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

October 30, 1967

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

E. M. Shoemaker received the Exceptional Scientific Achievement medal from NASA on October 24 for work on lunar exploration programs.

Surveyor TV Investigations

E. M. Shoemaker and E. C. Morris report that the crater in which the Surveyor V spacecraft landed is elongate in the northwest/southeast direction, and is the largest local member of a chain of small craters trending in that direction. It appears to be a compound crater consisting of 2 partially merged components separated by a subdued northwest trending ridge. The crater is probably a member of the family of elongated craters and crater pairs observed on the Lunar Orbiter V high resolution pictures in the vicinity of the Surveyor V landing site. The crater itself has not yet been identified on the Lunar Orbiter V pictures.

The Surveyor V crater was probably formed by drainage of surficial fragmental debris into a subsurface fissure. The lunar surface debris layer is exposed in the walls of the crater. At depths below about 10 cm the debris appears to be composed mainly of shock compressed aggregates, ranging from a few millimeters up to 3 cm in diameter set in a matrix of less coherent, finer particles. Rocky chips and fragments are dispersed as a subordinate constituent of the debris.

Orbiter

Distribution of large lunar circular basins and maria were studied by K. A. Howard and D. E. Stuart-Alexander on the complete photographic coverage of the Moon available from Orbiters IV and V. Twenty-eight basins covering 7300 km^2 were located and ranked in a general chronologic order according to size of superposed craters, degree of obliteration of ring scarps, circularity, and other factors. The basins appear to have

a moon-wide random distribution in both age and position. On the other hand, mare material is not randomly distributed but is concentrated in a large region of the northern frontside, is absent in a region of the northern backside, and is scattered in small areas over the rest of the Moon. All basins > 520 km^2 contain some mare material. The mare distribution may be primarily controlled by deep impact basins if Oceanus Procellarum and Mare Australe are old impact sites. Alternatively, the regional pattern of maria may reflect an internal control such as convection currents, as others have suggested.

Outside publications during month

Shoemaker, E. M., Batson, R. M., Holt, H. E., Morris, E. C., Rennilson, J. J., and Whitaker, E. A., 1967, Television observations from Surveyor III: NASA Technical Report 32-1177, p. 9-68.

Wildey, R. L., 1967, Spatial filtering of astronomical photographs: Publications Astronomical Society of the Pacific, v. 79, p. 220-225.

Wildey, R. L., 1967, Spatial filtering of astronomical photographs, II: Theory: Astronomical Journal, v. 72, p. 884-886.

Wildey, R. L., 1967, On the treatment of radiative transfer in the lunar diurnal heatflow: Journal of Geophysical Research, v. 72, p. 4765-4767.

Wildey, R. L., 1967, The nocturnal heat sources of the surface of the Moon (abs.): Astronomical Journal, v. 72, p. 837.

Chao, E. C. T., 1967, Impact metamorphism, in Abelson, P. H., ed., Researches in geochemistry, v. 2: New York, John Wiley and Sons, p. 204-233.

May, Irving, and Cuttitta, Frank, 1967, New instrumental techniques in geochemical analysis, in Abelson, P. H., ed., Researches in geochemistry, v. 2: New York, John Wiley and Sons.

Personnel

The following employees entered on duty:

Flagstaff, Arizona

Robert J. Batzli, Geologic Field Assistant
Neil A. Gambell, Geologic Field Assistant
Baerbel Lucchitta, Physical Science Technician
Charles Rourke, Geologic Field Assistant

Washington, D. C.

Newton Benjamin, Physical Science Technician
George A. Sellers, Geologist

Personnel (continued)

The following employees entered on duty:

Menlo Park, California

Kenneth L. Olevson, Physical Science Aid
Caroline K. Salzgeber, Physical Science Technician
Leroy Williams, Jr., Cartographic Aid

Transfers:

Erik Bramsoe, Electronic Technician, transferred to U.S. Navy Department, Washington, D. C.
Domitila E. Legleu, Clerk-Stenographer transferred to Branch of Regional Geophysics, Flagstaff, Arizona.
Shirley K. Swartz, Clerk-Stenographer transferred to Office of Equal Opportunity, Austin, Texas.

Conferences and scientific meetings attended at home or abroad

J. F. McCauley visited Professor William Van Dorn at the University of California, San Diego, to discuss the application of wave mechanics theory to a model of formation of the Orientale Basin.

Harold Masursky gave preliminary results of Lunar Orbiters IV and V at a Press Conference in Washington on October 17. He repeated this talk to the joint Congressional Space Committee in Washington on October 23.

Harold Masursky attended a Surveyor Working Group meeting at Jet Propulsion Laboratory, Pasadena, California, on October 30 to select the site for Surveyor Spacecraft No. 7.

Harold Masursky and J. D. Wells conducted a tour of the Cortez, Nevada area, October 7, 8, for R. K. Smith, F. N. Houser, A. H. Chidester, T. N. V. Karlstrom, M. R. Brock, D. V. Haines, G. A. Swann, R. L. Sutton.

A meeting was held September 27-29 in Menlo Park, California, to define the stratigraphic and structural conventions, format of explanations, and schedule for the 1:25,000 and 1:100,000 scales geologic maps of the Lunar Orbiter sites selected as candidate Apollo landing sites. Attending the meeting were: L. C. Rowan, D. E. Wilhelms, N. J. Trask, M. H. Carr, H. A. Pohn, T. A. Mutch, T. W. Offield, P. J. Cannon, Jerry Harbour, R. S. Saunders, H. J. Wilshire, M. J. Grolier, David Cummings, S. R. Titley, D. E. Stuart-Alexander, Phoebe Bernat.

G. G. Schaber and D. J. Emmons attended a course on atomic absorption techniques given by the Jarrell-Ash Corporation at Waltham, Mass., preliminary to installing the new Jaco atomic absorption unit in the Flagstaff petrology laboratory.

Talks or papers presented at meetings

Speaker and organization	Subject
E. M. Shoemaker, Distinguished Lecturer Tour for the Society of Exploration Geophysicists Farmington, New Mexico Salt Lake City, Utah Great Falls, Montana Calgary, Alberta Edmonton, Alberta Billings, Montana Casper, Wyoming Denver, Colorado San Francisco, California	The moon from five and a half feet and Meteors, airwaves, and impact craters
E. M. Shoemaker, Meteoritical Society Banquet Palo Alto, California	Meteorites, comets, and the surface of the moon
H. A. Pohn, American Congress of Surveying and Mapping Denver, Colorado	Application of Ronchi screens to photogeologic problems
Robin Brett, aboriginines in Class B, Finlse River Mission, Hermannsburg, Northern Territory, Australia	Gosses Bluff structure and its origin
H. J. Moore, Green Gables School 4th, 5th, and 6th Grades Palo Alto, California	Geology of the Moon
D. J. Roddy, Air Force Institute of Technology, Wright Patterson Air Force Base Dayton, Ohio	Impact mechanics of large bodies and planetary surfaces
D. J. Roddy, Department of Geology and Geophysics, Massachusetts Institute of Technology Boston, Massachusetts	Hypervelocity impact of large, low density bodies
J. F. McCauley, American Institute of Aeronautics and Astronautics Anaheim, California	Geologic results of the lunar precursor probes
H. G. Stephens Optimist Club Flagstaff, Arizona	Lunar Orbiter program; illustrated with film

Visitors

Visitors	Visited and purpose
John R. Healy and Paul M. Crosby Northern Arizona University Geography Department Flagstaff, Arizona	H. L. Krivoy--to discuss the Geophysics Observatory
Willard Groene Mummy Mountain Observatory Scottsdale, Arizona	H. L. Krivoy--to discuss station seismology
Richard W. Barringer Barringer Crater Co. Philadelphia, Pennsylvania	A. H. Chidester, J. F. McCauley, and R. H. Godson--to discuss Center activities and geophysical work at Meteor Crater.
D. B. Simons and Stanley A. Schumm Colorado State University Fort Collins, Colorado	Harold Masursky--to discuss lunar sinuous rilles and channel flow
Professor B. Boucek Academy of Sciences Prague, Czechoslovakia	J. F. McCauley--to discuss lunar geologic mapping.
Saguaro High School Science Club Scottsdale, Arizona	H. G. Stephens and Russell Wahmann--tour of Center of Astrogeology

General Information

Lunar and Planetary Physics

R. L. Wildey reports that the mathematical theory of the processing of video tapes for the acquisition of a comprehensive tabulation of the Moon's photometric function is complete. The segmented program for limb-curve determination, librational transformations between TV frame coordinates, "luminance" coordinates (photometric function parameters), and selenographic coordinates, including geocentric to topocentric corrections, and pixel signal processing is now being written. Obtaining facilities for analog to digital conversion remains the only frustration in the effort thus far.

R. L. Wildey and H. A. Pohn report that the 1:5,000,000 map of the Moon's normal albedo via photoelectric-photographic photometry has been corrected and is under compilation. Correction of the 1:2,500,000 map continues.

R. L. Widley reports that construction of the Caltech voltage converter has been completed and tested. The problem of interfacing with the IDT is significant and will be delayed until the occurrence of a natural production break in the latter instrument, which is under heavy use. When

done, the IDT will contour arbitrary functions of density, including brightness, rather than merely density.

Cosmic Chemistry and Petrology

The training of James Lindsay and Cristina Silber in microchemical aspects of X-ray Fluorescence Analysis is continuing.

The slope ratio technique.--The conservation of valuable and rare specimens of astrogeologic interest and the capability to obtain pertinent and meaningful chemical data on very small samples are problems inherent in space exploration programs. A new approach has been found to solve matrix problems in trace- and/or micro-analysis by x-ray fluorescence and atomic absorption spectroscopy. Trace element analysis and the determination of major constituents in submilligram quantities of samples by x-ray fluorescence have often required complex mathematical corrections, many of which did not fully explain or correct for all of the possible parameters--particularly where variations in composition are extreme and backgrounds uncertain.

In another interbranch collaborative research effort, Frank Cuttitta (Branch of Astrogeologic Studies) and Harry J. Rose, Jr. (Branch of Analytical Laboratories) pioneered the development of a completely new and fundamental concept to solving matrix problems in x-ray fluorescence and atomic absorption spectroscopy. This unique approach can be considered akin to the fundamental advancement in light absorption measurements as result of the formulation of Beer's law.

The method requires no prior knowledge of the chemical composition of the sample. Marked matrix effects are minimized by dilution, and the problem of variable backgrounds due to residual matrix effects is solved by using a slope-ratio technique. In this proposed technique, the slope of a standard curve prepared from pure solutions is compared with that of spiked samples. The ratio of the slopes of these two curves permits the calculation of an adjusted background which does not significantly differ from that of an absorbent impregnated with the sample matrix free of the element sought. Experimental parameters concerning the method have been worked out, and the technique has been successfully applied to the determination of bromine and iodine in saline waters, zinc in silicates, and individual elements in complex rare earth minerals and concentrates.

Micro-x-ray fluorescence analysis.--Interbranch collaborative studies by Harry J. Rose, Jr. (Branch of Analytical Laboratories) and Frank Cuttitta (Branch of Astrogeologic Studies) have resulted in the development of x-ray fluorescence methods for the semimicro determination of Sc, Y, and the individual rare earths (La, Z=57 to lu, Z=71). This suite of elements produces an extremely complex x-ray spectrum in which many of the analytical emission L_α lines coincide with the L_β and L_γ lines of a rare earth element several atomic numbers away. An analytical scheme was developed to correct for these interferences which were previously considered insurmountable when using x-ray fluorescence spectroscopy. The analysis can be performed on as little as one milligram of the combined rare earths separate. This analytical "break-through" will be invaluable not only

in the micro-analysis of extremely complex rare earth minerals but also in studies or rare earth abundances in materials of astrogeologic interest. Typical minerals already analyzed include a calcium-rare earth borate and a rare earth carbonate. In each 27 elements were determined on less than 250 mg of total original mineral.

L. P. Greenland in collaboration with C. J. Massoni, R. V. Fones, and Frederick Simon designed and constructed an automatic sample changer for use with the Ge-(Li) detector when undertaking long counts (i.e., 1000 minutes) of large number of samples.

L. P. Greenland technically reviewed manuscript entitled "Determination of gold in rocks by neutron activation analysis utilizing fire assay preconcentration" by F. O. Simon and H. T. Millard, Jr.

M. B. Duke reports that Fe, Ni, and Mn have been determined in spherules from deep sea sediments previously studied to determine density, mineralogical composition and uranium content. Spherules can be characterized in two categories: higher density spherules (> 5.0), containing α-iron or wüstite, with low uranium, have high Ni and low Mn. Lower density (< 4) spherules, containing no α-iron or wüstite, have higher uranium, and have low Ni and higher Mn. Spherules in the first category are definitely meteoritic; spherules in other category probably are not.

Missile Impact Investigations

H. J. Moore and M. J. Grolier report that at least 290 boulder tracks have been found on Lunar Orbiter photographs to date. This does not include about 100 secondary impact craters and their associated blocks.

H. J. Moore reports that missiles impacting water--saturated materials of white sands with velocities near 10,000 feet per second produce craters 1.6 larger in diameter than their counterparts in dry materials. This is consistent with previous data on missiles with different velocities.

Photogrammetry

W. T. Borgeson reports that stereo profiles of Apollo landing sites have been prepared for T. A. Mutch, Jerry Harbour and N. J. Trask from Orbiter photographs. The profile device constructed by the instrument shop was of great value in this work.

Photoclinometry

Profiles across the Surveyor I and III landing sites were derived by the photoclinometric method by scanning appropriate Lunar Orbiter photographs. These profiles were run primarily as a test of the photoclinometric methods against photogrammetric solutions, and are consistent with results obtained elsewhere.

Topographic profiles and statistical data concerning the microrelief of potential Apollo sites were derived photoclinometrically for use by Lunar Orbiter mappers.

Isodensitracings have been prepared from color photographs of rock polished sections. They have been shown to be extremely useful in preparing line drawings of microfolds, and of mineral distribution. Colored isodensitracings have been obtained by scanning rock thin sections. Mineral identification poses some problems, but the geometric pattern of the thin section is easily reproduced.

Surveyor

Preliminary photometric reduction of selected Surveyor V pictures by H. E. Holt indicates that the undisturbed lunar surface near the spacecraft has a photometric function similar to that observed at the Surveyor I and III landing sites. The estimated normal luminance factor (normal albedo) of the undisturbed lunar surface near the spacecraft is $7.9 \pm 1.0\%$. The disturbed surface debris around footpads 2 and 3 is slightly darker and the normal luminance factor is estimated to be 7.5%, about 5% lower than that of the undisturbed surface. Material exposed in the lower parts of the trench wall plowed by footpad 2 also has a normal luminance factor about 5% lower than the undisturbed surface.

Harold Masursky, J. F. McCauley and D. E. Wilhelms completed a description of the objectives and data reduction goals of a visual imaging experiment for the Mars 1973 Voyager. Prior to formal submission, however, the program was cancelled by NASA. The document will be transmitted informally to interested parties upon request.

J. F. McCauley completed a description of the Mission V photography and located a number of possible AAP sites in the Marius Hills area for the Mission V screening report. Also completed was a justification and location of a possible Surveyor landing site within the same area for Surveyor-Lunar Orbiter Utilization Committee.

Impact Investigations

D. J. Roddy reports that the Defense Research Establishment, Alberta, Canada, detonated 100 tons of TNT in the shape of a sphere lying tangent to the ground surface in July. A crater, about 30 m in diameter and 5.5 m deep, was formed in unconsolidated flat-lying alluvium and lacustrine sediments. A well-defined central mound about two meters high, occupied all of the crater floor and contained beds structurally uplifted 3 to 5 m. Excavations of the central uplift show that the internal structure is nearly identical to the tightly-folded dome formed in the central mound of the 100 m diameter crater produced by the 500-ton TNT surface hemisphere experiment. Rim uplift, faults and folds concentric to the crater are comparable in position and type to deformation in the rims of the Flynn Creek crater. Most of the ejecta and fallback consists of sheared blocks produced by compression of the upper meter of soil. Participation in this cratering experiment was made possible by Dr. G. H. S. Jones of the Defense Research Establishment.

Mission Planning

T. N. V. Karlstrom completed a photogeologic map of the simulated lunar crater field prepared by the Astrogeologic Center in the Cinder Lake area near Flagstaff. The crater field simulates a portion of an Orbiter photograph and contains a wide range of features. These features include: single-rimmed and double-rimmed craters ranging from less than 10 feet to more than 50 feet in diameter; superimposed ejecta blankets and secondary-crater ray patterns that should permit detailed field reconstruction of the cratering sequences and provide clues to underlying stratigraphy; and subtle lineament and ground patterns, reminiscent of lunar surface features, that in part cross and modify crater morphology.

The photogeologic maps of the Cinder Lake crater field have been prepared for use in the forthcoming field test that will focus on determining the utility of photogeologic maps for field use in Early Apollo Ground Excursions and for real time compilation purposes in the data compilation facility.

G. E. Ulrich, project chief for Advanced Systems Traverse Research, has selected the Mare Orientale area for preliminary traverse evaluation and comparative study of Apollo Application Program and Advanced Systems type missions. Compilation of current literature and available photogeologic maps is being undertaken by R. S. Saunders. J. D. Alderman and G. M. Nakata have begun procurement of Lunar Orbiter IV transparencies for obtaining topographic profiles across the eastern half of Mare Orientale.

Early Apollo Investigations

A computer program is being developed to determine the velocity distribution of seismic waves beneath a crater, for the interpretation of seismic data from craters.

Post Apollo Investigations

J. B. Fife has modified the Trombka 7094 LSQ computer program to permit analyses of the field spectrometer data on the Survey's 360 computer system. It should be only a short time before such spectrometer analysis will be routine.

The 6000 curie Cobalt^{60} gamma cell used in thermoluminescence studies has been moved from the Denver Federal Center to Flagstaff for installation in the Center laboratory.

The IBM 360/30 computer is being installed in Flagstaff. The Washington Computer Division has brought the HASP system on line which allows the Flagstaff group as a remote user direct access through a 2701 interface to the 360/65 system in Washington.

An experiment to mount the Varian rubidium-vapor magnetometer on the Explorer vehicle in order to continuously record magnetometer data along a traverse was carried out at Hopi Buttes test area. While the system

showed some highly magnetic features in the area, there is a problem with the heading and angle of inclination of the sensing head. Further experiments are being planned in order to correct this problem.

A gravity profile over a suspected diatreme in the northwest part of Hopi Buttes shows a large gravity low of between 3 and 4 milligals and lends support to a diatreme origin for the structure.

Seismic field work was started at Meteor Crater to investigate the seismic characteristics of the rim and of the configuration of the fractured material beneath the floor of the crater along an east-west profile.

Supporting Projects

Field Surveying project furnished the engineering control on determining distribution and size of explosion craters in the recently completed Cinder Lake crater field which was constructed to duplicate at 1:1 scale a portion of actual mare terrain as determined from lunar Orbiter photographs.

Two computer programs recently written by W. T. Borgeson for geodetic positioning of geophysics grids has greatly increased the accuracy and speed of establishing geodetic grids on the ground. The 250-meter grid over a 2.5 x 3 km area in the Hopi Buttes, Arizona, volcanic field was completed in about one-quarter the time required.

All field and geodetic control has been completed and a base sheet prepared for topographic compilation of the 30-square mile test-site area that adjoins the Malpais Springs Quadrangle, Arizona, on the west.

Film Documentation Unit has completed the color-sound film "Explorer." The ten-minute film is a documentary on construction, function, and performance of the Explorer vehicle which was recently completed by the Field Test Systems project for use in the Center's lunar exploration development program.

Field Test Systems project supplied two lunar mission development vehicles for display at Luke Air Force Base, Phoenix, Arizona, during their annual "Luke Day" ceremony.

Geophysical Observatory

Seismic monitor records written at Tonto Forest Seismological Observatory at Payson, Arizona, are now being received for our retention and use.

Preparations are under way for the acquisition of a mobile seismic observatory on loan from the Office of Earthquake Research and Crustal Studies.

LUNAR GEOLOGIC MAPS

REPORT FOR MONTH OF **October**

			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								
CLEOMEDES LAC 44	X	100	X	X	X	X	X	X	100	X	X	100				
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	10							
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	20							
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 HUMOREUM 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								
MARE VAPORUM LAC 59	X	100	X	X	X	X	X	X	100	X	X	100	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								
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	70				
PURBACH LAC 95	X	100	X	X	X	X	X	X	25							
RUPES ALTAI LAC 96	X	100	X	X	X	X	X	X	25							
SELEUCUS LAC 38	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	
TARUNTIUS LAC 61	X	100	X	X	X	X	X	X	60							
THEOPHILUS LAC 78	X	100	X	X	X	X	X	X	100	X	X	100	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		20														
CASSINI LAC 25	X	100	X	X	X	X	X	X	80							
EUDOXUS LAC 26	X	100	X	X	X	X										
GEMINUS LAC 27		5														
J. HERSCHEL LAC 11	X	100	X	X	X	X	X	X	75							
PLATO LAC 12	X	100	X	X	X	X	X	X	20							
RUMKER LAC 23	X	100	X													
SINUS IRIDUM LAC 24	X	100	X	X	X	X	X	X	80							
Southern Hemisphere (32°S - 64°S)																
CLAVIUS LAC 126		100	X			X										
HOMMEL LAC 127		100	X													
MAUROLYCUS LAC 113	X	100	X	X	X	X	X	X								
RHEITA LAC 114	X	100	X	X	X	X	X	X								
SCHICKARD LAC 110		10														
SCHILLER LAC 125		40														
TYCHO LAC 112		35														
WILHELM LAC 111		15														

Report for the month of
October

Orbiter site number	Author's geologic work in progress	Uncontrolled mosaic received from DOD	In drafting and technical review	Version on uncontrolled mosaic (for site selection data book) transmitted to MSC	Controlled mosaic received from DOD	Recompilation in progress	In technical review	Version on controlled mosaic (for mission operations) transmitted to MSC
SCALE 1:100, 000								
II P-2	100%	X	X					
II P-6	100	X	X					
II P-8	100	X	X		X			
II P-11	100	X	X					
II P-13	100	X	X					
III P-9	100	X	X					
III P-11	100	X	X					
III P-12	100	X	X					
SCALE 1:25, 000								
II P-2	100	X	X					
II P-6	30	X						
II P-8	100	X						
II P-11	30	X						
II P-13	75	X						
III P-9	100	X	X					
III P-11	60	X						
III P-12	80	X						

RANGER GEOLOGIC MAPS
Report for the Month of
October

RLC Number	Author's geologic work in progress--% complete	Map compilation by drafting	Review of preliminary map	Preliminary copy to JPL	Final version in Technical Review	Final map to APU	Director's Approval	Transmitted to BMR	Published
2	80								
3	50								
4	50								
7	100	X	X	X					
9	100	X	X	X	X				
11	100	X	X						
14	100	X	X	X					
15	100	X	X	X					
16	50								