Approved as Written
Date 4-12-06
Signature

PLANETARY MATERIALS BRANCH
SAMPLE PROCESSING PROCEDURE

DATE: February 2, 1993 SPP 71

CORE DISSECTION, LARGE-DIAMETER DRIVE TUBE

1. INTRODUCTION

1.1 The core material contained in a drive tube section is extruded horizontally into a cylindrical receptacle built up of 5 mm thick dissection plates and a quartz-glass cover plate. Removal of the quartz-glass cover plate and successive dissection plates allows the careful, progressive removal of segments of the core to the level of the remaining plates. The usual sequence for a 4 cm diameter drive tube is to make three dissection passes that are 1 cm thick each. The standard sampling interval along the length of the core is 5 mm, except where overridden by a stratigraphic boundary or other special situations. The unit of sample thereby has a cross sectional area transverse to the core of 1 cm thick by up to 4 cm wide by 5 mm along the length of the core.

1.2 The activities guided by this procedure begin after a core has been freshly extruded. In outline they are:

a) Removal of the quartz-glass cover plate and first dissection plate.

b) Photography of the exposed core.

c) Removal (de-rinding) of the outer 1 to 2 mm of material that was disturbed by movement along the walls of the core tube during the sampling process.

d) Detailed photography of the exposed core.

e) Binocular description of the exposed core.

f) Preparation of a dissection plan with intervals and numbering schemes worked out.

g) Dissection operations:

i) Dissection for samples of fine and coarse fractions.

ii) Dissection for samples exposed only to red light.

iii) Dissection for samples of highest chemical purity.

iv) Collection of descriptive data and photography for documentation.

v) Preparation of reports and information summaries.

The normal procedure for a dissection to obtain samples of fine and coarse fractions is to place all of the materials from a dissection interval on a 1 mm sieve to separate out the >1 mm fragments. These fragments are agitated gently so adhering fines are shaken off and through the sieve. Then the coarse particles are removed and photographed. The <1 mm and the >1 mm fractions are then weighed and packaged as separate samples. No attempt is made to preserve soil clods, but special provisions can be incorporated into the dissection plan to document and package separately unusual or large fragments. The plan may also be altered (with approval of the Curator) to make special arrangements for any unusual samples unexpectedly encountered.

Two types of special dissection operations are options provided for in the procedure, (1) dissection under red light and (2) minimum contamination sampling. The red light sampling is to obtain materials that have not been exposed to light since burial on the moon. It has been claimed that fluorescent light rapidly affects the samples, but white incandescent light for an hour does not cause significant degradation of the samples' thermoluminescent properties (letter and attachment to Curator from R. M. Walker, July 25, 1971). Under incandescent light with a red filter, a thin layer of covering soil is removed; then the underlying material is dissected to obtain a sample which can be stored in light-tight containers for use in study of thermoluminescence.

The minimum contamination samples are taken from the interior of the core (that did not touch the core tube walls) with specially-cleaned tools, using protocols designed to keep the tools and containers pristine. Both special dissection techniques are at the expense of some observational and photographic documentation.

1.3 An F-6 processing from (Appendix A) is started for each dissection pass and is reviewed by the Curator before starting the next pass. The weight of the core at the start of dissection is calculated from the difference between the gross weight of the core in the drive tube and the weight of the empty tube after extrusion. This weight is used for the pre-processing weight of the first dissection pass. At the end of each dissection, the weight of the sample remaining in the receptacle is calculated by subtracting the weight of all splits from the pre-processing weight.

1.4 After curatorial review of the final dissection pass, the receptacle with the remainder of the core is moved to the Thin Section Lab for taking peels and impregnating with epoxy.

2. RESPONSIBILITY

2.1 A core scientist prepares and modifies dissection plans. The scientist must assure that each bit of stratigraphic and textural data made momentarily available in the course of this procedure and thereafter lost through its continuance is preserved through written, photographic records, and sampling.

The core scientist must also perform the actual dissections, description, and documentations guided by this procedure. In addition, the core scientist is responsible for preparation of the dissection plan, the recording of all scientific observations (written, drawn, and photographic) and production of the final report on the dissection.

2.2 The Curator must be present for all transfers and other operations that involve picking up the core. This responsibility is not delegatable.

3. SAFETY

No specific CAUTIONS are incorporated; however take common sense care in all actions.

4. DEFINITIONS

CO - Curatorial Order
F-6 - Processing Form (see Appendix A, B and C)

5. REQUIRED EQUIPMENT

Bags, Teflon 5 mil	Asst. N/A
Balance, plus weight set	1 N/A
Heat sealer	
Brush, teflon, 3/8" x 7"	1 SC-034
Brush, teflon, artist	1 PC-075
Brush, teflon, floor	1 PC-049
Receptacle assy. (w/screws & pins)	1 SEZ 3611199-301
Rod, locking	1 SDZ 36112493-002
Scissors	1 SP-018 or equivalent
Scoop, core (small)	1 SDZ 36112706-003
Scoop, core (medium)	1 SDZ 36112706-002
Scoop, core (large)	1 SDZ 36112706-001
Scoop, long-handle (small)	1 SDZ 36112707-003
Scoop, long-handle (medium)	1 SDZ 36112707-002
Scoop, long-handle (large)	1 SDZ 36112707-001
Scale, metric	1 SL-063 or equivalent
Scale, small	

Scraper (notched)	1 SDZ 36112798-001
Screwdriver kit assy.	1 SDZ 26113529-201
Forceps, Brookstone, 10"	1 SC-011 or equivalent
Stand assy, fixed core (w/pins)	1 SEZ 36112879-301
Tray	3 PC-072 or equivalent
FTH containers	100 to 200 per dissection
FTH racks	
Aluminum foil sheets	
Sieve funnel	1 SDZ 36113525-301
Funnel stand	1 SDZ 26113521-003
Pentagonal holder	1 SDZ 36113527-001
Salve can or 251 teflon lid for photography	RCL 3
Spatula	1 SI-023 or equivalent
Standard color charts	
Film, Ektachrome, 4 x 5 Poloroid Type 52 or 53	

6. PROCEDURE

NOTE: Tools used to handle lunar core materials are to be CP-4 acid-washed, placed only on surfaces with similar cleanliness, and oriented so the soil-touching surface does not contact other hardware.

6.1 PREPARATIONS

6.1.1 Set up cabinet so that weighing, dissection, and photography can be performed easily and efficiently, with adequate work-space for dissection left near the core.

6.1.2 Pre-weigh FTH containers with tops in place. List on a note form.

6.2 EXPOSE, DERIND AND DOCUMENT CORE SURFACES

6.2.1 Start an F-6 form for the first dissection pass.

6.2.2 For the first dissection pass, lift the quartz cover vertically and place it gently on a flat, teflon-covered surface. Then remove one pair of 5 mm thick dissection plates by unscrewing and carefully sliding outward. Two pairs of dissection plates are removed for each subsequent dissection pass.

6.2.3 To prevent damage to quartz cover and side plates, prompty transfer them out of the cabinet for flushing, cleaning, and storage in a designated secure place in the tool room.

6.2.4 Lay in the number scales with the zero mark either at the top end of the soil column or, adjusted to account for the few mm removed from the top in a cross-dissection sampling. Replace the scales in the same place for each succeeding dissection pass.

6.2.5 Take documentation photography: An overall color view plus any other views that may be deemed appropriate. Then remove scales.

6.2.6 Remove sample of the disturbed outer zone that was in contact with the core tube wall (the rind) by gently slicing off the outer 1-2 mm in 5 cm long increments unless otherwise specified.

6.2.7 Replace the scales to their previous position in relation to the core end. (see 6.2.4)

6.2.8 Take color photos at 1.27x magnification (1 cm of core is 1/2" or 1 grid square on the photo), with each view containing the whole width of the core plus the scale on both sides. Overlap adjacent views by at least 50% to provide stereographic coverage.

6.2.9 Promptly send the film for processing because satisfactory negatives must be available before the next dissection pass may be started.

6.2.10 Describe the exposed core. Include color, textural, structural, and lithologic characteristics, and a comparison to the X-radiographic stratigraphy. Be sure to note types of unit boundaries on transitions between units.

6.3 PLAN FOR THE DISSECTION PASS

6.3.1 Use the general description produced in part 6.2.10 plus information from the X-radiographs in designing the plan for each dissection pass. Specify any items of special interest to be looked for during each dissection pass.

6.3.2 The standard plan calls for dissection in 5 mm intervals along the core. These interval dissections are done in three longitudinal passes, each advancing 1 cm (one-quarter diameter) across the diameter of the core. (The 4th cm of material is left in the receptacle and eventually fixed in epoxy to preserve stratigraphy and structure.) The first and third of the passes are usually processed to obtain fine and coarse samples whereas the second pass is done with minimum handling (no sieving) to reduce contamination (minimum contamination samples).

6.3.3 In establishing the dissection intervals follow these two "laws" as guidelines:

Increment law: Dissection intervals should encompass a transverse section of soil 5 mm thick and should be numbered consecutively from top of the section, and if possible fall on multiples of 5 or 10 mm.

Boundary Zone law: If a stratigraphic boundary would occur within a standard 5 mm interval, lengthen the adjoining dissection interval up to the stratigraphic boundary. (This approach gives greater flexibility in allocations than having samples from intervals shorter than 5 mm does.)

If the core appears to be thinly layered, up to 20 stratigraphic layers thinner than 2 mm may be individually sampled in each dissection pass.

6.3.4 Plan for the documentation, extraction and handling of materials now exposed that should be designated as special samples.

6.3.5 Numbering of subsamples is as follows (subsample ,1 is the parent of all)

First pass (including rind).....lowest-999
Second pass.....1000-1999
Third pass.....2000-2999
Peel and impregnated sections...6000-6999

Sample numbers for de-rinding and dissection passes should increase with distance from the upper end of the core.

6.4 DISSECTION AND DOCUMENTATION

6.4.1 Prepare the dissection plan for the pass and issue as a Curatorial Order.

6.4.2 Record all data for each interval on a dissection form (Appendix A) which will constitute a page of the F-6 for the dissection pass. The form receives descriptive data and the numbering and weight data for the samples from the interval. The unadjusted intervals also should be recorded on the F-6 for correlations of photos and thin sections.

The sample interval data is entered in the "core description" file of the Lunar Sample Data Base Update (LUP).

For the lower core tube of a double drive tube, when depths from the dissection scale are entered in LUP the "depths from surface" are automatically calculated and entered.

6.4.3 General guidelines for descriptive data are as follows:

a) Note and emphasize inhomogeneities and differences recognized in a 5 mm increment.

b) Sketch position of coarse particles or other features.

c) Sort >1 mm particles by rock type. Categories may vary with each core.

6.4.4 For red light sampling:

a) Determine pass and intervals where red-light samples are to be taken. This should be specified on the Curatorial Order.

b) When normal dissection has progressed to the interval for red light sampling, set up red light source and turn off room lights.

c) Derind 1-2 mm from the interval until material is exposed which has not been directly exposed to light.

d) Scoop 250-500 mg of sample directly into FTH container and close.

e) Restore normal lighting.

f) Bag container with aluminum tag which says "red light sample". Do not put in rack with other samples.

g) Continue with normal dissection.

6.4.5 For minimum contamination sampling only (when specified), follow these directions:

a) Using clean tools, prepare a fresh surface by scraping off approximately 1 mm of smeared outer edge of the core, and clean off the top of the dissected surface where it is necessary to remove possible cross-contamination. Material should be removed in 2 cm intervals, and packaged in #9 FTH containers. The same tools may be used for the entire length of the core.

b) Describe the freshly-cleaned surface and photograph the entire surface at 1.27x magnification as described in step 6.2.8.

c) During dissection, modify steps 6.4.6 through 6.4.17 with these directions, as applicable: Use freshly-cleaned tools for each major stratigraphic unit or other units. Do not sieve or separate different size fractions. Tap off visible surface dust on tools between each increment. Handle soil as little as possible, and package bulk soil directly into FTH containers. Describe only the surface of soil and notable features encountered during dissection.

6.4.6 For coarse and fine sampling, start the dissection intervals (usually 5 mm long) as specified in the plan and always at the upper end of the core.

6.4.7 Obtain two preweighed containers (FTH unless otherwise specified), and record container number and weight on the F-6. Keep each cap with the container on which it was weighed.

6.4.8 Ready a clean sievefunnel and sleeve in the funnel holder over a preweighed FTH container bottom. If there are enough funnels with sieves on hand, use a clean sieve for each dissection interval to reduce the possibility of cross-contamination among particles.

6.4.9 Place the receptacle tray (dust pan) against the dissection face.

6.4.10 With a spatula and forceps, carefully work the soil from the interval into the pan.

6.4.11 Maximum reasonable documentation should be made of coarse particles and distinctive features. Options include:

a) if a distinctive (e.g., larger than 1 interval) dust-free particle or cluster of particles is encountered, sketch the feature in place on processing form (Appendix A). Note original orientation. Then place it with other particles or designate it as a special sample, at option of dissector.

b) if particle has an orientable asymmetry but is dusty and/or otherwise non-distinctive, sketch position and orientation as accurately as possible, then place particle(s) in original relative position for group photograph.

c) if particle is relatively small or very dusty it may not be found until after sieving, and will be handled by steps 6.4.14 and 6.4.15.

6.4.12 As the fine materials are sliced away and moved into the pan, advance the pan to follow the retreating dissection face.

6.4.13 Empty the pan onto the center of the sieve in the funnel whenever the pan gets filled, and at the end of the dissection interval.

6.4.14 With a teflon block or other non-metallic object gently tap the funnel to separate the coarse and fine fractions.

6.4.15 Empty the >1 mm fragments from the sieve-funnel onto the photography tray, segregating them from the oriented and positioned particles. Separate by lithology whenever possible.

6.4.16 Photograph the particles on the photography tray with appropriate number tag and mm scale.

6.4.17 If it is feasible, measure >1 mm particles and record data on processing form (Appendix C). Weigh and package all >1 mm particles from a dissection interval together. (Be sure to get good documentation on friable soil breccia particles, which might be disaggregated if they are sieved later at 2 mm, 4 mm, and 10 mm for preparation of a coarse fines catalog.)

6.4.18 When an interval has been completely dissected, return the container or containers to the balance area, measure the gross weights and record them on the core F-6 (Appendix B). Calculate the net sample weight for each container, recording on the F-6.

6.4.19 Sum the subsample weights and do the F-6 weight balance calculations. Subtract the sum of subsamples produced through the just-completed dissection pass from the starting weight of the core (subsample number ,0) to get a value for the present weight of intact core (subsample number ,0) still remaining.

6.4.20 Complete all descriptions and obtain a Curatorial review of the F-6 for the dissection pass with all subsample forms.

6.4.21 After the Curatorial Representative signs the F-6, return to section 6.2 if another dissection pass is to be done.

6.5 At the conclusion of the final dissection, photograph post-dissection surface as in step 6.2.8.

6.6 Obtain measurements for cutting or preparing protective cover which must be present before core can be moved out of cabinet.

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This procedure replaces SPP 71, dated December 10, 1980.

The procedure takes effect on the date of the last signature.

The term of the procedure is indefinite.

Form F-6
WEIGHT CHECK SHEET

CO # _____ Laboratory _____

Date _____

Parent weight before processing

Rigid Container		Item	Weights		Description/ Container Configuration
			Measured	Calc/Inv.	
Type	S/N	Gross			
		Container			
Weights by		Dunnage			
		Sample			
		Calibr.			

Check of parent weight before processing

remarks

Inventory wt. parent _____ a

Parent wt from above _____ b

Difference (a-b) _____

Balance tolerance + _____

Calculations after processing

Maximum measured weight used to determine a sample or subsample weight:

Sample # _____ Sample Wt. _____

Inventory wt. parent _____ a

Total Wt. from "List of Subsamples" _____ c

Difference (a-c) _____ d

Balance tolerance + _____ e

If |d| < |e|, then adjust net wt. of above sample

If |d| > |e| assign "d" to ATTRITION or DISCREPANCY and enter below. Otherwise, enter "g" below.

remarks

Net weight _____ f

Difference (a-c) _____ d

Adjusted wt. (f+d) _____ g

Calculated values for Computer Inventory Entry

,	ENTIRELY SUBDI	0.000
,	ATTRITION	.
,	(Adjusted Sample #)	.
,		.

No more parent sample
= d, if |d| > |e|
=g, adjusted weight
(other)

_____
Calculations by

_____
Date

Comments:

Curatorial review and sample release _____
Curatorial Rep. Date

Parent Sample No.
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Fine Fraction < 1mm

Specific Number	Cabinet Number	Container Type/Ser.	Item	Weights		Comments
				Measured	Cal/inv	
			Gross			
Wts. by:			Cont.			
Bal. Reading/Actual Wts.			Dun.			
Cal. /			Sample			

Remarks:

Sample Number:_____

****

Coarse Fraction > 1mm

–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–

Specific Number	Cabinet Number	Container Type/Ser.	Item	Weights		Comments
				Measured	Cal/inv	
			Gross			
Wts. by:			Cont.			
Bal. Reading/Actual Wts.			Dun.			
Cal. /			Sample			

Remarks:

Sample Number:_____
Interval:_____
Date:_____
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	1-2mm	2-4mm	4-10mm	> 10mm	SUM	COMMENTS
ANORTHOSITE						
BASALT						
BRECCIA, DK MA						
BRECCIA, SOIL						
BRECCIA, MISC						
GLASS						

Sample Number:_____
Interval:_____
Date:_____
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