
Paleomagnetic investigation of the oldest-known andesite Erg Chech 002

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Résumé

Magnetic fields likely play a prominent role in the formation of the first planetesimals by enhancing momentum transport in protoplanetary disks. Paleomagnetic studies of meteorites provide us with estimates of the field that existed in the solar nebula, at a given time and distance to the Sun. Such data represent important constraints for models of disk evolution and planetary accretion.

Erg Chech 002 is the oldest-known andesitic meteorite, which crystallized from its parent melt 1.80 ± 0.01 Ma after calcium-aluminum-rich inclusions (CAI) formation. Here, we aim at understanding whether Erg Chech 002 experienced a magnetic field upon cooling on its parent body, and determine the intensity of this paleofield. The fast cooling of this achondrite makes it an excellent candidate for paleomagnetic investigation for two reasons. First, it implies the meteorite may contain abundant submicron ferromagnetic grains, capable of preserving the record of a magnetic field over geological timescales. Second, such fast and early cooling could point to a record of the solar nebula field, which dissipated ~ 5 Ma after CAI formation.

We analyzed the natural remanent magnetization of fourteen unoriented, > 1 -g samples; six were set aside due to unfortunate remagnetization by magnets. All remaining samples carry a stable magnetization that cannot be attributed to contamination on Earth. Our preliminary estimates suggest the intensity of this magnetic field was in the 15-30 μ T range. Given the Erg Chech 002's early cooling, a planetesimal dynamo is unlikely to be the source of this magnetizing field. On the other hand, our preliminary results are consistent with data obtained on the chondrules of the Semarkona LL chondrite, which holds the record of a 54 ± 21 μ T solar nebula field acquired < 3 Ma after CAI formation. Our data strongly suggest Erg Chech 002 could carry a similar record of the solar nebula field. Additional analyses will be conducted to confirm and refine this result.

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