USING MICRO-CT TO MAP METEORITIC MAGNETISM.

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Introduction: Chondrules can provide insights into the physical history of the meteorite's parent body and the processes and conditions of the early Solar System. Following the logic of the paleomagnetic conglomerate test [1]: magnetic fields recorded by individual chondrules would be expected to be unique and random in direction, unless a field overprinted the initial nebular magnetization on the parent body. Previous work [2-4] has aimed to re-orientate chondrules to determine whether the magnetization is of nebular or parent body dynamo origin.

Method: We present a method that uses x-ray micro-computed tomography (micro-CT) scans to reorient ex-situ chondrules to their in-situ position, allowing a full-vector paleomagnetic study of the chondrules in Bjurböle (L/LL4) (BM1927,11). Micro-CT is a non-destructive technique allowing the 3D visualization of a scanned object by reconstructing the x-ray attenuation of the object [5]. The 3D reconstruction can be used to accurately reorient ex-situ chondrules to their original in-situ positions, facilitating the conglomerate test to be conducted on samples with small clast sizes (i.e. chondrules in a chondrite). By step-wise demagnetizing the chondrules, paleomagnetic directions can then be reoriented relative to their in-situ positions.

Results: When comparing these directions, we find that the magnetization present in the chondrules of Bjurböle is statistically random.

Discussion: Bjurböle was heated to beyond the Curie point of its magnetic minerals on its parent body, so any pre-accretionary magnetization has been erased. Tetrataenite is a highly credible paleomagnetic recorder, and it is one of the primary magnetic minerals in Bjurböle [6]. As tetrataenite is a transformation of taenite, its acquired remanence is indicative of whether its parent body had an active magnetic field upon cooling below 320 ˚C, the reordering temperature [6].

Conclusion: The high anisotropy of tetrataenite likely resulted in its magnetization direction being governed by its crystallography rather than the presence of a unifying magnetic field. Future application of this method would be useful to investigate meteorites from parent bodies suggested to have had a magnetic dynamo [7,8].

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