Geophysical Research Abstracts
Vol. 16, EGU2014-4155, 2014
EGU General Assembly 2014


# Partial asteroid differentiation revealed by paleomagnetism of R-chondrite meteorites

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The study of the paleomagnetism of extraterrestrial material allows constraining magnetic fields in the early solar system. This can help us to understand primordial aspects of the history of the early solar system. Indeed, nebular or solar magnetic fields could have played a major role in the accretion process that generated the primary components of our solar system. Internal fields (i.e. generated by a dynamo within a solid body) are also of substantial interest since they provide information on parent body evolution, especially on parent body differentiation.
In this study we focused on Rumuruti chondrites (R chondrites) [1]. This meteorite group is of particular interest because R chondrites parent body is believed to have formed at a heliocentric distance greater than ordinary chondrites and less than carbonaceous chondrites [2]. As such, more than a simple new chondrite group, R chondrites offer the possibility to estimate the magnetic fields strength present in a yet unstudied part of the early solar system.
Only preliminary paleomagnetic data are available for these meteorites [3]. We performed a detailed magnetic and paleomagnetic study of two R chondrites, PCA91002 and LAP03639. Our aim was to establish the nature and the origin of the magnetic field recorded in these meteorites.
Our results show that these two meteorites contain sulfide (pyrrhotite). Magnetite was also found in PCA91002. Paleomagnetic analyses using thermal and alternating field demagnetization evidenced a stable and homogenous magnetization in both R chondrites. Because magnetic carriers in these meteorites are secondary phases formed during a metamorphic event several Myr after the parent body formation (I-Xe dating on magnetite, [4]), the magnetization was acquired after the possible existence of solar and nebular magnetic fields. Therefore the magnetizing field was most probably of internal origin. Using alternating field normalizing methods we estimate that the magnetization was acquired in a magnetic field of about 5 $\mu$T.
In view of the intensity and the likely internal (dynamo) origin of the magnetizing field, partial differentiation of the R chondrite parent body seems necessary. This idea, with a chondritic crust overlying a differentiated inner body has recently been proposed for CV chondrites parent body [5,6].

[1] Schulze et al., 1994. Meteoritics 29, 275-286. [2] Khan et al., 2013. 44th Lunar and Planet. Sci. Conf., abstract 2059. [3] Gattacceca and Rochette 2004. Earth Planet . Sci. Lett., 277, 377-393. [4] Claydon et al., 2013. 44th Lunar and Planet. Sci. Conf., abstract 2211. [5] Carporzen et al., 2011. Proc. National Acad. Sci., 108, 6386-6389. [6] Elkins-Tanton et al., 2011. Earth Planet . Sci. Lett., 305, 1-10.