Identification of magnetic noise on Lunar rocks (case for 15445.277 lunar rock), T. Kamenikova[1,2], G. Kletetschka[1,2,3], [1]Institute of Geology, Academy of Sciences of the Czech Republic, Czech Republic, [2]Faculty of Science, Charles University, Czech Republic, [3]Department of Geology and Geophysics, University of Alaska Fairbanks, USA, (Kletetschka@gmail.com).

Great effort was put forward to get new information about paleomagnetic fields that be recorded in samples' Natural Remanent Magnetiztion (NRM). Elaborated methods were designed to get value of paleofield by analyzing NRM without heating [1]. Rock samples, in general, have NRMs that depend on magnetic minerals, their grain size, aspect ratio, strain and temperature [2, 3]. In crustal rocks two major processes record paleomagnetic information. Process 1 is a cooling the magnetic grain of constant volume through the blocking temperature when fluctuation of the magnetic moments within magnetic minerals of the rock starts interacting with the external magnetic field (if present). Process 2 is when magnetic grain is growing chemically through the blocking volume of homogeneously distributed magnetic dipoles within the mineral and when this mineral volume starts interacting with the external field (if present) at fixed temperature. The acquired magnetizations by process one and two are called thermal remanent magnetization (TRM) and chemical remanent magnetization (CRM), respectively. Both of these processes contribute to overall paleofield recording capability with the similar efficiency [4].

Methods for paleofield estimates rely on laboratory manipulation of samples by giving them artificial TRM and compare them with the magnetization originally found. This manipulation, however, results in irreversible heat-induced alteration [5, 6].

Normalization method uses multiple empirical sample measurements without heating above room temperature and defines saturation magnetization as a proxy to estimate paleofield. This method depends on a constant determined from a large dataset of magnetic measurements. Such paleofield estimate is believed to fall at least within an order of magnitude to the approximating paleofield [2,3].

In this work we inviestigate a new method that does not involve heating and capture the amount of magnetic noise in the Lunar samples. We use the following logic.

If the sample A has not seen magnetic field during its formation it should be completely demagnetized and show magnetic background level M(A). This means that of all of the single magnetc domain and multidomain states that exist in the magnetic mineralogy contained in the samples are random in respect to each other and overall produce n-pol magnetic field that sharply falls with distance from the sample and to regular measurement sensors appears virtually non magnetic. Such sample can not be demagnetized any further when exposed to an alternating demagnetizing field of any amlitude. We take advantage of this feature as it defines sample for which AF demagnetization is 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 bacground.

When such sample is magnetically saturated by pulse and/or constant magnetic field, all of its magnetic states are combined into one magnetic dipole sensed by the magnetic instrumentation giving maximum MS(A) magnetic level. When we step-wise demagnetize this saturated sample by AF we get monotonous magnetic decay curve from its saturated value down to more and more demagnetized state MS(A(AF)). Deviding these two sequences M(A(AF))/MS(A(AF)) essentialy means that when function which is constant is devided 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.

Lunar samples contain iron as the main magnatic carrier [7]. Once sample-containg iron is exposed to geomagnetic field it can acquire soft magnetic moment, viscous magnetization, due to presence of superparamagnetic grains. 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). When Lunar sample with no original magnetization is exposed to the geomagnetic field it may acquire viscous magnetization. Thus when M(A) is demagnetized it is not constant for the lowest demagnetizing fields but for the lowest magnetic field falls rapidly to the magnetic background level. When sample MS(A) is demagnetized it also forms monotonous decreasing function but not as rapidly as the M(A). This is because the viscous magnetization is due to special class of magnetic carriers that have their grainsizes so small that their moments is perturbed by thermal fluctuation (superparamagnetic (SP) state). When magnetically saturated, in addition to SP grains there are also low coercivity multidomain

(MD) grains. Then mixture of MD and SP grains in MS(A) sample does not fall as rapidly as M(A) sample when demagnetizing by AF field. Then the ratio M(A(AF))/MS(A(AF)) would be at first rapidly decreasing, displaying the viscous behavior and than increasing, displaying the magnetic background level. This logic was tested on Lunar sample 15445.

Lunar sample 15445.277 was fragmented into 7 subsamples and one thin section. One sub-sample contained dust as a control for magnetic noise.

We applied the noise/viscosity detection procedure described above on the 15445.277's fragments. Sample with lunar dust served as a control for magnetic noise. It displayed monotonously increasing function as expected. Five lunar fragment samples, including the thin section, contained magnetic noise (we obtained monotonously increasing function). Two samples with the largest masses provided evident viscous magnetic component followed by magnetic noise detection.

Our non destructive (no heating) magnetic anlysis of 15445.277's fragments showed that two subfragments contained superparamagnetic component overprinted on magnetic noise. We were able to show with magnetic data from the other five subfragments without SP that they contain magnetic noise and did not record any level of magnetic field during their formation.

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