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UNITED STATES
DEPARTMENT OF THE INTERIOR
Geological Survey
Geologic Division
Branch of Astrogeology
345 Middlefield Road
Menlo Park, California

July 1, 1963

Memorandum

To: V. R. Wilmarth
From: D. P. Elston 
Subject: Monthly report for Director and Secretary

1. Highlights and noteworthy results:

R. E. Eggleton has found that some lunar craters larger than 25 km in diameter have sinuous outward-facing scarps ringing their flanks; the scarps have not been observed around craters that are less than 25 km in diameter. Examples of craters with outward-facing scarps are Lambert, Archimedes, Copernicus, Arzachel, Alphonsus, and Clavius, which have rim-crest diameters of 30, 80, 95, 100, 120, and 235 km, respectively. The bases of the scarps are located at a mean distance of 0.15 to 0.3 crater diameter from the rim crests. The scarps are 0.045 to 0.06 crater diameter wide and locally have slopes as great as 10 degrees. The scarps may mark the outer edges of thrust plate complexes underlying the higher parts of the crater rims. A possible terrestrial analogue occurs at the Ries basin in Bavaria, a probable meteorite crater about 25 km in diameter. Erosion at the Ries basin has exposed low-angle thrust faults that extend at least 0.24 crater diameter outside the rim crest.

Photographic observations of the L_4 and L_5 Lagrangian earth-moon libration regions were recommenced from Mt. Chacaltaya, Bolivia by E. C. Morris and H. G. Stephens. This program seeks to define the presence or limits

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of density of clouds of matter that may temporarily reside in these areas of near-gravitational equilibrium.

M. H. Carr, who is in the process of developing an inexpensive, rapid method for explosively shock-loading materials to determine their shock equation of state, has obtained results on the shock equation of state of copper in the pressure region 0-250 kb that agree well with previous data. The pressures developed by this new technique can be measured to within 20 kb for a material whose Hugoniot is not known, and to within 15 kb for a known material.

The Lunar Mapping project personnel have begun a visual observing program on the 12" refracting telescope at Lick Observatory, Mt. Hamilton, Calif.

3. Significant changes in continuing projects:

Callie Luckermann has begun recompilation of the Copernicus Region of the Moon on the Mercator projection standard topographic base. Additional information based on new photography will be added to the preliminary version of the map by E.M. Shoemaker and R.H. Hackman, which was based on a Lambert conformal conic projection.

5. Conferences and scientific meetings:

H. J. Moore with R. W. MacCormack and D. E. Gault, Ames Research Center, presented a paper at the Sixth Hypervelocity Impact Symposium, Cleveland,

Frank Cuttitta and Charles Annell attended the 44th Annual Meeting of the American Geophysical Union held in Washington, D. C. Cuttitta presented a paper entitled "Magnetic and Chemical Studies of Iron in Tektites", and Annell presented another paper entitled "The Alkali Content of Texas Tektites" at sessions of the Section of Planetary Sciences in the Great Hall, N.A.S.

R. J. Hackman, W. A. Fischer, and Henry Holt conferred with Paul Lowman, NASA, regarding the planning of possible photographic missions for the Gemini Project.

R. J. Hackman, Max Elias and Dennis Cox conferred with Mr. Sidney Weiser of Weiser Associates, Inc., in regard to the use of optical instruments for changing map projections.

E.C.T. Chao and R. J. Hackman gave a briefing to U.S.G.S. Public Inquiries personnel on work being undertaken by the Branch of Astrogeology.

H. Masursky spoke on lunar geologic mapping to the Colloquium of Lick Observatory, Mt. Hamilton, California.

D. P. Elston and H. Masursky visited the Bend area, Oregon, in company with Mr. Hollis M. Dole, Director, Department of Geology and Mineral Industries, and members of his staff, and Mr. Parke Snavely, Chief,

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Pacific Coast Branch, U.S.G.S., to observe maars and other young volcanic features of the area.

D.P. Elston and H. Masursky talked to a joint meeting of the Chamber of Commerce and the Kawanis Club of Bend, Oregon, on the Geological Survey's program of research in astrogeology and on lunar geologic mapping.

H. Masursky and H. J. Moore conferred on the design of the Ranger TV system with Jay Rennilson and John Adams of the Jet Propulsion Laboratory, Pasadena, Calif.

H. Masursky and E.C.T. Chao described the Lunar Geologic Mapping and the Cosmochemistry and Petrography programs of the Branch of Astrogeology to the Planetology Subcommittee, Space Sciences Steering Committee, at the NASA Western Operations Office, Santa Monica, California.

H. Masursky and E. C. Morris conferred with Drs. Stanley Vasilevskis and George Herbig of the Lick Observatory, University of California, and Robert Morgan, consulting engineer, on designing a new camera for lunar photography for the 120" reflecting telescope, and modifying the shutter on the camera on the 36" refracting telescope. They also discussed installing a lunar rate drive on the 12" refracting telescope to make it more useable for visual observations and polarimetry of the Moon.

J. F. McCauley spoke at the Weekly Seminar at the Museum of Northern Arizona on the subject: "The Stratigraphy of the Moon". The Seminar was attended by the Museum's staff scientists and geologists and other members of the Astronomical community including representatives from the

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Aeronautical Chart and Information Center's Flagstaff operations, Lowell Observatory, University of Minnesota, and University of Arizona.

J. F. McCauley gave talks on the U.S. Geological Survey Lunar Mapping Program to a group of Flagstaff, Ariz., realtors and to the Flagstaff Kiwanas Club.

D. P. Elston presented a talk on the research activities of the Branch of Astrogeology to the Science teachers of Eldorado County, Calif., who were attending a National Defense Education Act workshop.

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6. Visitors:

<u>Name and Affiliation</u>	<u>Visited and Purpose</u>
Dr. Frank Morgan, Physicist Atomic Weapons Res. Establishment Aldermaston Berks., United Kingdom	C. H. Roach - to discuss the application of solid state physics to "on site" inspections of clandestine: underground nuclear explosions.
Major Bruce Carswell DASA, Washington, D.C.	" "
Dr. Ulf Ericsson, Physicist, and Mr. Yan Prawitz, Physical Chemist FOA 4, Stockholm, Sweden	" "
Major W. Best, AF Office of Sci. Res., USAF, Washington, D.C.	" "
W. K. Dornbusch and J. D. Broughton, USAE Waterways Experiment Station Vicksburg, Mississippi	R. J. Hackman - to discuss the use of slope and height measuring instruments in the stereo model of two vertical aerial photographs.
Andres Bravo, CU-A.R.A. Dr. of Mines, Peru and Victor Mendoze, Interpreter State Department	R. J. Hackman - to discuss lunar photo- interpretation work being undertaken by the Branch of Astrogeology
Dr. S. E. Ansary General Petroleum Co. Cairo, Egypt, UAR	R. J. Hackman - to see lunar work being done by the Branch of Astrogeology.

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<u>Name and Affiliation</u>	<u>Visited and Purpose</u>
Bill Gilbert Free lance writer	R. J. Hackman - regarding literature available on stream classification.
H. Masursky, R. E. Eggleton, M. H. Carr, and D. E. Wilhelms, Branch of Astrogeology Menlo Park	Robert Stromm, University of Calif., Berkeley, Space Science Laboratory - to talk about the geology of the Ptolemaeus area of the Moon.
John Faick, American Exploration Company	H. Masursky - to talk about an explora- tion program in the Cortez Mining District.
Sigurud Thorarinsson Natural History Museum, Iceland	H. Masursky, R. E. Eggleton, D. Wilhelms, and M. H. Carr - to talk about volcanism on the Moon and in Iceland.
J. B. Miller, J. Van Den Acker, W. G. MacCloud, California Exploration Company	H. Masursky, D. P. Elston, R. E. Eggleton, D. Wilhelms - to discuss lunar geology and the photogeologic techniques used in studying the Moon.
Timothy Orrok, Robert Fudali, Bellcomm Inc.	H. Moore, R. E. Eggleton, M. H. Carr, and D. Wilhelms - to discuss the lunar environment.
Howard Pohn, Calif. Tech. Lunar Research Laboratory	R. E. Eggleton - to discuss lunar photo- metry and geology of the Tycho region of the Moon.
E. C. Morris, U.S.G.S. Branch of Astrogeology	Dr. I. Escobar, Director, Bolivian National Center of Investigations of Astrophysics, Aeronomy, Applied Physics,

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<u>Name and Affiliation</u>	<u>Visited and Purpose</u>
	and Space, at LaPaz - to obtain assistance and coordinate work on the earth-moon libration studies.
Dr. James Ring, Chairman Dept. of Applied Physics, University of Hull, England	E. C. Morris - discussed earth-moon libration region study at Mt. Chacaltaya, Bolivia, and problems related to the Zodiacal light and the Genenschine.
Harold Masursky, U.S.G.S. Branch of Astrogeology	Peter A. McCuen, Selden B. Spangder, and Ray W. Pfoutz of Vidya Div. of Itek Corp., Palo Alto, to discuss high resolution photography of craters of the Moon, Idaho, ultra-high altitude terrestrial photography, and color comparison lunar photography.
J. D. Bredehoeft, WRD	R. J. Hackman - regarding status of photogeologic mapping in the Uncompahgre area, Colorado.
Philip Oetking, Space Sci. Br. Chance Vought Corp.	R. J. Hackman - to discuss lunar geology.
Capt. W. J. Acker, E.W. King, and J. C. Neiman, U.S.A.F.	R. J. Hackman - to discuss state of the art in lunar environment studies.
Lt. Bulin, Kirkland A.F. Base Albuquerque, N. M.	C. H. Roach - to discuss shock induced properties of rocks near underground explosions.