THE APOLLO 17 HIGHLANDS: THE SOUTH MASSIF SOILS. Graham Ryder, Lunar Curatorial Laboratory, Northrop Services Inc., P.O. Box 34416, Houston, Tx. 77034.

In an attempt to understand the nature of the pre-Serenitatis crust in the Taurus-Littrow region, as well as amplify our knowledge of the Serenitatis ejecta blanket, a petrographic study of soils from the South Massif has been initiated. Unless the massifs are entirely Serenitatis melt ejecta, their soils should contain particles of pre-Serenitatis material. South Massif soils were chosen because they are least contaminated with mare material. The results of a preliminary petrographic characterization of 72500 and 73140 (sieved fractions) are listed in Tables 1 and 2. They show that mare material is low in abundance, and that 72500, a surface sample from Station 2, is not identical to 73140, from the bottom of a 15 cm trench at Station 2a. The lower TiO_2 of 73140 (1) appears to result from its higher ratio of aphanitic melt/poikilitic melt, rather than from lesser mare contamination. Most of the lithic material appears to be poikilitic-subophitic and aphanitic impact melt, similar to large rocks most commonly interpreted as Serenitatis melt ejecta. The pre-Serenitatis material is dominated by metamorphic feldspathic impactites (2) similar to large rocks such as 79215. Three significant lithologies which are not similar to large rocks are 1) anorthosites (which are rare), 2) olivine-plagioclase vitrophyres, and 3) granoblastic impactites with mafic laths:

1) ANORTHOSITES: Whilst anorthosites are common at Apollo 16, they are either rare among or absent from the Apollo 17 samples. Ferroan anorthosites are not known among rock, including rake, samples, nor have any been reported as clasts in breccias. Several reported "anorthosites" e.g. 72255,45 (3, 4) are not ferroan and are probably unrepresentative fragments of other plutonic rocks. The total abundance of anorthosites in the South Massif soils is very small (Tables 1, 2), and it has not yet been established if any of these are ferroan. They are certainly less than 1% of the greater than 500 μm fraction and their higher abundance in the 73141 fines fraction hence suggests that most shocked plagioclases do not represent true anorthosites.

This lack of ferroan anorthosite at Apollo 17 results either from a lack of pre-Serenitatis material at the site i.e. virtually the entire sample collection (hence massifs) is Serenitatis impact melt and later ejecta; or the pre-Serenitatis surface around Taurus-Littrow lacked anorthosites. The Serenitatis non-melted ejecta itself must lack ferroan anorthosites. This conclusion from the samples is supported by studies of the orbital geochemical data from the highlands around Taurus-Littrow, which indicates a very low abundance of anorthosite, ferroan or otherwise (5). Thus the Apollo 17 area $\sim$ 4.0 b.y. ago was probably mainly granoblastic impactite and norite/troctolite and their derivatives, substantially different from the Apollo 16 area which was predominatly ferroan anorthosite and its derivatives. This difference suggests that anorthosite was never formed as a moon-wide surficial shell, but that there were significant regional variations in crustal evolution.

2) OLIVINE-PLAGIOCLASE VITROPHYRES: Impact melt fragments consisting of olivine microphenocrysts and plagioclase laths set in glass (Figs. 1,2) are an ubiquitous component of the South Massif soils (Ol-Plag-Meso melt,

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Tables 1, 2), but there is no allusion to them in previous studies of Apollo 17 soils. The fragments are remarkably consistent petrographically: ∿50% nearly opaque mesostasis glass; ∿30% plagioclase laths 10-30 μm long, which do not form a network; and ∿20% olivine microphenocrysts, euhedral to subhedral. The olivines are mainly 10-20 μm, less commonly 50 μm in diameter. According to its reflectivity, the mesostasis glass is mafic. Spinel and other oxide phases are absent and Fe-metal is scarce. The clast population, rarely more than 20%, is mainly plagioclase. The vitrophyres are more abundant in the Station 2 soils (more than 10% of the lithic population) than in the Station 2a soils. A cursory inspection of soil particles from the North Massif (76500) also revealed the vitrophyres: 6 fragments out of ∿150 (greater than 1mm) inspected. This significant lithology in the Taurus-Littrow highlands appears to be more mafic than the typical rocks assumed to be Serenitatis impact melts. More study is required to assess its characteristics and hence significance.

3) GRANOBLASTIC IMPACTITES WITH MAFIC LATHS: Several fine-grained particles have textural characteristics similar to feldspathic impactites (2) with the additional characteristic of laths of a mafic phase, probably pyroxene. These samples consist mainly of granular olivines, pyroxenes, and plagioclases less than 20 μm in diameter, apparently texturally equilibrated (Fig. 3). Plagioclase content ranges from 60-75%. Interstitial glass is absent and Fe-metal and oxide phases are scattered. The mafic laths (Fig. 3) are ubiquitous, randomly oriented, and 10-30 μm long. The origin of this combination of equilibrated and unequilibrated textures is not yet known.

TABLE 1. Apollo 17 South Massif soils: preliminary petrographic characterization

	72501,193 500-1000μm	72501,194 250-500μm	73143,5 2-4mm	73142,9 1-2mm	73141,62 500-1000μm	73141,48 500-1000μm	73141,63 250-500μm	73141,49 250-500μm
Glass balls		3						1
Glass shards and breccia	1	7	1	2		5	3	3
Agglutinates: non-mare	2	7		2	2	3	7	9
Agglutinates: mare[1]	7	23		4	4	4	31	11
Vitric breccias: non-mare	2	9	3	4		9	4	10
Vitric breccias: mare[1]		19			2	1	6	10
Mare basalts and impacts		4		2		1	2	1
Poikilitic impact melts	5	24	3	15	4	2	16	6
Subophitic impact melts[2]	4	19	2	6		1	3	3
Aphanitic impact melts	1	16	10	22		13	17	13
Ol-Plag-Meso melts[3]	3	12		2	1	1	7	1
Aluminous melts[4]		1			2		3	2
Granoblastic impactites[5]		15	5	10	1	3	12	7
Poikiloblastic impactites[5]	2	4				1	1	3
Anorthosites	1	1		1	1		3	4
Norites				1		2		3
Dunites								1
Felsites		1	1				1	
Plagioclase	1	9		1	2		7	4
Mafic minerals		6		1		1	4	2
Fragmental breccias			1			3		3
Others[6]		1				1		1
Total # particles	29	181	26	73	19	51	127	99

Notes:

1. Ilmenite-rich particle(s) or orange glass(es) present.
2. Most closely related to fine-grained poikilitic impact melts; others dissimilar.
3. Distinct vitrophyres with small olivine phenocrysts and plagioclase laths (see text).
4. Varied group of variously shocked and shock melted aluminous particles.
5. Distinguished from poikilitic impact melts in having 70% plagioclase and lacking interstitial silica, phosphate, or glass. Ilmenite sparse, usually equigranular.
6. Mainly undecipherable fragments.

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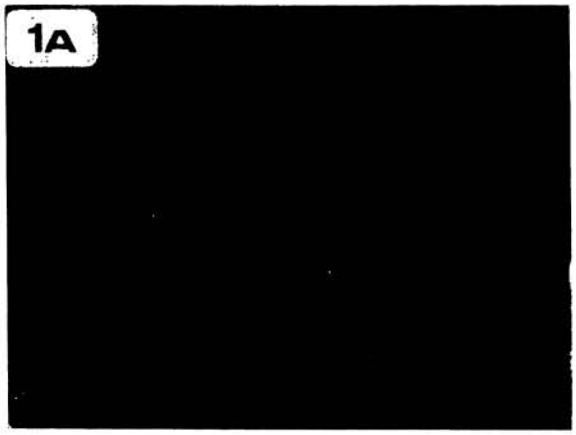
TABLE 2. Summary percentages of undegraded lithic fragments

	72501,193	72501,194	73143,5	73142,9	73141,62,48	73141,63,49
	500-1000μm	250-500μm	2-4mm	1-2mm	500-1000μm	250-500μm
(Total % of lithics)	(55%)	(54%)	(81%)	(81%)	(47%)	(49%)
Mare basalts	0	4	0	3	3	3
Poik/subophitic impact melts	56	44	24	36	21	25
Aphanitic impact melts	6	17	48	37	39	27
Ol-Plag-Meso impact melts	19	12	0	3	6	7
Aluminous melts	0	1	0	0	6	5
Impactites	12	20	24	17	15	22
Anorthosite	6	1	0	2	3	6
Other "plutonics"	0	1	5	2	6	5
Total # lithic particles	16	97	21	59	33	110



Figures: (widths ~200μm).

1) 2) Ol-Plag-Meso particles in 72501, 194; a) reflected b) plain polarized
3) Granoblastic/lathy mafic particle in 73141,9; reflected.

References:

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