

OFFICE OF THE CURATOR
SAMPLE PROCESSING PROCEDURE

DATE: January 11, 2001*

SPP 63

SECONDARY ENCAPSULATION, SPLITTING AND
SEGMENTING OF LUNAR CORES

1 INTRODUCTION

This procedure defines steps to be taken in secondary encapsulation, splitting and segmenting of lunar cores processed in Thin Section Laboratory (TSL). These techniques are the last steps in a series which enables us to produce petrographic thin sections along the length of the core.

Once the core has been initially impregnated and properly cured in accordance with SPP 73, secondary encapsulation may begin. During the positioning of the core in the mold, the original orientation of the core on the lunar surface is documented and carefully maintained throughout these procedures. During the secondary encapsulation an aluminum tag is secured in the epoxy stating "top" and "bottom". All information including photo documentation is kept in one data pack which includes F-6s used to record weight change generated by each procedure and an official copy of this procedure for initialing at certain stages of the operation.

The facilities, equipment, safety precautions, and personnel responsibilities for supporting secondary encapsulation activities are described in MP 14, Facility Description: TSL.

2 RESPONSIBILITY

All TSL personnel are required to follow these procedures for secondary encapsulation. No deviations are allowed except when specifically provided by the Curator.

3 SAFETY

This procedure uses materials which are toxic to personnel. Preparation, mixing, weighing, etc. of chemicals must be performed in a fume hood while wearing chemical resistant gloves and safety glasses. Caution notes precede 6.1.11. Refer to MSDS for additional information.

4 DEFINITIONS

Alignment	- Locating the proper place on the millimeter scale in the mold
Baseplate	-A rigid plate to support the rubber mold
Core	- Soil column taken from the lunar regolith with drill-stem or a drive tube
Drive tube	- A 4 cm diameter core tube (driven into the regolith to obtain a vertically continuous subsurface sample
Encapsulation	- Incasing the impregnated core in an epoxy plastic form
F6	- Weight check sheet

*This procedure is revised relative to version dated February 18, 1982, to reflect changes in procedure for secondary encapsulation.

Large Special Fixture	- Large aluminum channel used to hold encapsulated core during splitting procedure
Pre-cut forms	- Shapes of epoxy cut and filed to hold the impregnated core in the mold during secondary impregnation procedure
PTS	- Polished Thin Section
Segmenting	- Cutting encapsulated core half into segments for thin sectioning
Small Special Fixture	- Small aluminum channel used to segment core half
SO	- Science Observer
Splitting	- Cutting encapsulated core in half lengthwise
Teflon spacers	- 1/8" teflon strips used to center encapsulated core into special fixture for splitting
TSL	- Thin Section Laboratory

5 REQUIRED EQUIPMENT

5.1 Chemicals

Araldite 506 resin; 250 gram
 Eastman 1-(2 Aminoethyl)-Piperazine (AEP); 25 gram
 Eastman 1, 8-Diamino-P-Methane (MDA); 25 gram
 Almag Oil

5.2 Tools

File, 1/4" circular, rectangular, 2 each
 Precut support form, 6 each (Appendix A)
 250 ml beakers, 4 each
 Secondary encapsulation mold, 1 each (Appendix A)
 Baseplate, 1 each (Appendix A)
 Shims
 Aluminum foil, 1 roll
 Centimeter scale minimum, 40 cm length
 1/8" teflon spacers, 4 each
 5" x .015" x 5/8" diamond blade, 1 each
 5 gallon container, 2 each
 Polaroid film, type 52, 1 case

5.3 Equipment

Felker saw with stage
 Incubator
 Vacuum impregnation chamber
 Oven
 Mettler PC8000 balance
 Fume hood
 4 x 5 Polaroid camera and lenses
 Chemical resistant gloves
 Safety glasses

6 PROCEDURE

6.1 Secondary encapsulation (See Appendix A)

- 6.1.1 Determine number of pre-cut forms to be used and place in rubber mold.
- 6.1.2 Carefully place soil column core in mold and check alignment.
- 6.1.3 Remove soil column core and file pre-cut forms to achieve proper alignment. Rinse pre-cut forms and molds with 200 proof ethyl alcohol.
- 6.1.4 Place mold on baseplate and insert pre-cut forms in predetermined place.
- 6.1.5 Orientation and positioning of soil column core should be achieved as follows:
 - a) Core should be centered in the mold.
 - b) Position top of core to be adjacent to the 0 cm gradation on the mold, as long as 5 mm top has not been removed.
 - c) Confirm that the marks on the cm scale correspond to those on the dissection tables.
- 6.1.6 Periodically recheck positioning comparing photograph of soil column core taken during peeling and primary impregnation.
- 6.1.7 Inspect soil column core, pre-cut forms and mold to insure the top of the core is at, or near, the 0 cm gradation and that the right side is facing north. Inspection and approvals are required from the following personnel:
 - a) Science Observer
 - b) Curator or Associate Curator of Lunar Samples or his designate.
- 6.1.8 Place generic number and "top" and "bottom" tags in proper location of the mold.
- 6.1.9 Take over-all photograph of soil column in mold with cm scale and the orientation cube.
- 6.1.10 Vacuum Chamber:
 - a) Place aluminum foil in bottom of chamber to protect chamber baseplate from epoxy spills.
 - b) Verify that all valves to the vacuum chamber are closed.

- c) Carefully transfer mold containing the core to vacuum chamber. Core must be placed horizontally on baseplate.
- d) Inspection and approvals are required from personnel identified in paragraph 6.1.7.

6.1.11 CAUTION: Don chemical resistant gloves and safety glasses and mix epoxy in fume hood.

Mix, as follows:

Araldite 506	250 grams
Diamino-P-Methane (MDA)	25 grams
Aminoethyl-Piperazine (AEP)	<u>25 grams</u>
	300 grams

6.1.12 Pour epoxy into mold until it covers core and rises to the top of the mold.

6.1.13 Cover and seal lid of vacuum chamber. After clamping chamber shut, do the following:

- a) Press "pump" button to start roughing pump.
- b) Press valve button to open solenoid valve.
- c) Monitor the pressure during pump down. Verify that pressure inside the chamber reaches 0 mm on vacuum gauge.
- d) Open cut-off valve and open fine-adjust all the way and coarse-adjust three turns.

6.1.14 Record the pumping time and pressure below:

Time (HRS. & MIN.)	Chamber Pressure (mm)
_____ Start	_____ Start
_____ 15 min	_____ 15 min
_____ 30 min	_____ 30 min
_____ 45 min	_____ 45 min

Vacuum pumping should continue for 45 minutes, using 15-minute increments to record time and chamber pressure. Sample should not remain in the vacuum chamber longer than 45 minutes because epoxy begins to set up in one hour and requires atmospheric pressure for the process. It may sometimes be necessary to open the vent valve slightly to prevent epoxy bubbles from flowing over the sides of the rubber mold.

- 6.1.15 Open the vacuum chamber.
 - a) Push pump "off" button to turn off roughing pump.
 - b) Close shut-off valve.
 - c) Close fine and coarse adjustment valves.
 - d) Open the vent valve to allow atmospheric pressure to build up in the chamber.
 - e) Remove clamp and chamber cover.
- 6.1.16 Handling only the baseplate, remove core from chamber and place in incubator on flat, level surface. Cure at 35° C for 24 hours.
- 6.1.17 Remove core from mold
 - a) Place both thumbs on top of one end of mold with fingers extended on the bottom, and twist gently until core releases. Then repeat at the opposite end.
 - b) Lift soil column core from mold.
- 6.1.18 Weigh encapsulated core and enter gross weight on F-6,
- 6.1.19 Photograph encapsulated core
 - a) Place core on stage under 4x5 camera.
 - b) Photograph both sides of the encapsulated core using orientation cube and cm scale
- 6.1.20 Final inspection of the encapsulated core before cutting
 - a) Inspect core to insure the top of the core is at or near the 0 cm graduation and that the right side is facing north.
 - b) Obtain approval from core Science Observer.
- 6.1.21 Obtain curatorial review on F-6 for secondary encapsulation before continuing.
- 6.2 Splitting of 4 cm Drive Tube Sample
 - 6.2.1 Upon completion of secondary encapsulation, check encapsulated core for sharp edges and straightness. Remove any sharp edges with a smooth single cut file being careful not to chip epoxy.

- 6.2.2 Weigh encapsulated core and record on F-6.
- 6.2.3 Take pre-cut photos of encapsulated core using 4x5 camera located in TSL. Photos should be shot at 1:1 ratio and should include orientation cube and centimeter scale. (2 sets)
- 6.2.4 Place Felker saw in fumehood and attach .015" diamond blade. Use Almag oil to cool blade (gravity feed 5 gal. container above saw).
- Attach large special fixture to saw stage and place encapsulated core with the centimeter scale (S_1 surface) up into the fixture. Centering the core column with teflon spacers on each side, align the center of the core to the blade using the micrometer adjustment located on the side of the saw stage.
 - Lower the saw blade to where it will just touch the surface of the centimeter scale. Slowly push the encapsulated core through the fixture without the saw on, scoring the surface from top to bottom. If the alignment is straight and centered for the length of the core, proceed with cutting. If not, realign.
 - Have SO check this alignment and approve by signing with date and time on data pack copy of SPP 63.
 - Don chemical resistant gloves and safety glasses.
- 6.2.5 Start coolant and cut encapsulated core column using a very even pressure and backing out of cut about every .5 cm to clear blade.
- 6.2.6 Take post-cut photos of exposed surfaces and two sets of "pie shot" view.
- Weigh both halves and record on F-6.
 - Take 2 complete sets of overlapping photos of each exposed soil column using 4x5 Polaroid camera with 35 mm lens. (Exploded view of soil including cm scale located on S_1 epoxy surface of secondary encapsulation.)
 - Store 1 set of overlapping photos in the data pack and use the other set to produce mosaics of both halves to present SO for marking cutting plan for segmenting procedure.
- 6.3 Segmenting Encapsulated Core Half for Sectioning
- 6.3.1 Using marked mosaic, mark the core half chosen for thin sections with a diamond scribe. Take pre-cut photos showing intervals where core is to be cut. (2 sets)

- 6.3.2 Set up Felker cut-off saw as in Step 6.2.4, and attach small special fixture for segmenting core half onto saw stage.
 - 6.3.3 Have SO verify cut locations and initial and date the procedure.
 - 6.3.4 Cut segments using method described in Step 6.2.5.
 - 6.3.5 Take post-cut photos of core segments using 4x5 camera to show newly exposed soil of both ends of each core segment including orientation cubes and cm scale. (2 sets)
 - 6.3.6 Give pre-cut and post-cut photos of selected core half to illustrator to produce diagram showing interval and generation of splits.
 - 6.3.7 "Orientation of Core Thin Sections" sheet will accompany completed PTSs to PI. (Appendix B)
- 6.4 Obtain curatorial review on F-6 before proceeding.

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Date

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Date

This procedure replaces SPP 63 dated February 18, 1982.

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

The term of the procedure is indefinite.