

Mass-independent sulphur isotope compositions of iron meteorites determined by MS/MS MC-ICP-MS

MARTIN SCHILLER¹, KATRIN ADALBJÖRG ALFREDSDOTTIR² AND PROF. MARTIN BIZZARRO, PHD¹

¹Centre for Star and Planet Formation, Globe Institute, University of Copenhagen

²Center for Star and Planet Formation, Globe Institute, University of Copenhagen

The parent bodies of iron meteorites are thought to have accreted within 0.1 to 1 Myr after formation of the Sun. This early epoch represents a highly dynamic period of the protoplanetary disk typified by high infall rates to the proto-Sun as well as outward mass transport. These dynamic processes may be recorded in the isotope signal of first generation planetesimals such as the parent bodies of iron meteorites. Mass independent sulphur (S) isotope variations in achondrite meteorites have been suggested to reflect photochemical processing of H₂S in the hot inner disk region of the protoplanetary disk [1] and, hence probe mass transport in the inner disk. Thus, S isotopes can track the early protoplanetary disk evolution in the terrestrial planet forming region when infall rates onto the proto-Sun were high. A current limitation to take full advantage of the S isotope data is the low precision of the ³⁶S/³²S ratio involving the minor S isotope ³⁶S (abundance of 0.02%) typically obtained by gas mass spectrometry. Here, we used a ThermoFisher Neoma MS/MS MC-ICP-MS to overcome these limitation and obtain high precision S isotope measurements, including ³⁶S. All troilite inclusions are isotopically light with ³³S/³²S values relative to the SRM 3154 S standard ranging from -0.9 to -2‰. Repeat analyses of troilite inclusions from Cape York indicate precision (2SE) of <20 ppm and <50 ppm for the mass bias corrected ³³S/³²S and ³⁶S/³²S isotope data, respectively. Importantly, our new ³⁶S/³²S data improves the precision by 5-fold relative to earlier measurements [1]. Initial results for selected troilite inclusions from a range of iron meteorites confirm the inferred ³³S isotope contrast of troilite between magmatic (IIIAB and IC) and non-magmatic (IAB) irons [1]. In addition, our data also show a well resolved and systematic ³⁶S isotope variability, supporting the idea that this isotopic variability is due to photolysis in the early Solar System. We will report additional S isotope data for ungrouped iron meteorites and apply these data to better understand the nature of the S isotope variability in achondrites.

[1] Antonelli, M., et al. (2014) *PNAS* 111, 17749-17754.