The interpretation of magnetic noise component in lunar sample magnetic measurement. (15445)

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The paleomagnetic measurements of the lunar samples were based on Natural Remanent Magnetization (NRM) basis. There was developed methods, analyzing NRM without heating process needs. [1] Magnetic characteristics are based on magnetic minerals involved in sample, their grain size, temperature, strain and aspect ratio. [2, 3] There are existing two ways for the crustal rock sample how to record the paleomagnetic information. The chemical process when magnetic grain is growing through the blocking volume of homogeneously distributed magnetic dipoles. The magnetic minerals will interact with the magnetic field, in case the field will be present at the stationary temperature. This process is called chemical remanent magnetization (CRM). The second process is going on, in case the cooling magnetic grain passing the blocking temperature by constant volume, when fluctuation of the magnetic moments interacts with the external magnetic field, in case the field is present. This process is called thermal remanent magnetization (TRM). These processes having both the same similar efficiency for contribution the paleofield remanent capacity [4].

For the presented work was used a new method which don't involve the heating and capture the amount of magnetic noise in the Lunar samples. This method is based on this logic. In case the sample A has not seen magnetic field, when was formed. The sample should be completely demagnetized and have a magnetic background M(A) On behalf of this properties, the AF (alternating field) demagnetization would be in constant for any of the AF demagnetizing level. The first step of our approach is to take sample A and demagnetize it by 1 mT, 10 mT, 100 mT, 1000 mT and the overall magnetization M(A(AF)) should be constant magnetic background [5].

When the sample is saturated by pulse or constant magnetic field, all magnetic domains of the sample converging into one magnetic dipole. The magnetic instrumentation is giving maximum MS(A) magnetic level. The monotonous magnetic decay is given in case the sample is step-wise demagnetized, curve itself pointing from its saturated value down to demagnetized state MS(A(AF)). Dividing these two sequences M(A(AF))/MS(A(AF)) essentially means that when function which is constant is divided by decreasing monotonously decreasing function, that overall result is function that monotonously increases. And this monotonous trend is central for our test for magnetic noise presence in lunar samples [5].

The lunar rocks magnetic carrier is mostly iron minerals [6]. In case these minerals contain superparamagnetic grains, they are vulnerable to viscous magnetization when is exposed to geomagnetic field. Carriers of this magnetization have very low magnetic coercivity. Such magnetization is removed when demagnetizing the sample by using the lowest amplitude of the demagnetizing alternating field (usually up to 5 mT) [5].

We tested sample of lunar breccia chipped by Apollo 15 mission. The sample 15445.277 was fragmented. We had 7 subsamples, one thin section, one of these subsamples contained only dust as a residue from separation for control of magnetic noise (Fig. 1).

The noise/viscosity detection procedure was applied for all fragments. The results displayed monotonously increasing function as expected. The 4 fragments and thin section showed a magnetic noise only (monotonously increasing function), 2 fragments with the highest sample masses were induced by viscous magnetization and 2 fragments contained superparamagnetic component overprinted on magnetic noise. It was possible to show with magnetic data from the other 5 sub-fragments without SP that they contain magnetic noise and did not record any level of magnetic field during their formation [5].

References:

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