Geophysical Research Abstracts
Vol. 14, EGU2012-9373, 2012
EGU General Assembly 2012

Paleomagnetic study of the Kaba meteorite

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Kaba is the least thermally metamorphosed of all carbonaceous chondrites of the CV group [1], and shows no petrologic evidence for shock, making it a good candidate as a recorder of magnetic fields in the early solar system. Kaba belongs to the oxidized CVB sub-group, and contains abundant magnetite [2]. This magnetite was formed by aqueous alteration on the parent body [3] about 8 Myr after the formation of the solar system [4,5]. This age is at the boundary when external magnetic field sources of nebular or solar origin are supposed to decay. Previous paleomagnetic study is limited to a two-step alternating field (AF) demagnetization up to 20 mT of a single fragment of unknown mass, for which no interpretation is proposed [6]. We conducted an exhaustive magnetic study of the Kaba meteorite including magnetic microscopy, AF demagnetization of the natural remanent magnetization 20 mutually oriented sub-samples (including separated chondrules), hysteresis properties, anisotropy of magnetic susceptibility.
Our results showed that Kaba contains about 10 wt.% of pseudo-single domain magnetite. Preliminary paleomagnetic results indicate that the matrix possess an homogeneous natural remanent magnetization (NRM) that is stable upon AF demagnetization up to 120 mT, separated chondrules have rather unstable NRM and their ill-defined directions (when they can be defined) are scattered. The preliminary interpretation is that the fine-grained magnetite in the matrix carries a chemical remanent magnetization that was acquired in a paleofield of at least 10 μT on the parent body, 8 Myr after the formation of the solar system. We will discuss the possible origin of this paleofield, but we note that these preliminary results are in agreement with the recent suggestion, based on the paleomagnetism of Allende meteorite, that the CV parent body had a dynamo-generated field at about the same time [7].

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