Paleomagnetism of 30 CV chondrites: testing the hypothesis of the CV chondrite parent body partial differentiation

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Résumé

Asteroids are classically categorized as differentiated or undifferentiated. The former category has undergone large scale melting leading to the formation of a core and mantle structure. The latter category corresponds to smaller and/or younger asteroids that have escaped melting and have preserved their original chondritic structure. Based on the paleomagnetic record of a couple of CV chondrites, and modeling, it has been proposed that the CV parent body may be partially differentiated, with a chondritic layer overlying a differentiated interior. However, this paradigm shift has raised a number of concerns, particularly about the reliability and interpretation of the paleomagnetic data obtained from CV chondrites.

We conducted a paleomagnetic and rock magnetic study of 30 CV3 meteorites. The parent body thermal metamorphism of the same meteorites was assessed using Raman spectroscopy of their organic matter-rich fine-grained matrix (from the literature, and new data).

The magnetic mineralogy consists mostly of pyrrhotite and/or magnetite. We used thermal and alternating field demagnetization of the natural remanent magnetization of these meteorites. Both methods show that most studied samples possess a stable paleomagnetic record. Overall, this paleomagnetic dataset suggests the existence of a global and stable magnetic field of several tens of μT during metamorphic cooling of the CV parent body. The most plausible explanation for such a long-lived strong field is the existence of a metallic core generating a dynamo field, implying partial differentiation of the CV parent body.

Mots-Clés: paleomagnetism, CV chondrites, meteorites, partial differentiation

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