MAGNETIC PROPERTIES OF LUNAR SAMPLES 60315 AND 60018: STRONGLY MAGNETIZED BRECCIAS; N. Sugiura, D.W. Strangway, Department of Geology, Univ. of Toronto, Ontario, Canada, M5S 1A1.

60315.190. Magnetic properties of 60315 have been previously reported (1,2). Because this breccia contains large metal grains, the reported magnetic properties are variable. It has one of the highest saturation magnetizations among lunar samples.

After sawing sample 60315.190 into four pieces, the NRM direction showed some scatter. Af demagnetization revealed that the scatter, however, is mainly due to a soft component of magnetization and the direction of stable magnetization is coherent in the subsamples. The similar stability of NRM and ARM (Fig.1) indicates that the NRM could be of thermal (TRM) origin. Results of paleointensity determinations using Thellier's method are shown in Fig. 2. The experiment was not entirely successful, probably because of the oxidation of large exposed metal grains not enclosed in glass particles. The change in magnetic properties due to heating to high temperature was monitored by measuring the pTRM ($0<T<200°C$) after heating steps. Corrections to the pTRM data were made assuming that the capacity to acquire pTRM changes uniformly over all temperature ranges. If we use the data below 500°C we obtain a paleointensity of more than 1 Oe. A comparison of the intensity of NRM and ARM also implies a similar paleointensity.

60018.19. The magnetic properties of this breccia have been described previously (3). This is the most strongly magnetic sample so far reported among lunar rocks. It contains large angular metallic grains (1mm), glass, partially melted materials and unmelted clasts. Ten small pieces of glass and partly melted material were chosen for detailed study, because they do not contain large metal grains. (These samples are not oriented with respect to the whole rock. Bulk samples are homogeneously magnetized.) As shown in Fig. 3 partly melted materials carry a greater remanence than glass samples, while the bulk sample is far more strongly magnetized than these subsamples. Thermomagnetic analysis showed that partly melted material contains two kinds of kamacite ($Ni = 0$ and $Ni = 6$), while the glass samples contain more homogeneous kamacite.

The NRM in these samples (Fig.4) is very stable, although it is not quite as stable as ARM. The NRM is also fairly stable against thermal demagnetization (Fig.5).

The paleointensity was estimated using Thellier's method (Fig.6). This was also not a very successful test. Changes in the pTRM capacity were observed after heating to 400°C. Using the data corrected for the effect of chemical change, paleointensities of more than 10 Oe are inferred.

In Fig. 7, paleointensity values obtained from lunar samples are plotted against bulk saturation magnetization. It can be seen that there is a positive correlation between these parameters. This correlation is not due to a phenomenon such as self-demagnetization , since the subsample of 60018 has a small saturation magnetization as opposed to the large saturation magnetization found in the bulk sample. Samples with a large metal content appear to have been magnetized in large magnetic fields. Transient fields such as lightning strikes associated with meteorite impact may be an explanation.

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2. Brecher, A., Vaughan, D.J., Burns, R., (1973), Proc. 4th Lunar Sci. Conf., p. 2991-3001.

3. Sugiura, N., Strangway, D.W., Pearce, G.W., (1970), Proc. 9th Lunar Planet. Conf., p. 3151-3163.

Figure Captions.

1. AF demag. of NRM and ARM; 2. Paleointensity estimate by Thellier's method; 3. NRM and induced moment in small glass and partly melted materials in 60018.19; 4. AF demag. of NRM, ARM (1000 Oe, 15 Oe), IRM (300 Oe) and SIRM; 5. Thermal demag. of NRM in two pieces of 60018.19; 6. Paleointensity estimate by Thellier's method; 7. Paleointensity vs. saturation magnetization plot for various lunar samples.