REPORT ON DRILL STEM 70003

Drill stem 70003 is the seventh stem below the top of the Apollo 17 Drill String. Calculations based on X-radiographs and previous dissections of other drill stems in the string place the top of 70003 at 211.7 cm below the lunar surface. Due to various factors such as mechanical compaction, this figure is but a close approximation. The drill string, with a total length of about 292.1 cm, has three major stratigraphic units: an upper, coarse-grained basaltic unit, 110.7 cm thick; a middle, fine-grained zone 53.6 cm thick, high in anorthosite; and a lower zone of alternating coarse and fine basaltic and breccia material, 127.8 cm thick. Drill stem 70003 is wholly contained within the lower unit. The Apollo 17 Deep Drill String was taken about 40 meters north of the ALSEP central station.

Upon extraction of the drill string from the drill hole, the string was separated into three segments for packing. Drill stem 70003 was the middle stem of the lowest segment. Upon separation in the lab, the lower end was plugged and both ends were capped. Early PET and cold storage samples were

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taken from the upper 13 mm and the void thus created was plugged before recapping. In preparation for the milling process, the plugs were pressed deeper into the tube in order to provide a proper fit for the milling hardware and to lessen any looseness of the soil. The amount of shortening due to this compression was 4 mm. The soil exposed after removal of the upper split half of the drill stem was 38.2 cm in length, extending from 1.8 to 40.0 cm on the dissection scales.

Dissection began at the upper end of the core in order to more quickly process the intervals with disrupted rind. Standard 5 mm intervals were taken throughout, with the exception of lead-free sample intervals at 4.0-5.5 cm and 20.5-22.0 cm. Red light samples were taken in conjunction with the lead-free samples and additionally at 10.0-10.5 cm and 30.0-30.5 cm. Also, the interval 1.8-2.5 cm was taken to even up the intervals. Unusual or large particles transcending interval boundaries were individually containerized as special samples. Wherever possible, large

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70003 PHYSICAL UNIT DESCRIPTION INDEX

70003 Units	x-ray Units	Lunar Depth	Thick -ness	Location Notation	Sample Numbers	Wt. % Matrix	Tonal Value	Cohes. Value	Major Comp.	Minor Comp.	Other Comments
VII E	23	211.7	3.0	035-05	3-5,25-30	89.9	6.0	8	SOBX	RXBX	Big RXBX
VII D	23	214.7	2.0	055-35	31-36	91.1	5.5	8	SOBX	ANBX	Orange SOBX
VII C	23	216.7	1.5	070-55	37-42	95.5	6.0	7	SOBX	-	Dk.Int.Clast
VII B	23	218.2	2.0	090-70	43-50	94.5	5.5	4	SOBX	VSGL	Orange/beady
VII A	23	220.2	1.5	105-90	51-60	90.6	6.0	3	SOBX	BSRF	Clean BSRF
VI G	23	221.7	1.5	120-05	61-67	94.6	4.0	3	-	SOBX	Clean glass
VI F	23	223.2	1.5	135-20	68-75	92.2	5.0	3	-	SOBX	Big ANBX
VI E	22	224.7	1.0	145-35	76-79	88.8	4.5	3	BSRF	-	Beat-up BSRF
VI D	21	225.7	1.0	155-45	80-83	94.4	4.5	4	-	SOBX	BSRF/VSGL
VI C	20	226.7	1.5	170-55	84-91,100	78.4	4.0	5	BSRF	RXBX	Big RXBX
VI B	19	228.2	1.0	180-70	92-97	95.6	3.5	7	-	SOBX	Also BSRF
VI A	18	229.2	1.0	190-80	98-103 *	70.3	4.0	6	BSRF	VSGL	Dirty/Beat-up
V	17	230.2	3.0	220-90	104-115 *	92.4	3.0	7	-	SOBX	Big ANBX
IV C	16	233.2	2.0	240-20	116-123	92.2	5.0	8	-	SOBX	VSGL @ bottom
IV B	15	235.2	1.5	255-40	124-129	95.0	4.5	7	-	SOBX	-
IV A	15	236.7	2.0	275-55	130-137	96.8	5.0	5	-	-	Few particles
III B	15	238.7	4.5	320-75	138-156	95.2	3.5	4	-	SOBX	Sharp peak
III A	14	243.2	2.5	345-20	157-167	91.5	4.0	1	BSRF	Misc	Dirty BSRF
II	13	245.7	2.5	370-45	168-178	86.6	3.5	3	BSRF	SOBX	Clean BSRF
I B	13	248.2	2.5	395-70	179-189,192	88.4	2.0	7	-	SOBX	Big PXGL/BSRF
I A	13	250.7	0.5	400-95	190-191	93.7	2.0	7	-	VSGL	Cont.in 70002

Relative tonal value -- 10=white/0=black
Relative cohesivity value -- 10=tight/0=loose

* Sample ´10 is in unit VI A.

particles were located on a diagram of the interval in order to record orientations. All particles not passing through a 1 mm sieve were classified, photographed, and containerized for each dissection interval. Voids created by the extraction of large particles extending below standard dissection depth were maintained if possible. It was necessary to remove these particles in order to obtain a peel sample. After peeling, the remaining core was impregnated with epoxy, then encapsulated in a mold of more epoxy. This mold provides a block of epoxy containing sample which is longitudinally sawn and transversely cut into blocks for thin-sectioning.

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Analysis of Data

The collected quantitative data consists of the weights of the fine fraction and coarse fraction of each interval, plus the weights of special samples. In addition, frequency counts of particles in the coarse fraction were taken in three size ranges -- 1-2 mm, 2-4 mm, and greater than 4 mm. Each size range is also divided into seven compositional types. Frequencies are computer-normalized to the standard interval width and average weight. Graphs of normalized frequencies versus depth are plotted in eight groupings: by compositional type for each of the three size ranges; by compositional type for the combined sizes; by combined compositions for each of the three sizes; and by combined compositions for the combined size ranges. When combining sizes, scale factors are used. In addition to the frequency graphs, a weight percent coarseness indicator is plotted. The percentages are computed by dividing the weight of material greater than 1 mm in size by the weight of all the material per unit.

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Bias is introduced by the sampling size of the drill stem, in that the presence of a particle approaching tube diameter in size eliminates the possibility of occurence of other particles. Other statistical error is brought about by the discrete size categorization, rather than a continuous size measurement of each particle. This error is demonstrated by comparing the weight percent coarseness graph with the combined composition/combined sizes graph. The lack of congruence that can be seen is partially due to this "pidgeonhole" effect and partially due to generalizing assumptions that had to be made in order to combine the discrete size categories. Other biases or errors include -- sampling below standard dissection level, measurement error, assumptions of uniform density, and misclassification of lithology. Bearing these limitations in mind, interpretation of the constructed graphs was not attempted at the order of resolution available.

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Compositional Classifications

Seven compositional categories were used to classify particles greater than 1 mm in grain size: anorthositic breccia (ANBX); agglutinates (AGGL); devitrified or partially-crystallized glasses (PXGL); recrystallized or high-grade breccia (RXBX); vesicular, droplet, or fresh glasses (VSGL); soil or low-grade breccia (SOBX); and basaltic or crystalline rock fragments (BSRF). Of these seven, SOBX is the most abundant.

The category "BSRF" includes any particle which is apparently not recrystallized material, but which is polycrystalline and contains plagioclase and pyroxene. In practice, some of the smaller particles classified as BSRF's may be monomineralllic. Also, many particles are soil or glass coated to the point of being barely recognizable. Some soil coated BSRF's may have been misclassified as SOBX's for this reason. Most occur as fairly equant chunks with coarsely-textured surfaces. When the rough pockets in

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the surface are filled with soil, they are easily mistaken for the equant, smooth-surfaced SOBX's. Effort was taken to remove as much loose soil as possible without significantly damaging the normally friable SOBX's in the process. Some BSRF's have shocked plagioclase or anorthositic material. ANBX's may be derived directly from this source, in which case they are more likely to display some evidence of crystal structure. When found as clasts in SOBX's, they tend to be sugary in texture. Some particles classified as "ANBX" may either be soil coated ANBX's or anorthositic clasts from broken SOBX's. SOBX's therefore, exclude white, sugary masses of supposed anorthositic material, even though the only difference may be the color of the soil matrix in which it is formed. SOBX refers to a particle of welded, non-white soil matrix. Welding may have been brought about by heat, pressure, small amounts of molten glass, or some combination of these. When glass welding creates a more spindly particle, it is considered to be an AGGL rather than a more massive and rounded SOBX. SOBX's are usually friable and occasionally break open to reveal an interior of

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crystalline mash. Others simply disintegrate when broken. Certain SOBX's are distinguished as medium grade in that they are tougher and seemingly transitional to the category of RXBX. RXBX is an angular, waxy-appearing particle that would seem to be the high grade equivalent of SOBX or ANBX. PXGL is somewhat similar in appearance to RXBX, but readily distinguishes itself with a duller surface luster and characteristic glass fracture shapes. VSGL refers to fresh, vitreous glass which occurs as beads, shards, or coatings. It is often found as coatings on SOBX and causes some difficulty in classification, as SOBX may be glass welded.

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Description of Physical Units

Drill stem 70003 is entirely within the lower major unit of the drill string. The transition frpm the alternating light and dark layers in 70002 to the slightly orangish, massive soil breccia-rich 70004 can be seen at about 10.5 cm. This boundary is quite definite, and although not of the magnitude of a major contact, it is the primary dividing line in this drill stem.

The upper 70004-like unit is composed mostly of small, rounded, homogenous, slightly friable soil breccia. Occasional concentrations of vesicular glass and glass beads are seen. The very large particles of 70004 are not in evidence. The color tone has a slight reddish or orangish cast.

The lower 70002-like unit has coarse zones of basaltic material and very fine-grained zones of diverse lithology. Occasional concentrations of white anorthositic breccia and

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soil "droplets" are expressed in the alternating light zones. The overall tone is more neutral than the upper unit.

In drill stem 70003, 6 minor units are marked off in the 70002-like zone and 1 in the 70004-like zone. The minor units are further subdivided into 19 sub-units in all, mostly based on variations seen in tonal, cohesivity, coarseness, and compositional factors. See the attached chart for a detailed account of these variations.

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