MAGNETISM OF THE APOLLO 17 SAMPLES, G. W. Pearce, Univ. of Toronto, Ont., Canada; W. A. Gose, Lunar Science Institute, Houston, Tx 77058; D. W. Strangway, Univ. of Toronto, Ont., Canada

A. Magnetic Properties

We have performed a variety of magnetic measurements at room temperature on 24 Apollo 17 samples. Table I, a summary of these measurements, includes saturation magnetization (J_s), paramagnetic (X_p) and initial (X_o) susceptibilities, ratio of saturation remanence, J_{rs}, to J_s, coercivity (H_c), remanence coercivity (H_{rc}) and three derived quantities--approximate values of wt % Fe^o and Fe^{++} and their ratio. The procedures used and the accuracy of these parameters have been previously documented (1).

Some observations are as follows:

1. The Apollo 17 mare basalts have similar magnetic properties to those returned on previous missions (Apollo 12 and 15)(1). These samples continue to have a fairly low metallic iron content but the values range somewhat higher than we have seen previously. 74275, in particular, is high in metallic iron. Low values of the ratio J_{rs}/J_s imply that the iron is largely multidomained (>300Å) again in a manner similar to other mare samples.

2. The massif rocks--noritic and anorthositic in composition--have high Fe^o contents when compared to the mare basalts, but the metallic iron present is also coarse grained (>300 Å as shown by low J_{rs}/J_s ratios). In this sense the Apollo 17 massif rocks are similar to the highly recrystallized highland rocks collected at Apollo 16 (2). The Apollo 17 rocks in general have less Fe^o than those from Apollo 16. Four measurements (3 of matrix, 1 of a clast) of 76315 show however that there is considerable variation in the Fe^o content within individual rocks. Such variability is also shown by 72415 and 72435, which are, respectively, an Fe^o poor dunite clast and an Fe^o rich sample of the matrix from the same boulder sampled on the South Massif. On the basis of grain size of the iron particles and iron content these are by and large highly recrystallized samples.

3. The soil 75081 (from a mare site) differs from 72321 and 72441 (from a massif site) in the same way that mare and highland soils from previous missions have been found to vary (1). Thus 75081 has a higher J_{rs}/J_s ratio and a more rounded magnetization curve signifying a greater abundance of fine iron metal particles (single domain (~150-300 Å) and superparamagnetic (<150 Å)) than do the massif soils.

4. The orange soil 74220 has a very low saturation moment and thus is quite distinct from the ordinary regolith soils. Magnetically, it most closely resembles the green clod

MAGNETISM OF APOLLO 17 SAMPLES

Pearce, G. W. et al.

15426 (1) in containing very little or no Fe^o. In fact, we have previously reported that this sample appears to contain magnetite rather than iron.

5. Soil breccia 79135 is similar to breccia 15498 (3) in that it has a high coercive force and a high value of J_{rs}/J_s implying the presence of a large proportion of single domain particles.

6. Figure 1 shows the correlation between wt % FeO of some rock samples as measured magnetically and as measured by X-ray fluorescence (4) by LSPET. The agreement is very good for the massif rocks, while for the mare basalts the magnetic measurements tend to be slightly high possibly signifying the presence of paramagnetic ions other than Fe^{++}. The mare soil breccia 79135 shows a very high metallic iron concentration due to the presence of superparamagnetic iron particles (1) which have not been destroyed on heating the sample.

B. Remanent Magnetization of Samples for Station 2 and Station 6 Boulders.

Of particular interest among the Apollo 17 rocks are the samples from the boulders. Seven chips from two rock samples (76015, 76315) are very stable against AF demagnetization, both in direction as well as in intensity (Fig. 2). By contrast, 3 chips of 72275 decrease to less than 10% of their NRM intensity upon demagnetization to 100 Oe. This intensity change is accompanied by a very large change in direction along a great circle (Fig. 2). No stable direction can be obtained. The different behavior of the two boulders is surprising in that both rocks are magnetically dominated by multidomain iron. Detailed petrographic examination and further magnetic studies are necessary to explain the difference.

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MAGNETISM OF APOLLO 17 SAMPLES

Pearce, G. W. et al.

TABLE I

Sample	J_s emu/gm	X_p emu/gm oe x 10^6	X_o emu/gm oe x 10^4	J_{rs}/J_s	H_c oe	H_{rc} oe	equiv wt % Fe^o	equiv wt % Fe^{++}	Fe^o/Fe^{++}
mare basalts									
70035,1	.320	35.2	2.0	.008	15	--	.15	16.1	.010
70215,1	.246	35.0	.8	.007	23	--	.11	16.1	.007
75035,37	.129	38.4	.4	--	--	--	.06	17.6	.0034
75055,6	.155	33.3	2.3	.003	20	--	.07	15.3	.005
74275,56	.424	35.9	.6	.013	22	--	.19	16.5	.012
noritic rocks									
72275,2	1.12	19.0	3.4	.005	35	--	.51	8.72	.059
72435,1	.86	14.9	2.1	.003	19	--	.39	6.83	.058
76055,5	1.14	15.3	3.7	.004	15	--	.52	7.02	.075
76315,2[1]	1.64	15.7	4.4	.005	30	--	.75	7.20	.105
,30M[2]	.19	16.9	.73	.011	60	--	.09	7.75	.011
,30$_2$3[3]	1.37	18.1	2.6	.002	11	--	.63	8.30	.076
,35[2]	.54	15.8	2.5	.005	10	--	.25	7.25	.034
77135,2	1.11	14.5	3.8	.003	--	--	.51	6.65	.035
anorthositic rocks									
76230,4	.81	8.37	1.5	.004	22	--	.37	3.84	.097
77017,2	.41	10.62	2.1	.009	--	--	.19	4.87	.039
78155,2	.19	10.0	.58	.008	27	--	.09	4.59	.019
dunite clast									
72415,2	.064	19.3	.35	--	--	--	.03	8.85	.0033
soils									
72321,7[4]	1.38	25.9	26.9	.044	25	420	.63	11.9	.053
72441,12	1.02	20.0	18.3	.035	22	390	.47	9.2	.057
75081,27	1.24	37.9	18.2	.073	37	410	.56	17.4	.033
74220,24[5]	.195	40.0	1.6	.073	88	540	(.09)	18.3	--
soil breccia									
79135,1	2.01	30.5	18.1	.057	62	590	.92	14.0	.066
small soil components									
72321,7NA[6]	2.2	--	14	.021	--	--	1.0	--	--
72321,7A[7]	2.0	--	7	.005	--	--	.9	--	--

[1]matrix, outer surface, patina; [2]matrix; [3]clast; [4](<20 μm fraction); [5]orange soil; [6]non-agglutinate material; [7]agglutinate material.

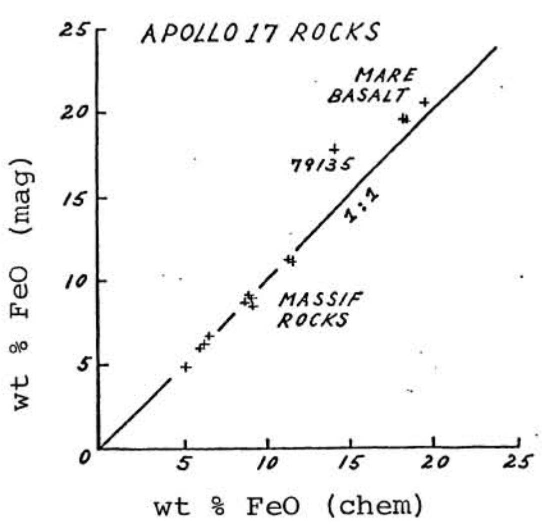

Fig. 1

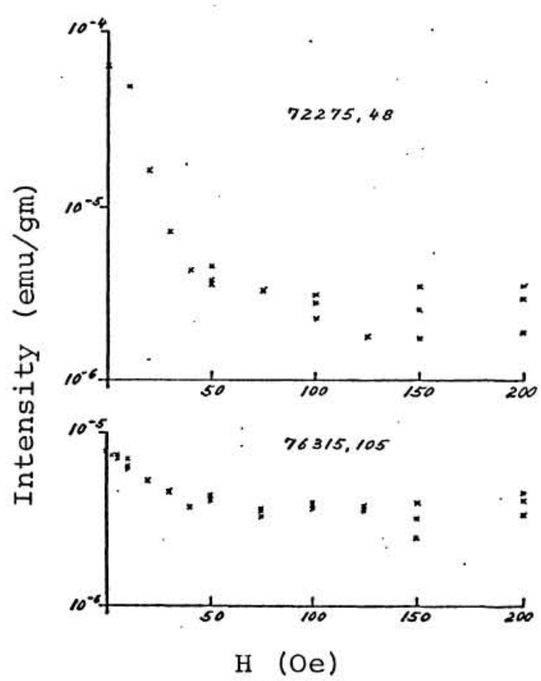

Fig. 2