ROCK MAGNETIC CRITERIA FOR DISTINGUISHING LUNAR SAMPLES AS SUITABLE PALEOMAGNETIC RECORDERS

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Isothermal magnetic measurements have been performed on five additional subsamples of mare basalts in order to gain further evidence for the existence of an ancient lunar magnetizing field. In addition to AF demagnetization of NRM, IRM acquisition experiments were done on each subsample, followed by AF and DC demagnetization. Figure 1 (a-e) indicates saturation by about 500 mT. Unlike induced magnetization properties (Jr/Js generally <.02) which reflect the presence of large multidomain Fe grains, the remanence properties of lunar basalts are often dominated by finer, single domain-like carriers, as expressed by these symmetrical IRM acquisition and demagnetization curves and high remanent coercive force values.

Figure 2 (a-c) compares the response of NRM and saturation IRM to 3 axes AF demagnetization for each subsample. Both 10069 and 10072 (Fig. 2a) exhibit relatively high ratios of NRM/IRMs throughout most of their AF spectra, and both NRM's are directionally stable above 10 mT AF. The NRM of 10072 is the more TRM-like, with the stability of its NRM at higer fields comparable to that of its IRMs. By comparison with the TRM/IRMs ratios of fine-grained lunar samples heated in known laboratory fields (1), these results imply a magnetizing field of greater than 0.01 mT, and suggest that the lunar "high field" era may have extended into the time of extrusion of the Apollo 11 "high potassium" basalts, at about 3.5 AE.

In contrast, the NRM of 10045 is much less resistant to AF demagnetization as compared to IRMs, and its directional behavior is erratic for AF >15 mT, while both the NRM intensity and direction of 15662 are widely inconsistent with repeat demagnetizations at the same field values (Fig. 2b). This implies that 10045 is not carrying a TRM, and that 15662 is acquiring a spurious magnetization in the AF process. Thus neither sample is an appropritate candidate for the IRMs normalization intensity method. Fig. 1 d&e show the IRMs of both samples to be considerably less resistant to AF demagnetization than for 10069 and 10072 (Fig. 1 a&b). This difference in coercivity spectra is reflected in remanent coercive force (Hrc) values >75 mT for the well behaved samples, but <40 mT for the erratic samples. 10044 is intermediate in its Hrc value (50 mT - Fig. 1c) and in its AF response (Fig. 2c) is between these two extremes, with moderately consistent directional and intensity behavior for AF <30 mT.

1. Cisowski, S.M., Paleomagnetism of unbrecciated eucrites, Fig. 1e, this volume.

Figure 1(a-e). Isothermal remanence (IRM) acquisition, AF (one axis) and DC demagnetization experiments on five mare basalt subsamples. Remanent coercive force (Hrc) is defined by the intersection of the DC demagnetization line and the abscissa.

Figure 2(a-c). Response of NRM vs IRMs (saturation isothermal remanence to three axes AF demagnetization. Dashed lines represent constant NRM/IRMs ratios of 0.1, 0.01, and 0.001.

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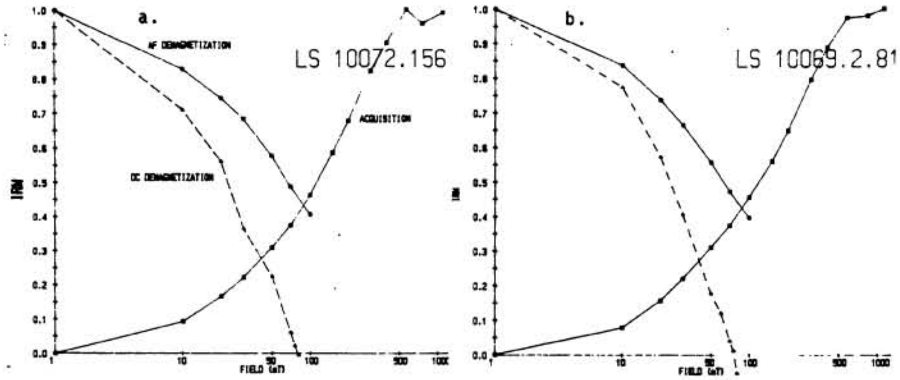
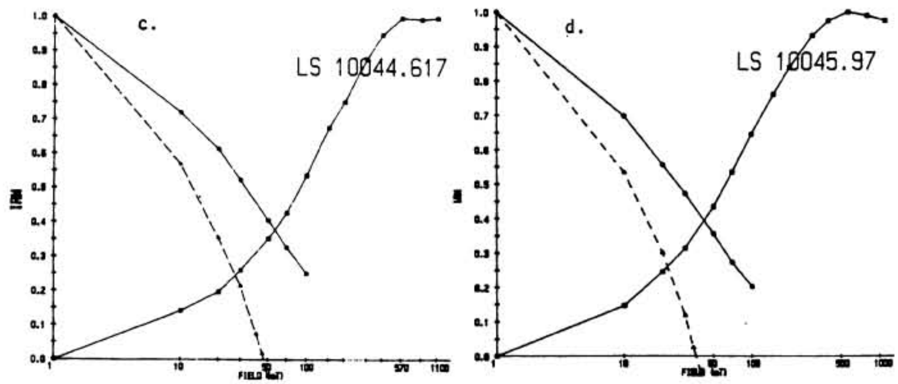
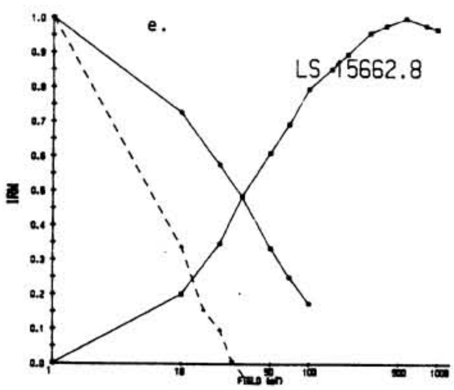


Figure 1.





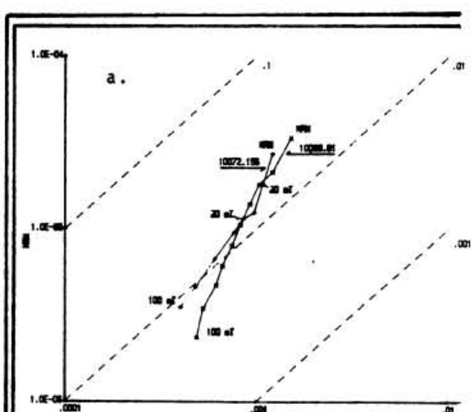


Figure 2.