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

December 30, 1966

MEMORANDUM:

TO : Assistant Chief Geologist for Engineering Geology

FROM : Chief, Branch of Astrogeology

SUBJECT: Monthly report for Director and Secretary

4. Outside publications reported during month:

Brett, Robin and Kullerud, Gunnar (1966), Melting relationships of galena-pyrite-pyrrhotite assemblages: a homogeneous sulfide melt at 718°C. (Abs): Econ. Geol. 61, 1302.

Wildey, R. L., 1966, On terrain figure of merit for spacecraft landers: Journ. Spacecraft and Rockets, v. 3, p. 1551-1552.

Karlstrom, T. N. V., Rowan, L. C., Grolier, M. J., Eggleton, R. E., and Masursky, Harold, 1966, contributed to Lunar Orbiter I Preliminary terrain evaluation and Apollo landing site analysis based on Lunar Orbiter I photography: Langley Working Paper 323, NASA, Langley Research Center, Hampton, Virginia.

Schaber, Gerald G., 1966, Mineralogy and crystal chemistry of the sulfosalt minerals: Bournonite, seligmannite aikinite, diaphorite and freieslebenite. Abstract: Dissertation Abstracts, vol. 26, July.

Edmonds, K. V., 1966, Times spent on geologic operations during Early Apollo Investigations, Field Test 8. U. S. Geological Survey Technical Letter, Astrogeology 25.

5. Personnel

The following employees entered on duty

Flagstaff, Arizona

Michael F. Driggs, Geologic Field Assistant
Greye Dunning, Mathematics Technician
Bruce R. Janis, Geologic Field Assistant
Karen E. Lemos, Geologic Field Assistant
Dorothy H. Smith, Clerk-Typist
John R. Thompson, Geologic Field Assistant

Menlo Park, California

David H. Scott, Physical Science Technician

Transfers

Carl H. Roach, Research Geologist, transferred to the Denver Mining Research Center, U. S. Bureau of Mines, Denver, Colorado.
Robert A. Speirer, Physical Science Technician, transferred to the Denver Mining Research Center, U. S. Bureau of Mines, Denver, Colorado.

Resignations

Henry Faul, Research Geophysicist, Washington, D. C.
Thomas B. McCord, Geologic Field Assistant, Flagstaff, Arizona
Robert C. Myers, Electronic Technician, Flagstaff, Arizona
Susan E. Werner, Geologic Field Assistant, Flagstaff, Arizona

6. Scientific meetings and conferences attended at home or abroad

E. M. Shoemaker, N. J. Trask, M. H. Carr, and D. J. Milton visited C. W. Henderson, Jr. at Lockheed Corporation, Mountain View, California for a demonstration of 1/6 gravity simulation device.

M. B. Duke, G. Desborough, and N. J. Page visited K. F. J. Heinrich at the National Bureau of Standards, Gaithersburg, Maryland, to discuss electron microprobe analysis.

E. C. T. Chao visited M. R. Dence, J. J. S. Innes, Ian Halliday, and B. Robertson, Dominion Observatory, Rock Physics Laboratory at Ottawa, Canada to establish channel of communication for exchange of samples and information.

E. M. Shoemaker, M. H. Hait, and J. W. M'Gonigle attended a review meeting for the Apollo lunar hand tools at Manned Spacecraft Center, Houston, Texas.

M. H. Hait took part in 1/6 gravity tests of lunar hand tools on KC-135 flights at Wright-Patterson Air Force Base, Dayton, Ohio.

M. H. Hait, J. W. M'Gonigle, H. E. Holt, and I. Lucchitta visited Mr. Robert Littleton of the Bureau of Reclamation in Boulder City, Nevada, and discussed the availability of topographic and geologic maps at the Lake Mead area.

7. Talks or papers presented at meetings

Speaker and organization	Subject
David J. Roddy California Institute of Technology students Pasadena, California	Impact of giant meteorites on the earth
H. J. Moore San Jose State College class San Jose, California	Nature of lunar surface as determined from data on radar and light reflectivities, radio and infrared emissions, and high resolution photographs of the lunar surface
J. F. McCauley Seventh Grade of Sechrist School Flagstaff, Arizona	The earth and the moon
N. J. Trask The Society of Sigma Xi University of California Davis, California	Geological exploration of the moon
L. C. Rowan Apollo Site Selection Board NASA Headquarters Washington, D. C.	Results from Lunar Orbiter I
L. C. Rowan Apollo Site Selection Board NASA Headquarters Washington, D. C.	Preliminary results of Lunar Orbiter II screening
L. C. Rowan American Astronautical Society Washington, D. C.	Orbiter observations

8. Visitors

Visitors	Visited and purpose
Milton Boone and L. Clyde Groover Representatives of House Appropriations Committee Investigation Staff Washington, D. C.	M. L. Troyer, A. Honka, A. H. Chidester, and M. L. Brock--discussed Branch of Astrogeology program
Professor Glen Martin Montana State University Bozeman, Montana	H. J. Moore--discussed lunar craters and rock mechanics
R. L. Stanton University of New England Armadale, NSW, Australia	P. R. Brett--discussed textures of sulfides
Rolf Paulson National Bureau of Standards	M. B. Duke--discussed cosmic dust analysis
James Burke and Roy Brereton Jet Propulsion Laboratories Pasadena, California	J. F. McCauley--discussed lunar geologic mapping and Apollo mission planning
Mrs. Elizabeth Hogenes and Algebra students Flagstaff Junior High School Flagstaff, Arizona	Tour of Branch facilities conducted by Russell Wahmann and J. A. Dushek

General Information

Astrogeologic studies

G. A. Desborough has been modifying existing X-ray diffraction equipment and designing new equipment to improve sensitivity for individual cosmic dust particles smaller than 10μ. A new 100μ capillary collimator built for a standard 57 mm diameter powder camera greatly reduces background intensities, thereby increasing sensitivity. A newly designed 20 mm diameter camera offers much improved peak intensities at the cost of some loss of resolution and increased difficulty of handling.

Three Lunar Orbiter I photogrammetric models have been set up and worked in support of Branch geologic investigations of Apollo landing sites. Five Lunar Orbiter II models are scheduled for working during next month.

Preliminary map and explanation of Ptolemaeus quadrangle have been completed.

T. N. V. Karlstrom represented the U. S. Geological Survey as senior scientist at the Space Flight operations facility, Jet Propulsion Laboratories, Pasadena, California, during the photographic mission of Lunar Orbiter II. Preliminary geologic evaluations of the photography were made as a basis of news released by the Lunar Orbiter Project Office. Karlstrom acted as coordinator for preliminary screening and evaluation of Lunar Orbiter II photography by Branch personnel at Flagstaff and the University of Arizona. Preliminary reports of selected prime sites were transmitted to Langley Research Center from Flagstaff and Tucson, Arizona.

The following attended Orbiter II screening at Langley: D. E. Wilhelms, M. J. Grolier, L. C. Rowan, M. H. Carr, Anne Kelly, and for short periods of attendance, J. D. Alderman, Daniel Olivas, Raymond Jordan, J. J. Wooldridge, and J. W. Ridgley, Jr.

Maurice Grolier has tentatively located the Ranger VIII impact crater in Lunar Orbiter Frame H-70 from Site II, P-5 and is preparing a paper describing the method, location, and morphology of the crater formed by the impact.

H. A. Pohn is working on a crater evolutionary sequence on the basis of Orbiter II high resolution photography.

LUNAR GEOLOGIC MAPS

REPORT FOR MONTH OF December, 1966

			PRELIMINARY MAPS						FINAL MAPS							
	AGIC Bases Received	Author's Geological Work in Progress	Cartography - Scribing & Assembly in Progress	1st Composite Completed	1st Explanation Completed	Map in Technical Review (Branch)	2nd Composite Completed	2nd Explanation Completed	Geology Revision in Progress	Cartography - Final Map Prep	Map in Technical Review (Branch)	Submitted to APC	Director's Approval Received	Map Materials Transmitted to BTI	Transmitted to BMR	Published
Equatorial Belt																
ARISTARCHUS LAC 39	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BYRGIUS LAC 92	X	X	X	X	X	X	X	X								
CLEOMEDES LAC 44	X	X	X	X	X	X	X	X	X	X	X					
COLOMBO LAC 79	X	X	X	X	X	X	X	X	X	X						
COPERNICUS LAC 58	X	X	X	X	X	X	X		X	X	X	X				
FRACASTORIUS LAC 97	X	X	X	X	X	X	X	X								
GRIMALDI LAC 74	X	X	X	X	X	X	X	X	X							
HEVELIUS LAC 56	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
JULIUS CAESAR LAC 60	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
KEPLER LAC 57	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LANGRENUS LAC 80	X	X	X	X	X	X	X	X								
LETRONNE LAC 75	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
MACROBIUS LAC 43	X	X	X	X	X	X	X	X	X	X	X					
MARE HUMORUM LAC 93	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
MARE SERENITATIS LAC 42	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
MARE UNDARUM LAC 62	X	X	X	X	X	X	X	X								
MARE VAPORUM LAC 59	X	X	X	X	X	X	X	X	X	X	X					
MONTES APENNINUS LAC 41	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
MONTES RIPHAEUS LAC 76	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PETAVIUS LAC 98	X	X	X	X	X	X	X	X								
PITATUS LAC 94	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PTOLEMAEUS LAC 77	X	X	X	X	X	X	X	X	X							
PURBACH LAC 95	X	X	X	X	X	X	X	X								
RUPES ALTAI LAC 96	X	X	X	X	X	X	X	X	X							
SELEUCUS LAC 38	X	X	X	X	X	X	X	X	X	X	X					
TARUNTIUS LAC 61	X	X	X	X	X	X	X	X	X	X	X					
THEOPHILUS LAC 78	X	X	X	X	X	X	X	X	X	X	X					
TIMOCHARIS LAC 40	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Northern Hemisphere (32°N - 64°N)																
ARISTOTELES LAC 13																
CASSINI LAC 25		X	X	X	X	X	X									
EUDOXUS LAC 26																
GEMINUS LAC 27																
J. HERSCHEL LAC 11		X	X	X	X											
PLATO LAC 12		X	X	X	X											
RUMKER LAC 23		X														
SINUS IRIDUM LAC 24		X	X	X	X	X	X	X	X	X	X					
Southern Hemisphere (32°S - 64°S)																
CLAVIUS LAC 126		X														
HOMMEL LAC 127		X														
MAUROLYCUS LAC 113		X	X	X	X	X	X	X								
RHEITA LAC 114		X														
SCHICKARD LAC 110																
SCHILLER LAC 125																
TYCHO LAC 112		X														
WILHELM LAC 111																
North Polar Cap																
ANAXIMANDER LAC 2																
BAILLAUD LAC 1																
METON LAC 4																
PHILOLAUS LAC 3																
South Polar Cap																
BAILLY LAC 136																
CABEUS LAC 144																
MANZINUS LAC 138																
NEWTON LAC 137																
HELMHOLTZ																

LUNAR GEOLOGIC MAPS
Scale 1:500,000

REPORT FOR MONTH OF DECEMBER, 1966

PRELIMINARY MAPS

AIC NUMBER	Preliminary AIC Base Received	Published AIC Base Received	Author's Geological Work in Progress	Cartography - Scribing & Assembly in Progress	1st Composite Completed	1st Explanation Completed	Map in Technical Review (Branch)	2nd Composite Completed	2nd Explanation Completed
57C	XXXXXX		XXXXXX						
57D	XXXXXX		XXXXXX						
58C	XXXXXX	XXXX	XXXXXX						
58D	XXXXXX	XXXX	XXXXXX						
59C	XXXXXX	XXXX	XXXXXX						
59D	XXXXXX	XXXX	XXXXXX						
60C	XXXXXX	XXXX							
60D	XXXXXX	XXXX	XXXXXX						
61C									
61D	XXXXXX	XXXX	XXXXXX						
75A	XXXXXX		XXXXXX						
75B	XXXXXX		XXXXXX						
76A	XXXXXX		XXXXXX						
76B	XXXXXX	XXXX	XXXXXX						
77A	XXXXXX	XXXX							
77B	XXXXXX	XXXX	XXXXXX						
78A	XXXXXX	XXXX	XXXXXX						
78B	XXXXXX	XXXX							
79A	XXXXXX	XXXX	XXXXXX						
79B									

Surface planetary exploration

Astronaut training

A geologic field trip in the program of geologic training for the astronauts was held in the Pinacate volcanic region, Sonora, Mexico, under the leadership of Dean R. H. Jahns, Stanford University. Twenty astronauts attended; 4 geologists and 3 geophysicists from the Geological Survey in Flagstaff, Arizona, and 5 geologists from the Manned Spacecraft Center, Houston, Texas, participated in the instruction.

Early Apollo investigations

Personnel of the Early Apollo group made a brief aerial inspection in the Lake Mead area of possible test sites for a geological mapping exercise during the winter.

Apollo lunar hand tools were tested by space-suited subjects under 1/6 g in KC-135 aircraft flights at Wright-Patterson Air Force Base, Dayton, Ohio. Most of the tools functioned properly, although some difficulties were met with the sample bags and with aseptic sampling tool. The sample bags will be modified for ease in opening and holding. Modification of the aseptic sampling tool is needed to permit collection of more material.

Supporting projects

The vehicle navigation system was removed from the Mobile Geological Laboratory (MGL) and returned to Marshall Space Flight Center in Huntsville, Alabama, for further testing and installation of telemetry.

Modifications were made to the power train of the MGL incorporating a rubber insulated type of drive-line suspension. This system was field-tested at the Hopi Buttes test site area. The new drive-line system provides greatly reduced vibration and noise levels in addition to minimized strain on the vehicle when being transported on the solid-suspension lo-boy trailer.