CURATORIAL NEWSLETTER

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PATRICK BUTLER, JR., LUNAR SAMPLE CURATOR
CURATORIAL BRANCH, SN2, NASA-JSC
HOUSTON, TEXAS 77058 (713)483-3274

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LAPST AND REQUESTS FOR SAMPLES

The Lunar and Planetary Sample Team (LAPST) met May 17-20, and recommended allocation of 180 samples to 19 Principal Investigators. Their next meetings will be August 16-19 and November 16-19, 1979. Please submit requests for samples at least a week or two in advance of the meeting dates to allow time for assembly of background information. Also, remember to include your schedule for studying the samples so appropriate priorities can be set for their preparation.

LUNAR HIGHLANDS NEWSLETTER

Volume 1, number 3, was mailed July 16. Let us know if you want to receive a copy but have not as yet.

CORES

Attached are the post-dissection synopses for double drive tube 15010/15011 and single drive tube 14220. The core schedule as given in Newsletter 19 (April 1978), has been set back by the delay in completion of the Lunar Sample Building. Consequently, the dissection of Apollo 15 drive tubes 15007, 15008, and 15009, the first to be done in the new laboratory, will be 3 to 6 months behind schedule. It should be possible to regain some of this lost time in 1980, however.

LUNAR SAMPLE BUILDING

Work was completed by the construction contractor several weeks ago. The final clean-up and installation of plumbing and nitrogen cabinets (by curatorial technicians) are underway. Following checkout of all systems and approval of operating procedures, the samples will be moved to the new vault and processing operations will begin in the new laboratories. Transfer of samples should take place in the third or fourth week of August.

On July 20, the tenth anniversary of the Apollo 11 landing, the first floor display area and the second floor viewing room into the new laboratories were opened to the public. Exhibits in the display room describe the samples and their care and study. A recorded explanation of laboratory activities is played for visitors to the laboratory viewing area on the second floor. It is expected that the Lunar Sample Building will have several hundred thousand visitors every year.

SAMPLES WITH RESTRICTED ACCESS

It is the function of LAPST to advise not only on allocations of samples for scientific study, but also on protection of the overall integrity of the collection. Since the collection contains many samples with unique or special characteristics that could be degraded or lost through routine handling or allocation, both the Curatorial staff and LAPST must be alert to which samples these are. Various designations on inventory listings and other means have been used to flag these samples, but the flagging systems are not fully effective and inappropriate use of some of these samples has been prevented only by the alertness of individuals familiar with the particular sample.

Now to more fully assure protection of special samples, those samples will be physically separated from the rest of the collection and all stored together in cabinets with access restricted to the Curator. These samples will become a reserve or Restricted Access Material (RAM) collection. Comments in general and suggestions of specific candidate RAM samples are solicited from sample investigators.

Establishment of the RAM collection will require identification by sample number of each such sample and an inclusion document stating specific reasons for selection of this sample for the RAM collection. It is intended that only parts of rocks will be in this collection. Access to a RAM sample for sampling or removal will require a removal justification document that addresses the specific reasons of the inclusion document. Eventually, listings of the RAM materials, along with brief reasons for the inclusion of each, will be published. For the time being, the samples at the Brooks Storage Vault will be considered part of the RAM collection.

PADDED BAG SAMPLES

Apollo 16 rocks 67215 and 67235 were collected in special padded bags in order to have samples for study of the outermost surface layer of materials exposed on the Moon. Although to date no studies of these surfaces have been proposed, the rocks have received careful and minimum handling and have not been subdivided or allocated for any other purpose. Now we are considering examination of the rocks as breccias in conjunction with the Highlands studies. Tentative plans are to saw or break the rocks in two, set one part aside for preservation of the surfaces, and study and allocate material from the other part. Since this procedure would entail some handling and would also provide an opportunity for getting a surface sample for study, we are inviting suggestions on handling the rocks and proposals for making surface studies. It should be noted that the rocks are probably dusty all over from the adhering soil collected with the rocks.

SIEVING OF SOILS

During the preliminary examination period after receipt of the samples from the Moon, most of the soils were sieved at 10 mm, 4 mm, 2 mm, and 1 mm. In the past two months, to prepare samples for the Lunar Highlands studies, stocks of less than

1 mm size fractions have been sieved for 11 Highlands soils. Eventually, we hope to have stocks of these smaller size fractions for all of the plentiful soil samples, and for core material as well, for rapid filling of allocations. To build these stocks gradually, the curatorial laboratories will do a reasonable amount of sieving in the preparation of allocations. This will conserve sample material (many studies use only certain size fractions), save effort (most time is spent in preparation and cleaning sieves and relatively little extra time is taken in sieving a larger sample), and produce a uniform product (the techniques and equipment used are those used by D. S. McKay).

The sieves are Buckby-Meares with nickel mesh and stainless steel frames. An epoxy cement is used to seal the mesh in the frame so grains cannot work their way into the inside of the frame. For one set of sieves, a flash coating of rhodium was applied over the nickel mesh. The sieve sizes in microns are 1000, 500, 250, 125, 90, 75, 45, 20, and 10. Fractions with few subdivisions are made for some allocations, as for example 1000-90, 90-20, 20-10 and <10 microns. For making grain mount thin sections, however, the size spread should not be too great or the largest and smallest grains cannot both be given proper representation in a section at a particular thickness.

August 1979

LAPST MEMBERSHIP

Dr. William V. Boynton
University of Arizona
Lunar and Planetary Laboratory
Department of Lunar Science
Tucson, AZ 85721

Dr. Charles Hohenberg
Laboratory for Space Physics
Washington University
St. Louis, MO 63130
(314)889-6225 - FTS: (OPR 87-279-4110)

Dr. Robert N. Housley
Science Center, Rockwell Int'l
1049 Camino Dos Rios
Thousand Oaks, CA 91360
(809)498-4545 - FTS: 87-798-2000

Mr. Richard S. Johnston, Chairman
NASA-Johnson Space Center
SA/Space and Life Sciences Directorate
Houston, Texas 77058
(713)483-2251 - FTS: 87-525-2251

Dr. Michael E. Lipschutz
Purdue University
Department of Chemistry
Lafayette, IN 47907
(317)749-2724 - FTS: 87-331-7000

Dr. J. Douglas MacDougall
University of California, San Diego
Scripps Institution of Oceanography
Geological Research Division
P.O. Box 1529
La Jolla, CA 92037

Dr. David S. McKay
NASA-Johnson Space Center
SN6/Geology Branch
Houston, TX 77058
(713)483-5171 - FTS: 87-525-5171

Dr. Charles Meyer, Jr.
NASA-Johnson Space Center
SN7/Geochemistry Branch
Houston, TX 77058
(713)483-4715 - FTS: 87-525-4715

Dr. Carleton B. Moore
Center for Meteorite Studies
Arizona State University
Tempe, AZ 85281
(602)965-3576 - FTS: 87-766-3576

Dr. James J. Papike, Vice-Chairman
State University of New York
Dept. of Earth & Space Sciences
Stony Brook, NY 11794
(516)246-4047 - FTS: 87-264-3311

Dr. Lawrence A. Taylor
University of Tennessee
Department of Geology
Knoxville, TN 37916
(615)974-2366 - FTS: 87-855-2366

4/17/79

ADVOCATE LIST

GROUP A

HOUSLEY	MCKAY	TAYLOR
Adams	Albee	Bell
Brownlee	Bence	El Goresy
Burns	Drake	Goldstein
Buseck	Haggerty	Hays
Butler	Hollister	Huebner
Keil	James	Lovering
Lofgren	Papike	Roedder
McKay	Ringwood	Rutherford
Phinney	Sclar	Smith, J.V.
Reid	Taylor, L.	Weiblen
Sato	Takeda	Weill
Stoffler	Wood	Winzer

GROUP B

MOORE	BOYNTON	LIPSCHUTZ	HOHENBERG	MEYER
Clayton	Arnold	Anders	Blanchard	Ahrens, L.
Des Marais	Kirsten	von Gunten	Geiss	Bhandari*
Epstein	Marti	Haskin	Nyquist	Blanford*
Gibson	Meyer	Laul	Pepin	Fireman
Heymann	Murthy	Morgan	Perkins	Lal*
Kaplan	Tatsumoto	Reed	Reynolds	Philpotts
Rhodes	Tilton	Schmitt	Schaeffer	Pillinger
Thode	Turner	Wanke	Signer	Taylor, S.R.
	Wasserburg	Wasson	Walker	Tombrello

*Track requests to Housley

GROUP C

MACDOUGALL

Aronson	Ahrens
Banerjee-Hoffman	Brownlee
Burns	Comstock
Bussey	Gold
Dollfus	Hapke
Fuller	Hartung
Gose	Hörz
Horai	Housley
Larsen	Klein
Runcorn	Simmons
Spetzler	Tittman
Strangway	Uhlmann

C O R E S Y N O P S I S

Sample No. 14220, a single, 2 cm diameter drive tube, taken to augment trench samples 14148, 14149 and 14156.

Field relationships: Core 14220 was taken at station G, 6 meters East from the trench, which sampled a surficial dark brown layer, then a thin layer of small, glassy-like pebbles, and a third layer, 18 inches below the surface, of some very light material. Station G was located 100 meters East from 100-m North Triplet Crater, on the Fra Mauro Plains, and was 200 m Southwest from the Fra Mauro Ridge, 1 km Southwest from Cone Crater, and 500 m Southwest from the continuous ejecta blanket of Cone Crater.

Sample history - possible contamination or disturbance: The core tube was driven to a depth of approximately 36 cm, but contained approximately 16 cm of soil, for a 45% sample recovery; the exact quantity and location of missing material is unknown. After opening, soil was found on all sides of the plug, which was supposed to have been at the lunar surface, and there was 0.575 gm of soil above the plug. The pull ring hole at the top of the core was open, and the largest rock fragments in the soil above the plug could have fit through the hole. Hence, it is not certain that the 0.575 gm of soil came through the pull ring hole from outside the core tube, or from the top of the soil column within the core.

Core 14220 was collected on 5 February, 1971, and placed in the Apollo Lunar Sample Return Container (ALSRC) No. 1006, which was sealed on the moon, and maintained a pressure of 60 microns Hg until opened on 12 February, 1971, in the SNAP line of the Lunar Receiving Laboratory. The core was placed in bolt-top container 266-1004, and stored in dry N_2 until 9 May, 1979. Dissection took place between 17 and 24 May, 1979.

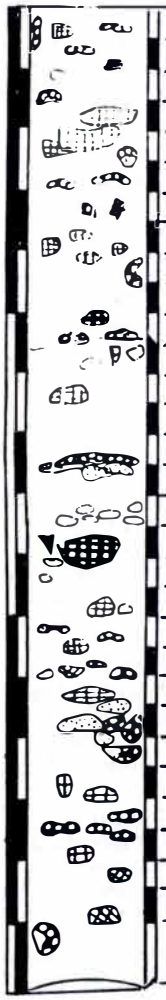
Length: 16.0 cm, with sloping bottom, slope of $\pm$ 0.1 cm. Total mass: 80.7 gm. Bulk density: 1.69 gm/cm^3

Numbering of samples: Dissection took place in one pass, and dissection splits are numbered consecutively downward from the top of the core. About one-third of the diameter of the core was left in the core tube for impregnation with epoxy in order to provide a permanent stratigraphic record of the core, and to provide material for thin sections.

Summary of stratigraphic units identified during dissection:

Unit	Depth/samples	light/dark color	relative grain size	major petrographic components
6	0.0 - 5.5+cm 14220,7 - ,28	dark	fine, with large clasts 9% > 1mm	Unit 6 is unusually friable. In the 1mm fines, agglutinates, fragmented glass and soil breccia are abundant throughout the unit, and there are spot concentrations of light-colored annealed-matrix breccia. Rounded, tan to whitish granules and silvery droplets are common in the < 1mm fines. Appears comparable to trench soil 14148.
5	5.5+ - 7.5 cm 14220,29 --,36	dark	moderately fine 10% > 1mm	Fragmented mineral grains are noticeably commoner in unit 5 than 6, and the coarse fraction shows an abundance of light-matrix breccia. Vesicular glass is concentrated at the bottom of the unit (as well as elsewhere in the core) but the soil is otherwise not comparable to the trench middle, sample 14156.
4	7.5 - 9.0 cm 14220,37 -,42	moderately dark, whitish clasts	coarse 14% > 1mm	Large clasts of light-matrix breccia are very conspicuous in this unit, but a variety of annealed-matrix breccia fragments are also common. Fragmented mineral grains predominate in the < 1mm fines from here to the base of the core, with tiny whitish granules less common, glass and metallic droplets relatively rare.
3	9.0 - 11.0 cm 14220,43 -,50	moderately dark	fine 5% > 1mm	Agglutinates, basalt fragments and dark annealed-matrix breccia particles predominate in the coarse fraction; fines as above.
2	11.0- 12.5 cm 14220,51 -,56	moderately dark	very coarse 26% > 1mm	Fragmented vesicular glass and soil breccia are the only common coarse components in this unit; fines as unit 4.
1	12.5- 16.0 cm 14220,57 -,68	moderately dark	moderately fine 8% > 1mm	This unit contains a variety of particle types, including agglutinates, fragmented glass, soil breccia, basalt, and dark annealed-matrix breccia. It appears to be very similar to trench bottom sample 14149.

DRIVE TUBE 14220: LOCATION OF DISSECTION SAMPLES

Stratigraphic Unit	Columnar Section	Depth Below Surface(cm)	Fine (<1mm) Fraction Sample No.	Fine (<1mm) Fraction Sample Wt.	Coarse (>1mm) Fraction Sample No.	Coarse (>1mm) Fraction Sample Wt.	Special Samples Sample No.	Special Samples Sample Wt.	Special Samples Sample Type and Position in Core
		0.5	,7	0.965	,8	0.079	,2	0.575	bulk soil from above plug
		1.0	,9	1.183	,10	0.227			
		1.5	,11	1.306	,12	0.067			
F		2.0	,13	1.408	,14	0.122			
		2.5	,15	1.478	,16	0.406	,4	0.461	rind*, from 0 - 5 cm
		3.0	,17	1.342	,18	0.092			
		3.5	,19	1.329	,20	0.141			
		4.0	,21	1.609	,22	0.189			
		4.5	,23	1.337	,24	0.071			
		5.0	,25	1.283	,26	0.078			
		5.5±	,27	1.711	,28	0.066			
		6.0	,29	1.305	,30	0.150			
5		6.5	,31	1.624	,32	0.217			
		7.0	,33	1.448	,34	0.100			
		7.5	,35	1.486	,36	0.194	,5	0.478	rind, from 5 - 10 cm
		8.0	,37	1.484	,38	0.072			
4		8.5	,39	1.468	,40	0.102			
		9.0	,41	1.484	,42	0.565			
		9.5	,43	1.657	,44	0.078			
3		10.0	,45	1.544	,46	0.065			
		10.5	,47	1.253	,48	0.088			
		11.0	,49	1.139	,50	0.084			
		11.5	,51	1.346	,52	0.504			
2		12.0	,53	1.577	,54	0.346			
		12.5	,55	1.168	,56	0.626			
		13.0	,57	1.292	,58	0.037	,6	0.445	rind, from 10 - 16 cm
		13.5	,59	1.394	,60	0.056			
1		14.0	,61	1.461	,62	0.182			
		14.5	,63	1.258	,64	0.065			
		15.0	,65	1.236	,66	0.116			
		16.0±	,67	2.079	,68	0.281	,69	0.376	dissection table sweepings
							,3	0.380	bulk soil in bottom cap

Lithologic symbols in columnar section:

Agglutinates Fragmented vesicular glass Soil Breccia Dark-matrix breccia Basalt

Annealed-matrix breccia - dark light

* The rind is a thin layer of soil immediately adjacent to the core tube wall; this soil has been smeared during the sampling process, and is removed to improve the purity and integrity of material within the core.

CORE SYNOPSIS

Sample Number: 15011, top half of a double, 4 cm diameter drive tube(15010/15011)

Field Relationships: Core 15010/15011 was taken on a mare surface 20 m from the rim of Hadley Rille at station 9A. The tube was driven full depth, but the last 20 - 30 cm were more difficult to penetrate.

Sample History - possible disturbance or contamination: The core was collected August 2, 1971 and placed in an unsealed Sample Collection Bag. This bag, after being exposed to spacecraft cabin and terrestrial atmosphere on the return flight, was sealed in 2 teflon bags and a polyethylene bag on board the recovery ship as quickly as possible after splashdown on August 7, 1971. The sample bag was opened in the Lunar Receiving Laboratory in a nitrogen atmosphere cabinet August 20, 1971. During sampling the top of the tube was tipped downward about 50° from the horizontal before the keeper confined the upper surface of the soil. Loss of soil from the bottom of 15011 was possible as the two tubes were separated by unscrewing. The capacity of the tube was 34.9 cm length of soil. When the keeper was emplaced after separation and capping, the tube contained 29.2 cm of soil. Incomplete filling of tube and compaction of soil may account for some of this difference in length. About 8 g of soil was found inside the tube on top of the keeper (top end of core). In this configuration, this excess soil was not considered part of the core. Whether this soil, which was equivalent to 3 - 4 mm core depth, came from inside the core by leaking through small holes in the keeper or from outside the core through larger holes in the plug is not now known. Grain size data indicated that probably some of the 8 g, but definitely not all of it, came from inside the tube. Between 1971 and 1978 the core was stored horizontally and some settling of soil occurred, especially at the ends of the core. The only unit which was not affected was Unit 7 (14.0 - 20.0 cm). This unit was particularly dense and coherent. Problems arising from mixing of soil due to settling may be minimized by examining soil from the second or third dissection, since the void created by settling of soil was confined to the volume removed in the first dissection. Retention of stratification away from the ends of the core was evident from distinct unit boundaries observed in the 1977 x-radiographs.

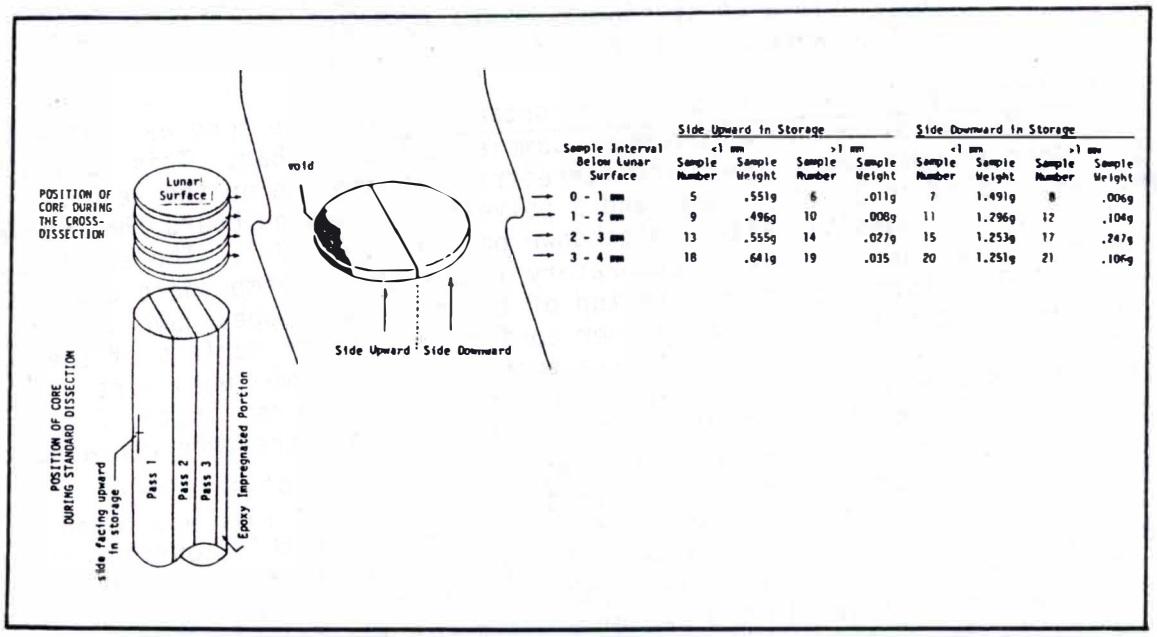
Weight, Length, Density:

	Before opening tube	After extrusion
Weight	660.7 or 651.5* g	647.8 g
Length	29.2 cm	26.4 cm
Density	1.70 or 1.68 g/cm^3	1.84 g/cm^3

*calculated only weight of soil confined by keeper, see 8 g referred to in Sample History section

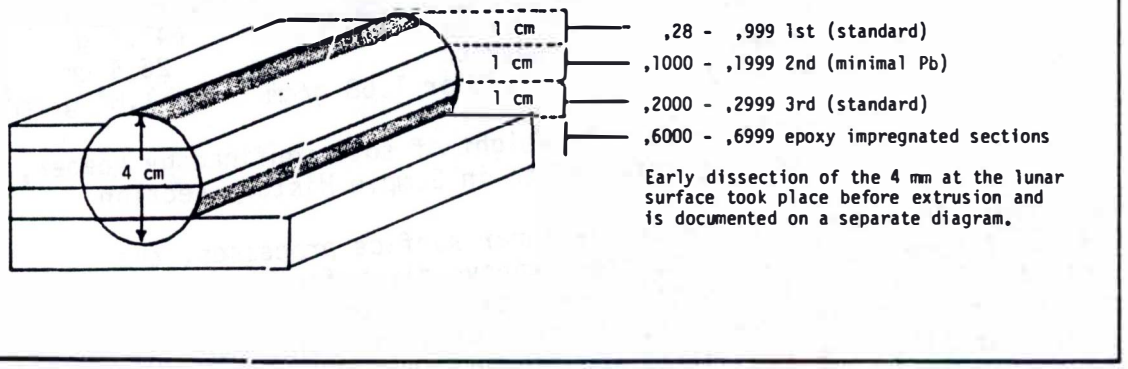
Cross-dissection: In order to characterize lunar surface processes, the uppermost 4 mm of core 15011 were dissected transversly before the core was extruded into the longitudinal dissection receptacle. For the cross-dissection, the core was place upright, and four discs of soil each 1 mm thick, were removed. Normally five 1 mm discs are removed, but the extruder failed to push the sample completely into the 5 mm receptacle, so only the top 4 mm were dissected. For this core each disc of soil was removed in halves. The upward half during storage and the downward half were processed as separate

samples. This was done because settling during storage had caused a void space to form on the side upward, and, therefore, the side downward was believed more stratigraphically preserved. Samples were sieved at 1 mm, and the size fractions were numbered as shown below. Then the core was turned horizontally and extruded into the dissection receptacle, where it was dissected lengthwise in 5 mm increments. Three passes down through the diameter were required to complete the dissection.



Sample Interval Below Lunar Surface	Side Upward in Storage <1 mm Sample Number	<1 mm Sample Weight	>1 mm Sample Number	>1 mm Sample Weight	Side Downward in Storage <1 mm Sample Number	<1 mm Sample Weight	>1 mm Sample Number	>1 mm Sample Weight
→ 0 - 1 mm	5	.551g	6	.011g	7	1.491g	8	.006g
→ 1 - 2 mm	9	.496g	10	.008g	11	1.296g	12	.104g
→ 2 - 3 mm	13	.555g	14	.027g	15	1.253g	17	.247g
→ 3 - 4 mm	18	.641g	19	.035	20	1.251g	21	.106g

Longitudinal Dissections: In a standard dissection, samples are sieved at 1 mm under organically uncontaminated (CP-7) conditions. To produce samples with reduced contamination, the material in the second dissection was not sieved, was subject to minimal handling with specially acid washed tools, and should be suitable for Pb analyses. Each dissection is assigned a separate series of split numbers as shown in the diagram below.

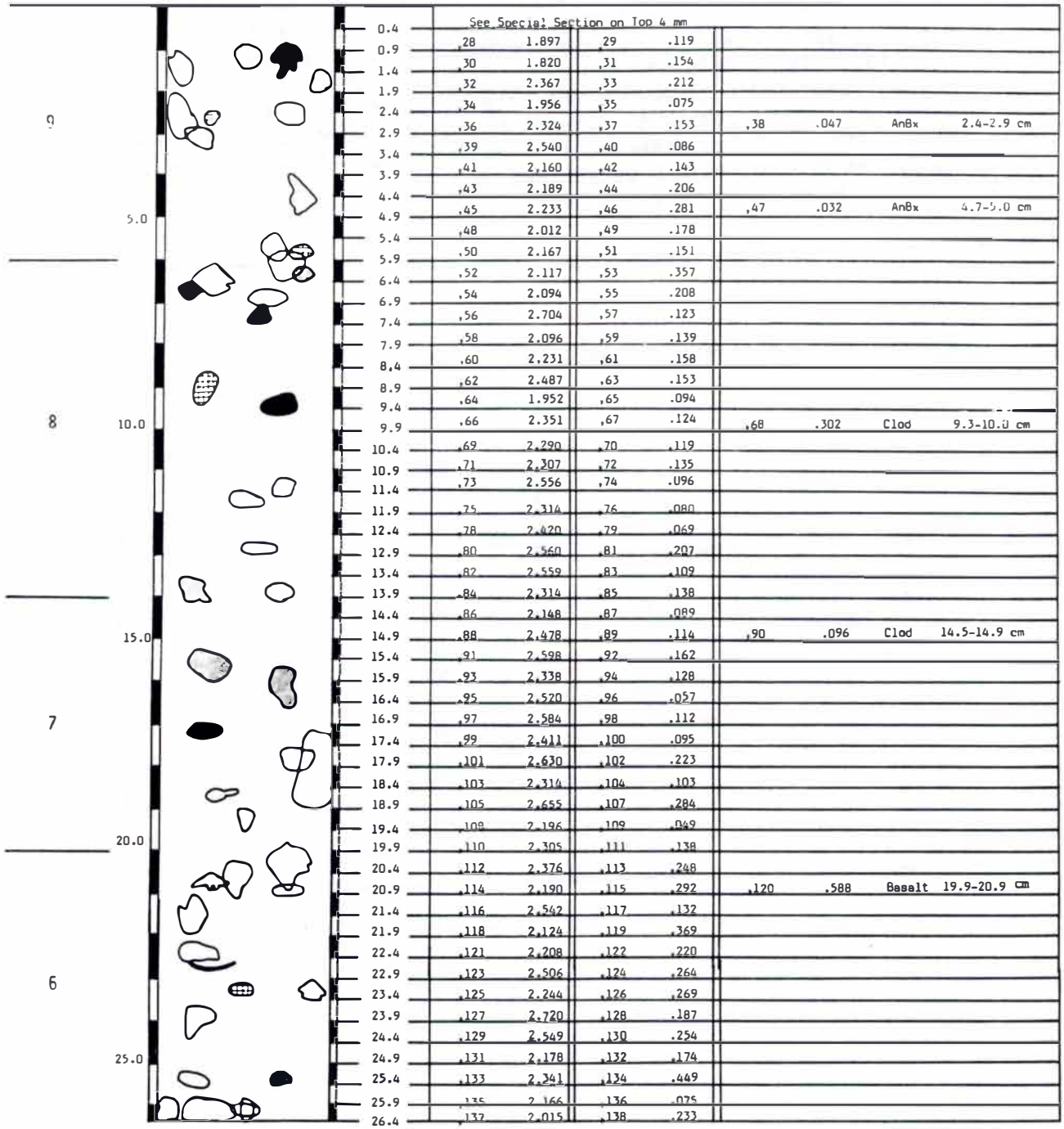


Summary of Stratigraphic Units Identified During Dissection: The color of the core was 5Y 3/1 to 4/1 on the Munsell Soil Color Scale, a medium to dark gray. No gradations were noted except a band containing 5 - 10% lighter color mottles from 3 - 6 cm depth. Among rock fragments greater than 1 mm, mare basalt was the dominant lithology in all units. The abundance of glass and anorthositic fragments was enriched in the upper units. Variance in weights of lithic components among units was much less in 15011 than 15010. Because the core appeared uniform in color, grain size, and lithic composition, unit boundaries were mainly determined from texture and densities observed in x-radiographs. Typically, core unit boundaries are not mainly determined by x-ray data. Lithic abundance numbers given below are directly comparable with those for 15010.

Unit	Depth	Sample Numbers	X-ray: Relative Texture, Density	Grain Size	Major Lithologic Components			
				grams soil >1 mm per gram soil	grams basalt >1 mm per gram soil	grams soil bx >1 mm per gram soil	grams glass >1 mm per gram soil	grams anorth bx >1 mm per gram soil
9	0.4 - 6.0 cm	,28 - ,50 ,1000 - ,1012 ,2000 - ,2023	medium grain size	.087	.051	.020	.012	.005
8	6.0 - 14.0 cm	,51 - ,85 ,1013 - ,1032 ,2024 - ,2057	finer grain size	.056	.031	.013	.007	.004
7	14.0 - 20.0 cm	,86 - ,111 ,1033 - ,1045 ,2058 - ,2082	finer grain size, more dense	.094	.063	.020	.008	.002
6	20.0 - 26.4 cm	,111 - ,138 ,1046 - ,1059 ,2083 - ,2107	medium grain size	.101	.080	.014	.009	.002

DRIVE TUBE 15011

LOCATION OF SAMPLES, FIRST DISSECTION (STANDARD)



Stratigraphic Unit	Cm Depth	Columnar Section	Cm Depth Below Lunar Surface*	Interval Samples Fine (< 1 mm) Fraction Sample No.	Sample Wt.	Interval Samples Coarse (> 1 mm) Fraction Sample No.	Sample Wt.	Special Samples Sample No.	Sample Wt.	Sample Type	Sample Interval
			0.4	See Special Section on Top 4 mm							
			0.9	,28	1.897	,29	.119				
			1.4	,30	1.820	,31	.154				
			1.9	,32	2.367	,33	.212				
			2.4	,34	1.956	,35	.075				
9			2.9	,36	2.324	,37	.153	,38	.047	AnBx	2.4-2.9 cm
			3.4	,39	2.540	,40	.086				
			3.9	,41	2.160	,42	.143				
			4.4	,43	2.189	,44	.206				
	5.0		4.9	,45	2.233	,46	.281	,47	.032	AnBx	4.7-5.0 cm
			5.4	,48	2.012	,49	.178				
			5.9	,50	2.167	,51	.151				
			6.4	,52	2.117	,53	.357				
			6.9	,54	2.094	,55	.208				
			7.4	,56	2.704	,57	.123				
			7.9	,58	2.096	,59	.139				
			8.4	,60	2.231	,61	.158				
			8.9	,62	2.487	,63	.153				
			9.4	,64	1.952	,65	.094				
8	10.0		9.9	,66	2.351	,67	.124	,68	.302	Clod	9.3-10.0 cm
			10.4	,69	2.290	,70	.119				
			10.9	,71	2.307	,72	.135				
			11.4	,73	2.556	,74	.096				
			11.9	,75	2.314	,76	.080				
			12.4	,78	2.420	,79	.069				
			12.9	,80	2.560	,81	.207				
			13.4	,82	2.559	,83	.109				
			13.9	,84	2.314	,85	.138				
			14.4	,86	2.148	,87	.089				
	15.0		14.9	,88	2.478	,89	.114	,90	.096	Clod	14.5-14.9 cm
			15.4	,91	2.598	,92	.162				
			15.9	,93	2.338	,94	.128				
			16.4	,95	2.520	,96	.057				
7			16.9	,97	2.584	,98	.112				
			17.4	,99	2.411	,100	.095				
			17.9	,101	2.630	,102	.223				
			18.4	,103	2.314	,104	.103				
			18.9	,105	2.655	,107	.284				
	20.0		19.4	,108	2.196	,109	.049				
			19.9	,110	2.305	,111	.138				
			20.4	,112	2.376	,113	.248				
			20.9	,114	2.190	,115	.292	,120	.588	Basalt	19.9-20.9 cm
			21.4	,116	2.542	,117	.132				
			21.9	,118	2.124	,119	.369				
			22.4	,121	2.208	,122	.220				
6			22.9	,123	2.506	,124	.264				
			23.4	,125	2.244	,126	.269				
			23.9	,127	2.720	,128	.187				
			24.4	,129	2.549	,130	.254				
	25.0		24.9	,131	2.178	,132	.174				
			25.4	,133	2.341	,134	.449				
			25.9	,135	2.166	,136	.075				
			26.4	,137	2.015	,138	.233				

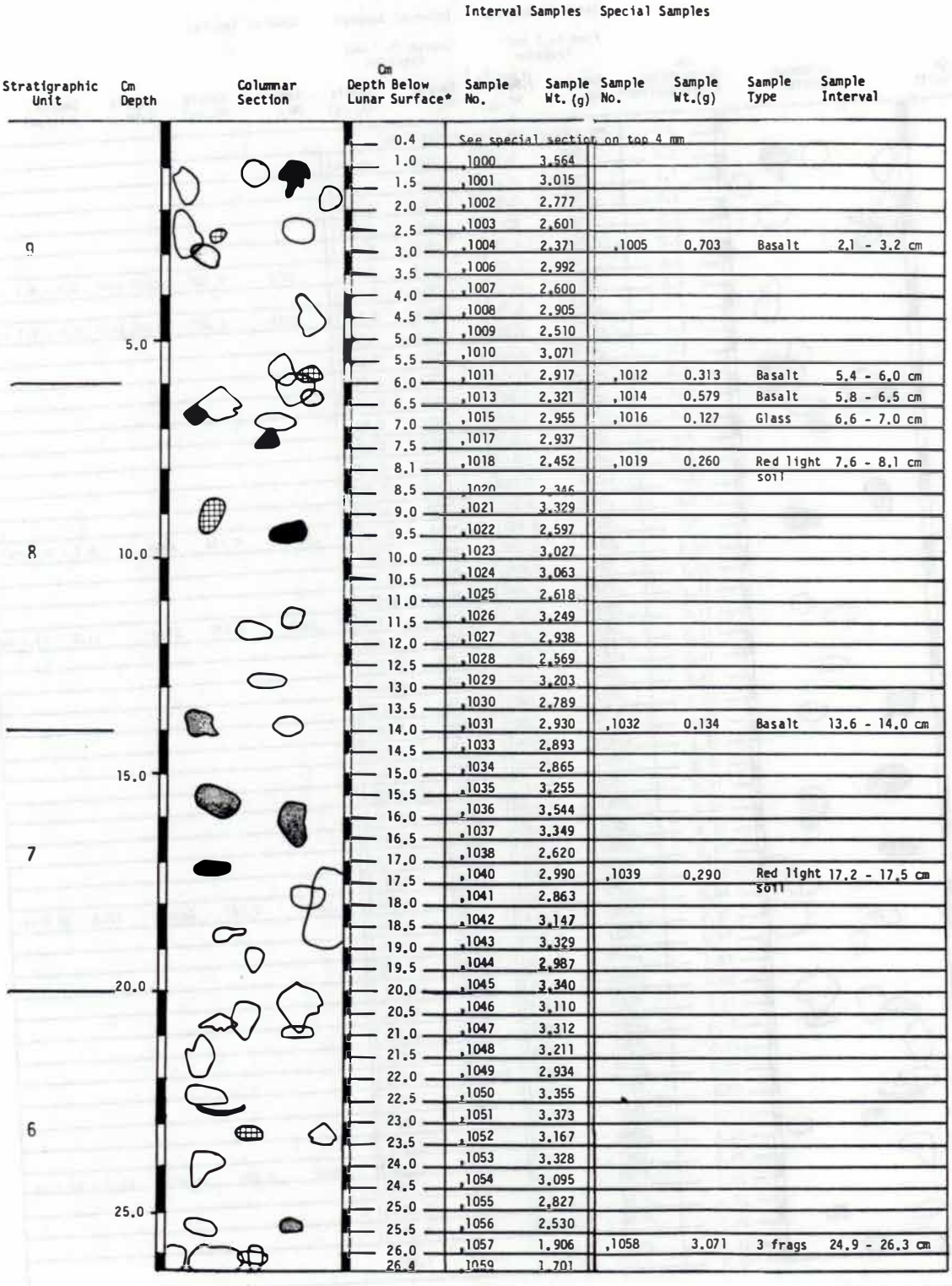
Lithologic Symbols

Basalt | Soil Breccia | Glass | Anorthositic Breccia

*Measured after extrusion

DRIVE TUBE 15011

LOCATION OF SAMPLES, SECOND DISSECTION (MINIMAL PB)

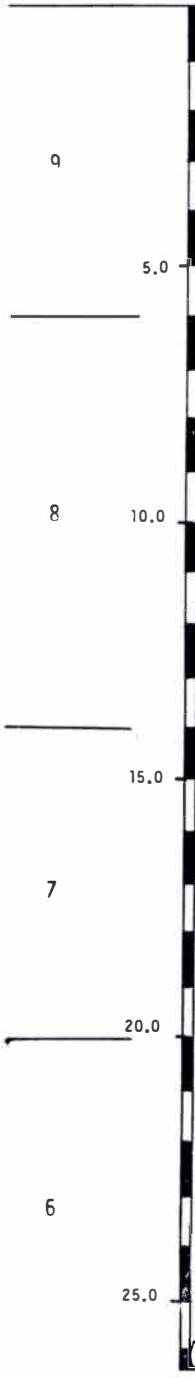


LITHOLOGIC SYMBOLS

*Measured after extrusion

DRIVE TUBE 15011

LOCATION OF SAMPLES, THIRD DISSECTION (STANDARD)



Stratigraphic Unit	Cm Depth	Columnar Section	Cm Depth Below Lunar Surface*	Interval Samples Fine (< 1 mm) Fraction Sample No.	Sample Wt.(g)	Interval Samples Coarse (> 1 mm) Fraction Sample No.	Sample Wt. (g)	Special Samples Sample No.	Sample Wt. (g)	Sample Type	Sample Interval
			0.4	See special section on top 4 mm							
			1.0	,2000	3.935	,2001	0.259				
			1.5	,2002	2.654	,2003	0.601				
			2.0	,2004	3.090	,2005	0.196				
			2.5	,2006	3.070	,2007	0.523				
9			3.0	,2008	2.745	,2009	0.169				
			3.5	,2010	2.837	,2011	0.655	,2012	0.282	dark soil	3.0 - 4.1 cm
			4.0	,2013	2.479	,2014	0.183				
			4.5	,2015	3.289	,2016	0.157	,2017	0.067	light soil	4.0 - 4.7 cm
	5.0		5.0	,2018	3.008	,2019	0.184				
			5.5	,2020	3.206	,2021	0.322				
			6.0	,2022	2.918	,2023	0.236				
			6.5	,2024	2.829	,2025	0.112				
			7.0	,2026	2.955	,2027	0.267				
			7.5	,2028	3.222	,2029	0.229				
			8.0	,2030	3.152	,2031	0.127				
			8.5	,2032	2.874	,2033	0.090				
			9.0	,2034	3.092	,2035	0.139				
			9.5	,2036	2.994	,2037	0.105	,2038	0.136	AnBx	8.7 - 9.4 cm
8	10.0		10.0	,2039	3.201	,2040	0.257				
			10.5	,2041	2.676	,2042	0.211				
			11.0	,2043	3.205	,2044	0.050				
			11.5	,2045	3.031	,2046	0.180	,2047	0.174	Clod	11.2 - 11.7 cm
			12.0	,2048	2.626	,2049	0.254				
			12.5	,2050	2.867	,2051	0.096				
			13.0	,2052	3.050	,2053	0.404				
			13.5	,2054	2.646	,2055	0.118				
			14.0	,2056	3.380	,2057	0.094				
			14.5	,2058	2.935	,2059	0.055				
	15.0		15.0	,2060	2.842	,2061	0.080				
			15.5	,2062	3.571	,2063	0.220				
			16.0	,2064	3.029	,2065	0.414				
			16.5	,2066	2.563	,2067	0.546				
7			17.0	,2068	3.030	,2069	0.129				
			17.5	,2070	3.563	,2071	0.191				
			18.0	,2072	2.888	,2073	0.074	,2074	2.287	Basalt	17.3 - 19.0 cm
			18.5	,2075	2.954	,2076	0.130				
			19.0	,2077	2.809	,2078	0.159				
			19.5	,2079	3.008	,2080	0.370				
	20.0		20.0	,2081	3.361	,2082	0.197				
			20.5	,2083	3.163	,2084	0.238				
			21.0	,2085	3.010	,2086	0.248				
			21.5	,2087	3.420	,2088	0.158				
			22.0	,2089	3.034	,2090	0.160				
			22.5	,2091	3.207	,2092	0.457				
			23.0	,2093	2.798	,2094	0.227				
6			23.5	,2095	3.305	,2096	0.333				
			24.0	,2097	3.145	,2098	0.366	,2099	0.095	Basalt	23.8 - 24.5 cm
			24.5	,2100	2.856	,2101	0.144				
	25.0		25.0	,2102	3.273	,2103	0.220				
			25.5	,2104	3.275	,2105	0.390				
			26.0	,2106	4.740	,2107	1.685				
			26.4								

Lithologic Symbols

Basalt | Soil Breccia | Glass | Anorthositic Breccia

*Measured after extrusion

CORE SYNOPSIS

Sample Number: 15010, bottom half of a double, 4 cm diameter drive tube (15010/15011)

Field Relationships: Core 15010/15011 was taken on a mare surface 20 m from the rim of Hadley Rille at station 9A. The tube was driven full depth, but the last 20 - 30 cm were more difficult to penetrate.

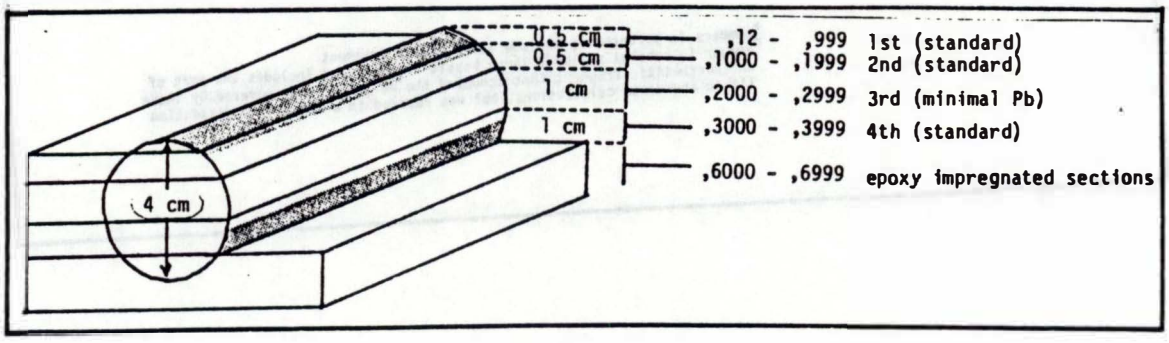
Sample History - possible disturbance or contamination: The core was collected August 2, 1971 and placed in an unsealed Sample Collection Bag. This bag, after being exposed to spacecraft cabin and terrestrial atmosphere on the return flight, was sealed in 2 teflon bags and a polyethylene bag on board the recovery ship as quickly as possible after splashdown on August 7, 1971. The sample bag was opened in the Lunar Receiving Laboratory in a nitrogen atmosphere cabinet August 20.1971. After the keeper was emplaced by the astronaut, the tube contained only 32.9 cm of soil (it should have contained the maximum capacity of 34.9 cm). Compaction may account for some of the difference in length. Lunar soil may have been lost from the top of 15010 when the two tubes were separated by unscrewing and from the bottom of the tube before it was capped. Astronaut Scott had some difficulty with screwing the plug in the top end of the core. Some mixing of soil in the bottom 6 cm may have occurred when the large 5 cm-long rock entered the 4 cm diameter drive tube. 1977 x-radiographs revealed that some settling of soil occurred near the ends of the core while the core was stored horizontally. Void areas created by settling were confined to the ends of the tube and to the volume of soil removed in the first dissection.

Weight, Length, Density:

	Before opening tube	After extrusion
Weight	740.4 g	733.8 g
Length	32.9 cm	28.9 cm*
Density	1.69 g/cm^3	1.91 g/cm^3

*approximately 1 cm of soil was removed from the bottom of 15010 before extrusion (sample no. 3)

Longitudinal Dissections: In a standard dissection, samples are sieved at 1 mm under organically uncontaminated (CP-7) conditions. To produce samples with reduced contamination, the material in the third dissection was not sieved and was subject to minimal handling with specially acid washed tools. These samples should be suitable for Pb analyses. Each dissection was assigned a separate series of split numbers as shown below.



Summary of Stratigraphic Units Identified During Dissection: The color of the core was 5Y 2/1 to 4/1 on the Munsell Soil Color Scale, a medium to dark gray. Soil in 15010 appeared darker at the top than at the bottom. A diffuse lighter color band occurred at 36 - 38 cm. Below a vague, marbled boundary at 46 cm, the core appeared lighter in color. Among rock fragments >1 mm, mare basalt was the dominant lithology in all units. The units in 15010 were more coarse and showed more variability in grain size and lithology of the >1 mm fragments than units in 15011, the upper part of the core. Lithic abundance numbers given below are directly comparable with those for 15011. The term "relative abundance" used in the diagram means weight ratio of a component compared to basalt. A 40 g basalt rock was found in the bottom of the core. Because this rock completely dominates compositional data, figures are given both with and without the large rock included in the calculations.

Unit	Depth	Sample Numbers	Grain Size	Major Lithic Components				
				grams soil >1 mm per gram soil	grams basalt >1 mm per gram soil	grams soil bx >1 mm per gram soil	grams glass >1 mm per gram soil	grams anorth bx >1 mm per gram soil
5	0.0 - 8.5 cm	,12 - ,47 ,1000 - ,1035 ,2000 - ,2018 ,3000 - ,3035	.075	.042	.014	.006	.003	Similar in grain size and absolute lithic abundance to average for all of 15011
4	8.5 - 17.0 cm	,48 - ,84 ,1036 - ,1072 ,2019 - ,2041 ,3036 - ,3080	.207	.144	.049	.007	.002	Coarsest unit if large rock is excluded. Abundance of glass & anorth. bx are depleted.
3	17.0 - 22.0 cm	,85 - ,105 ,1073 - ,1093 ,2040 - ,2054 ,3081 - ,3104	.138 (.127)[a]	.098 (.085)	.017 (.017)	.012 (.012)	.004 (.004)	Least coarse of lower 4 units. Relative abundance of glass slightly enriched.
2	22.0 - 25.0 cm	,107 - ,118 ,1094 - .1105 ,2055 - ,2058 ,3105 - ,3119	.578 (.126)	.552 (.072)	.010 (.021)	.005 (.011)	.007 (.014)	Large rock excluded: unit is similar to unit 3 but higher in anorthositic components.
1	25.0 - 28.9 cm	,119 - ,134 ,1106 - ,1122 ,2059 - ,2071 ,3120 - ,3145	.392 (.185)	.315 (.083)	.054 (.072)	.010 (.014)	.005 (.007) (.033)[b]	Large rock excluded:unit is coarse; soil bx & anorth. bx very abundant. Glass is enriched.

[a] numbers in parentheses exclude large basalt fragment
[b] number in bracket excludes large basalt fragment and includes the part of an anorthositic fragment that occupied the volume of core covered by these lithic abundance calculations, but was removed in a minimal Pb dissection

DRIVE TUBE 15010
LOCATION OF SAMPLES, FIRST DISSECTION (STANDARD)

Cm Depth Below Lunar Surface*	Fine (< 1mm) Fraction Sample No.	Fine (< 1mm) Fraction Sample Wt.	Coarse (> 1mm) Fraction Sample No.	Coarse (> 1mm) Fraction Sample Wt.	Special Samples Sample No.	Special Samples Sample Wt.	Special Samples Sample Type	Special Samples Sample Interval
26.9	,12	0.130	,13	0.010				
27.4	,14	0.477	,15	0.086				
27.9	,16	0.677	,17	0.073				
28.4	,18	0.681	,19	0.061				
28.9	,20	0.723	,21	0.070				
29.4	,22	0.813	,23	0.026	,24	0.105	Clod	29.2 - 29.5
29.9	,25	0.682	,26	0.040				
30.4	,27	0.974	,28	0.043				
30.9	,29	0.920	,30	0.071				
31.4	,31	0.804	,32	0.022	,33	0.148	Basalt	31.2 - 31.7
31.9	,34	0.864	,35	0.052				
32.4	,36	0.935	,37	0.064				
32.9	,38	1.129	,39	0.086				
33.4	,40	1.047	,41	0.050				
33.9	,42	1.025	,43	0.123				
34.4	,44	1.146	,45	0.070				
34.9	,46	1.080	,47	0.090				
35.4	,48	1.154	,49	0.047				
35.9	,50	0.848	,51	0.173	,54	0.250	SoBx	35.4 - 36.4
36.4	,52	1.012	,53	0.078	,55	0.047	Soil	36.4 - 37.5
36.9	,56	0.889	,57	0.496				
37.4	,58	0.696	,59	0.075				
37.9	,60	0.995	,61	0.309				
38.4	,62	0.949	,63	0.174				
38.9	,64	0.801	,65	0.721				
39.4	,66	1.010	,67	0.054				
39.9	,68	1.102	,69	0.094				
40.4	,70	0.933	,71	0.100				
40.9	,72	1.054	,73	0.053	,74	0.258	Basalt	40.4 - 41.4
41.4	,75	0.976	,76	0.098				
41.9	,77	1.117	,78	0.060				
42.4	,79	1.085	,80	0.358				
42.9	,81	0.968	,82	0.137				
43.4	,83	1.082	,84	0.082				
43.9	,85	1.163	,86	0.062				
44.4	,87	1.188	,88	0.120				
44.9	,89	1.079	,90	0.195				
45.4	,91	1.099	,92	0.226				
45.9	,93	1.045	,94	0.156				
46.4	,95	1.176	,96	0.199				
46.9	,97	1.089	,98	0.116				
47.4	,99	1.057	,100	0.314				
47.9	,101	1.001	,102	0.106	,103	0.232	Basalt	47.2 - 48.0
48.4	,104	1.094	,105	0.181				
48.9	,106	1.064	,107	0.156				
49.4	,108	0.935	,109	0.061				
49.9	,110	0.805	,111	0.088				
50.4	,112	0.694	,113	0.278				
50.9	,114	0.767	,115	0.117				
51.4	,116	0.727	,117	0.158				
51.9	,118	0.850	,119	0.208				
52.4	,120	0.723	,121	0.095				
52.9	,122	1.088	,123	0.251				
53.4	,124	0.951	,125	0.266	,126	0.015	AnBx	53.2 - 53.4
53.9	,127	0.894	,128	0.188				
54.4	,129	1.146	,130	0.271				
54.9	,131	0.963	,132	0.215				
55.3	,133	0.745	,134	0.103				
					,3	3.212	unsieved, approximately 1 cm of soil removed from bottom of core before extrusion	

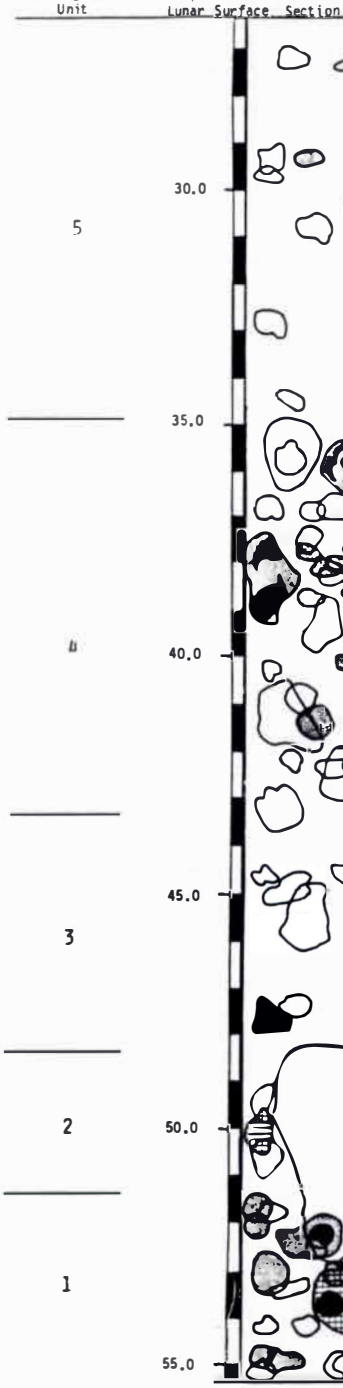
LITHOLOGIC SYMBOLS

Basalt | Soil Breccia | Glass | Anorthositic Breccia

*measured after extrusion

DRIVE TUBE 15010

LOCATION OF SAMPLES, SECOND DISSECTION (STANDARD)



Stratigraphic Unit	Cm Depth Below Lunar Surface	Cm Depth Below Lunar Surface*	Interval Samples Fine (<1 mm) Fraction Sample No.	Sample Wt.	Interval Samples Coarse (>1 mm) Fraction Sample No.	Sample Wt.	Special Samples Sample No.	Sample Wt.	Sample Type	Sample Interval
		26.9	,1000	1.081	,1001	0.171				
		27.4	,1002	0.900	,1003	0.046				
		27.9	,1004	1.072	,1005	0.094				
		28.4	,1006	1.183	,1007	0.072				
		28.9	,1008	1.222	,1009	0.068				
		29.4	,1010	1.222	,1011	0.109				
	30.0	29.9	,1012	1.086	,1013	0.090	,1014	0.030	SoBx	29.5 - 29.9
		30.4	,1015	1.236	,1016	0.065				
5		30.9	,1017	1.207	,1018	0.277				
		31.4	,1019	1.153	,1020	0.028				
		31.9	,1021	1.331	,1022	0.069				
		32.4	,1023	1.213	,1024	0.034				
		32.9	,1025	1.311	,1026	0.114				
		33.4	,1027	1.288	,1028	0.112	,1029	0.023	SoBx	32.0 - 33.2
		33.9	,1030	1.149	,1031	0.077				
		34.4	,1032	1.132	,1033	0.201				
	35.0	34.9	,1034	1.040	,1035	0.083				
		35.4	,1036	1.302	,1037	0.160				
		35.9	,1038	1.118	,1039	0.045				
		36.4	,1040	1.182	,1041	0.108				
		36.9	,1042	1.267	,1043	0.642				
		37.4	,1044	0.935	,1045	0.113	,1046	0.042	SoBx	37.0 - 37.4
		37.9	,1047	1.159	,1048	0.113				
		38.4	,1049	1.290	,1050	0.569				
		38.9	,1051	1.078	,1052	0.054				
		39.4	,1053	1.227	,1054	0.108				
4	40.0	39.9	,1055	1.3 7	,1056	0.103				
		40.4	,1057	1.246	,1058	0.091				
		40.9	,1059	1.283	,1060	0.047	,1061	0.102	Basalt	40.7 - 41.2
		41.4	,1062	1.151	,1063	0.111				
		41.9	,1064	1.070	,1065	0.055				
		42.4	,1066	1.445	,1067	0.148				
		42.9	,1068	1.169	,1069	0.191				
		43.4	,1070	1.280	,1071	0.151				
		43.9	,1072	1.145	,1073	0.325				
		44.4	,1074	1.234	,1075	0.043				
	45.0	44.9	,1076	1.422	,1077	0.177	,1078	0.217	Basalt	44.5 - 45.2
		45.4	,1079	1.336	,1080	0.126				
3		45.9	,1081	1.275	,1082	0.042				
		46.4	,1083	1.251	,1084	0.158				
		46.9	,1085	1.163	,1086	0.128	,1087	0.097	Soil	46.5 - 47.4
		47.4	,1088	1.232	,1089	0.191				
		47.9	,1090	1.302	,1091	0.067				
		48.4	,1092	1.367	,1093	0.143				
		48.9	,1094	1.045	,1095	0.061				
		49.4	,1096	0.651	,1097	0.047				
2	50.0	49.9	,1098	0.453	,1099	0.045				
		50.4	,1100	0.486	,1101	0.035				
		50.9	,1102	0.669	,1103	0.086				
		51.4	,1104	0.539	,1105	0.052				
		51.9	,1106	0.704	,1107	0.008				
		52.4	,1108	0.955	,1109	0.127				
		52.9	,1110	0.842	,1111	0.083				
1		53.4	,1112	0.813	,1113	0.132	,1114	0.029	Soil	53.0 - 53.5
		53.9	,1115	0.889	,1116	0.085				
		54.4	,1117	1.055	,1118	0.289				
	55.0	54.9	,1119	1.178	,1120	0.169				
		55.3	,1121	0.891	,1122	0.071				

Lithologic Symbols

Basalt | Soil Breccia | Glass | Anorthositic Breccia

*Measured after extrusion

DRIVE TUBE 15010

LOCATION OF SAMPLES, THIRD DISSECTION (MINIMAL PB)

Cm Depth Below Lunar Surface*	Interval Samples Sample No.	Sample Wt.	Sample No.	Sample Wt.	Sample Type	Sample Interval
26.9	,2000	2.526				
27.4	,2001	2.128	,2002	0.089	frag	27.0 - 27.4
27.9	,2003	3.626				
28.4	,2004	2.940				
28.9	,2005	2.953				
29.4	,2006	2.647				
29.9	,2007	3.120				
30.4	,2008	3.157				
30.9	,2009	2.104	,2010	1.821	frag	30.1 - 31.2
31.4	,2011	2.676				
31.9	,2012	3.515				
32.4	,2013	3.069	,2014	0.380	RL	32.2 - 32.5
32.9	,2015	3.170				
33.4	,2016	3.436				
33.9	,2017	3.563				
34.4	,2018	3.200				
34.9	,2019	2.902				
35.4	,2020	3.227				
35.9	,2021	2.696				
36.4	,2022	2.934				
36.9	,2023	3.297				
37.4	,2024	2.839				
37.9	,2025	2.723				
38.4	,2026	2.643	,2027	0.210	frags	37.8 - 38.4
38.9	,2028	2.306	,2029	0.336	frag	38.4 - 38.9
39.4	,2030	2.836				
39.9	,2031	2.291	,2032	0.410	RL	39.6 - 40.0
40.4	,2033	3.270	,2034	0.078	clod	40.2 - 40.7
40.9	,2035	2.579	,2036	0.464	clod	40.4 - 41.0
41.4	,2037	2.461				
41.9	,2038	2.861				
42.4	,2039	2.954				
42.9	,2040	2.819				
43.4	,2041	3.139	,2042	0.645	frag	42.6 - 43.4
43.9	,2043	2.826				
44.4	,2044	2.810				
44.9	,2045	2.768				
45.4	,2046	2.938				
45.9	,2047	2.441				
46.4	,2048	2.947				
46.9	,2049	3.141	,2050	0.166	lt.soil	46.6 - 47.2
47.4	,2051	2.841				
47.9	,2052	3.350	,2053	0.188	frag	47.7 - 48.1
48.4	,2054	3.109				
48.9			,2055	3.169	left	48.4 - 49.9
49.4			,2056	1.910	right	48.4 - 49.9
49.9						
50.4			,2057	2.880	left	49.9 - 51.4
50.9			,2058	0.974	right	49.9 - 51.4
51.4			,2059	0.247	frag	50.3 - 51.0
51.9	,2060	1.908				
52.4	,2061	2.471				
52.9	,2062	2.962				
53.4	,2063	2.762	,2064	1.361	frag	52.4 - 53.5
53.9	,2065	2.230				
54.4	,2066	2.996	,2067	2.463	frag	53.0 - 54.4
54.9	,2068	4.416	,2069	0.324	frag	54.6 - 55.0
55.3			,2070	0.092	frag	54.8 - 55.2

RL = soil sample taken in red light

Lithologic Symbols

*measured after extrusion

DRIVE TUBE 15010
LOCATION OF SAMPLES, FOURTH DISSECTION (STANDARD)

Stratigraphic Unit	Cm Depth	Cm Depth Below Lunar Surface*	Interval Samples Fine (< 1 mm) Fraction Sample No.	Sample Wt.	Interval Samples Coarse (> 1 mm) Fraction Sample No.	Sample Wt.	Special Samples Sample No.	Sample Wt.	Sample Type	Sample Interval
		26.9	,3000	3.029	,3001	0.206				
		27.4	,3002	2.844	,3003	0.134	,3004	0.209	Basalt	26.9 - 27.4
		27.9	,3005	2.997	,3006	0.523				
		28.4	,3007	2.716	,3008	0.182				
		28.9	,3009	3.444	,3010	0.178				
		29.4	,3011	2.509	,3012	0.255				
		29.9	,3013	2.623	,3014	0.080				
	30.0	30.4	,3015	2.837	,3016	0.174				
5		30.9	,3017	2.973	,3018	0,151				
		31.4	,3019	2.956	,3020	0.140				
		31.9	,3021	3.307	,3022	0.370	,3023	0.018	soil	31.5 - 31.7
		32.4	,3024	2.790	,3025	0.142				
		32.9	,3026	2.757	,3027	0.187				
		33.4	,3028	2.748	,3029	0.306				
		33.9	,3030	2.580	,3031	0.141				
		34.4	,3032	2.947	,3033	0.109				
		34.9	,3034	2.403	,3035	0.172				
	35.0	35.4	,3036	2.944	,3037	0.140	,3038	0.224	soil	34.9 - 36.4
		35.9	,3040	1.995	,3041	0.175	,3039	2.622	Basalt	34.9 - 36.4
		36.4	,3042	2.605	,3043	0.204	,3044	0.013	soil	36.1 - 36.4
		36.9	,3046	2.863	,3047	0.170	,3045	0.152	soil	35.9 - 36.9
		37.4	,3048	2.754	,3049	0.279				
		37.9	,3050	2.712	,3051	0.577	,3052	0.526	Basalt	37.0 - 37.8
		38.4	,3053	2.030	,3054	0.275				
		38.9	,3055	3.203	,3056	0.252	,3057	1.758	SoBx	37.4 - 39.1
4		39.4	,3058	2.771	,305	0.412	,3060	0.552	Basalt	38.5 - 39.7
	40.0	39.9	,3061	2.312	,3062	0.230				
		40.4	,3063	2.776	,3064	0.458				
		40.9	,3065	3.138	,3066	0.172				
		41.4	,3069	2.453	,3070	0.516				
		41.9	,3071	2.948	,3072	0.234				
		42.4	,3073	2.706	,3074	0.410	,3077	1.841	Basalt	41.7 - 43.1
		42.9	,3075	2.887	,3076	0.082	,3080	0.246	soil	42.9 - 43.4
		43.4	,3078	2.741	,3079	0.346	,3089	0.864	Basalt	44.8 - 46.1
		43.9	,3081	3.121	,3082	0.326				
		44.4	,3083	3.162	,3084	0.440	,3090	0.128	YSoil	41.0 - 41.8
		44.9	,3085	3.294	,3086	0.386	,3091	0.038	GSoil	41.0 - 41.8
	45.0	45.4	,3087	3.287	,3088	0.479	,3092	0.038	YSoil	41.0 - 41.8
		45.9	,3093	3.254	,3094	0.153	,3137	0.066	Soil	41.0 - 41.8
3		46.4	,3095	2.991	,3096	0,280	,3138	0.144	soil	41.0 - 41.8
		46.9	,3097	2.735	,3098	0.440	,3139	0.087	YFrag	41.0 - 41.8
		47.4	,3099	2.903	,3100	0.275	,3140	0.234	YFrag	41.0 - 41.8
		47.9	,3101	3.213	,3102	0.314	,3142	0.034	GFrag	41.0 - 41.8
		48.4	,3103	2.932	,3104	0.466	,3143	0.039	GFrag	41.0 - 41.8
		48.9	,3105	2.780	,3106	0.523	,3144	0.003	YFrag	41.0 - 41.8
		49.4	,3107	2.353	,3108	0.200				
		49.9	,3109	1.984	,3110	0.090	,3111	0.354	Basalt	42.9 - 50.0
2	50.0	50.4	,3112	1.494	,3113	0.378	,3114	1.216	Soil	48.3 - 53.1
		50.9	,3116	1.958	,3117	0.328	,3115	44.050	Basalt	48.3 - 53.1
		51.4	,3118	2.303	,3119	0.194				
		51.9	,3120	2.135	,3121	0.344				
		52.4	,3122	3.479	,3123	0.546	,3124	0.878	SoBx	51.5 - 52.3
		52.9	,3125	3.304	,3126	0.415	,3127	0.530	SoBx	51.7 - 52.6
1		53.4	,3129	2.930	,3130	0.399	,3128	0.739	SoBx	52.5 - 53.7
		53.9	,3131	3.143	,3132	0.644				
		54.4	,3133	2.661	,3134	0.693				
	55.0	54.9	,3135	4.615	,3136	0.732				
		55.3								

Yellow Glass Samples

Lithologic Symbols

Basalt | Soil Breccia | Glass | Anorthositic Breccia

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*Measured after extrusion