LUNAR *NEWS*

No. 66 March 2001

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CAPTEM Meeting – March 16–18, 2001

EXPLORING THE MOON

A Teacher's Guide with activities for Earth and Space Sciences

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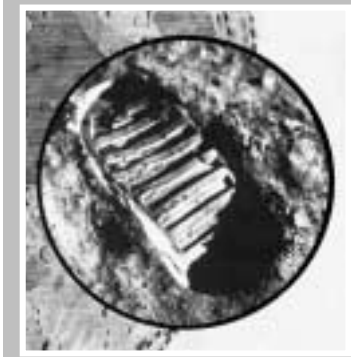

Lunar *News* Mission

The purpose of "Lunar News" is to provide a newsletter forum for facts and opinions about lunar sample studies, lunar geoscience, and the significance of the Moon in solar system exploration.

Editor's Notes

"Lunar News" is published by the Planetary Missions and Materials Branch, Earth Science & Solar System Exploration Division, Johnson Space Center of the National Aeronautics and Space Administration. It is sent free to all interested individuals. To be included on the mailing list, write to the address below. Please send to the same address any comments on "Lunar News" or suggestions for new articles.

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THE 32ND LUNAR AND PLANETARY SCIENCE CONFERENCE

The 32nd Lunar and Planetary Science Conference will be held in Houston, Texas on March 12-16, 2001. Sessions will be held at the NASA Johnson Space Center (JSC). The oral presentation sessions will be held at the JSC Gilruth Center beginning on Monday, March 12, at 8:30 a.m. and ending on Friday, March 16, at noon. Poster sessions will be held at Space Center Houston on Tuesday and Thursday evenings from 7:30 to 10:00 p.m. A fee of $50 ($30 for students) will be assessed each participant to cover conference services. You must preregister and prepay by February 16, 2001, to avoid a $20 late fee. Foreign participants who state on the registration form that they have a currency exchange problem may pay in cash at the meeting and avoid the $20 late fee if they return the form by February 16, 2001. The Sunday night registration and reception will take place at LPI from 5:00–8:00 p.m. Also on Sunday, the LPI will offer a preconference workshop for scientists interested in becoming more involved in education and public outreach. The program will explore the diverse variety of programs and

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Curator's Comments

Gary Lofgren
NASA JSC

I was looking at the lunar program for the upcoming LPSC 32 and found 4 sessions with 52 oral talks and 32 papers presented as posters. This formidable list of Lunar presentations is largely due to the recent CAPTEM (Curation Analysis Planning Team for Extraterrestrial Materials) science initiative "New Views of the Moon" (described in the last issue of "Lunar News"). This effort to bring together detailed studies of samples with remote sensing studies has not only given us new insights into lunar processes, but also new insights into how effectively we can study other planetary surfaces. These studies emphasize the importance of both return samples and remote sensing studies and the increased value of using them in concert.

Our program for long term display samples has received a boost with the successful design of a new display container that is easier to build and assemble. This will allow us to continue a program that provides an important means for people around the world to share the fascination we in lunar science have for the lunar rocks. The one note of caution I must inject here is that we have a limited number of rocks left that can be used for these kinds of displays.

CAPTEM has recently completed a review of the Lunar Facility. Our building, affectionately known as 31N, is now over 20 years old and we need to determine how well it is holding up. In fact, it is holding up very well, but nothing lasts forever. We are initiating a thorough evaluation of the state of the building and will determine changes and improvements that need to be done. As a part of this review, CAPTEM has decided to begin a concerted effort to review all proposals as they are received and not wait for one of the 2 meetings per year to evaluate them. So there is no need to wait until the deadline is near to submit requests. Send them in when the ideas strike you. We cannot guarantee that all requests can be handled this way, but those that can will. Spreading out the processing of lunar samples requests should speed up the allocation time. In fact you will have an opportunity to comment on the request/allocation process in the future. See the PI questionnaire included in this newsletter. At the last meeting in October, 282 samples were approved for allocation and those allocations are nearly completed.

The 32nd Lunar and Planetary Science Conference

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partnering opportunities to which scientists can contribute to bring current and accurate lunar and planetary science to a wider audience of students, educators, and the public. The chili cook-off and barbecue dinner will be held on Wednesday, March 14, from 6:00 to 9:30 p.m. Guest tickets for the dinner will be available at the registration desk for $15 per person. For further information, call the LPI Publications and Program Services Department (logistics and program: 281-486-2158; registration: 281-486-2142). Web site: www.lpi.usra.edu

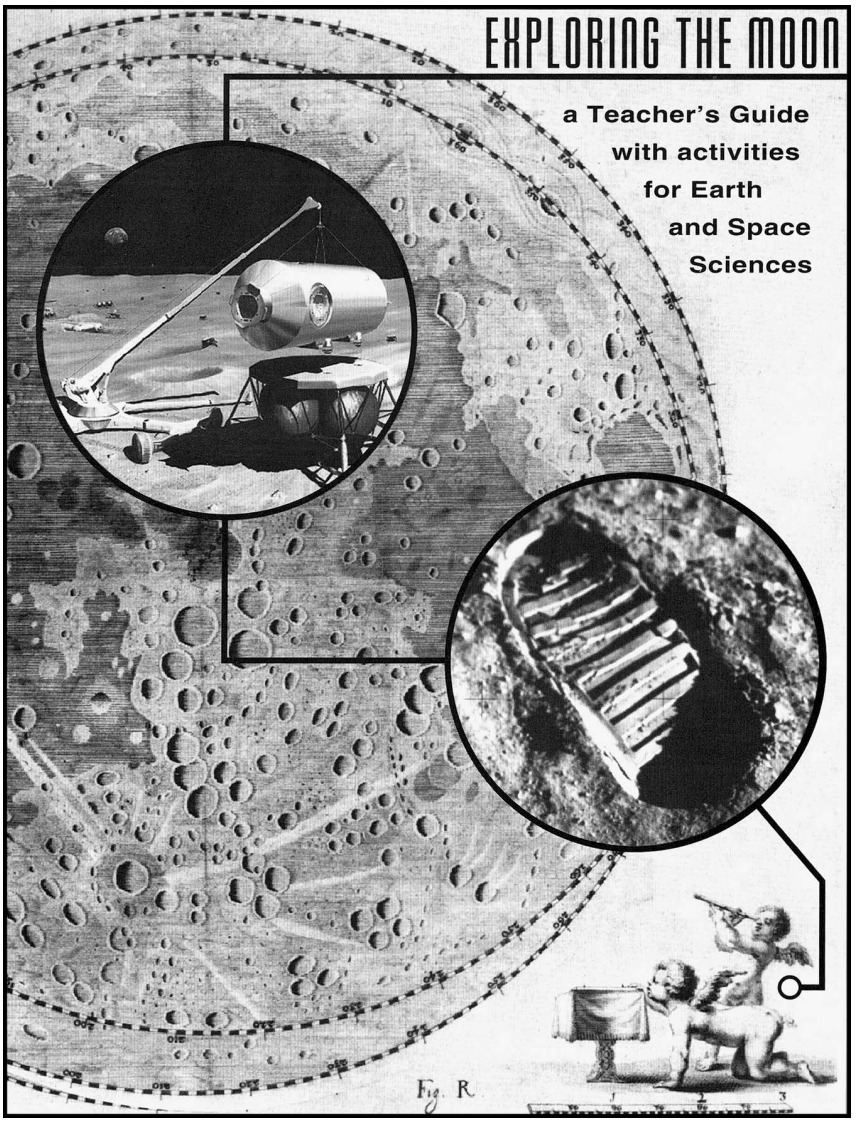
Exploring the Moon — Background and Activities for the Classroom

Article submitted by Jackie Allen, SN Education

Activities developed by University of Hawaii team led by G. Jeffery Taylor, Linda Martel, and a team of teachers

Exploring the Moon—A Teacher's Guide with activities for Earth and Space Science
1997 NASA publication
Cat. no. EG-1991-10-166-HQ

Share the legacy of the astounding accomplishments of the Apollo Program in the classroom. Exploring the Moon is a set of seventeen activities appropriate for a wide variety of classrooms from upper elementary to early college. It is designed to accompany a Lunar Sample Disk but may also be used without the disk.* The background material assists the teacher by telling the story of the Moon's geological history and how scientists try to decipher that story. It is also useful as background reading for a special student project. A set of thirty-six 35-mm slides accompanies each disk. The slide set has detailed captions.



xploring the Moon activities are divided into three units: Pre-Apollo, Learning from Apollo, and The Future. These correspond roughly to exercises designed for use before the Lunar Sample Disk arrives in the classroom (Pre-Apollo), while thedisk is there (Learning from Apollo), and after the teacher returns the disk to NASA (The Future).

Classroom activities promote problem solving, communication skills, and teamwork. Each

Continued on next page

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activity consists of teacher pages and reproducible student sheets. Check out this useful resource for sharing planetary science with students.

How to get the Exploring the Moon Activities Guide and a slide set:

Slide Set – Web site: <http://spacelink.nasa.gov/Instructional.Materials/NASA.Educational.Products/Exploring.the.Moon.Slide.Set/.index.html>

PDF version – Web sites: <http://ares.jsc.nasa.gov/outreach/Activities/ExpMoon/ExpMoon.htm> or <http://spacelink.nasa.gov/products/Exploring.the.Moon/.index.html>

Hard copy – may be obtained from NASA Educator Resource Centers located at all NASA centers. Or you may contact:

NASA CORE
Lorain County Joint Vocational School
15181 Route 58 South
Oberlin, OH 44074
Phone: 440-774-1051, Ext. 249 or 293
Fax: 440-774-2144
e-mail: nasaco@leeca.esu.k12.oh.us
home page: <http://spacelink.nasa.gov/CORE>

* You may borrow a Lunar Disk from the NASA center closest to you; contact them for security requirements. Students can examine six samples of the moon brought to Earth by the Apollo astronauts. The samples, encased in a Lucite disk, are easily used in the classroom. A slide set and the Exploring the Moon activities guide will both come with the disk.

Students Working with NASA on a few Mars Mission studies…

There are seven students spending two months at NASA's Johnson Space Center performing studies relating to the Mission to Mars. The students are from Worcester Polytechnic Institute in Worcester, Massachusetts, and are working with NASA to complete their senior projects. There are three groups working on gloves, glove boxes, and clean room contamination control with respect to the handling of Mars samples.

Students working with NASA are (L to R)
Daniel Nicholas Erickson, Eian Michael Lynch, Eric T. Kenney, Allison Berube, Michael Alan Young, and Bonnie Henderson.
Kathy Pacheco was not available for the photograph.

Descriptions of the individual projects are below:

Controlling organic outgassing in clean rooms

The focus of this study is on the two class-10 Genesis Mission clean rooms, which are located in Building 31 of the Johnson Space Center. Past testing has shown that there are organic contaminants being outgassed from certain materials present in the rooms. Clean rooms are classed based on the number of 0.5 micron or larger particles that are present per cubic foot in the room; however, the amount of molecular species in the room is not accounted for under these specifications. These contaminants pose a problem when associated to Mars sample handling. Any foreign Earth material that is exposed to the samples may result in false assumptions about conditions on Mars.

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The goal of the project is to determine the sources of the molecular contamination, recommend ways the clean room can be altered to reduce or eliminate these contaminants, and ensure that the environment is suitable for Mars sample return handling. Past tests on outgassing in the rooms are being analyzed, and further testing will be done to verify what materials are outgassing the organics being found in the rooms. Low-outgassing materials and products are being investigated so that recommendations on alternate materials can be made. The two students currently working on this study are Dan Erickson (WPI Chemistry major) and Kathy Pacheco (WPI Chemical Engineering major). JSC's Ed Mickelson and Judy Allton are advising the project.

Glove Material Selection

The purpose of this project is to investigate the best glove material for the lunar sample handling facility and the future Mars sample receiving facility. Gloves are used in glove boxes to prevent cross-contamination between the operator and the sample and to preserve the condition of the sample. In order to ensure the sample remains pristine, the glove should not allow contaminants to pass through. The material used for the gloves should not allow oxygen and water vapor to permeate from the clean room environment into the glove box or allow carbon dioxide to permeate from the sample to the clean room. The material also should not release particles that may contaminate the sample being handled. Glove box glove manufacturers have recommended hypalon, viton, and butyl rubber as possible glove materials that would meet these standards.

Renco Corporation, North Safety Products, Latex Technology Inc., and Guardian Manufacturing have provided samples of the recommended materials. These samples will be tested for permeability, particulate extraction, off-gassing products, and flexibility. The glove material that provides the best overall results will be recommended for use. The two students currently working on this project are Eric Kenney (WPI Chemical Engineering major) and Mike Young (WPI Chemical Engineering major). Prof. Karen McNamara from WPI is advising the project, along with Judy Allton from JSC and Eric Dahlgren, a WPI graduate student who assists in the project while at JSC.

Cold Glove Box Design

The goal of our project is to identify design requirements for a preliminary interaction unit that would define a basic system for Mars Return Sample Handling at cold conditions. These conditions require a proposed operation temperature of -40°C in an attempt to duplicate the environment on the Martian surface and prevent the loss of valuable geological research from heat effects on the returned samples. Originally, the unit was termed a glove box, but has been revised to a Sample Isolation and Containment Unit (SICU) due to anticipated design characteristics that distinguish the unit from preceding systems. These characteristics were basic, but vital in defining potential applications and capabilities of the unit, and include structure, cold source, internal atmosphere, sample manipulation, cleanliness and sterility, and possible monitoring equipment. We have chosen to focus our efforts on two of these factors primarily because of our chemical engineering background. The structure and cold source of the unit will be the bulk of our design work. As of now, we have prioritized structural aspects that outline the overall design of the SICU such as shape, visibility options, sample manipulation and transfer, equipment storage, and atmospheric flux. We have reviewed options under these categories that have brought new and exciting designs into consideration. In addition, we are in the process of devising leakage rate tests for each design. In the upcoming weeks, we will concentrate on defining aspects of the cold source for the SICU in regards to equipment, location, and heat transfer. In the end, we hope to present our design proposals and recommend the best overall design for the SICU. (The Lockheed Martin supervisor for this project is Lisa Vidonic.)

Employee Highlights

Lisa Prejean

Lisa Prejean was the Graphic Artist & Exhibits Coordinator for Earth Sciences and Solar System Exploration Division since July 1997. She left at the end of February to be near her fiancé in Washington, D.C. Lisa and Jerry Butwid will marry in Galveston, Texas in September of this year.

Lisa was born in Port Arthur, Texas in 1964. She and her mother lived in Beaumont and then Houston before moving to Nassau Bay, Texas, in 1971 when her mother got a job at NASA-JSC and married Terry Semple, a flight controller for Apollo 13–17. Lisa lived in the NASA area until she graduated from Clear Lake High School in 1983 when she moved to Houston. In 1985 she moved to Knoxville, Tennessee where she lived for 7.5 years and attended the University of Tennessee. Lisa moved back to the Clear Lake area in 1993 and finished her college education at the University of Houston – Clear Lake while working full time at Geocontrol Systems, GHG Corporation, and finally Lockheed Martin.

Lisa loves camping and any type of water sports, in particular, offshore fishing, water skiing, sailing and SCUBA diving. She also enjoys painting, acting, live music, and reading.

Washington, D.C. is Jerry's first assignment as an officer in the United States Coast Guard (he was enlisted for five years prior to getting a BS degree in Environmental Science from Texas A&M – Corpus). Lisa and her friend, NRC Fellow Melissa Lane, decided to take a SCUBA course in 1999 and Jerry was their Open Water diving instructor. Lisa continued through Advanced Open Water dive classes from Jerry, who also was employed as a diver in the Neutral Buoyancy Lab here at JSC. They became engaged on the beach in Cozumel, Mexico, on the one-year anniversary of their first date. The couple is looking forward to starting their lives together and, eventually, a new family.

Hats off to Lisa for doing an excellent job. Her bubbly personality and big smile will surely be missed. We wish the very best for Jerry and Lisa.

Lab Tours

Mouriaux Pierre-Francois and Claeys Didier (French Air and Space Museum)

Nancy Chabot and dad, Paul Chabot

Nancy Chabot, Eric Tonui, Paul Chabot, Julie Moses, and Eleanor Dixon

Desmond Anthony (PAO) and Gary Lofgren with Heather and Thistle Society Members

Carl Agee and wife, Hannah

Family members of Carl Agee: Hannah (wife) with Ella, Dutch, and Richard Koch (sister, brother-in-law, and nephew)

MORE LAB TOURS

Lisa Vidonic (JSC Facility Engineer), Hershull Figaro (Lockheed Martin), and Ed Mickelson (Senior Scientist)

Eric Kenny (WPI) and Laurie Y. Carrillo (JSC Materials Scientist)

Gary Lofgren, Dr. Eugene Levy (Provost of Rice University), and Carl Agee

Professor Karen McNamara and Worchester Polytechnical Institute chemical engineering students

CAPTEM FACILITY REVIEW TEAM:
Carl Allen, Gary Lofgren, Larry Haskins, Lindsey Keller, Graham Ryder, Allen Treiman, Jack Warren, Charles Shearer, Glenn MacPheason, Brad Jolliff, Larry Nyquist, and D. A. Papanastassiou

Joe Fragola (SAIC) and Dave Lindstrom

Revised: February 1998

How to Request Lunar Samples

NASA policies define lunar samples as a limited national resource and future heritage and require that samples be released only for approved applications in research, education, and public display. To meet that responsibility, NASA carefully screens all sample requests with most of the review processes being focused at the Johnson Space Center (JSC). Individuals requesting a lunar sample should follow the steps given below for the appropriate category of sample.

1. RESEARCH SAMPLES (including thin sections)

NASA provides lunar rock, soil, and regolith-core samples for both destructive and non-destructive analysis in pursuit of new scientific knowledge. Requests are considered for both basic studies in planetary science and applied studies in lunar materials beneficiation and resource utilization.

A. The sample investigator demonstrates favorable scientific peer review of the proposed work involving lunar samples. The required peer review can be demonstrated in either of two ways: (1) A formal research proposal recommended by NASA's Lunar and Planetary Geosciences Review Panel (LPGRP) or an equivalent scientific peer-review panel, within the past three years; (2) Submittal of reprints of scientific articles, as published in peer-reviewed professional journals that directly pertain to the specific sample requested.

B. The investigator submits a written request specifying the numbers, types, and quantities of lunar samples needed, as well as the planned use of the samples. For planetary science studies, the sample request should be submitted directly to the Lunar Sample Curator at the following address:

Dr. Gary Lofgren
SN2/Lunar Sample Curator
NASA/Johnson Space Center
Houston, TX 77058-3696 USA
Telephone: (281) 483-6187
Fax: (281) 483-5347

For engineering and resource-utilization studies, the sample request should be submitted to the Lunar Simulant Curator at the following address:

Dr. Douglas W. Ming
SN4/Lunar Simulant Curator
NASA/Johnson Space Center
Houston, TX 77058-3696 USA
Telephone: (281) 483-5839
Fax: (281) 483-5347

The Lunar Simulant Curator will assure that all necessary demonstration tests with simulated lunar materials have been satisfactorily completed. Requests determined to be sufficiently mature to warrant consideration for use of lunar materials will then be forwarded to the Lunar Sample Curator.

For new investigators, tangible evidence of favorable peer review (step A) should be attached to the sample request. Each new investigator should also submit a résumé.

Investigators proposing the application of new analytical methodologies (not previously applied to lunar samples) also should submit test data obtained for simulated lunar materials. New investigators who are not familiar with lunar materials should consult *Lunar Sourcebook: A User's Guide to the Moon* (G. Heiken, D. Vaniman, and B. M. French, Eds.; Cambridge University Press, 736 pp.; 1991; ISBN 0-521-33444-6) as the best available reference on the chemical and physical properties of lunar materials.

Investigators with access to the World Wide Web on the Internet also can find updated information at the following URL: http://www-sn.jsc.nasa.gov/curator/curator.htm. The home page cited above provides links to sample databases and other information of use to sample requestors.

C. The Lunar Sample Curator will research the availability of the requested samples and decide whether a unilateral action can be taken or an outside scientific review is required. Outside review is prescribed for all new investigators and for most established investigators except where returned (previously used) samples are being requested. For outside review, the Curator forwards the original request, with background information, to the Curation and Analysis Planning Team for Extraterrestrial Materials (CAPTEM), a standing committee of scientists who advise NASA on the care and use of lunar samples. CAPTEM checks for favorable peer review (step A) and appropriate sample selection (step B).

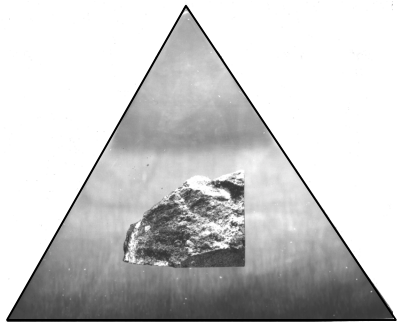
D. Given CAPTEM endorsement and concurrence by NASA Headquarters, the Lunar Sample Curator will prepare a Lunar Sample Loan Agreement for signature by the investigator's institution. The agreement includes a simple security plan that prescribes precautions to minimize prospects for theft or unauthorized use of lunar samples.

E. Upon receipt of the properly executed loan agreement, the Lunar Sample Curator prepares the authorized samples and sends them to the investigator. Quantities less than 10 grams can be sent directly by U.S. registered mail to domestic investigators. Shipments to foreign investigators are sent by U.S. diplomatic pouch mail to the American embassy nearest the requestor's location. Quantities larger than 10 grams must be hand-carried by the investigator or his/her representative.

F. Continuation as a Lunar Sample Investigator. An investigator's privilege for retention and use of lunar samples is contingent upon continued good standing with the Office of the Curator. The investigator will remain in good standing by fulfilling the following obligations: (1) Maintenance of, and adherence to, the lunar sample loan agreement and security plan; (2) Timely cooperation with annual lunar sample inventory; (3) Timely cooperation with sample recalls.

2. PUBLIC DISPLAY SAMPLES

NASA provides for a limited number of rock samples to be used for either short-term and long-term displays at museums, planetariums, expositions, or professional events that are open to the public.



Requests for such display samples are administratively handled by the JSC Public Affairs Office (PAO). Requestors located in the United States should apply in writing to the following address:

Mr. Boyd E. Mounce
Lunar Sample Specialist
AP4/Public Services Branch
NASA/Johnson Space Center
Houston, TX 77058-3696
Telephone: (281) 483-8623
Fax: (281) 483-4876

Mr. Mounce will advise successful applicants regarding provisions for receipt, display, and return of the samples. All loans will be preceded by a signed loan agreement executed between NASA and the requestor's organization. Mr. Mounce will coordinate the preparation of new display samples with the Lunar Sample Curator.

3. EDUCATIONAL SAMPLES (disks and educational thin sections)

A. Disks
Small samples of representative lunar rocks and soils, embedded in rugged acrylic disks suitable for classroom use, are made available for short-term loan to qualified school teachers. Each teacher must become a certified user of the disks through a brief training program prior to receiving a disk. Educational sample disks are distributed on a regional basis from NASA field centers located across the United States. For further details, prospective requestors should contact the nearest NASA facility as follows:

IF YOU LIVE IN:

Alaska	*Nevada*
Arizona	*Oregon*
California	*Utah*
Hawaii	*Washington*
Idaho	*Wyoming*
Montana	

NASA Teacher Resource Center
Mail Stop T12-A
NASA Ames Research Center
Moffett Field, CA 94035-1000
Phone: (415) 604-3574

IF YOU LIVE IN:

Connecticut	*New Hampshire*
Delaware	*New Jersey*
New York	*Maine*
Pennsylvania	*Maryland*
Rhode Island	*Massachusetts*
Vermont	
District of Columbia	

NASA Teacher Resource Laboratory
Mail Code 130.3
NASA Goddard Space Flight Center
Greenbelt, MD 20771-0001
Phone: (301) 286-8570

IF YOU LIVE IN:

Colorado	*North Dakota*
Kansas	*Oklahoma*
Nebraska	*South Dakota*
New Mexico	*Texas*

NASA Teacher Resource Room
Mail Code AP-4
NASA Johnson Space Center
Houston, TX 77058-3696
Phone: (281) 483-8696

IF YOU LIVE IN:
Florida
Georgia
Puerto Rico
Virgin Islands

NASA Educators Resource Laboratory
Mail Code ERL
NASA Kennedy Space Center
Kennedy Space Center, FL
32899-0001
Phone: (407) 867-4090

IF YOU LIVE IN:
Kentucky
North Carolina
South Carolina
Virginia
West Virginia

NASA Teacher Resource Center
for Langley Research Center
Virginia Air and Space Center
600 Settler's Landing Road
Hampton, VA 23669-4033
Phone: (804) 727-0900, ext. 757

IF YOU LIVE IN:

llinois	*Minnesota*
Indiana	*Ohio*
Michigan	*Wisconsin*

NASA Teacher Resource Center
Mail Stop 8-1
NASA Lewis Research Center
21000 Brookpark Road
Cleveland, OH 44135-3191
Phone: (216) 433-2017

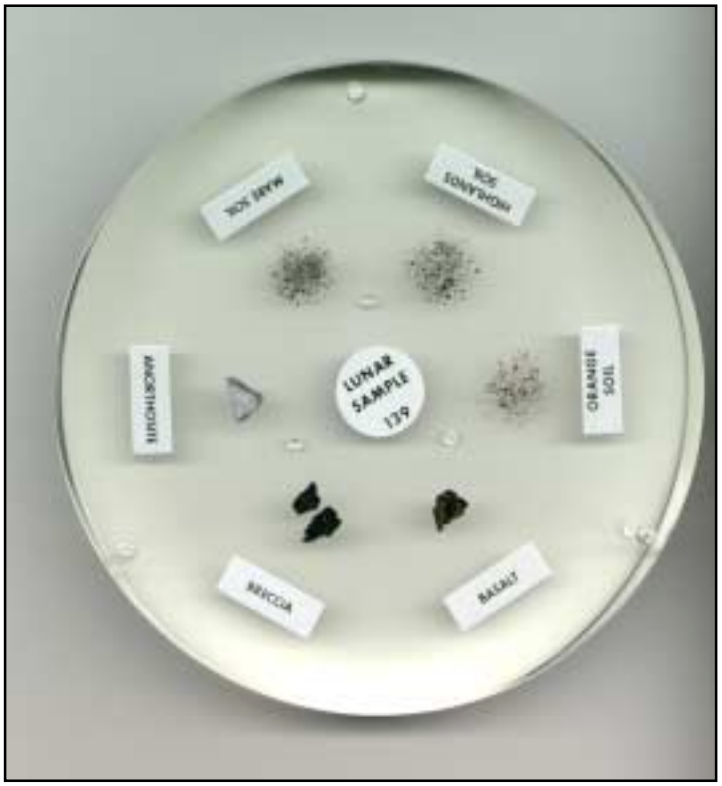
IF YOU LIVE IN:

Alabama	*Louisiana*
Arkansas	*Missouri*
Iowa	*Tennessee*

NASA Teacher Resource Center
for Marshall Space Flight Center
U.S. Space and Rocket Center
P.O. Box 070015
Huntsville, AL 35807-7015
Phone: (205) 544-5812

IF YOU LIVE IN:
Mississippi

NASA Teacher Resource Center
Building 1200
NASA John C. Stennis Space Center
Stennis Space Center, MS
39529-6000
Phone: (601) 688-3338



B. Thin Sections
NASA prepared thin sections of representative lunar rocks on rectangular 1 x 2-inch glass slides, with special safety frames, that are suitable for use in college and university courses in petrology and microscopic petrography for advanced geology students. Each set of 12 slides is accompanied by a sample disk (described above) and teaching materials. The typical loan period is two weeks, including round-trip shipping time. Each requestor must apply in writing, on college or university letterhead, to the following address:

SN2/Lunar Sample Curator
NASA/Johnson Space Center
Houston, TX 77058-3696
Telephone: (281) 483-6187
Fax: (281) 483-5347

For each approved user, the Curator will prepare a loan agreement to be executed between NASA and the requestor's institution prior to shipment of the thin-section package. ❑

Lunar Sample Investigators

As part of our efforts to improve the curation, processing, and distribution of lunar samples, we are asking for your evaluation. Please take a few minutes to rate our service on your sample requests and mail, fax, or e-mail your response. We particularly appreciate specific comments and recommendations for improvement.

Please be aware that the Lunar Sample Curator and the Curation and Analysis Planning Team for Extraterrestrial Materials (CAPTEM) subject all requests to careful review. The Curator has authority to allocate some samples directly, while the final approval on other requests rests with CAPTEM.

If you have specific questions concerning lunar samples please check our Web site:
<http://curator.jsc.nasa.gov/>
or contact us directly.

Carlton Allen, Astromaterials Curator
NASA Johnson Space Center
Houston, TX 77058
281-483-5126/fax: 281-483-5347
carlton.c.allen1@jsc.nasa.gov

Gary Lofgren, Lunar Sample Curator
NASA Johnson Space Center
Houston, TX 77058
281-483-6187/fax: 281-483-5347
gary.e.lofgren1@jsc.nasa.gov

Questionnaire

Check one each of the following: (1 = Not satisfactory; 5 = Superior)

Questions	1	2	3	4	5
Sample Request Process					
Was your sample request acknowledged promptly?					
Did the sample(s) selected satisfy your request?					
Was your allocation processed and shipped expediently?					
Were you notified of any delays (i.e., recalled samples)?					
Were your samples packaged and shipped properly?					
Was your paperwork handled properly?					
Interaction with Curator					
Were scientific issues concerning your request handled adequately?					
Was your correspondence handled expediently?					
Were all issues concerning your samples resolved?					
Interaction with Processors					
Was your correspondence handled efficiently?					
If you came to the lunar laboratory to examine samples, was the processing handled adequately and professionally?					
Were the processors knowledgeable about the issues of your samples?					
Were all issues concerning your samples resolved?					
International PI's only					
Were you notified upon the arrival of your samples in your country?					
Overall Rating of the Process					

Comments:

_____
_____
_____
_____
_____
_____

Name

_____

E-mail

_____

Sample request date

_____