a substantial contribution of CI to Earth.

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