Isotopic Composition of Sulfur in Enstatite Meteorites

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Enstatite meteorites encompass two categories: enstatite chondrites (undifferenciated Fe-rich EH and Fe-poor EL) and aubrites (differenciated counterparts). They are the most reduced bodies of the Solar System, thought to come from its most inner region, likely to be the environment of formation of Earth. Several elements (O, Cr, Xe, Mo, Ni, but not Si) show similar compositions between Enstatites and Earth, suggesting a possible Enstatite origin for the Earth. Yet, the genetic relationship between Enstatite groups remain unclear.

Sulfur is a volatile element which could help apprehend the mechanisms underwent by the Enstatite parent bodies. We therefore analysed the S isotopic composition ($^{33}S/^{32}S$, $^{34}S/^{32}S$, $^{36}S/^{32}S$) of 26 samples of all groups (EL3, EL6, EH3, EH5 and aubrites) with a precision of 0.01 per mil for ^{32}S, ^{33}S and ^{34}S and 0.1 per mil for ^{36}S

Our results [1] show that EL3, EH3 and EH5 give similar compositions than what was previously published in literature, with a mean $\delta^{34}S = -0.3 \pm 0.2$ ‰. However the chondrite group EL6 shows noticeably lighter composition of $\delta^{34}S = -0.64 \pm 0.11$. The aubrites (with the exclusion of Shallowater) display an even lighter composition with a $\delta^{34}S = -1.3 \pm 0.2$.

The distinction of EL6 compared to the EL3 and EH could either indicate an additional parent body, or it could be a consequence of higher metamorphism on the EL6 parent body, since, as of today, there are no meteorites of such high petrographic degree for EH meteorites. It is interesting to note that EL6 have an intermediary composition between the group of the other chondrites (undifferentiated meteorites) and the aubrites (differentiated). However, Shallowater is an aubrite thought to come from a distinct parent body. Its isotopic composition in Sulfur is different from the main aubrite group, which may suggest a heterogeneity of the Solar Nebula at the time of formation of this parent body (and likely, all the parent bodies of enstatite meteorite). Therefore, it cannot be excluded that the EL6 composition comes from the heterogeneity of the Nebula.

[1] Defouilloy *et al* (2013) Mineralogical Magazine, **77**(5) 961