COMPOSITIONAL STUDIES OF THE LUNAR REGOLITH AT THE APOLLO 17 SITE,
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Instrumental 14 MeV and ^{252}Cf neutron activation techniques (1) were used for the determination of nine major and minor abundance elements in one breccia, two basalts and ten soils from the Apollo 17 site and two recently allocated Apollo 16 breccias. Data obtained to date are presented in Tables 1 and 2. Most of the analyses reported are means of 3 to 5 replicate determinations. Error limits based on the standard deviations of the means for the replicate analyses are typically: ±0.3% O, 0.1% Si, 0.2% Al, 0.5% Mg, 0.4% Fe, 0.4% Ca, 0.2% Ti, 0.003% Mn, and 0.01% Na. The mean of the abundance summations is 98.5±1.6% and would be >99%, if estimated abundances for elements not determined in this work were included in the summations.

Apollo 17 basalts 70017 and 74275 have similar compositions and closely resemble the Apollo 11 mare basalts. The most obvious similarities are their high Ti contents(6 to 7%), their Al/Si ratios(Apollo 11 basalts=0.254, Apollo 17 basalts=0.259) and their Fe/Si ratios(Apollo 11 basalts=0.795, Apollo 17 basalts=0.785). Their composition is intermediate between the type A and type B mare basalts, but they are most similar to the type B material. The two basalts analyzed are especially similar to Apollo 11 basalt 10050,29. Apollo 17 soils exhibit the greatest compositional variation we have observed for soils from a specific mission site. The variability is pronounced for Al(3.4 to 11.3%), Fe(5.8 to 16.2%), and Ti(<1 to 6%). Orange soil 74220 has the lowest Al and O contents and the highest Fe, Ti and Mg contents of any lunar soil we have analyzed. Station 2 soils 72501, 73121 and 73141 are virtually indistinguishable and may be characteristic of the "light mantle" material distributed throughout this site. Station 1a soil 71500 and station 5 soil 75081 have similar compositions and closely resemble the composition of the basalts 70017 and 74275. These two soils may be representative of at least a portion of the "dark mantle" material at this site and are similar in major element composition to Apollo 11 soil 10084,50 (although their Al contents are somewhat lower). Station 8 soils 78441 and 78481 are nearly identical and intermediate between the light and dark mantle soils described above. Soil 74121 is also intermediate in composition while soil 72161 from the dark mantle at LRV 3 appears to have a rather unique composition which is quite distinct from the dark mantle material at stations 1a and 5.

In our previous work(2) we noted the strong inverse Fe-Al correlation for all previously analyzed lunar rocks, breccias and soils, excluding the Apollo 16 breccias and soils. The regression line is defined by the equation: Fe% = -1.34 Al% + 21.4. The end members of the regression appear to be the mare basalts and the VHA Apollo 16 basalts. The Apollo 16 breccias and soils could be interpreted as being on the Fe-rich side of the regression line at an Al content of approximately 15%. As may be seen in Fig. 1, the Apollo 17 samples fall almost precisely on the same regression line and cover almost the entire range of previously determined Al and Fe abundances. The excellent direct Fe-Mn correlation reported by other authors(3,4) is also supported by our data (Fig. 2). Excluding the Apollo 16 breccias and soils

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this regression line is defined by the equation: Fe% = 72.2 Mn% + 0.8. Again, the Apollo 17 samples cover almost the entire range of previously reported analyses, excluding the Apollo 16 breccias and soils. The Apollo 16 breccias and soils could be interpreted as being on the Fe-rich side of this regression line, as was the case for the Fe-Al correlation. At least a portion of the Apollo 16 breccia and soil deviations from these regression lines may be due to a relatively higher (ancient?) meteoritic component (high Fe content and high Fe/Mn ratio) in these materials as compared to similar materials from the other sites sampled.

As in previous studies in our laboratory (5), an O-depletion of approximately 1 to 2% O with respect to simple stoichiometry is observed for the Apollo 17 samples. The largest effects were again in the soils and the largest depletion was observed for soil 78481 which is a skim of the upper 1/2 to 1 cm of soil. This observation is consistent with our earlier suggestion (5) that a portion of this depletion is related to solar-wind reduction of lunar surface materials.

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Table 1. Elemental abundances in Apollo 16 and 17 rocks (weight %).

Element	66075 ,30 Breccia	67475 ,35 Breccia	70017 ,28 Basalt	73235 ,54 Breccia	74275 ,30 Basalt	74275 ,63 Basalt
O	43.6	43.5	40.4	45.3	39.9	41.0
Si	21.3	20.8	18.0	22.3	17.9	18.5
Al	14.8	16.0	4.8	11.0	4.5	4.8
Mg	4.0	2.0	7.2	7.7	6.3	6.1
Fe	3.9	2.5	14.1	6.1	14.2	14.1
Ca	10.9	13.1	6.5	7.9	6.5	8.5
Ti	<1	nd	7.5	nd	7.2	7.3
Mn	0.048	0.036	0.151	0.080	0.192	0.197
Na	0.39	0.46	0.30	0.35	0.28	0.29

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Table 2. Elemental abundances in Apollo 17 fines (weight %).

Element	71500 ,5* Sta 1a	72161 ,5 LRV3	72501 ,20 Sta 2	73121 ,5 Sta 2a	73141 ,6 Sta 2	74121 ,7 LRV6	74220 ,90* Sta 4	75081 ,55 Sta 5	78441 ,9 Sta 8	78481 ,21 Sta 8
O	41.0	41.4	42.2	43.8	42.7	42.6	40.2	39.7	42.0	40.8
Si	18.8	20.0	20.8	21.2	20.9	20.7	18.5	18.1	20.6	20.2
Al	5.8	7.6	10.7	11.3	11.2	10.4	3.4	5.8	9.1	9.0
Mg	5.6	6.8	6.3	6.5	5.0	6.5	9.1	6.4	6.6	6.8
Fe	14.2	12.2	6.4	6.7	5.8	8.2	16.5	13.2	9.6	9.3
Ca	7.3	7.7	9.1	9.6	9.7	7.8	6.6	7.5	7.9	7.6
Ti	5.4	2.8	<1	nd	<1	1.4	6	5.0	1.9	1.8
Mn	0.180	0.149	0.089	0.092	0.087	0.087	0.207	0.172	0.131	0.103
Na	0.35	0.35	0.40	0.34	0.34	0.34	0.35	0.31	0.36	0.29

* These samples are unsieved fines. All other are <1 mm fines.

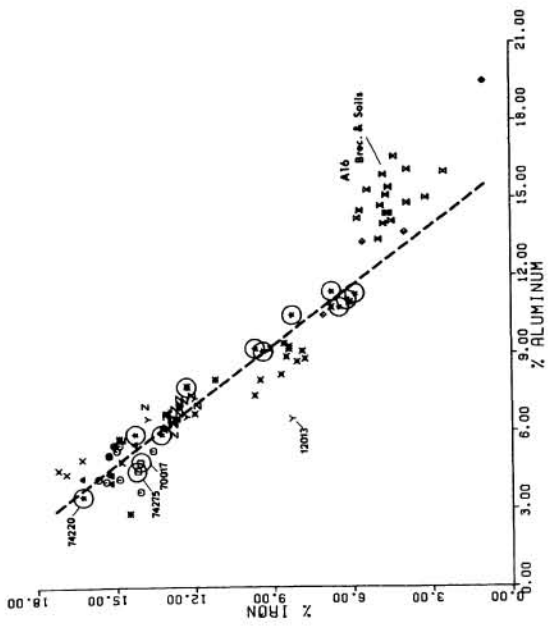

Fig. 1. Fe-Al correlation. Apollo 17 data points are circled.

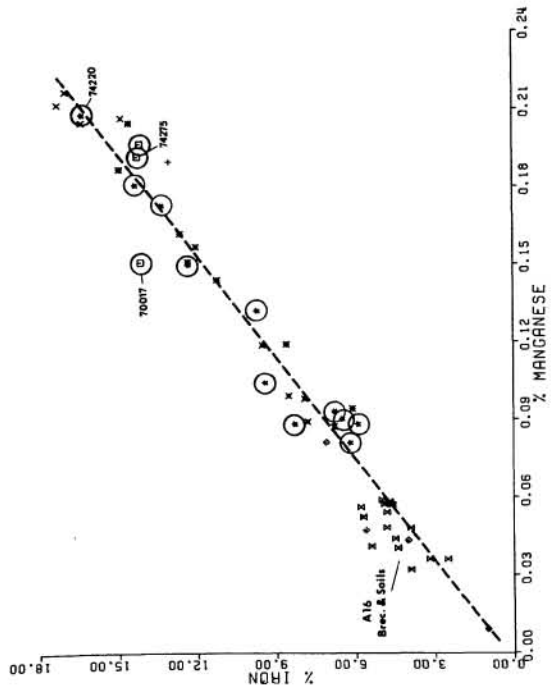

Fig. 2. Fe-Mn correlation. Apollo 17 data points are circled.