UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Center of Astrogeology
601 East Cedar Avenue
Flagstaff, Arizona 86001

March 29, 1968

Memorandum

To : Assistant Chief Geologist for Engineering Geology

From : Deputy Assistant Chief Geologist for Astrogeology

Subject: Monthly report for Director and Secretary

HIGHLIGHTS AND NOTEWORTHY RESULTS

Astrogeologic Studies Branch

Lunar and Planetary Geologic Mapping

R. E. Eggleton and E. I. Smith report that in Rümker quadrangle 54 craters on the mare apparently were formed on a single nearly flat surface and then flooded to a nearly constant depth. Assuming that all of the craters originally had approximately the same ratio of rim height to diameter, the rims of small craters are relatively more buried after flooding. It was observed that those smaller than a critical size (1 or 2 km diameter) are completely inundated. The surface of the covering sheet inside all the 27 inundated craters near the critical size is substantially depressed. This may suggest deflation and compaction like that which occurs during welding in terrestrial ash-flow deposits. It is concluded that much of the mare area here is covered by an ash flow sheet about 50 to 100 m thick, or by several localized sheets of this thickness.

Surveyor Television Investigations

A geologic map at a scale of 1:19,000 of the Surveyor VII landing site on the rim of Tycho has been prepared by E. M. Shoemaker and E. C. Morris. The map includes an area 64 km^2 around the landing site. Several of the geologic units shown on the map are visible from the Surveyor VII camera.

The rim of Tycho is composed of ejected debris and a sequence of flows which range from those that appear to have been emplaced as highly viscous, steep fronted flows to very fluid low viscosity smooth surface flows that have collected on the floors of closed depressions.

The Surveyor VII pictures show a great variety of rock fragments scattered about on the surface of the landing site. Some of these fragments contain vesicles, and others contain bright spots of various sizes and shapes, some of which may be resolvable crystals. Most fragments appear to be dense, coherent rock, but some appear less dense and porous.

Preliminary photometric measurements have been made from the Surveyor VII television pictures in the lunar highlands about 30 km north of the crater Tycho. Photometric measurements were obtained from the undisturbed lunar surface, the fine-grained material disturbed or ejected by the spacecraft footpads and the surface sampler, and from several rocks. These photometric measurements are estimated to be accurate within one-tenth of the true values.

The estimated normal luminance factor (normal albedo) of the undisturbed fine-grained surface material near the space craft is 13.4 percent while the rock fragments scattered over the nearby lunar surface have estimated normal luminance factors ranging from 14 to 22 percent. In contrast to the maria landing sites, many of the rock fragments are difficult to distinguish near zero phase angle because a very small difference between the reflectance from the fine-grained surface and many of the rocks. The ranges of normal luminance factors of rocks in the Surveyor VII and in the maria areas are very similar, but the Surveyor VII fine-grained material has nearly twice the luminance of the fine-grained material of the landing areas in the maria. However, the photometric function of selected fine-grained areas around Surveyor VII was sampled at 10 different sun angles and the resulting normalized function is similar to the normalized photometric function observed at other Surveyor landing sites.

The debris ejected by the spacecraft footpads is noticeably darker than the undisturbed surface and the normal luminance factor is estimated to be 9.6 percent. The fine-grained material dug up by the surface sampler apparatus also has an estimated normal luminance factor of about 9.6 percent. The ratio of the darker disturbed material to the undisturbed material near Tycho (1.39) is very similar to ratios observed on the maria at the Surveyor I (1.33) and VI (1.35) landing sites. Apparently, the lunar surface environment can produce similar optical effects on fine-grained material derived from different rock types much like earth weathering processes produce similar soils over different rock types.

Lunar Engineering Geology

H. J. Moore has completed a review of Lunar Orbiter photographs as part of a study of boulder tracks and secondary impact craters. As a result of the review, the number of observed boulder tracks has increased from about 290 to nearly 400.

The next phase of the study of boulder tracks and secondary impact craters will include static bearing analysis of the boulders that produced the tracks and application of various low velocity impact theories to the secondary impact craters. Although precise results

on the mechanical properties may not result from the study, information on the minimum thickness of the lunar regolith will be obtained.

H. J. Moore reports that Gary Latham of Lamont Geological Observatory, Palisades, New York, obtained data on seismic disturbances generated by missile impact craters. As part of the experiment, eight craters were produced by chemical explosives at the impact site.

W. J. Rozema has computed power spectral density (P.S.D.) for two samples of terrestrial topography, for comparison with P.S.D. obtained previously for the Surveyor III crater. Results indicate that a portion of the Aberdeen Proving Ground, Maryland, is "rougher" than part of the Yuma Test Area, Arizona, which in turn, is "rougher" than the Surveyor III site within the frequency range affecting vehicle mobility.

S. E. Wilson has written a second Fortran program for obtaining data on terrain slope curvature from both contour maps and topographic profiles. Sampling of landscapes in Northern Arizona, Central Florida, and North Eastern Kentucky suggests the program detects real differences in contrasting topographic types.

R. J. Pike has begun an investigation of two terrain parameters, W. F. Wood's elevation: relief ratio, and A. N. Strahler's hypsometric integral. Preliminary results suggest that both parameters describe a similar topographic aspect.

Lunar and Planetary Physics

D. W. G. Arthur has completed measures of 30 tiepoints and 10 selenodetic controls on Orbiter IV high resolution photographs 114, 121, 126, 133, and 138. These photographs together constitute a test block (No. 133) which will be used to test the mathematical formulation and programming. Equally important is the use of the block to investigate the nature and magnitude of the errors of the photographs. While it is obvious that measures on the photographs must be adjusted and corrected to some extent, it is not clear how much must be done in order to obtain positions of acceptable precision. Experiments with block 133 should provide the required data.

The measures already reveal a shear-effect which causes the framelet edges to depart from perpendicularity to the edges of the register frame. The cause of this is not known, and the effect is not mentioned in the ACIC calibration results.

Cosmic Chemistry and Petrology

E. C. T. Chao started collaborative experiment with P. M. Bell of the Geophysical Laboratory, Carnegie Institution of Washington, Washington, D. C., on the annealing effects of feldspar glasses made above liquids temperatures at pressures from 5 to 45 kilobars. Three compositions of feldspar glasses were used: An_{20}, $An_{67.5}$, and Or_{96}.

Results of nearly 80 annealing runs show that the effect of annealing is strongest within the first 5 seconds of heating. Similar annealing experiments will be carried out on experimentally shock-produced plagioclase glasses and natural shock-produced feldspar glasses. It is hoped that the annealing experiments carried out between 400 and 825°C would establish some correlation between statically and dynamically formed dense glasses; and that an estimate on the cooling rate would place limits on the minimum peak pressure experienced by the rock containing the dense thetomorphic feldspar glass.

O. B. James has made a detailed petrographic examination of chain silicate minerals from shocked samples of amphibolite, gabbro, and diorite from the Ries impact structure. The most prevalent shock effect in amphibole and clinopyroxene at low shock pressures is fine lamellar mechanical twinning. Preliminary U-stage and spindle stage work indicates that the composition plane of the twinning is most commonly (001). At higher shock pressures the chain silicate grains are fragmented and typically exhibit chemical alteration (possibly oxidation), lowered birefringence, and fine mosaic structure.

Analysis (major elements and 20 trace elements) of 18 selected specimens of old granite from Vredefort Formation, Transvaal, South Africa, have been completed for H. G. Wilshire.

Specifications for the new ultraclean laboratory in Washington, D. C., have been sent out and bids will be opened on April 10, 1968. Renovation of the space prior to construction of the ultraclean laboratory has been initiated by the General Services Administration.

Impact Investigations

D. J. Atkinson has continued work on the origin and significance of shatter cones, most effort being devoted to completing a review of the literature. He has devised an alternative method of assessing the degree of fit of reoriented shatter cones to a central focus, different from that used for the data from Vredefort and Sierra Madera. Preliminary microscope studies of sandstone shatter cones from the Sierra Madera structure (thin sections SM-DC-17, 30, 31, 32, 33, 34, 35, 52A, 52B) proved very difficult as the orientation of the sections relative to the cone's geometry is not clear, and in most of them the position of the trace of the cone's surface is not precisely known. However, there is a suggestion that microfractures are more abundant in grains close to the surface of the cones and that careful U-stage work might indicate whether the fractures bounding the cones involved failure in extension or in shear. A detailed study of shatter cones in situ is necessary to collect oriented samples for careful sectioning, preserving the material just outside and inside the cone boundary.

Engineering Research and Support

During the period in which photoclinometry data tape errors are being isolated, the Joyce-Loebl microdensitometer has been used to generate four-color isodensitracer plots of (1) Gemini color photograph, (2) six-inch focal length aerial color photography, (3) slide mounted rock thin sections. This is an exploratory effort to see of what use isodensitracer plots can be in various kinds of image analysis.

The Aristarchus crater map at 1:100,000 scale with 180 meter contour interval has been completed. This is the first reasonably reliable lunar topographic map we have compiled from Lunar Orbiter photography.

In photoclinometry, the first slope data reduced by use of the Langley (Taylor-lambiotte) photoclinometry program are becoming available. These data were turned over to the trafficability project for power spectral density analysis late in the month.

Surface Planetary Exploration Branch

Apollo Investigations

A major review of the Apollo Lunar Geology Experiment was held in Flagstaff, Arizona. Members of the investigator team present included Principal Investigator, E. M. Shoemaker, Center of Astrogeology, Flagstaff, Arizona, and Co-investigators: G. A. Swann and M. H. Hait, Jr., Center of Astrogeology, Flagstaff, Arizona, J. Hoover Mackin, University of Texas, Austin, Texas, Edwin N. Goddard, University of Michigan, Ann Arbor, Michigan, Ted H. Foss and Harrison H. Schmitt, NASA, Manned Spacecraft Center, Houston, Texas. Other attendees included members of the Center of Astrogeology and representatives from Manned Spacecraft Center, Houston, Texas, NASA Headquarters, Washington, D. C., Bellcomm, Inc., Washington, D. C., and Marshall Space Flight Center, Huntsville, Alabama. The meeting had two prime objectives: first, to conduct a comprehensive review of the experiment and the necessary background information and, second, to review and complete for the National Aeronautics and Space Administration the Definitive Experiment Plan which defines all the operational requirements of the experiment.

The meeting included discussion of all the topics important to planning and implementing the geologic parts of the main phases of Apollo missions: Pre-flight preparation, lunar surface operations, and Post-flight analysis. The following outline of topics indicates the scope of the meeting and the breadth of the Lunar Geology Experiment:

Apollo landing sites

Site selection (Harold Masurksy)
Small scale geologic maps (L. C. Rowan)
Large scale geologic maps (N. J. Trask)

Detailed problems of lunar maria

General geologic features and origin of maria (J. F. McCauley)
Details of Surveyor sites (E. M. Shoemaker)
Polarimetry and photometry of Surveyor sites (H. E. Holt)

Apollo mission profile

Summary of the lunar surface mission--detail description of operational and scientific activities on the lunar surface (H. H. Schmitt)

Demonstration of Apollo lunar hand tools

Hand tools, sample bags, sample return container(M. H. Hait, Jr.)
Stereo and other photograph techniques (R. M. Batson)

Film and television cameras

Apollo TV camera (G. A. Swann)
Hasselblad camera (W. T. Borgeson)

Data reduction of Hasselblad photos
  Photogrammetry (R. M. Batson)
  Photometry (H. E. Holt)
  Interpretation (E. M. Shoemaker)
Time-sequence camera (M. H. Hait, Jr.)

Geologic field procedures, traverses, and traverse planning

Traverse planning
  Problem of locating Lunar Module (N. G. Bailey)
  Nominal vs. contingent traverses (J. M. M'Gonigle)
  Lunar Surface geologic maps (T. N. V. Karlstrom)
  Field geology guides (Ivo Lucchitta)
Traverse techniques (T. H. Foss)
Sampling (E. M. Shoemaker, J. H. Mackin)
Vision problems on lunar surface (K. V. Edmonds)

Field simulation of Apollo geologic traverse

Demonstration of simulated scientific support room, Mission Control Center, Houston, Texas, (D. L. Schleicher, D. H. Dahlem, N. G. Bailey, G. G. Schabler, R. L. Sutton, G. E. Ulrich)

Experiment requirements for preliminary sample examination

Activities of preliminary sample examination team (J. H. Mackin)
Stereo photography of returned samples (W. T. Borgeson)

Experiment requirements for astronaut time

Astronaut training (A. H. Chidester, T. H. Foss)
Astronaut debriefing (E. M. Shoemaker)

Data analysis and reports

Preliminary report, mission report, scientific papers (E. M. Shoemaker)

The Investigator Team succeeded, through resounding discussions, in arriving at a consensus for the Definitive Experiment Plan so that the plan can be submitted to NASA for consideration and implementation.

W. T. Borgeson has tested preliminary alignment and calibration procedures for the Early Apollo Hasselblad camera, using the camera calibrator at the U.S. Geological Survey, Branch of Research and Design, McLean, Virginia.

The film magazine obstructed the line of sight required for the standard procedure for alignment by auto collimation, and it will be necessary to make a mirror attachment for the calibrator to overcome this difficulty. No other difficulties are anticipated in the calibration of these cameras by standard methods.

Post-Apollo Investigations

Results of a detailed gravity survey at Odessa Crater, Odessa, Texas, show a gravity low of about .2 milligal centered over the crater. After reducing the data to take into account the density contrast between the sand that fills the crater and the surrounding rock, a residual high anomaly of about .2 milligal exists. This result was entirely unexpected and the cause is unknown.

The rubidium-vapor magnetometer mounted on the Explorer vehicle was tested in Hopi Buttes area. The results compare favorably with the hand-held fluxgate magnetometer and airborne magnetometer results.

Astronaut Training

R. L. Sutton and M. H. Hait, Jr., along with geologists from the Manned Spacecraft Center, Houston, Texas, visited Pisgah Crater, Nevada, to plan an astronaut training trip.

Geophysical Observatory

Large amplitude storm microseismic noise contined to require lower than normal gain settings.

The "trenching" nuclear explosion, Project Buggy, Nevada Test Site, Nevada, was recorded and is being studied.

Supporting Projects

Geomagnetic exploration with the Explorer

R. A. Mills, B J. Tinnin, and I. L Wiser participated in the geomagnetic field work conducted by H. L Krivoy in the Hopi Buttes area involving the Explorer vehicle.

This trip provided our first opportunity to field test modifications made to the magnetometer boom and to test drive the Explorer from the rear control station.

Magnetometer boom modifications consisted of relocating and offsetting the sensor head to maintain magnetic alignment of the head while traversing geographically laid out lines. Results obtained by Mr. Krivoy indicated this modification was successful.

Other problems involving the boom when used in a continuous moving traverse are dynamic in nature and concern the severe accelerations imposed on the tip of the structure. Even though the vehicle provides an extremely low pitch ride, it appears that some type of dampened suspension will be required on the boom mounting base.

The rear control station was used to operate the vehicle while backing through a complete recording traverse, traveling south while maintaining its north alignment, thus eliminating the wasted loop south to begin another traverse.

Operation of the rear control station was tested and evaluated by R. A. Mills, B. J. Tinnin, and I. L. Wiser during actual traverses. Minor changes are being made in the throttle response rate to smooth out the control.

As the rear station is all electric, it easily lends itself to remote radio control by plugging in a receiver in an outlet provided. This was also tested briefly in the Hopi Buttes area.

Work continues on the Astrogeologic Data Facility (ADF) trailer vans with one nearing completion. Estimate of completion for both trailers is approximately May 15, 1968.

Various television and instrument console mounts and related devices designed by J. C. Nuttall were constructed for the Astrogeologic Data Facility during the month.

Film Documentation Unit

The Film Documentation Unit has completed the color-sound motion picture "Early Apollo Test Number 13." This film documents a test conducted in late 1967 at the Cinder Lake area, near Flagstaff, Arizona. Two suited test subjects conducted geologic traverses carrying maps and photographs in order to define graphic aid criteria for lunar exploration. The film also documents the building of the crater field on which the test was conducted, describes graphic aids, results of test, and suggestions for lunar use. The running time of the film is 12 minutes, forty seconds.

SIGNIFICANT CHANGES IN CONTINUING PROJECTS

Astrogeologic Studies Branch

Lunar and planetary physics

R. L. Wildey has completed theoretical derivation of a possible short cut to conclusion of the lunar polarimetry project. If one places a Ronchi ruling against a photographic emulsion, for astrophotography, wherein the spatial frequency corresponding to the ruling interval is at least twice the highest spatial frequency passed by the atmosphere, the optically obtained Fourier transform will be modified in the sense that the spatial picture spectrum will be found not only at the optic axis, but reproduced intact at every spatial harmonic of the ruling interval, and without overlap. This follows from the fact that the original picture, thought of as a function of two coordinates, is replaced by the product of that function and a periodic sampling function whose argument is a controllable linear combination of the two coordinates. The Fourier transform of the product of the two functions is thus the convolution of the separate Fourier transforms. Assuming the Moon has the reasonable degeneracy in Stokes parameters whereby the position angle of maximum polarization is always either parallel or perpendicular to the phase plane, one can produce a color image in which color is in a one to one correspondence with percentage polarization. If a polarizer is placed in front of the aforementioned ruling, two separate images can be recorded on the same plate, one with the plane of polarization perpendicular and one parallel to the phase plane. For each the Ronchi ruling is of sufficiently different position angle that the picture-transforms at the first harmonics are separated. Diaphragms can then be used to capture an image of one polarization in red light and the other in blue light. A series of step wedges turned end-for-end between changes of ruling orientations provides percentage polarization versus intensity and color.

Although the practical limitations require laboratory study, now underway, one obvious advantage lies in the cancellation of all errors due to emulsion non-uniformity.

INFORMAL PUBLICATIONS

Karlstrom, T. N. V., McCauley, J. F., and Swann, G. A., 1968, Preliminary exploration plan of the Marius Hills region of the Moon: U.S. Geol. Survey Interagency Report: Astrogeology 5, 42 p., 3 pls., 3 figs. (approved for open-file release 3-15-68).

Moore, H. J., Kachadoorian, Reuben, and McCauley, J. F., 1968, Imagery of craters produced by missile impacts: U.S. Geol. Survey Interagency Report: NASA-103, 38 p., 17 figs. (approved for open-file release (4-1-68).

OUTSIDE PUBLICAIONS

Moore, H. J., 1968, Ranger VIII and gravity scaling of lunar craters: Science, v. 159, no. 3812, p. 333-334.

PERSONNEL CHANGES

Office of the Deputy Assistant Chief Geologist

Joseph L. Remy, Messenger, entered on duty, Flagstaff, Arizona
Phyllis L. Newman, Clerk-Typist, resigned, Flagstaff, Arizona

Astrogeologic Studies Branch

Earl F. Kiernan, Electronic Engineer, terminated, Flagstaff, Arizona
George B. Mangan, Physical Science Technician, entered on duty, Washington, D. C.
Linnea P. Wardwell, Physical Science Technician, resigned, Washington, D. C.

Surface Planetary Exploration Branch

Irene K. Alcott, Physical Science Aid, resigned, Flagstaff, Arizona
Henry C. Blee, Physical Science Aid, entered on duty, Flagstaff, Arizona
David M. Kieffer, Physical Science Technician, resigned, Tucson, Arizona

CONFERENCES AND SCIENTIFIC MEETINGS ATTENDED AT HOME OR ABROAD

E. M. Shoemaker participated in the Lunar and Planetary Missions Board Meeting held in Flagstaff, Arizona.

G. A. Swann attended the Fifth Lunar Surface Operations Meeting at Manned Spacecraft Center, Houston, Texas.

Kenna V. Edmonds attended the Sixth Annual Meeting of the Working Group on Extraterrestrial Resources at Brooks Air Force Base, Texas.

W. T. Borgeson went to Washington, D. C., March 11-15, 1968, to collaborate with the McLean Research Center of the Topographic Division to develop a method of calibrating the Apollo Hasselblad camera.

CONFERENCES AND SCIENTIFIC MEETINGS ATTENDED AT HOME OR ABROAD (cont.)

R. M. Batson, W. T. Borgeson, and Raymond Jordan attended the combined meetings of the American Society of Photogrammetry and the American Congress on Surveying and Mapping, Washington, D. C.

TALKS OR PAPERS PRESENTED AT MEETINGS

Speaker and organization	Subject
R. M. Batson and Raymond Jordan, Annual Meeting of the American Society of Photogrammetry, Washington, D. C.	Topography of the Surveyor V Landing Site
E. C. T. Chao Department of Geology Yale University New Haven, Connecticut	The interpretation of shock features in rock-forming minerals
E. M. Shoemaker Argonne National Laboratory Argonne, Illinois	The Lunar Regolith
E. M. Shoemaker National Association of Geology Teachers, Chico State College Chico, California	The Lunar Regolith
Harold Masursky American Association of Petroleum Geologists, Distinguished Lecturer, University of North Carolina, Chapel Hill, North Carolina Shreveport Geological Society, Shreveport, Louisiana Lafayette Geological Society, Lafayette, Louisiana New Orleans Geological Society, New Orleans, Louisiana Lousiana State University, Baton Rouge, Louisiana Columbia University, New York, New York	Lunar Stratigraphy and Sedimentation
R. L. Sutton Flagstaff Optimist Group Flagstaff, Arizona	Preparations for Manned Exploration of the Moon

VISITORS

Visitors	Visited and Purpose
Lee R. Scherer, Jerry M. Goldberg, and John E. Greene, NASA Headquarters, Washington, D. C. John W. Small, NASA, Manned Spacecraft Center, Houston, Texas	A. H. Chidester, A. L. Brokaw, and Jerry Harbour--review the Center of Astrogeology activities
Hubert S. Skinner, National President Sigma Gamma Epsilon Earth Science Honorary Fraternity Tulane University New Orleans, Louisiana	Russell Wahmann--tour of Center of Astrogeology
James A. Burns, Richard E. Wong, and Bernard A. Pilon Bendix Aerospace Systems Ann Arbor, Michigan	A. L. Brokaw, A. H. Chidester, G. A. Swann--to discuss manned and unmanned lunar vehicles
T. H. Foss, H. H. Schmitt, R. A. Moke, N. C. Costes, V. L. Ettredge, R. G. Zedekar, M. C. McEwen, A. J. Calio, Elbert King, H. R. Greider, and W. K. Stevenson, NASA, Manned Spacecraft Center, Houston, Texas	Center of Astrogeology, Flagstaff, Arizona--to discuss Apollo Lunar Geology Experiment (Definitive Experiment Plan)
J. H. Mackin Department of Geology University of Texas Austin, Texas	" "
E. N. Goddard University of Michigan Ann Arbor, Michigan	" "
N. W. Hinners Bellcomm, Inc. Washington, D. C.	" "
D. A. Beattie, V. R. Wilmarth, Richard Green, and E. M. Davin, NASA Headquarters, Washington, D. C.	" "
James Mitchell University of California Berkeley, California	" "

VISITORS

Visitors	Visited and Purpose
Owen D. Minnick Philco-Ford SRS Division Palo Alto, California	H. J. Moore and T. L. Youd--to discuss mechanical properties of lunar surface
David Engelbert NASA/ARC Moffett Field, California	H. J. Moore and T. L. Youd--to discuss mechanical properties of lunar surface
Noel W. Hinners Bellcomm, Inc. Washington, D. C.	D. E. Wilhelms--to discuss scientific objectives of photography from a lunar-orbiting manned Command Module
John W. Dietrich NASA, Manned Spacecraft Center Houston, Texas	N. J. Trask and D. E. Wilhelms--to discuss astronaut training course and geologic mapping of Apollo sites.
Lee R. Scherer and John E. Greene NASA Headquarters Washington, D. C.	J. F. McCauley--to discuss aerial reconnaissance of San Francisco volcanic field
Dennis B. James Bellcomm, Inc. Washington, D. C.	J. F. McCauley--to discuss lunar geologic mapping and geology of San Francisco volcanic field
Otha Vaughn Marshall Spaceflight Center Huntsville, Alabama	L. C. Rowan, R. J. Pike, Jr., P. J. Cannon, and W. J. Rozema--to discuss lunar trafficability analysis.
Charles H. Tyler Computer Division Washington, D. C.	L. C. Rowan, R. J. Pike, Jr., P. J. Cannon--to discuss computer support for lunar trafficability.
Lee R. Scherer NASA Headquarters Washington, D. C.	L. C. Rowan, R. J. Pike, Jr., P. J. Cannon--to discuss lunar trafficability analysis and lunar terrain analysis.
William R. Greenwood NASA, Manned Spacecraft Center Houston, Texas	M. B. Duke and G. A. Sellers--to discuss mineral separation techniques for returned lunar samples
John G. Dennis Department of Geology California State College Long Beach, California	D. J. Milton--to discuss proposed structural studies in the Ries-Steinheim area.

VISITORS

Visitors	Visited and Purpose
A. L. Dilonardo, Assistant Chief Geologic Maps and Illustration Branch Publications Division Washington, D. C.	George W. Colton and Russell Wahmann--to expedite mapping processes
Jerry M. Goldberg NASA Headquarters Washington, D. C.	L. C. Rowan, R. J. Pike, Jr., and P. J. Cannon--to discuss computer support for lunar trafficability.

Alfred H. Chidester

LUNAR GEOLOGIC MAPS

REPORT FOR MONTH OF March 1968

Astrogeologic Studies Branch

			PRELIMINARY MAPS						FINAL MAPS							
	ACIC Bases Received	Author's Geological Work in Progress % Compl	Cartography - Scribing & Assembly in Progress	1st Composite Completed	1st Explanation Compl.	Map in Technical Review (Branch)	2nd Composite Completed	2nd Explanation Compl.	Geology Revision in Prog. % Completed	Cartography - Final Map Preparation	Map in Technical Review (Branch)	Authors' Revision in Progress, % Completed	Submitted to [illegible]	Director's Approval Received	Transmitted to BMR	Published
Equatorial Belt																
ARISTARCHUS LAC 39	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
BYRGIUS LAC 92	X	100	X	X	X	X	X	X	20							
CLEOMEDES LAC 44	X	100	X	X	X	X	X	X	100	X	X	90				
COLOMBO LAC 79	X	100	X	X	X	X	X	X	100	X	X	90				
COPERNICUS LAC 58	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
FRACASTORIUS LAC 97	X	100	X	X	X	X	X	X								
GRIMALDI LAC 74	X	100	X	X	X	X	X	X	40							
HEVELIUS LAC 56	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
JULIUS CAESAR LAC 60	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
KEPLER LAC 57	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
LANGRENUS LAC 80	X	100	X	X	X	X	X	X	50							
LETRONNE LAC 75	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
MACROBIUS LAC 43	X	100	X	X	X	X	X	X	100	X	X	90				
MARE HUMORUM LAC 93	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
MARE SERENITATIS LAC 42	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
MARE UNDARUM LAC 62	X	100	X	X	X	X	X	X	20							
MARE VAPORUM LAC 59	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	
MONTES APENNINUS LAC 41	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
MONTES RIPHAEUS LAC 76	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
PETAVIUS LAC 98	X	100	X	X	X	X	X	X	30							
PITATUS LAC 94	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
PTOLEMAEUS LAC 77	X	100	X	X	X	X	X	X	100	X	X	100	X	X		
PURBACH LAC 95	X	100	X	X	X	X	X	X	25							
RUPES ALTAI LAC 96	X	100	X	X	X	X	X	X	50							
SELLUCUS LAC 38	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
TARUNTIUS LAC 61	X	100	X	X	X	X	X	X	70							
THEOPHILUS LAC 78	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	
TIMOCHARIS LAC 40	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
Northern Hemisphere (32°N - 64°N)																
ARISTOTELES LAC 13	X	30														
CASSINI LAC 25	X	100	X	X	X	X	X	X	100		X					
EUDOXUS LAC 26	X	100	X	X	X	X	X	X	60							
GEMINUS LAC 27	X	15														
J. HERSCHEL LAC 11	X	100	X	X	X	X	X	X	95							
PLATO LAC 12	X	100	X	X	X	X	X	X	50							
RUMKER LAC 23	X	100	X	X	X	X	X	X								
SINUS IRIDUM LAC 24	X	100	X	X	X	X	X	X	100	X	X					
Southern Hemisphere (32°S - 64°S)																
CLAVIUS LAC 126	X	100				X										
HONMEL LAC 127	X	100				X										
MAUROLYCUS LAC 113	X	100	X	X	X	X	X	X	15							
RHEITA LAC 114	X	100	X	X	X	X	X	X								
SCHICKARD LAC 110	X	30														
SCHILLER LAC 125	X	100				X										
TYCHO LAC 112	X	35														
WILHELM LAC 111	X	15														

REPORT FOR MONTH OF MARCH

Astrogeologic Studies Branch

Orbiter site number	Author's geologic work in progress	Controlled or uncontrolled mosaic print received	Controlled or uncontrolled mosaic reproducible received	In technical and editorial review	In drafting (% completion)	Preliminary map transmitted to MSC	Controlled mosaic reproducibles received	Author's geologic recompilation in progress	In technical and editorial review	In drafting (% completion)	Revised map transmitted to MSC
SCALE 1:100,000											
II P-2	X	X	X	X	X	X	X	X			
II P-6	X	X	X	X	X	X	X	X			
II P-8	X	X	X	X	X	X	X	X			
II P-11	X	X	X	X	X	X	X	X			
II P-13	X	X	X	X	X	X	X	X			
III P-9	X	X	X	X	X	X	X	X			
III P-11	X	X	X	X	X	X	X	X			
III P-12	X	X	X	X	X	X		X			
SCALE 1:25,000											
II P-2	X	X	X	X	X	X	X	X			
II P-6	X	X	X	X	X	X	X	X			
II P-8	X	X	X	X	X	X	X	X			
II P-11	X	X	X	X	X	X	X	X			
II P-13	X	X	X	X	X	X	X	X			
III P-9	X	X	X	X	X	X		X			
III P-11	X	X	X	X	X	X	X	X			
III P-12	X	X	X	X	X	X		X			

Report for March

Astrogeologic Studies Branch

MAP	Author's geologic work in progress -- % completed	Preliminary map to JPL	Map in technical and editorial review	Author's revisions in progress	Submitted to TRU	Director's approval	Transmitted to BMR	Published
RLC 2	80							
RLC 3	100		x					
RLC 4	100		x					
RLC 7	100	x	x					
RLC 9	100	x	x	x				
RLC 11	100		x					
RLC 14	100	x	x					
RLC 15	100	x	x					
RLC 16	50							