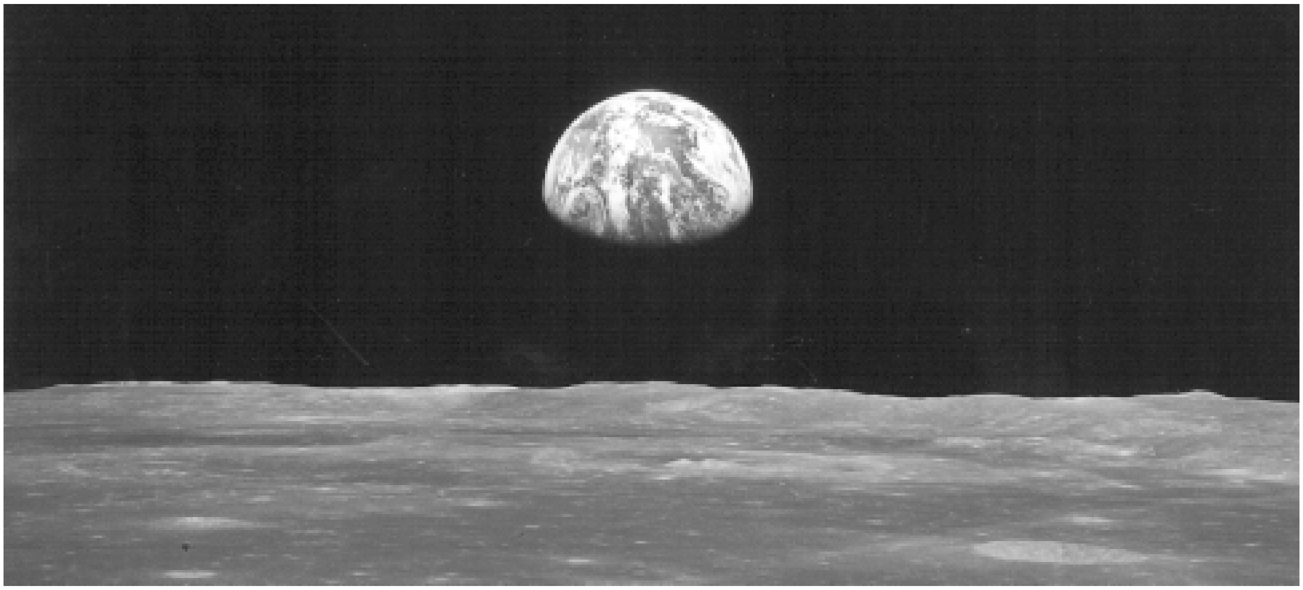
LUNAR *NEWS*

No. 64 December 1999



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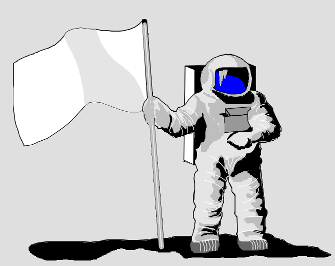

Lunar News Mission

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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New Chief Scientist

Carl B. Agee is the new Chief Scientist for Astromaterials and the Acting Astromaterials Curator at NASA Johnson Space Center (JSC). His major areas of interest are origin and evolution of solar system bodies with specific interests in astromaterials, high pressure mineral and magma physics, Materials science, curation and quarantine of extraterrestrial samples, and experimental petrology.

Carl received his B.A. with High Honors in Geology (1984) from the University of California at Berkeley. His honors thesis was “Experimental biotization of hornblende.” Attending Columbia University in New York City, NY, he received his M.A. (1986), M.Phil. (1988), and his Ph.D. (1988) in Geological Sciences. His dissertation was titled

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Curator's Comments

Gary Lofgren
NASA JSC

This has been a notable year that has seen the preparations for the next sample return mission. These preparations include the first ever modification of the lunar facility. The new facility includes 2 class 10 clean rooms that will be used to mount the sampling surfaces in the Genesis payload and then process the returned samples. These modifications have, however, delayed the current round of lunar sample allocations and, for that, we apologize. Those allocations are nearly complete.

Requests for lunar samples for scientific study remain strong. We have sent out 312 samples from the last round of allocations in March. Requests for lunar samples have taken a new turn. As we look forward to the return of samples from Mars, many questions have arisen about how to maintain the organic cleanliness of these samples. One test of the process is to determine how well we have maintained the organic cleanliness of existing lunar samples. We have allocated the first samples that will look at that issue. Note that the next round of sample requests are due in Houston on the 3rd of March, 2000 for the CAPTEM meeting later that same month. We are preparing lunar samples for long-term displays at the Western Australian Museum in Perth and the University of Colorado Heritage Center in Boulder. Because the demand for educational samples remains strong, we have prepared another 30 lunar disks, those plastic disks with several samples enclosed in them, for use by the various NASA centers for distribution to schools.

The second conference "New views of the Moon II, Understanding the Moon Through the Integration of Diverse Datasets" took place in Flagstaff, Arizona. This conference laid the groundwork for the analysis of the new data from the Prospector and Clementine Missions. Speaking of Prospector, the mission was completed July 31, 1999 with a final experiment, an attempt to record evidence for water vapor associated with the impact of the space craft near the south pole of the moon. The effort did not appear to be successful.

An Apollo 11 basalt was presented to the White House for long term display by the Apollo 11 Crew, Neil Armstrong, Buzz Aldrin, and Mike Collins on July 20th as part of the 30th anniversary celebration of the mission. As part of the 30th anniversary we have been busy in the laboratory showing off the moon rocks to the interested media who have been filming material for a number of programs. Many of these programs are more than news releases and you may see them on the more science oriented networks in the future.

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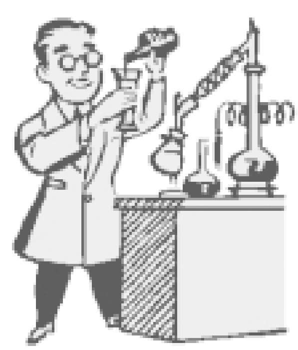
"Experimental phase density and mass balance constraints on early differentiation of chondritic mantle." He served as a visiting scientist at Bayerisches Geoinstitut from 1988-1990, as a faculty member at Harvard University from 1990-1998 and is presently a Senior Staff member at JSC. He Co-Chaired the Lunar and Planetary Science Conference in March 1999. Carl has received the F.W. Clarke Medal, "For original research on mantle differentiation," the John L. Loeb Associate Professor Endowment, the Milton Fund Research Award from Harvard University, and the P.H. Hearst Distinguished Lecturer Award at U.C. in Berkeley.

Carl has many professional memberships. Some of them include the Geochemical Society, the AGU service (member of Mineral and Rock Physics Committee 1996-2000) and Editor (Solid Earth and Planets) for Geophysical Research Letters 1997-2000.

Carl can be contacted by e-mail at carl.b.agee1@jsc.nasa.gov or by fax at 281-244-8892.



New Views of the Moon II

by Wendell Mendell
NASA-JSC

The planetary sample advisory committee to NASA, CAPTEM, has undertaken the Lunar Initiative, a project designed to refresh and revitalize lunar science studies. To this end, they have sponsored two workshops under the title, New Views of the Moon. The second workshop was held in Flagstaff, AZ, in late September, 1999. Its theme was Understanding the Moon Through the Integration of Diverse Datasets.

The return of lunar samples by the Apollo missions catalyzed the creation of the discipline of planetary science, in general, and lunar science, in particular. At the early Lunar Science Conferences, the sample investigators were kings. A decade later, the bloom of sample science had begun to fade and new infusions of information came from remote sensing, largely from observers on the Earth. These new kids on the block interpreted their observations in geologic terminology but used tools and techniques regarded with suspicion by the Old Ones. After all, a rock in the hand is worth a hundred at the end of a telescope.

The bulk of the remote observations come from the spectral analysis of sunlight reflected from the lunar surface in visible and near infrared wavelengths. The detected ensemble of reflected photons have touched surfaces only two or three grains deep on the Moon. Therefore, while such data can be collected from regions all over the planet, the information (like beauty) is only skin-deep. In recent years, remote observers have begun to appreciate the effects of in-situ surface coatings and surface alterations on grains, which can produce changes in spectra that would come from samples of pure minerals in the laboratory. Sample scientists have been wary of conclusions about lunar geochemical evolution based on such data.

At the Flagstaff workshop these two subcultures of lunar science engaged in a dialogue on the fundamentals of their research and thereby promoted a better understanding of the value and the limitations of their scientific models. Thrown into the mix were a smattering of geophysicists and Bill Feldman, the neutron spectrometer wizard from the Lunar Prospector team.

To the eye of this reporter, one of the most interesting aspects of the workshop was the education of Feldman on the idiosyncracies of the lunar regolith and the education of the other participants on the information content of the neutron data. For example, Feldman intended to register global iron maps of the Moon derived from neutron data with global iron maps derived by Paul Lucey from spectral data. Pam Clark pointed out (forcefully) that the two techniques measure iron resident in different settings in the soil. In addition, a complete explanation of the calibration of the Lucey algorithm revealed that the spectral detection of iron in crystal lattice sites is not the same as the bulk iron content of lunar soils used as the standard to interpret the spectral data quantitatively. (The correlation is actually better that one should expect.) Consequently, Feldman learned that differences between his maps and the Lucey maps could be information about the state of the iron in the soils rather than shortcomings of the neutron measurements.

Other interesting results were the detection of a small lunar core by two widely disparate techniques: analysis of gravity data derived from tracking Lunar Prospector and modeling of very long term laser ranging observations using Earth-based lasers to measure the distance to reflectors left on the Moon during Apollo. B. Ray Hawke determined that some crater rays result from deposition of bright highland material in the ejecta while others are caused by stirring of local material by ejecta. The two types of rays are expected to weather differently, raising questions about the validity of using ray disappearance as a uniform age measure in lunar stratigraphic classification. Graham Ryder eloquently pleaded for a rational and consistent nomenclature for lunar rocks. No one knew how to do that, so his plea was ignored. Finally, it became clear to all participants that the Moon is an exceedingly lumpy planet. The incredibly deep South Pole-Aitken basin was found by the Clementine mission. Now, Lunar Prospector's data reveal the Procellarum KREEP Terrane, an enormous radioactive "hot spot" in the northern hemisphere. Added to the well known nearside - farside dichotomy, these new findings place a stake in the heart of spherically symmetric evolution models of our neighboring planet.

The meeting was alive with burgeoning collaborations within and between the two scientific cultures. This series of workshops is clearly breathing new life into lunar science. Now, we just need a few more samples.......

Students at Madison High School Get a Glimpse of the Moon

At the invitation of Dr. Waltine Bourgeois, an overview of Lunar Sample Curation and "a glimpse of the Moon" were given to the magnet class students at Madison High School in Houston, Mr. Warner Ervin, principal. Andrea Mosie, a Senior Scientist for Lockheed Martin at NASA JSC, was the speaker for this presentation. During her presentation, Ms. Mosie exhibited laboratory photos and distributed handouts pertaining to Planetary Sample Curation. She highlighted her presentation with a viewing of an Apollo 16 lunar sample display, sample 60135,0. Her presentation was well received and she has been invited to return to share this informative and inspiring presentation with upcoming classes.

Andrea Mosie, far left, with several James Madison High School/Space & Meteorology Program students.

Employee Highlights

After moving from New Mexico to Texas, Alene Simmons began her career at JSC in 1970 working in the Curatorial Facility located in a trailer before the Sample Control Center was moved to Building 31. She has worked with seven Lunar Sample Curators and had seen numerous changes in the procedures for shipping and accounting of Lunar Samples that are sent to Principal Investigators. Alene was employed with Northrop Services (presently Lockheed Martin acquired the contract). In 1978, she transferred out of the Curatorial Facility to take a Staff Assistant position. She returned to the Sample Information Center again in 1992 on a half-time basis.

Alene was born in Alamogordo, New Mexico to the parents, Reba and the late Ivan Andrews. She is married to Don Simmons and has one son Dwayne who is a nurse at Methodist Hospital.

Alene's knowledge of the Curation processes, hard work, and great effort is irreplaceable.

Hats off to Alene for a job well done!

Stepping Stones: JSC Astromaterials Team Prepares for the Future

By Nicole Cloutier

Reprinted from the July 30, 1999 JSC Roundup

Protected by more than 18 inches of concrete and steel, a motion detector system and sound-build-up alarm quietly resides the country's moon, meteorite, and cosmic dust samples in JSC's curation facility. But inside those reinforced walls, researchers and acclaimed scientists are piecing together the solar system's history bit-by-bit, while preparing to make some history of their own.

"Being NASA's home of extraterrestrial materials makes us a unique facility," said Dr. Carl Agee, chief scientist for astromaterials. "But the continued work here has prepared us for making history again — by receiving the samples that will be brought back from Mars in 2008."

A visitor's scan across the JSC campus would hardly suggest that one of our national treasures is neatly tucked away in Bldg. 31N. But there, the Lunar Sample Laboratory Facility houses the more than 842 pounds of lunar rocks, core samples and soils gathered during six Apollo lunar landings, plus a small amount (3/4 of a pound) from unmanned Soviet missions. Although the samples were collected more than 27 years ago, nearly 1,000 samples are distributed each year for continuing research and teaching projects.

Improvements in research technology along with fresh theories from budding researchers allow scientists to revisit unanswered questions and pursue new ones.

"Lunar sample research is not complete by any means — it is alive and well," said Andrea Mosie, a senior scientist for Lockheed Martin at JSC. "People sometimes visit the facility expecting to find a museum, but it's not. It is a working lab with research continuing everyday."

Mosie celebrated more than 24 years with the facility in June and provides an invaluable "corporate memory" for the center. Others like her make up the lunar sample team, which experiences low turnover. Lunar sample processor Linda Watts similarly is a 23-year veteran of the team, and Dr. Gary Lofgren, head curator for the Lunar Sample Facility, has been on staff since 1968.

"It's a rare find in itself," said Dr. Agee of the wealth of experience among the astromaterials team and the Planetary Sciences Branch of SN. After 8 years as an Earth and planetary sciences professor at Harvard, Dr. Agee joined JSC Director George Abbey's senior staff in August 1998 to lead the center's astromaterials research and to prepare facilities for Mars sample return. "The amount of enthusiasm and involvement from colleagues here at JSC, all working towards this common goal, all with lots of new ideas and approaches, makes for a very stimulating environment."

The goal Dr. Agee refers to is NASA's forthcoming missions to Mars for sample retrievals.

Although sample return missions aren't planned to visit the Red Planet until 2003, and a second in 2005, discussions are already under way about facilities needed to accommodate the samples once they arrive.

Compared with the lunar sample facility, which is a model laboratory, Mars presents many new issues to contend with.

"The lunar facility has turned out to be a wonderful stepping-stone for preparing us for the Mars samples," said Dr. Lofgren. "But the Mars samples will bring new challenges for clean room and laboratory processes, which is what we are working on now."

The lunar facilities, regarded as a level 1000 clean room, require researchers to gear up with full-coverage smocks ("bunny suits"), caps and gloves and undergo an "air shower" before entering the 'pristine' laboratory. The samples are additionally contained in nitrogen-filled glove box cabinets. Samples are loaned out for external research, but only about 10 percent of the collection are considered compromised and are kept separated from the 'pristine' samples upon return.

All of these barriers are designed to protect the lunar samples from Earth oriented contaminants, but Mars samples will need two-way contamination control.

"We'll be investigating the Mars samples for life forms and organic compounds," said Dr. Lofgren. "This requires a new process to handle quarantine and analysis, both to protect the samples from Earth contaminants as well as protecting us from any unknown contaminants the samples might contain."

Reduced pressure, colder temperatures, and mimicking of a $C0_2$ rich environment are other facility issues still being considered.

The Mars samples will be coordinated in two separate phases: initial assessment, quarantine and analysis and then archiving, curation and distribution. Soon, NASA will assess various sites for these projects, including White Sands Test Facility, Ames Research Center and JSC. JSC's experience with the lunar samples uniquely positions it as a coordinating site for the Mars samples, but it may be more than a year before an official decision is made.

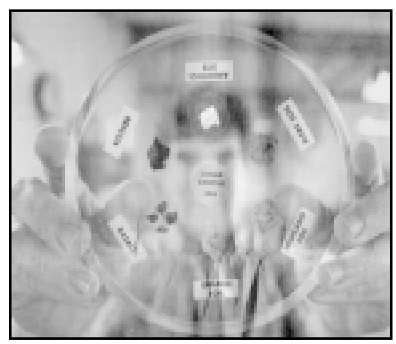
Meanwhile, under the leadership of team member Dr. Eileen Stansbery, construction is currently under way in Bldg. 31N for a new facility for the Genesis project. Nearing completion in July, this facility is located directly beneath the lunar lab and will house specimens from the Genesis discovery mission. Genesis is a three-year mission scheduled to depart in 2001. It will collect atoms from the sun's radiation onto silicon, diamond, aluminum, and gold wafers for analysis in the new lab upon return to Earth. This research will help understand our sun and the chemical make up of our solar system.

"All of the projects and research done at our astromaterials facility are aimed at understanding our solar system," explains Lofgren. "We're unraveling the stories of our universe piece by piece."

Thirty New Educational Disks

In October of 1998, thirty new lunar educational disks were produced under an agreement with NASA Headquarters for distribution as requested to the Educational Centers.

Andrea Mosie and Linda Watts worked many laboratory hours preparing the small samples of basalt, breccia, anorthosite, Highland soil, Mare soil, and orange soil for use in the new educational disks. Andrea and Linda carried the prepared samples to Clear Float, Inc. in



Mike George / The Sun Chronicle

Tim Murphy, president of Clear Float holds one of the educational discs his company makes for NASA.

South Attleboro, MA. Clear Float, a family owned and operated company, does excellent encapsulation work. Mrs. Jessie Murphy owns the company and her son, Tim, is the president.

The last of the previous 201

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Lab Tours

Above: Alan Ladwig, Assistant to the Chairman, and Lou Dobbs, Chairman of the Board of space.com and Gary Lofgren

Above: *Juanita Price, teacher; Clear Creek Independent School District 8th grade Honor Students from VITAL LIN Program; and Paula Thomas of Lockheed Martin*

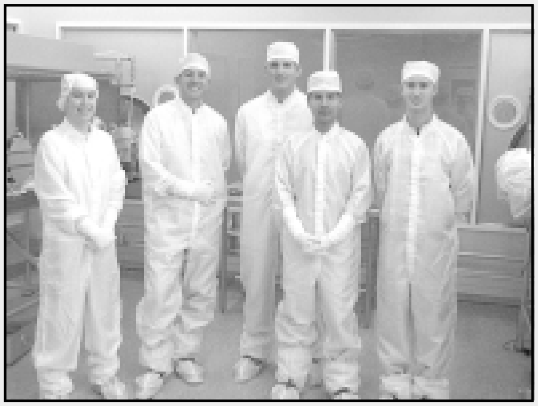
Above: *1999 Summer Teachers Group*

Above: *1999 ASCANS (Astronaut Candidates)*

Above: *Carl Agee; Dr. Paul Lucey, University of Hawaii at Manöa; and Gordon McKay*

Above: *Gary Lofgren; Jim Quick,USGS; and Gordon McKay*

Lab Tours



Above: *1999 JSC Summer Interns*

Above: *Gary Lofgren with 1999 LPI Summer Interns*

Above: *Carl Agee; Dave Williams; and Chief Scientist, Kathie Olsen*

Above: *Carl Agee; Reginald Beer (Robotics Specialist) and Kent Copeland of Oceaneering*

Above: *JSC Summer Co-ops and Interns*

Above: *Ray Beiersdorfer, Summer Faculty, Youngstown State University; James Randi, James Randi Educational Foundation; and Gary Lofgren*

Lab Tours

Above: *Astronaut and Assistant Director of University Research and Affairs, Bonnie Dunbar, and Carl Agee*

Above: *Comedian Penn Jiliette, of Penn & Teller, and Andrea Mosie*

Above: *1999 National Research Fellows — Melissa Lane, Markus Landgraf, Lovely Fotedar, Michael Kelley, Charley Adams, Dave Draper, Dimitri Xirouchakis, Alex Borisov, Takashi Mikochi, I-Ching Lin, and Tetsuya Kawata*

Above: *The Burkett-Lofgren family — Larry, Alison, Melanie, and Rachel Burkett; P.J. Burkett; and Gary Lofgren*

Above: *Cary Radoff, JSC PAO; White House Liaison, Leslie C. Tagg; and Marilyn Lindstrom*

Above: *Roberta Rudnick, Harvard University, and Carl Agee*

Lab Tours

Above: *Carl Agee; Eileen Hawley, PAO; Nicole Cloutier, JSC Roundup; and Barbara Zelon, PAO*

Above: *Anthony Desmond, PAO; Mrs. Rothenberg; Jean Pierre Pritchard; Dougie Alexander; and Gary Lofgren*

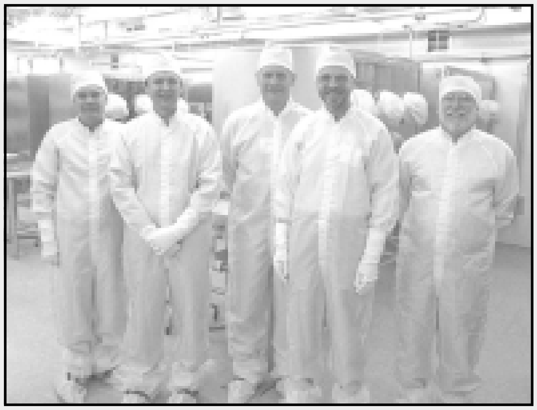
Above: *Gordon McKay; Jill Banfield, University of Wisconsin-Madison; Gary Lofgren; and Carl Agee*

Above: *Noreen N. Khan; Feliciz Conley; Dave Draper; TSU Professor, Bobby Wilson; Malinda Wilson; and Carl Agee*

Above: *Alene Simmons, Dwayne Simmons, and Mary Brennan*

Above: *Malinda Wilson; TSU Professor, Bobby Wilson; and Carol Schwarz*

Lab Tours



Above: *Don Bogard, Carl Agee, Gary Lofgren, Carl Pilcher from NASA headquarters, and Gordon McKay*

Above: *Anthony Desmond, PAO; John & Margaret Ingless; Heather Lawson; Gary Lofgren; and Alastair Campbell*

Above: *Andrea Mosie and José Alvarez*

Above: *David Draper and Julianne DiChiro of Compaq, California*

Above: *Ms. Bennie Smith of Partner Alliance Operating Services with Astronaut and Assistant Director of University Research and Affairs, Bonnie Dunbar*

Above: *Honorable Oliver Bateman, Former Georgia State Senator; Ms. Edna Bateman, Student, Macon, GA; Gary Lofgren; Mr. Dan Mitchell, retired Chief Pilot, Unocal Corp & Lifetime V.P. of HLS&R; and Mrs. Janette Zackery, wife of V.P. of Unocal Corp.*

Lunar Prospector's Mother Lode

By John E. Gruener
Hernandez Engineering

It's been a little over four months since the Lunar Prospector (LP) spacecraft was targeted into the lunar surface in one last hurrah for lunar science. It was hoped that the impact into a permanently shadowed crater near the moon's south pole (now to be named Shoemaker crater) might produce an observable signal proving that the hydrogen detected earlier by LP's neutron spectrometer was in water-ice form. Astronomical observations of the impact were focused primarily on using sensitive spectrometers tuned to look for the ultraviolet emission lines expected from the hydroxyl (OH) molecules that should be a by-product of any water vapor and dust kicked up by the crash of LP into the moon. Though given less than a 10% chance of success, LP's science team, and indeed people all around the world, held their breath at 09:52:02 GMT, July 31, 1999, and waited for some observatory somewhere to say it saw something, anything, but nothing was detected.

So, the question of ice on the moon is still open and it will be up to future lunar missions to resolve just what form the hydrogen concentrations are in. However, the assay of the 'mother lode' of science data that was collected by Prospector during its 18 months in lunar orbit is only beginning. On November 1, 1999, the LP science team began the Numerical Reduction and Analysis of Lunar Prospector Data Program. This NASA-funded program will result in the delivery of numerically reduced, higher level science data products of the LP mission to the Planetary Data System (PDS). The PDS is then responsible for delivering the data to the National Space Science Data Center (NSSDC). Unfortunately, however, due to budget shortcomings, not all of the data acquired by LP will be reduced in this program. No data from the Alpha Particle Spectrometer (APS) will be reduced, and magnetic data from the Magnetometer/Electron Reflectometer (MAG/ER) will be not be reduced beyond level 2 (defined later in this article). The lunar gravity data collected from LP is being reduced separately at the Jet Propulsion Laboratory (JPL).

Below is a brief discussion of Lunar Prospector's higher level science data products and their scheduled delivery dates. A more detailed description can be found in the Lunar Prospector Numerical Reduced Data Management Plan.

The first delivery of higher level science data from the LP mission is scheduled to be delivered to PDS on Sep. 1, 2000. This will include level 2 data for the Gamma-ray spectrometer (GRS) and Neutron Spectrometer (NS). For the GRS, equal area (equivalent to 5° latitude by 5° longitude at the equator) maps of the absolute abundances of Th and K, and relative abundances of O, Si, Fe, Ti, Al, Ca, and Mg (mapped as the following ratios: Ti/Fe, Al/Fe, Ca/Fe, Si/Fe, Ca/O, Si/O, and Mg/O) will be delivered. For the NS, 5° x 5° equal area maps of the thermal, epithermal, and fast neutron fluxes at 100 km altitude will be delivered. Fast neutron flux energy spectra between 0.5 and 8 MeV will also be generated for each equivalent equatorial-area pixel.

Level 2 MAG/ER data, scheduled to be delivered Oct. 31, 2000 will consist of selected MAG time series lunar magnetic field data in selenocentric east, north, and radial coordinates (spacecraft event time, latitude, longitude, and altitude are included in the data file). Also included will be ER time series of electron loss cone angles when the moon is in the geotail (but outside of the current sheet), with an electron reflection coefficient map binned at 5° x 5°

resolution, covering as much of the moon as the sampling allows.

Level 3 data products, scheduled to be delivered June 30, 2001, will consist of 5° x 5° equal area maps of the absolute abundances (along with their 1-sigma uncertainties) for the elements Th, K, U, Fe, Ti, Si, O, Al, Ca, and Mg. Also included will be 5° x 5° equal area maps of H, Gd, and Sm abundances (in ppm by weight).

Level 4 data products, scheduled to be delivered Oct. 31, 2001, will consist of 2° x 2° equal area maps of Th, K, and H abundances, as well as the ratio of Ti to Fe abundances. Also, neutron data measured at all altitudes between about 15 and 150 km will be combined to estimate the subsurface (about 5 cm below the surface) temperature of the moon in each 5° x 5° equal-area pixel element.

It should be stressed that the Numerical Reduction and Analysis of Lunar Prospector Data Program is quite necessary and has to be done so that LP's vast amount of data can be put in a usable form for the lunar science community at large. Hopefully, additional resources will be found in the future to enable the reduction of the alpha particle spectrometer data and further the analysis of the magnetometer/electron reflectometer data. It would be an awful waste to spend such an effort and amount of time to collect data important to lunar science and then do nothing with it.

"Not So Pristine" Samples Useful

By Judy Allton

The wisdom of carefully curating all lunar samples, even those crumbs from equipment and dust from spacesuits, is paying off. Among the lunar collection are samples useful for distinguishing contamination resulting from surface sample collection from curatorial sample handling. Ranging from the very clean to the "not so clean," are the following kinds of samples:

1) A clean sample, uncontaminated by astronauts and uncontaminated by curation: Samples extracted from the chemically pure dissection pass of a 4-cm diameter core meet this requirement. The ideal core sample is one which was returned to Earth in a sealed ALSRC and from a sample vial not further allocated or handled since dissection.
2) Sample exposed to minimal contamination by astronauts: SESC (Space Environment Sample Containers – indium-sealed cans). One SESC sample was opened and subdivided in the University of California at Berkeley organically clean cabinet.
3) A sample exposed to contamination during collection, but little handled during curation: Fines from ALSRCs (rock boxes) and from Tote Bags or Sample Collection Bags (which were returned outside of an ALSRC) are candidates, if samples are selected based on minimal subsequent handling in laboratory.
4) Lunar material expected to be heavily contaminated by surface activities and LRL processing: samples from vacuuming of space suits and freon rinsing of flight hardware.
5) Material expected to be heavily contaminated from curation handling: cabinet sweepings.
6) Sample especially handled for organic cleanliness: organic reserve or University of California at Berkeley prepared samples.
7) Sample uncontaminated by astronauts and with limited exposure to laboratory handling: band saw fines.
8) Sample stored frozen.
9) Sample stored in air for extensive time (returned sample vault). A band saw fines sample from category 7 may meet this requirement, if stored for 20+ years.

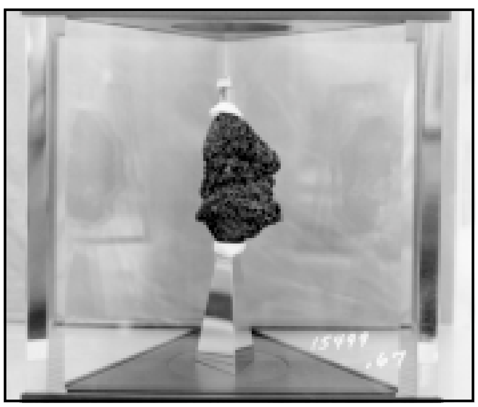
The Curators of the lunar sample collection are working to establish a reference suite of samples for organic and bioanalyses. Complementary data obtained with an appropriate suite of analytical methods on the same samples will be informative. Firm sample numbers are not currently available.

Lunar Sample Curator Celebrates Apollo 11 Anniversary in Washington, D.C.

By Linda Watts

An Apollo 11 vesicular basalt was presented to President Clinton in the oval office for a long-term display by the Apollo 11 Crew, Neil Armstrong, Buzz Aldrin and Mike Collins on July 20th as part of the 30th Anniversary celebration of the mission.

Dr. Gary Lofgren, Lunar Sample Curator, transported the display containing 10057,30 to Washington, D.C. He, with the display under his constant protection, accompanied the Apollo 11 crew to the 30th Anniversary ceremony at the Air and Space Museum. During this ceremony Vice President Gore presented Langley Medals to each of the Apollo 11 crew members. The Langley Medal was instituted at the suggestion of Alexander Graham Bell to honor Samuel P. Langley. The Medal is awarded for “meritorious investigations in connection with the science of aerodromics and its application to aviation.” Previous recipients include the Wright Brothers, Glenn Curtiss, Charles Lindbergh, Robert Goddard and Wernher von Braun.



After the Air and Space Museum ceremony, Dr. Lofgren entered the White House with the Apollo 11 crew. In the Oval Office the crew presented the lunar sample display to President Clinton. The President was reported to be enthused about receiving the sample on behalf of the White House.

Dr. Lofgren had many interesting experiences while accompanying the crew in Washington, DC.

After the White House ceremony, Buzz Aldrin flew to Chicago for another anniversary ceremony. He spoke at the dedication of The Chicago Tribune’s new Apollo 11 exhibit. The central item in the exhibit is another long-term lunar sample display provided by the Curator and his staff.

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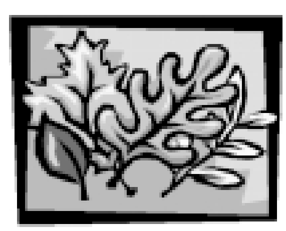
lunar educational disks were prepared at Clear Float in 1979. All of the workers who had assisted previously with the lunar samples are no longer there except for Erna Gomez. She prepared and packaged the completed products for shipment to JSC.

With the competent help of Clear Float’s staff, Karen Owens and Chris Salvas, the process of preparing the disks began. Andrea and Linda carefully placed each sample into a mold that was partially filled with acrylic. Each sample mold was annotated as to sample type and sample number. Then, the samples were covered with acrylic and placed in an oven to cure. The six different singularly encapsulated samples, disk number tags, and sample type tags were the placed into the 6-inch molds using the same procedure as before. After the disks were cured, they were polished to a fine finish by Clear Float’s Wayne Hazerty.

The trip was a pleasant experience due to our Lockheed Martin secretary, Helen Klyng, Clear Float’s office manger, Cathy Gadoury, and all of the friendly and helpful people of Clear Float. The wonderful scenery with the trees in beautiful Fall colors also added tremendously to the trip.



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 Cura-

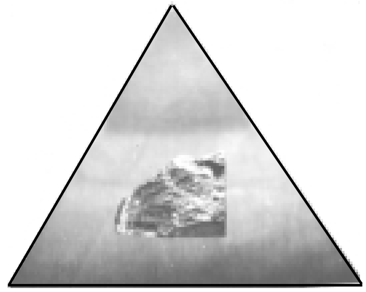
tor will prepare a Lunar Sample Loan Agreement for signature by the investigator's institution. The agreement includes a simple security plan that prescribes precautions to minimize prospects for theft or unauthorized use of lunar samples.

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, Arizona, California, Hawaii, Idaho, Montana, Nevada, Oregon, Utah, Washington, Wyoming

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

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, Kansas, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, 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 Laborarory
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 x757

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

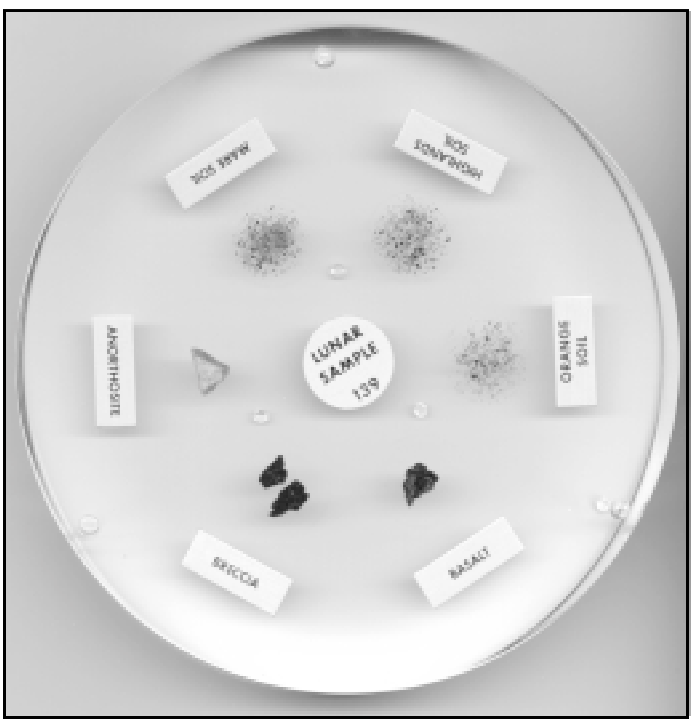
IF YOU LIVE IN:

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. ❑