

On the discovery of the main belt source of the enstatite chondrites.

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Introduction: Linking a meteorite type to a specific parent asteroid allows us to gain insight into the composition of the latter as well as the time, and indirectly the heliocentric distance of its formation. Up to now there have been established solid links between the HEDs and the inner main belt asteroid family of (4) Vesta [1] as well as between the ordinary chondrites and asteroids belonging to the so-called spectroscopic S-complex [2]. Here we report on our search for the enstatite chondrites parent body. We base our analysis on two facts: that (i) inner main belt asteroid collisional families are the most favoured to deliver meteorites to Earth, and (ii) enstatite chondrites (divided in EH and EL groups) have reflectance spectra that are within the broad asteroid spectroscopic X-complex [3]. The newly discovered asteroid families of Athor and Zita [4] are the only two families of the inner main belt that belong to the spectroscopic X-complex and thus are promising candidates.

Methods and Results: In order to investigate the potential link between the enstatite chondrite meteorites and the aforementioned X-complex asteroid families, we performed near-infrared observations of a statistically significant number of members of Athor and Zita. These were combined with the visible data from the literature and finally each asteroid spectrum was classified using the most common asteroid spectral taxonomy. We showed that the Athor and Zita families are spectroscopically distinct from each other and homogenous among their respective members. Moreover, both families have distinct geometric albedo values, with Athor family being brighter. Focusing on the Athor family, we performed curve matching and absolute reflectance comparison with all the available laboratory meteorite spectra in NASA *Reflectance Experiment Laboratory* and *Planetary Spectrophotometer Facility* databases. We will report on our matching and provide a number of further evidence that inner main belt families could indeed deliver enstatite chondrites to Earth.

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References:

- [1] Russell C.T. et al. 2012, *Science* 336, 6082, 684.
- [2] Reddy V. et al. 2015, *Asteroids IV*, University of Arizona Press, Tucson, 895, 43-63
- [3] Vernazza P. et al. 2009. *Icarus* 202, 2, 477-486.
- [4] Delbo M. et al. 2019. *Astronomy & Astrophysics* 624, A69.