MAGNETIC REMANENCE OF L/LL4 BJURBÖLE: TIMING, INTENSITY, AND IMPLICATIONS

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Introduction: The paleomagnetic field recorded by chondrules can provide insights into the physical history of the meteorite's parent body and the processes and conditions of the early solar system. By using micro-CT scans in order to re-orientate chondrules to their in-situ position, we present a full-vector paleomagnetic study of the chondrules in Bjurböle (L/LL4). Chondrules formed before the meteorite accreted, so the magnetic fields recorded by individual chondrules would be expected to be unique and random in direction, unless there was a stable dynamo field active on the parent body. Previous work [1-3] has aimed to re-orientate chondrules to determine whether the magnetization is of nebular or parent body dynamo origin. Bjurböle contains tetrataenite, a highly credible paleomagnetic recorder [4]. As tetrataenite is a secondary mineralization of taenite, its acquired remanence is indicative of whether its parent body had an active magnetic field during its mineralization [4], and could apply tighter constraints on its lifetime.

Experimental: The bulk sample, 686 mg of Bjurböle (BM1927,11), was first micro-CT scanned prior to disaggregation. After disaggregation, each individual chondrule was mounted upon a circular carbon stub of 11 mm height and 6 mm diameter. The chondrules were subsequently micro-CT scanned in order to then accurately mutually re-orientate the magnetic directions of each individual chondrule to their in-situ positions. Micro-CT scans were made with a Metris X-Tek HMX ST 225 CT scanner at the Natural History Museum, London. The magnetic data are measured with a 2-G SQUID Cryogenic Magnetometer at Oxford University and a Princeton Measurements Vibrating Sample Magnetometer at Imperial College London. These data are used in order to determine the full-vector paleofield of the chondrules with the Preisach Paleointensity (PP) method [5] and the REM methods [6,7] for comparison.

Results & Discussion: The micro-CT scans of the bulk meteorite and individual chondrules showed enough detail in distinct dense sulphides and metals to identify and mutually orientate 40 chondrules. The chondrules disaggregated are of a size range of approximately 0.2 mm to 1.5 mm, with the majority being of sub-mm size. The magnetic mineralogy of the chondrules shows a distinct high-coercivity tetrataenite component, which means the high-coercivity remanent magnetization component would have been acquired upon cooling from 350˚C to 320˚C [4]. Detailed paleomagnetic results of the chondrules in Bjurböle will be presented at the conference.

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