APOLLO 16 CORE 60013/14 AS A PRODUCT OF PATH I AND PATH II REGOLITH EVOLUTION PROCESSES; A. Basu, Department of Geological Sciences, Indiana University, Bloomington, IN. 47405, and LPI, Houston, TX. 77058; K. McBride and S.J. Wentworth, LESC, Houston, TX. 77058; D.S. McKay, NASA-JSC, Code SN 14, Houston, TX. 77058, U.S.A.

We have made a petrographic study of 12 samples along the 62 cm profile of Apollo 16 core 60013/14, taken at Station 10' near the lunar module. The basic core description and maturity variations have been discussed earlier [1-4]. This core is important because it enables a stratigraphic comparison with nearby cores 60001-7 and 60009/10. These cores form a triangle with sides 35-40m. FMR data show a maturity-match between 60009/10 and 60013/14 [3,5]. Unfortunately, segments of the core 60001-7 are too disturbed for any cm scale comparison [6].

We present new data on the grain size distribution (Table 1) and the modal petrography (Table 2) for six samples from six levels of 60013 using the same approach and rationale used for 60014 [4]. We have combined the new data with our previous data on 60014 [4] to plot the variations of grain size distributions and grain type abundances, in the 500-1000μm and 90-150μm size fractions, with depth (Figs. 1-3). Agglutinate abundances match the I_S/FeO profile (Fig.1) and both show a significant break at a depth of about 45 cm, with lower maturity material below that point [3,8]. Grain size distributions show that for all analyzed samples, the mean grain size is below 90μm. The two lowest samples are somewhat more coarse-grained than the rest of the core. The break at about 45 cm is the most prominent feature of the core and was described during the initial dissection as a pronounced change in color from dark to light [2]. As emphasized by [8], it now seems clear that this break is primarily one of maturity rather than of bulk chemical composition.

In our data, the abundances of single feldspar grains (Felds) and feldspathic fragmental breccias (FFBx) are positively correlated with each other down to a depth of about 27 cm. Below that depth, the correlation between these two components is not particularly good. This correlation does not mainly result from closure driven by variations in the major components (crystalline breccias at the larger grain size and crystalline breccias plus agglutinates at the finer grain size); the variations in the much less abundant feldspathic components does not mirror, in most cases, the variations in these major components as would be expected from simple closure relationships (Fig. 2,3). In the lower part of the core below about 41 cm, the feldspar fragments correlate (in a positive sense) better with the crystalline breccia lithic fragments and do not correlate positively with the feldspathic fragmental breccias. In normal reworking or Path I soil evolution [7], feldspars correlate negatively with feldspar-rich lithic fragments; the lithic fragments are systematically comminuted and destroyed and single mineral grain abundance increases. Conversely, in Path II evolution (mixing), daughter feldspars and parent lithic fragments may be mixed into soils as endmember pairs, and the ratio between the two will then reflect the ratio in the original endmember, rather than any reworking in the mixed soil. This suggests that single feldspars in these two stratigraphic intervals were derived principally from these two types of breccias respectively; this derivation occurred in processes that operated prior to the emplacement of the stratigraphic segments at this location. The major source of feldspars in the lower core may be from crystalline breccias and this lower core may include an endmember which contained these two components as a set. The segment between 27 cm and 41 cm is intermediate. It may reflect some degree of in situ reworking, or may simply reflect a more complex mixing. We infer that Path II processes operated to produce much of the mineralogic variability, which then may have been subdued or modified by subsequent Path I processes. It is likely that both processes were dominant during different and possibly even in overlapping episodes. One implication of this interpretation is that two major populations of feldspars may be present, and the relative abundance of each may change significantly with depth.

Finally, fragments of mare basalts are extremely rare in the >90μm fraction; green and orange glasses are also rare. Therefore, the chemical mare basalt component [8] must be in the finer fractions, and the mare basalt glasses [9] could be a part of an ancient regolith.

Table 1. Grain size distribution (60013 wt%)

Depth(cm)	33.5	41.0	43.0	48.5	54.5	61.5
Split	226	227	228	229	230	231
>1mm	6.7	7.9	9.3	3.5	14.7	11.3
0.5-1mm	8.1	7.5	6.6	5.4	5.4	7.1
250-500μm	10.4	9.5	8.6	8.1	8.1	11.3
150-250μm	9.3	9.4	8.3	7.4	6.8	8.3
90-150μm	10.8	9.8	9.9	9.2	8.1	9.4
<90μm	54.2	56.0	57.1	66.3	56.8	52.7

REFERENCES : [1] Schwarz, C. (1991) LPSC XXII, pp. 1201-1202; [2] Schwarz, C. (1992) LPSC XXIII, pp. 1249-1250; [3] Morris, R.V. and Lauer, H.V. (1992) LPSC XXIII, p. 935; [4] Basu, A. et al. (1992) LPSC XXIII, pp. 71-72; [5] McKay D.S. et al. (1976) PLSC 7th, pp. 295-313; [6] Korotev, R. (1991) PLPSC 21st, pp. 229-289; [7] McKay, D.S. et al. (1974) PLSC 5th, pp. 887-906. [8] Korotev et al. (1993) This Vol.; [9] Delano, J. (1992) LPSC XXIII, pp. 305-306.

REGOLITH EVOLUTION AT 60013/14: Basu, A. et al.

Table 2. Petrographic Modal Analysis of Core 60013

	(500-1000μm)						(90-150μm)					
Split	233	248	263	278	293	308	239	254	269	284	299	314
Depth(cm)	33.5	41.0	43.0	48.5	54.5	61.5	33.5	41.0	43.0	48.5	54.5	61.5
Aggl	22.8	17.6	16.6	7.0	8.3	11.7	28.7	33.2	25.7	18.3	19.8	21.2
RegBx	21.4	16.9	24.3	16.0	7.4	11.7	16.0	11.0	13.3	8.5	4.4	9.4
FFBx	6.7	2.8	5.5	1.0	2.7	2.3	3.9	4.5	2.2	2.2	2.2	1.3
XllBx	39.5	48.5	38.8	49.0	51.8	50.7	24.2	25.7	32.5	39.8	40.5	29.4
Felds	2.6	6.3	9.0	14.0	20.3	19.5	19.6	17.9	18.8	24.6	24.2	32.0
Pyrox	0.0	0.0	0.6	1.0	0.0	0.0	2.9	2.2	2.6	1.8	2.2	2.6
OrGl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.9	0.0
GrGl	0.0	0.0	0.6	4.0	0.0	0.7	0.6	0.3	0.0	0.3	0.9	0.0
YlGl	0.6	0.7	0.0	0.0	0.0	0.0	0.9	0.9	0.3	0.6	0.9	0.3
ClGl	0.6	0.7	0.0	1.0	0.0	0.7	2.2	2.6	3.5	2.2	1.5	1.6
KBasalt	2.6	2.1	0.6	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
MBasalt	0.0	0.0	0.0	0.0	0.9	0.7	0.0	0.0	0.0	0.0	0.0	0.0
Other	2.6	4.2	3.4	7.0	8.3	1.5	0.6	0.9	0.3	1.2	1.9	2.0
Total	99.4	99.8	99.4	100	99.7	99.5	99.6	99.5	99.5	99.5	99.4	99.8
Ngrain	149	142	144	100	108	128	306	307	307	316	313	306

MATURITY AND PETROLOGIC PROFILES OF 60013/14