SOILS IN 15009 AND THE GEOLOGY OF THE APOLLO 15 SITE; Abhijit Basu, Dept. Geol., Indiana University, Bloomington, IN. 47405; S.J. Wentworth, Lockheed ESC, Houston, TX. 77058; and D.S. McKay, NASA-JSC, Houston, TX. 77058

The soil column in drive tube 15009 represents about 30cm of the uppermost regolith at Station 4 near the Dune Crater in the Apollo 15 site. This station is on the mare plain below the Apennine Front and of all the mare stations it is farthest from the Hadley Rille. Thus a comparative study of soils from near the rille with those from LM/ALSEP area and Station 4 is likely to provide an insight into the effect of the rille and mare basalt flows at the Apollo 15 site. We have completed a detailed modal analysis of 1995 particles in the 90-150μm size range of samples from six discrete levels of the drive tube. In this abstract we report the modal data, our preliminary interpretation of the provenance of these soils, and discuss their implications in understanding the near-surface geology of the Apollo 15 site.

Agglutinate contents (Table 1) indicate that these soils are mostly submature to barely mature; therefore, the petrology of these soils are likely to be good indicators of their provenance. Pyroxene fragments, many of which are pink (i.e. probably high Ti), dominate the monomineralic fraction, and mare basalt fragments dominate the lithic fraction. However, the abundance of mafic minerals is significantly less than those in soils from near the Hadley Rille [1,2]. Further, the relative abundance of mare basalt fragments with texture akin to those of olivine normative basalts (ONB) is less than those of quartz normative basalts (QNB). This is the opposite of the general case of Apollo 15 soil composition [3,4,5]. The abundance of KREEP basalt (KB) fragments on an *agglutinate + regolith breccia-free* basis is higher than that in other mare soils, and is comparable to the soils from near St. George Crater on the Apennine Front. Many studies have suggested that the Apennine Bench Formation underneath the mare plains is the most likely source of KREEP basalt fragments [6,7]. The ratio *high grade crystalline breccias/total breccia* and the ratio *green glass/total glass* vary in tandem along the depth profile of the core (fig. 1). Other particle types and their ratios do not exhibit such a relationship. This probably suggests that the same source region, the Apennine Front to be specific, supplied crystalline breccias and green glasses to the mare plain below.

The ratio QNB/ONB>1, despite the caveat that it is hard to identify basalt texture types in 90-150μm sized particles, suggests that the upper ONB flow of the Apollo 15 site [3] must be very thin here and that the Dune Crater must have penetrated and excavated substantial amounts of QNB from below. The greater abundance of KB also suggests that the Dune crater likely penetrated into the Apennine Bench Formation. The layer-cake scenario of the Apollo 15 site geology of Ryder [3] is not fully compatible with such an interpretation. Rather, mare basalt flows thinning away from the Hadley Rille towards the Front, and over an either hummocky or terraced surface of the Apennine Bench Formation, explains the particle type abundances of 15009 much better (fig. 2).

REFERENCES : [1] Basu & Mckay (1979) PLPSC 10, pp. 1413-1424 [2] McKay et al. (1980) PLPSC 11, pp. 1531-1550 [3] Ryder (1989) PLPSC 19, pp. 43-50 [4] Basu et al. (1988) PLPSC 18, pp. 283-298 [5] Dowty et al. (1973) PLSC 4, pp. 423-444 [6] McKay et al. (1989) PLPSC 19, pp. 19-41 [7] Spudis et al. (1988) PLPSC 18, pp. 243-254.

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Table 1. APOLLO 15 STATION 4 DRIVE TUBE CORE 15009 : MODAL DATA (90-150 μm)

Sample Number (DSM)	440	441	442	443	444	445	Average
Depth (cm)	2	9	13	16	21	29	
Monomineralic	18.1	18.1	17.3	21.4	24.5	21.0	20.1
Plagioclase	8.4	4.9	4.5	8.9	12.3	7.2	7.7
Pyroxene	8.8	12.0	12.5	11.9	11.0	12.9	11.5
Olivine	0.3	0.9	0.3	0.3	0.9	0.3	0.5
Opaques	0.0	0.3	0.0	0.0	0.3	0.6	0.2
Ilmenite/Chromite	0.0	0.3	0.0	0.0	0.3	0.6	0.2
Troilite/Metal	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silica phases	0.6	0.0	0.0	0.3	0.0	0.0	0.2
Crystalline Lithics	9.4	12.6	14.2	13.6	12.9	16.2	13.1
ANT Suite	0.3	0.3	0.3	0.6	0.6	0.9	0.5
Anorthositic	0.3	0.3	0.3	0.3	0.6	0.9	0.5
Gabbroic	0.0	0.0	0.0	0.3	0.0	0.0	0.0
Mare Basalts	5.3	8.9	9.1	9.5	8.9	11.7	8.9
Olivine-bearing	0.6	0.9	0.6	0.3	1.8	1.5	1.0
Olivine-free	3.4	6.1	5.4	6.5	5.5	5.4	5.4
Microgabbroic	0.6	1.8	0.3	0.9	1.2	0.9	1.0
Porphyritic/Variolitic	2.2	2.5	3.1	2.7	1.8	3.0	2.5
Ophitic/Subophitic	0.6	1.5	2.0	2.1	1.8	1.5	1.6
Intersertal/Intergranular	0.0	0.3	0.0	0.9	0.6	0.0	0.3
Other/Indeterminate	1.3	1.8	3.1	2.7	1.5	4.8	2.5
KREEP Basalt	3.4	3.4	4.8	3.6	3.4	2.7	3.5
Indeterminate	0.3	0.0	0.0	0.0	0.0	0.9	0.2
Breccias	17.8	14.4	19.9	15.4	18.1	15.9	16.9
Low Grade/Vitric	15.0	12.6	16.8	10.7	13.8	11.4	13.4
Regolith Breccias	13.1	12.0	15.9	9.8	12.3	10.5	12.3
Feldspathic Fragmental	1.9	0.6	0.9	0.9	1.5	0.9	1.1
High Grade/Crystalline	2.8	1.8	3.1	4.7	4.3	4.5	3.6
Poikilitic	1.3	0.3	0.9	1.2	1.8	1.5	1.2
Melt matrix	0.9	0.9	0.9	0.9	0.9	1.5	1.0
Other	0.6	0.6	1.4	2.7	1.5	1.5	1.4
Agglutinates	35.9	40.2	29.0	32.9	24.8	22.5	30.9
Glasses	18.4	14.7	19.0	16.6	19.6	24.3	18.8
Ropy/Clast Laden	6.9	4.0	5.4	4.5	4.9	6.3	5.3
Quench Crystal/Vitrophyric	5.0	3.7	4.3	6.2	5.2	6.0	5.1
Green	4.1	0.3	0.6	2.7	1.8	3.3	2.1
Other	0.9	3.4	3.7	3.6.	3.4	2.7	2.9
Clear/Homogeneous	6.6	7.1	9.4	5.9	9.5	12.0	8.4
Green	2.2	3.7	5.1	3.3	4.3	6.3	4.1
Yellow	1.3	1.2	1.7	0.9	2.1	1.2	1.4
Colorless	1.6	2.1	2.6	1.8	2.8	2.7	2.3
Black/Brown/Red	1.6	0.0	0.0	0.0	0.3	1.8	0.6
Miscellaneous	0.3	0.0	0.6	0.0	0.0	0.3	0.2
Total Number of Grains	320	326	352	337	326	334	1995

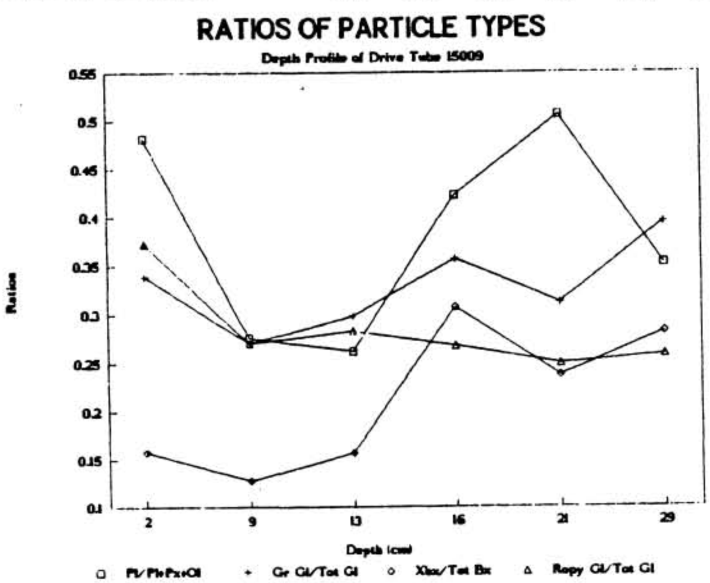

Figure 1

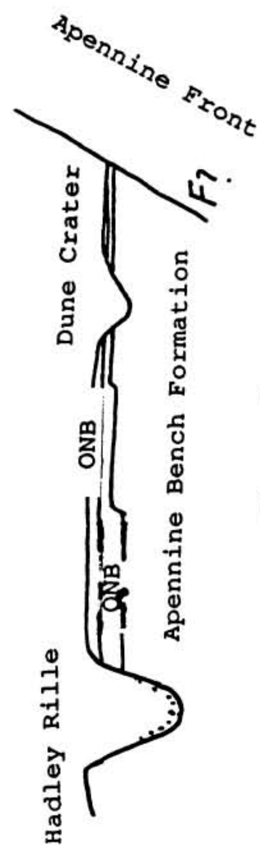

Figure 2