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High precision sulfur isotopes in 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. Therefore, they are 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 ^{33}S and ^{36}S mass-independent anomalies of ~0.5‰, although the precision on ^{36}S has remained typically larger than 0.25‰. We make use of these anomalies in chondrites to test different scenarios for the accretional origin of the Earth. However, no high-precision data has been acquired for CI and EC chondrites, although they have been invoked as a potential carrier of volatiles to planets.

Here, we report new high precision S isotopic data for both carboneaceous and non-carbonaceous chondrites. We sequentially extracted sulfates, elemental sulfur, and sulfides, determined their S isotope composition and found that those of the CI chondrite Orgueil do not match with the Earth S isotope composition. In addition, the various splits of Orgueil show substantial amounts of oxidized sulfur. 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 sulfur in CI.