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Tungsten and other Siderophiles in Iron-Nickel Metal in Enstatite Chondrites

HANNAH L. NECHIN[1], **RICHARD D ASH**[1], PHILIP M. PICCOLI[1], TIMOTHY MOCK[2] AND MICHELLE JORDAN[2]

[1]University of Maryland

[2]Carnegie Institution for Science

Presenting Author: rdash@umd.edu

Enstatite chondrites (EC) are extremely reduced materials (IW-5 to -7), with many isotopic affinities with the Earth and, as such, have been used to infer characteristics of terrestrial building blocks and the early history of the Earth. The EC are subdivided into two groups, the EH and EL with the former characterized by a higher total iron content. They have disparate mineralogies but in each iron is in the reduced form of metal or as sulfide, with minor phosphides. As such the EH are often portrayed as having a higher Fe metal content.

Recent studies of metal separates of EH and EL chondrites show they have the same W content (Hellmann et al., 2024), which cannot be reconciled with their supposed different metal abundances as the bulk as whole rock W contents are indistinguishable between the sub-groups.

In order to address this conundrum we have performed LAICPMS analysis of a suite of four EH and four EL chondrites, in conjunction with quantitative petrographic characterization.

Our in situ analysis of metal grains confirms that the metal grains in EH and EL are indistinguishable for W concentration (440-580ppb) and agree with the measured concentrations in the least contaminated (largest) metal grains reported by Hellmann et al., (2024) but show variation in other siderophile elements. There is no evidence for zoning, nor a variation with grain size.

Other siderophile elements within, and between, individual metal grains of the EL chondrites show a greater range of abundances than do those of EH chondrites, despite being of higher petrologic type.

We have also undertaken a petrographic survey of the ECs using FIJI to quantify the amount of metal, sulfide and silicate in the samples. Initial results support the observations of Keil (1968), derived by point counting, that the metal abundance in EH and EL chondrites are systematically indistinguishable.