SPATIALLY RESOLVED MAGNETIC STUDIES ON HED METEORITES: PRELIMINARY RESULTS

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Introduction: The magnetization history of small planetary objects is still not well understood and therefore requiring further detailed and extensive research. Studying the natural remanent magnetic (NRM) properties of meteorites can provide us with valuable data towards understanding the polyphase magnetization they have undergone during various exposure events to magnetic fields within our Solar System. Magnetic exposure can be of primary nature, imparting, for example thermoremenant and chemical remanent magnetizations during condensation and differentiation processes, or of secondary nature, such as shock, viscous and isothermal remanent magnetizations, causing magnetic overprinting. Such magnetization can originate from long or short-term, strong or weak, local or solar-system-scale events under thermal or non-thermal conditions. The results of detailed spatially resolved (<10 μm) magnetic studies of meteorites allow us to distinguish between such magnetizing events, allowing us to identify and peel off secondary overprintings to reveal the primary magnetizations. Together with further results of the acquired magnetic intensity and direction and subsequent EBSD and TEM studies, insight is offered into the source of magnetization and the conditions in which it was acquired. Such data help us to assemble and complement an (at least relative) chronology of magnetizing occurrences within our Solar System.

HED Meteorites: HED meteorites are especially interesting for study purposes, since they are thought to have originated from various crustal levels of a Vesta-like body and thus may possibly reveal evidence of the existence or non-existence of a magnetic field originating from an internal dynamo, which is of significance in understanding the structure and evolution of planetary bodies and their energy sources[1]. We present preliminary results of magnetic studies carried out on ten HED meteorite samples, both as bulk rock (magnetic mineralogy and remanent magnetization) and thin section specimens (magneti-optical imaging, see below), as first step towards understanding the magnetization history of these samples and thus Vesta-like bodies. This is particularly interesting, since Vesta itself currently awaits the forthcoming arrival of NASA's DAWN probe, from which we hope to obtain further data in the coming months.

MOI: We also describe one of the latest developments in magnetic testing techniques, the magneto-optical imaging (MOI) technique, which uses the Faraday effect of a thick MO active film to image the perpendicular component of the magnetic field at the specimen surface and identify the components carrying the remanence magnetization[2].

References: [1] D. W. Collinson, 1994. *Philosphical Transactions: Physical Sciences and Engineering,* 349, 1690: 197-207. [2] M. Uehara, C. J. van der Beek, J. Gattacceca, V. A. Skidanov and Y. Quesnel, 2010. *Geochemistry, Geophysics, Geosystems*, doi:10.1029/2009GC002653 - in press.