PRELIMINARY DESCRIPTION AND INTERPRETATION OF APOLLO 14 CORES

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The Apollo 14 deep core 14211/10 is especially valuable because it contains three different light-colored soils that are uncontaminated by surface material; such soils are poorly represented in the Apollo 14 collection (2). This short note provides petrographic information and a preliminary intertation on the origin of these soils as a starting point for further investigations.

14211/10 is a 2 cm diameter double drive tube, collected at station A well within the smooth plains area of the Apollo 14 site, 175 m NE from the LM, 300 m W from the north-trending linear ridge, and 550 m from the continuous ejecta blanket of Cone Crater (5, pl. 1). Although some section was lost from the top 10 cm of the core during uncoupling of the drive tubes, the total section is at least 37.7 cm long. Late in 1978, the double core was dissected in 5 mm increments by standard procedures (1, ch. 1), sieved at 1 mm, with coarse particles identified on a classification of (4), simplified because observations were limited to the binocular microscope. After synthesis of data, a total of 7 units were identified in the double core (Figure 1).

The deepest light soil, from 26.5 - 37.7 cm, is designated unit 1. It contains ±20% 5 mm whitish friable clasts and is otherwise relatively coarse-grained, with an average of 15% >1 mm. Unit 1 is unique--it contains many angular, dust-free fresh-looking basalt and breccia particles plus emerald green glass. Unit 2, from 19.5 - 26.5 cm, is relatively homogeneous (Table 1), moderately coarse, averaging 10% >1 mm, but contains few rock fragments >4 mm. It is similar to 1 in containing clasts of light soil but these clasts are small (<2 mm in diameter). Great quantities of brownish to tan, ropy glass and light-colored, annealed matrix breccia characterize the coarse fraction of this unit. Unit 3, from 15.5 - 19.5 cm, is relatively fine, with only 6% >1 mm, but has much lighter material disseminated through the matrix, giving this unit the lightest color in the core. Although ropy glass is very common in this unit, the prevalent annealed-matrix breccia is dark, rather than light.

The section between 15.5 cm and the lunar surface is unusually dark (2 on the Munsell color scale), and is subdivided into units on the basis of texture. Unit 4, from 12.5 - 15.5 cm, is extremely coarse-grained, with 50-60% <1 mm soil breccia, topped by vesicular glass at 12.5 cm. Units 5 and 7 are very fine-grained, with 95-97% <1 mm, and contain dark, vesicular agglutinates, (as opposed to ropy glasses of 1-3) which are scattered, but which show shall concentrations at 2, 7 and 11 cm. Unit 6 is slightly coarser grained, and contains relatively large particles of basalt and breccia.

Texturally, the only unit that has a well-defined immature component is unit 1, which shows immature populations of basalt and light-matrix breccia and light, annealed-matrix breccia that are generally angular and dust-free. It is likely that the light soils are of local, plains origin because there is a 90 and 300 meter crater less than 1 diameter away, that could penetrate through the 8.5 m (5, p. 14) of regolith at the coring site and deposit fresh material on the lunar surface. However, it is not possible to specify which crater was the source of which deposit, or even if the different light soils are from different craters, or are part of one sequence.

The dark soils at the top of the core are texturally, compositionally, and FMR mature (3) with the very coarse zone of unit 4 being interpreted as a crater-bottom deposit that marks the limit of surface reworking. Unit 6 may be related to the small craters seen in lunar surface panorama 6 (5, pl. 4) as it contains a few coarse, clean rock fragments in an otherwise mature soil, and is the type of deposit expected from a small crater which did not penetrate

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through the regolith.

Conclusion: The uppermost 15.5 cm of 14211/10 is a mature surface-reworked soil that is underlain by a very fine-grained light soil, a coarser light soil with abundant ropy glass, and a moderately coarse-grained light soil with immature clasts populations of light and dark annealed-matrix breccia and basalt rock fragments. Ropy glass and emerald-green glass occurs in the lowest unit. Because the core was taken near two large craters in the Fra Mauro plains, the most likely source of the immature material is plains bedrock, rather than ridge or Cone Crater ejecta.

Drive Tubes 14211/14210, Grain Size and Compositional Data, 1 - 4mm Coarse Fines

Apparent Depth	Samples used in analysis	< 1mm Wt.	Pct.	1 - 2 mm Wt.	Pct.	2 - 4 mm Wt.	Pct.	4 - 10 mm Wt.	Pct.	>10 mm Wt.	Pct
0.0 - 1.5	,3 - ,8	4.971	97%	0.155	3%	0.018	tr.				
1.5 - 2.5	,9 - ,12	3.876	95%	0.119	3%	0.091	2%				
2.5 - 3.5	,13 - ,16	4.071	95%	0.126	3%	0.087	2%				
3.5 - 4.0	,17 - ,18	1.727	84%	0.083	4%	0.143	7%	0.097	5%		
4.0 - 4.5	,19 - ,20	1.908	88%	0.057	3%	0.041	2%	0.158	7%		
4.5 - 5.0	,21 - ,22	2.121	94%	0.085	4%	0.040	2%				
5.0 - 6.0	,23 - ,26	3.699	97%	0.101	3%	0.028	1%				
6.0 - 7.0	,27 - ,30	4.037	97%	0.067	2%	0.057	1%				
7.0 - 7.7	,31 - ,34	2.367	97%	0.043	2%	0.022	1%				
7.7 - 8.5	,19 - ,20	2.493	96%	0.076	3%	0.022	1%				
8.5 - 9.5	,21 - ,24	2.879	97%	0.075	3%						
9.5 - 10.5	,25 - ,28	3.767	94%	0.061	2%	0.169	4%				
10.5 - 11.5	,29 - ,32	3.625	97%	0.127	3%						
11.5 - 12.5	,33 - ,36	3.158	97%	0.100	3%						
12.5 - 14.0	,37 - ,38	1.367	46%	0.083	3%	0.147	5%	0.237	8%	0.111	38%
12.5 - 15.5	,39 - ,46	5.010	61%	0.911	11%	0.557	7%	0.814	10%	0.914	11%
15.5 - 16.5	,47 - ,50	3.767	92%	0.224	5%	0.091	2%				
16.5 - 17.5	,51 - ,54	3.502	95%	0.113	5%						
17.5 - 18.5	,55 - ,58	3.474	94%	0.225	6%						
18.5 - 19.5	,59 - ,62	4.040	94%	0.140	3%	0.135	3%				
19.5 - 21.0	,63 - ,68	5.625	90%	0.249	4%	0.355	6%				
21.0 - 22.5	,69 - ,74	5.492	90%	0.247	4%	0.300	5%	0.049	1%		
22.5 - 23.5	,75 - ,78	3.530	90%	0.222	6%	0.179	5%				
23.5 - 25.0	,79 - ,84	5.331	89%	0.239	4%	0.407	7%				
25.0 - 26.0	,85 - ,88	3.218	86%	0.148	4%	0.172	5%	0.217	6%		
26.0 - 26.5	,89 - ,90	1.632	89%	0.145	8%	0.048	3%				
26.5 - 28.0	,91 - ,96	4.705	78%	0.212	3%	0.246	4%	0.069	1%	0.844	14%
28.0 - 29.0	,97 - ,100	3.513	95%	0.106	3%	0.011	Tr.	0.085	2%		
29.0 - 29.5	,101 - ,102	1.820	83%	0.053	2%	0.134	6%	0.181	8%		
29.5 - 30.5	,103 - ,106	3.228	92%	0.161	5%	0.092	3%	0.039	1%		
30.5 - 31.5	,107 - ,111	4.680	78%	0.266	4%	0.322	5%			0.700	12%
31.5 - 33.0	,112 - ,117	5.569	92%	0.242	4%	0.110	2%	0.096	2%		
33.0 - 34.0	,118 - ,121	3.895	91%	0.116	3%	0.286	7%				
34.0 - 34.5	,122 - ,123	1.420	90%	0.082	5%	0.074	5%				
34.5 - 35.5	,124 - ,127	3.251	76%	0.194	5%	0.025	1%	0.807	19%		
35.5 - 36.5	,128 - ,131	3.255	79%	0.138	3%	0.269	7%	0.443	11%		
36.5 - 37.7	,132 - ,135	3.981	95%	0.171	4%	0.046	1%				

Apparent Depth	Samples used in analysis	BsRF mg/cm	pct.	DAMBx mg/cm	pct.	LAMBx mg/cm	pct.	LtBx mg/cm	pct.	Aggl. mg/cm	pct.	Fg-Gl mg/cm	pct.	DkBx mg/cm	pct.	ScBx mg/cm	pct.
0.0 - 1.5	,3 - ,8	3	2%	39	35%			3	2%	31	26%	18	14%	2	1%	24	18%
1.5 - 2.5	,9 - ,12	6	3%	79	36%			12	6%	81	38%	19	9%	5	2%	13	6%
2.5 - 3.5	,13 - ,16			71	33%			4	2%	19	9%	28	13%	4	2%	87	41%
3.5 - 4.0	,17 - ,18			120	54%	20	7%	13	6%			18	7%	43	21%	10	4%
4.0 - 4.5	,19 - ,20	7	7%	54	55%	5	5%					21	22%	3	3%	8	8%
4.5 - 5.0	,21 - ,22			19	16%			23	20%			65	57%			8	7%
5.0 - 6.0	,23 - ,26	6	5%	35	27%			12	9%	31	24%	29	22%	4	3%	12	9%
6.0 - 7.0	,27 - ,30			23	18%			36	29%	11	9%	29	23%	3	2%	22	18%
7.0 - 7.7	,31 - ,34			15	23%			5	8%	35	54%	5	8%			5	8%
7.7 - 8.5	,19 - ,20			28	29%					6	6%	8	8%	19	19%	37	38%
8.5 - 9.5	,21 - ,24	5	6%	6	8%			2	3%	13	17%	22	29%	12	16%	15	20%
9.5 - 10.5	,25 - ,28	8	4%	50	20%	8	4%			6	3%	118	56%	3	1%	2	1%
10.5 - 11.5	,29 - ,32	12	10%	13	11%					23	19%	30	24%	13	11%	32	25%
11.5 - 12.5	,33 - ,36			27	27%			3	3%	9	9%	13	13%	4	4%	44	44%
12.5 - 14.0	,37 - ,38			29	12%					42	18%			5	2%	154	67%
12.5 - 15.5	,39 - ,46	3	Tr.	22	3%			2	Tr.	12	2%					701	94%
15.5 - 16.5	,47 - ,50	2	1%	77	24%	2	1%	2	1%			99	31%	29	9%	124	38%
16.5 - 17.5	,51 - ,54			52	26%			19	10%			25	13%	16	8%	86	43%
17.5 - 18.5	,55 - ,58			42	18%			19	8%			43	19%	25	11%	101	44%
18.5 - 19.5	,59 - ,62			53	19%	44	16%					84	31%	11	4%	87	32%
19.5 - 21.0	,63 - ,68	3	1%	7	2%	198	49%	15	4%			59	14%	4	1%	119	29%
21.0 - 22.5	,69 - ,74	2	Tr.	72	18%	75	19%	27	7%	6	1%	141	36%	11	3%	55	14%
22.5 - 23.5	,75 - ,78	5	1%	12	3%	68	18%					196	53%	18	5%	72	19%
23.5 - 25.0	,79 - ,84			28	6%	215	50%	14	2%			107	25%	15	3%	58	13%
25.0 - 26.0	,85 - ,88			58	11%	266	50%					126	23%	8	2%	79	15%
26.0 - 26.5	,89 - ,90			18	5%	28	7%			38	11%	118	70%			26	7%
26.5 - 28.0	,91 - ,96			27	8%	76	21%			40	8%	137	42%	2	1%	70	20%
28.0 - 29.0	,97 - ,100			15	7%	28	14%	93	46%			33	16%			33	16%
29.0 - 29.5	,101 - ,102	52	7%	12	2%	436	59%	104	14%			52	7%			82	11%
29.5 - 30.5	,103 - ,106			10	3%	112	38%	7	2%			83	28%	9	3%	71	24%
30.5 - 31.5	,107 - ,111	36	6%	3	1%	116	20%	148	26%			81	14%	43	7%	161	27%
31.5 - 33.0	,112 - ,117	12	6%	24	10%	5	2%	18	8%			97	41%	14	6%	67	29%
33.0 - 34.0	,118 - ,121			134	33%	136	34%	3	1%			77	19%	5	1%	47	12%
34.0 - 34.5	,122 - ,123			64	20%	34	11%	15	10%			72	23%	6	2%	106	34%
34.5 - 35.5	,124 - ,127	2	1%	28	13%	25	11%	11	5%			62	28%			91	42%
35.5 - 36.5	,128 - ,131			18	4%	287	70%					49	12%	17	4%	36	9%
36.5 - 37.7	,132 - ,135	3	1%	14	6%	10	4%	10	4%			95	44%	22	10%	66	30%

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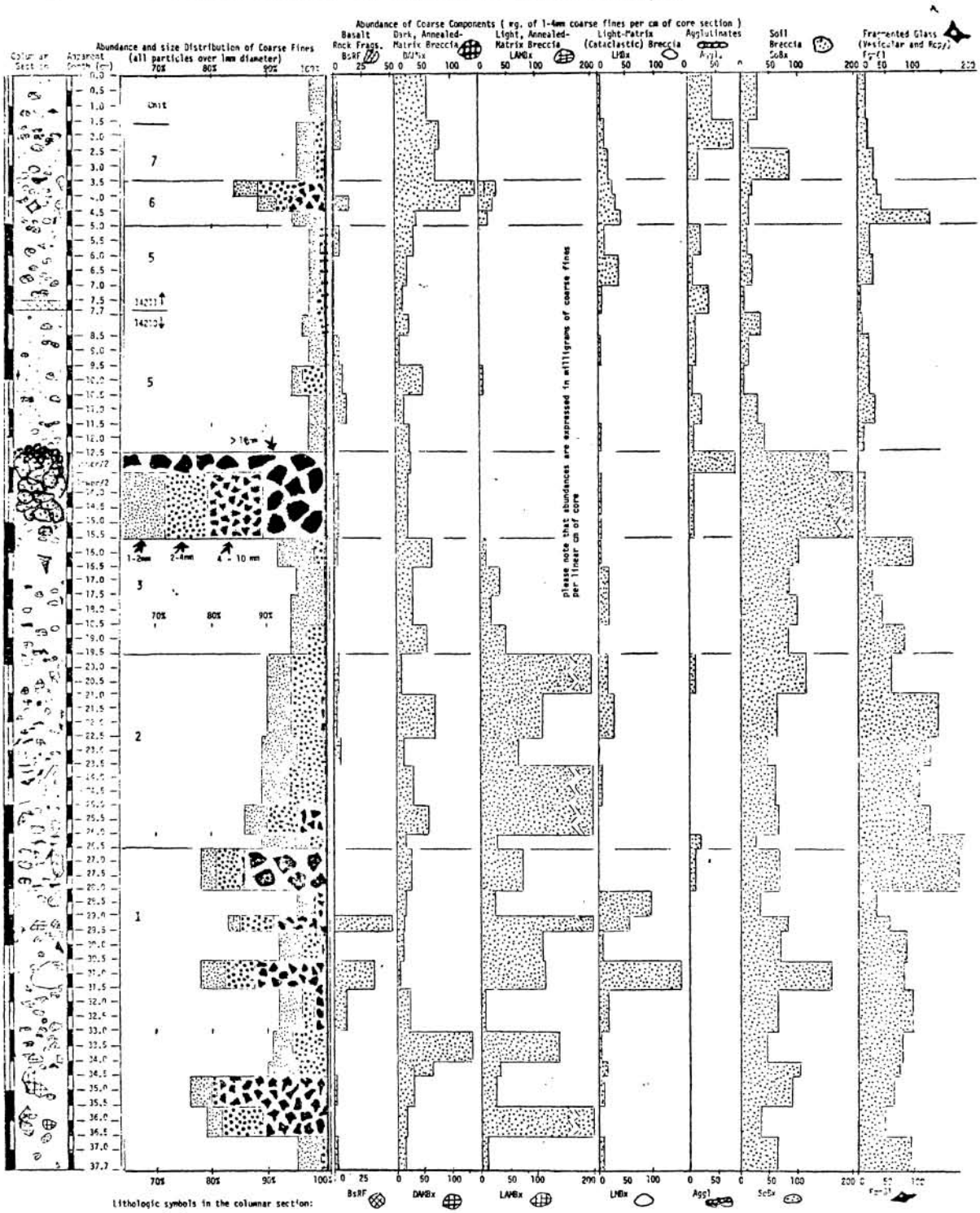
Fig. 1: Lithologic summary of Apollo 14 cores 14211/10



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