MIXING MODEL STUDIES OF THE APOLLO 17 REGOLITH, B. R. Hawke, Department of Geological Sciences, Brown University, Providence, R.I. 02912 and W. D. Ehmann, Department of Chemistry, University of Kentucky, Lexington, Ky. 40506.

Mixing model calculations were performed on the chemical compositions of 36 Apollo 17 soils to obtain estimates of proportions of their various components and investigate the manner in which these components vary as a function of position on the valley floor. The method used is essentially the same as that described by Bryan et al.[1] A least-squares compositional mixing model was used to explain the chemical composition of the soils in terms of the major rock types found at the site. The chemical data for determining average rock type compositions and for the soils were those of the Kentucky group[2,3] combined with values from the published literature.[4,5,6] Eighteen major, minor, and trace elements were used and each was given equal weight in determining the solutions. The rock type compositions used as end members in the calculations were: 1) quartz-normative mare basalt, 2)olivine-normative mare basalt, 3) KREEP-rich breccia, 4) anorthositic rock, and 5) orange and black glass. One major difference between this work and other mixing model studies of the Apollo 17 regolith[5,6,7]is the use of two chemically defined types of mare basalt as separate end members. The results are given in Table 1 and agreement with the results of similar studies is good where comparison is possible.

Soils collected from the dark valley floor can be divided into two groups on the basis of mare basalt content. One group, younger regolith, was collected from areas covered by variable thicknesses of the central crater cluster and Camelot Crater ejecta (stations 1.5 and LM-ALSEP) and is characterized by its high mare basalt content (∿65%) with lesser amounts of highland material (∿20%) and orange and black glass (∿15%). This material was probably generated by the mixing of freshly comminuted mare basalt with older regolith during impact events such as those which formed the central crater cluster. If this cluster were formed by Tycho secondaries as has been suggested[8],a small amount of the highland component in these soils may be secondary projectile material. The other group, older regolith, contains roughly twice as much highland material (∿42%) as the younger regolith and also has more orange and black glass. This older regolith was probably sampled at stations 4 (gray trench soils), 9, and LRV-3. This material is interpreted to be the end product of impact reworking and mixing of subfloor basalt and orange and black glass with massif material from the surrounding highlands.

Soils which contain abundant mare basalt yield satisfactory mixing model solutions, when a single average mare basalt component is replaced by two components: quartz-normative and olivine-normative mare basalt. The results suggest that quartz-normative mare basalt may be more abundant in the Apollo 17 regolith than petrographic studies[9,10] of coarse fractions have indicated. No systematic trend can be recognized in the distribution of the two types of mare basalt. Olivine-normative basalt comprises 73% to 92% of the total mare basalt present at the various stations with the exception of

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gray trench soil from station 4, where the two types are calculated to be present in roughly equal amounts.

Soils from the light mantle (stations 2, 2A, LRV-6 and LRV-2) are dominated by highlands material that seem to be composed of roughly equal amounts of anorthositic rock and KREEP-rich breccia. Material of orange glass composition is far more abundant than mare basalt in most light mantle soils. This suggests that the source material of the light mantle, probably regolith material high on South Massif, contained some orange and black glass prior to the emplacement of the light mantle. This material may be related to the dark mantling material on South Massif described by Lucchitta.[11] LRV-2 soil differs significantly from the other light mantle soils. Since it was collected from the rim of a small crater near the edge of a narrow tongue of the light mantle and is very similar to LRV-3 soil from the intertongue area, the LRV-2 sample may contain very little light mantle material.

Soils collected from North Massif (stations 6 and 7) and the Sculptured Hills (station 8) are similar and differ from one another only in their relative proportions of mafic material. As a group, they differ from light mantle soils in that they contain more mare basalt and orange glass and have a highland component dominated by anorthositic rock. The Sculptured Hills soil has a KREEP to anorthositic rock ratio similar to that in regolith collected at the base of North Massif, suggesting that the Sculptured Hills may not differ greatly in composition from North Massif. A complicating factor is the possibility that much of the material sampled at stations 6, 7, 8, and 9 originated as ejecta from the north crater cluster.

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Table 1. Results of mixing model calculations for the Apollo 17 soils.

Site/Comp.(%)	A	B	C	D	E	F	G	H
LM-ALSEP	8.8	49.7	58.5	11.8	14.1	15.6	25.9	45.6
1	15.4	49.3	64.7	6.1	9.3	19.9	15.4	39.6
5	10.0	63.0	73.0	9.9	7.0	10.1	16.9	58.8
9	8.2	34.1	42.3	12.0	28.2	17.5	40.2	29.9
4	17.1	14.3	31.4	22.6	14.3	31.7	36.9	61.1
LRV-3	-	-	28.7	18.4	29.7	23.2	48.1	38.3
LRV-2	-	-	23.0	22.2	36.4	18.4	58.6	37.9
LRV-6	-	-	9.5	40.1	42.2	8.2	82.3	48.8
2	-	-	0.6	51.0	41.8	6.6	92.8	55.0
2A	-	-	1.5	41.4	50.8	6.3	92.2	44.9
6	-	-	15.2	26.3	47.4	11.1	73.7	35.7
7	-	-	21.2	24.1	42.6	12.1	66.6	36.1
8	2.3	26.8	29.1	17.6	41.4	11.9	59.0	29.8

A = Quartz-norm. mare basalt

B = Olivine-norm. mare basalt

C = Total mare basalt

D = KREEP-rich breccia

E = Anorthositic rock

F = Orange and black glass

G = Total highland material

H = % of KREEP-rich breccias in highland materials