The Lunar Science Institute

Semi-Annual Status Report

under

Contract No. NSR 09-051-001

for the period

15 July 1973 - 31 December 1973

Universities Space Research Association
Post Office Box 5127
Charlottesville, Virginia 22903

Respectfully submitted,

February 5, 1974

Date

A. R. Kuhlthau, President
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I. Introduction

This report covers the scientific and administrative activities at the Lunar Science Institute during the period 15 July through 31 December 1973.

During this period, the LSI has been under the leadership of two interim directors: Dr. David Strangway for the period 15 July through 31 August, and Dr. James Head since 1 September. The technical portions of this report were assembled from material prepared by them.

The Universities Space Research Association is a consortium consisting presently of 53 member universities from the U. S. and Canada. It was organized in 1969 "to constitute an entity in and by means of which universities and other research organizations may cooperate with one another, with the Government of the United States, and with other organizations toward the development of and knowledge associated with space science and technology" through research, development, and educational activities. The Lunar Science Institute is one of the major facilities which it operates under contract to NASA.
II. Staff

In addition to the interim directors, the following individuals were in residence during the period of this report:

A. Staff Scientists

1. Dr. Robert T. Brinkmann - Planetary atmospheres and their evolution, astronomy of satellites of the planets; space probe ultra violet measurements; laboratory photon and electron spectroscopy.

2. Dr. David R. Criswell - Theoretical modeling of moon/solar-wind interaction; electrostatic transport of lunar dust.

3. Dr. Wulf Gose - Magnetic properties of igneous and sedimentary rocks; paleomagnetism; Mossbauer spectroscopy.

4. Dr. W. I. Ridley (through 31 September) - Microscope analysis of mineral phases in lunar rocks and soils; mass spectrometric analysis of rare-earth and alkali elements in lunar rocks, fines, and soils.

5. Dr. Charles H. Simonds (effective 1 October) - Rates and mechanisms of recrystallization of some specific silicate aggregates.
B. **Visiting Scientists**

1. **Dr. J. A. Bastin**, Queen Mary College, University of London (through September) - Study thermal aspects of the formation of the maria and in particular to investigate the possibility that they have developed as a result of thermal instabilities in the outer layers of the original lunar surface; to produce an axially symmetric model for such an instability and also to survey the relevant observational data together with other possible mechanisms for maria formation.

2. **Dr. Gordon M. Biggar**, University of Edinburg, Scotland (November only) - Eu$^{2+}$/Eu$^{3+}$ equilibria in silicate liquids.

3. **Dr. J. W. Chamberlain**, Rice University, Houston (beginning October) - The formation of coupled lines in a planetary atmosphere.

4. **Dr. J. A. Hamed**, Arya-Mehr University of Technology, Tehran, Iran (August - September) Determination of the lunar surface topography at mare sites and their geophysical interpretation; density distribution inside the moon; and free oscillations of the moon.
5. Dr. A. G. Hermann, Geochemisches Institut der Universität, Göttingen, Germany (beginning October) - Determination of the distribution of REE and other trace elements in special earth rocks (e.g. greenstones, amphibolites) with methods of neutron activation.

6. Dr. Petr Jakes, Geological Survey, Hradebni 9, Praha 1, Czechoslovakia (beginning November) - Participate in the soil survey work dealing with the compositional evolution of lunar regolith.

7. Dr. John F. Lindsay, Department of Geology, La Trobe University, Bundoora, Victoria, Australia (beginning December) - Complete grain size and shape work on Apollo 16 and 17 samples using particle counting equipment at JSC.


9. Dr. Donald Rehfuss, California State University, San Diego (through November) - Returned to LSI to use PDP-11 computer in connection with research on "Glass Production Differences for Equal-Diameter Impact Craters" and "Hypervelocity Impact Heating of Porous Aluminum."
10. Dr. Eberhard Schneider, Max-Planck-Institut
fur Kernphysik, Germany - Micro-crater studies on
lunar rock surfaces.

11. Dr. Stuart R. Taylor, the Australian National
University, Australia (beginning September) - Prepare
a synthesis and review of geochemical aspects of the
Apollo lunar science program.

C. Visiting Post Doctoral Fellows

1. Dr. Russell B. Merrill, Ph.D. 1973, University of
Chicago - Study possible origins of lunar highland
basalts, using experimental petrological techniques.

2. Dr. Charles H. Simonds, Ph.D. 1971, University
of Illinois (through September) - Rates and mechanisms
of recrystallization of some specific silicate aggregates.

3. Dr. Joseph Smyth, Ph.D. 1970, University of
Chicago - High temperature crystal chemistry of the
pyroxene, olivine, and feldspar mineral groups:
refinement of the crystal structures of two olivines and ortho,
proto, and high and low clino pyroxenes at elevated temper-
atures; reaction kinetics and mechanisms of transitions
between the polymorphs of enstatite.

4. Dr. Raymond Watts, Ph.D. 1972, University of
Toronto - Electromagnetic exploration; electrical properties
and electrical structure of the Moon.
D. Visiting Graduate Fellows

1. Mr. Colin Donaldson, University of St. Andrews, Scotland - An extension of geological and geochemical training towards a post-graduate degree concerned with a study of vectorial mineral growths, particularly of macrocrystalline ["harristic" or "crescumulus"] olivines from the layered ultrabasic intrusion of Rhum, Scotland, but also from the "quench periodotite" or "spinifex" rocks from the Archaean of Canada, South Africa and Australia. (This study has relevance to the origin of lunar samples 12009 which has olivine textures with similarities to the two terrestrial examples being studied.)

2. Mr. Howard Sharpe, University of Toronto, Ontario, Canada (August - September) (Student of Dr. David Strangway) - Evolutionary models of the Moon with particular emphasis on density, moment of inertia and thermal constraints; convection in the Moon; photogeologic interpretations.

E. Visiting Scientists - Outstanding Appointments At end of Period

1. Mr. Rex Gibbons, (Cal Tech) Wesleyville, Newfoundland, Canada - Visiting Scientist for approximately one month beginning in January, 1974. - Study of shock induced crystal
lattice defects and how they contribute to overall thermoluminescence behavior of lunar materials and at what pressures olivine melts.

2. Dr. Charles E. Bicket, California State University, San Francisco, California - Visiting Scientist for approximately one week beginning January 7 - 11, 1974. Petrographic Study of Igneous and Metamorphic Rocks and to study the lunar samples with J. Warner and W. Phinney at JSC.

3. Professor Bruno J. Giletti, Brown University, Providence, Rhode Island - Visiting Scientist for approximately two weeks beginning in January 1974. Continue work at the Johnson Space Center in collaboration with Dr. Charles Meyer on Ion Microprobe Studies of Diffusive Transport of Ions in Silicates.

III. Lectures and Colloquia Sponsored by LSI

1. July 4, 1973: Dr. Mike Rhodes, JSC, "Chemical Diversity of Basalts from the Mid-Atlantic Ridge at 45° N."

2. July 13, 1973: Dr. Fred Horz, JSC, "What We Don't Know about the Lunar Regolith."


5. August 17, 1973: Dr. Donald Rehfuss, LSI
"Thermodynamic Models of Lunar Meteorite Impact."

6. August 31, 1973: Dr. Joseph Smyth, LSI,
"Crystal Structure of Armaclolites from Apollo 17."

7. September 7, 1973: Dr. S. R. Taylor, LSI,
"Trace Element Chemistry of the Lunar Highlands."

8. September 28, 1973: Dr. Robin Brett, JSC,
"The Lunar Crust: A Product of Heterogeneous
Accretion or Differentiation of a Homogeneous Moon."

9. October 5, 1973: Dr. Fred Horz, JSC, "The
Emplacement of the Cayley Formation."

10. October 26, 1973: Dr. Gordon Biggar, LSI
"Were Experimental Petrologists Incapable of
Remelting Lunar Samples?"

11. November 2, 1973: Dr. Eberhard Schneider,
LSI, "Fracture Systems in Lunar Flat-Bottom
Craters."

12. November 9, 1973: Dr. Dick Morris, JSC,
"EPR Measurements on the Oxidation State of
Europium."

13. November 20, 1973: Dr. Michael R. Dence,
Ottawa, Canada, "Setting and Petrological
Characteristics of Impact Melts."

14. November 13, 1973: Professor Hannes Alfven,
University of California, San Diego, "Origin and
Evolution of the Lunar Orbit."
15. December 7, 1973: Dr. Yoji Kondo, JSC, "Comet Kohoutek."


IV. Scientific and Professional Meetings Held at the Institute

The following meetings, sponsored by the organizations as noted were held at LSI during the period of this report.


7. October 2, 1973: Meeting on "110 Stabilization Management" chaired by Mr. Bruce Johnson of JSC; approximate attendance - 50.


V. Contributions of the Lunar Science Institute

An updated complete listing of the publication series by staff and visitors at the Institute entitled "Contributions of the Lunar Science Institute" is attached as Appendix A.

VI. Special Activities of the Institute

The following paragraphs provide a brief status report on some of the other major programs of LSI which were especially active during the period covered by this report.

A. First Lunar Petrology Conference

From July 23-25, approximately 100 lunar scientists from U.S. and Europe attended the first Lunar Petrology Conference. An additional, informal session on lunar rock nomenclature was held on July 26. The conference was structured to minimize formal presentation and maximize discussion by having only 2-3 keynote speakers per session. This format largely contributed to the overall success of the meeting. Petrologists and chemists were able to discuss their different approaches to lunar research and areas of agreement and contention. Important topics discussed included the recognition and origin of highland rocks; the characteristics of mare basalts and their role in understanding the composition of the lunar mantle; the variability and formation of lunar breccias; and models for lunar genesis based on studies of lunar, meteoritic, and terrestrial rocks.
B. Lunar Data Center

In the 1972 Post-Apollo Lunar Science Study it was concluded that "a vigorous program of lunar science investigation is essential as a continuation of the Apollo Program in the post mission era and as a more general undertaking in fundamental scientific research." The Lunar Science Institute is embarking on a program to achieve goals and objectives which are related to the growth and strengthening of lunar science in the post-Apollo period.

In general, the LSI is striving to:

1. Work with lunar scientists to create a unique facility for scientific utilization of the lunar samples, information returned from the lunar surface, orbital experiments, and for general lunar studies.

2. Facilitate communication between scientists working in the field of lunar science.

3. Promote the interaction between lunar science and workers in other areas in order to improve the quality and to stimulate diversity in lunar research.

To achieve these goals, the LSI is actively establishing a Lunar Data Center (including photo and map libraries and sample information libraries in addition to its already well established publications library). A guide to the data center and related facilities at the LSI is in preparation. Numerous lunar data users guides are
in the planning stage. These documents are designed to help investigators both familiar and unfamiliar with lunar studies to gain increased awareness of other Apollo data which might be relevant to their particular areas of interest. The Lunar Data Center is designed to aid scientists in the immediate area and also to encourage scientists to take advantage of the unique facilities concentrated in the Houston area.

C. Fifth Lunar Science Conference

Once again, the LSI will assist JSC in the planning, conduct, and publication of proceedings for the Lunar Science Conference.

The conference will be held March 18-22, 1974 at the NASA Johnson Space Center. It is being organized along somewhat different lines than previous conferences and will center on the following six broad, problem oriented topics:

1. Constraints on structure and composition of the deep interior.
2. Characteristics and movement of materials in the lunar regolith.
5. Nature of impact processes and their effects on lunar materials
6. Exchange of material and energy between the Moon and its environment.
All abstracts submitted to the conference will be designed to address one of these problems. The abstracts are intended to be short papers. There will be fewer concurrent sessions and more time for discussion than in previous conferences. For six half-days there will be three simultaneous sessions at which investigators will present papers. A half-day session is planned for informal consortium discussions and another half-day for special talks to be selected by the Program Committee from submitted abstracts or by special invitation.

On the final day the morning will be scheduled for summaries of each of the six problem-oriented topics. The following schedule indicates important dates in reference to the conference:

12/3/73 Abstract forms mailed to PI's
1/4/74 Deadline for submission of abstracts to the Fifth Conference
Mid-February Distribution of abstracts volume to conference participants by mail.
3/18-22/74 Fifth Lunar Science Conference, Houston, Texas
4/19/74 Deadline for submission of manuscripts for the Proceedings of the Fifth Lunar Science Conference.

D. Lunar Geology Conference

A three-day Lunar Geology Conference will be held at the Lunar Science Institute from January 14-16, 1974.
A considerable amount of geologic information has been collected in the Apollo program through surface and orbital observations, photography, sample collection, and experiments. Much of the analysis so far has been necessarily related to the Apollo landing sites and the preliminary analysis of materials returned from these missions. By the time of the conference, over a year will have passed since the last Apollo mission and we will have moved from a mission related phase to a data analysis and synthesis phase.

Therefore, this seemed an opportune time to reconsider some of the basic problems that were addressed in planning lunar exploration, to consider how far we have gone toward answering these questions, and finally, and perhaps most importantly, to discuss future directions for lunar geologic research. This conference will, therefore, be more problem-oriented than the annual Lunar Science Conferences. Since many of the questions and problems in lunar geology are multi-disciplinary, a number of individuals from related fields are being invited. It is the intent, however, to keep attendance at a small conference level so that individual interchange is encouraged and not to duplicate the topics covered in previous LSI conferences on Lunar Geophysics and Petrology.

Proposed topics for the Geology Conference include impact processes, magmatic history, tectonics, lunar regolith, geologic provinces, and a discussion of the availability of lunar data.
E. Information Bulletin

One of the major goals of the Lunar Science Institute is to facilitate communication between investigators working in the field of lunar science. In addition, we are striving to promote the interaction between lunar science investigators and workers in other areas of science so as to maximize the quality and diversity of lunar research. To these ends, we are planning to distribute an informal short communication to a wide audience in lunar science and related areas. It will be known as the LSI Information Bulletin and will be composed and distributed as significant information is available and the need arises.

Following is a list of topics that are potential subjects for the Information Bulletin: Description of Lunar Data Center; announcement and description of specific data user guides; meeting and conference summaries; abstracts of LSI talks and seminars; short summary of work being done by a Visiting Scientist or Staff Scientist; listing of recent Apollo cartographic products and sources; new publications of interest; lunar science calendar; meeting and conference announcements; teaching guides: plans, summaries, and availability; summary of new publications and products available from NSSDC; summary of products which have been published by Curator's Office for various missions; organization and flow charts for various aspects of NASA and lunar science, including committees, review process, etc.; announcement of Visiting Scientist and other positions available at LSI;
periodic listing of scientists in residence; and LSI contributions announcements.

We anticipate that the first issue will be distributed in early February.

F. **Lunar Sample Review Panel**

LSI continues to operate a Lunar Sample Review Panel to review, analyze, and evaluate proposals concerned with research on lunar samples. The Panel met in September and again in October. The September meeting featured a joint session with LSAPT.

The current composition of the Lunar Sample Review Panel is as follows:

- Dr. John B. Adams
  Fairleigh Dickinson University

- Professor Arden L. Albee
  California Institute of Technology

- Dr. Robert N. Clayton
  University of Chicago

- Dr. David R. Criswell
  Lunar Science Institute

- Dr. Fred Frey
  Massachusetts Institute of Technology

- Dr. James W. Head
  Lunar Science Institute

- Dr. Lincoln S. Hollister
  Princeton University

- Dr. Johns W. Hopkins
  Washington University
VII. **LSI Administration**

A. **LSI Objectives**

During the summer and early fall of 1973 NASA conducted a review of the LSI program. At the same time the Board of Trustees of USRA requested its Ad-Hoc Search Committee to Select a New Director for the LSI to also make recommendations concerning the future role of LSI in lunar science. As a result of these efforts,
the mission of LSI in the immediate years ahead has been agreed upon in principle by all interested parties. The following excerpts from this agreement may be of value to help the scientific community to better understand the role of LSI and some of the programs through which it hopes to achieve its objectives:

PROGRAMS AND GOALS OF THE LUNAR SCIENCE INSTITUTE

"A vigorous program of lunar science investigations is essential as a continuation of the Apollo Program in the post-mission era and as a more general undertaking in fundamental scientific research."* The LSI can play an important role in leading this program by contribution in unique and substantive ways to the generation and promulgation of scientific knowledge concerning the Moon. It should serve as a focal point for lunar science.

To achieve this status it will require imaginative leadership to recognize needs of the scientific community and the nation and to plan innovation programs. NASA should be encouraged to avail itself of every opportunity to work through the LSI as it sees the need for general interaction with the academic community in areas of lunar science.

Specifically, the LSI should fulfill the following roles:

1. Work with lunar scientists to create a unique facility for scientific utilization of the lunar

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samples, information returned from the lunar
surface, orbital experiments, and for general
lunar studies.
2. Facilitate communication between scientists
working in the field of lunar science.
3. Promote the interaction between lunar science
and workers in other areas of science in such a
fashion as to maximize the overall quality and
diversity of lunar research.
4. Communicate the results of lunar science to
scientists, the academic community, and to the
general public.
5. Provide a forum for the critical evaluation of the
lunar program and its overall relationship to
planetary and space sciences.

To implement these major objectives, the following program can
be defined for the Lunar Science Institute:

1. Establishment of the Lunar Data Center*

*It should be noted that the intent was not to set up a truly encyclopedic
library of photos, maps and publications, but rather a very good working
library. In no way should the photo science and map library grow into an
enormous research program which exhausts the resources of the LSI.
The effective quality of the libraries will be a reflection of its accessibility
and completeness (in that order) and how much service it can provide to
the scientific community.
a. Lunar Photo Science and Map Library

(1) Photo library with a staff geologist to aid investigators, and facilities to make certain basic measurements.

(2) Black and white films of EVA's with accompanying transcripts.

(3) Regional maps.

(4) Topographic mission maps.

(5) To establish means to aid scientists in efficiently selecting and obtaining mission and rock photographs from different repositories on a rapid time scale.

(6) Photo lending library to encourage maximum use of photographic data.

b. Lunar Sample Information Library

(1) Photographs and cutting diagrams of all rocks.

(2) Basic information file on samples.

(3) Models of rocks.

(4) Library of selected thin sections of lunar rocks.
c. Lunar Science Publication Library

Cataloging, indexing, and retrieval of subject information in publications, reports, and books. The intended scope is a basic set of lunar publications and an appropriate key word list to provide rapid and efficient access to information and documents from a wide variety of government and university repositories.

2. Scientific Symposium Program

a. A program to facilitate communication on specialized topical subjects in the lunar sciences.

b. A program directed towards synthesizing the overall content of lunar science.

c. A program to promote imaginative interaction with non-lunar scientists in order to identify new fields of research.

3. Visiting Scientist Program

a. Appointments to encourage and stimulate the productive use of lunar data through the data center.
b. Appointments on an international basis to provide interaction among lunar scientists, and between lunar scientists and scholars from other segments of the scientific community.

c. Appointments designed to broaden the base of the lunar science community.

d. Establishment of a working relation between the Johnson Spacecraft Center and the Lunar Science Institute which will provide reasonable access to the unique facilities at JSC for qualified lunar scientists on visiting appointments.

4. Publications and Communications

   a. Provide publications, particularly directed toward syntheses of lunar data and diverse studies on collections of lunar data.

   b. Make available the results of important symposia to the scientific community at large.

   c. Develop a dynamic program to interpret and disseminate new and important results of the lunar science program to the public at large. This is an area that has not received attention by the LSI in the past and one that is deemed of crucial importance for the future.
B. **Directorship of the Lunar Science Institute**

The ad-hoc search committee appointed by the Board of Trustees of USRA has made its report to the Board containing its recommendations and USRA, with the assistance of some members of this committee and its Advisory Committee for the LSI, is proceeding with the recruitment of a new director. In the interim, arrangements have been made with Brown University to allow one of their faculty, Dr. James W. Head, to serve as Interim Director.

C. **Board of Trustee Actions**

In the fall of 1972 the Board of Trustees appointed an Advisory Committee for the Lunar Science Institute to advise it as well as the Director of LSI concerning policy and programs to assure that USRA is being responsive to the needs of the scientific community and NASA. Dr. Robert Pepin of the University of Minnesota, who served as chairman of the committee since its inception, resigned from this post in July, but the committee continued action with Dr. Strangway replacing Dr. Pepin on the committee and Dr. Kuhlthau serving as Acting Chairman.

The Advisory Committee met twice during the period: in August in Boulder, Colorado jointly with the Ad-Hoc Search Committee, and in October at the Lunar Science Institute.

The Board itself met in October at LSI and in response to inputs from the reviews mentioned in Section A, and from both the Advisory Committee and Ad-Hoc Search Committee, adopted a new approach to
its own responsibilities and concerns with the management and guidance of LSI. This consisted of the formation of a Scientific Council for LSI as described below:

CREATION OF SCIENTIFIC COUNCIL

1. The Board of Trustees of USRA would continue to have the corporate responsibility for administrative and management policies for all activities, including the LSI. This includes the ultimate responsibility of confirming the appointment of the director.

2. The Board of Trustees should appoint, with due consultation from whatever sources they consider to be appropriate, a Scientific Council for each major activity within its responsibility.

3. The number of members of each Scientific Council needs to be determined in a way consistent with the objectives and functions of the Council. It need not be the same for each facility.

4. The criteria for membership on the Scientific Council should consider the following:

   a. Interest of individual in the general scientific area and mission of the activity.
   b. Competence of individual in his field.
   c. Status or acceptance of individual by the general community of lunar scientists.
   d. Willingness of the individual's institution to participate with their representative in whatever way necessary to assure the proper support of the activity.
e. Resources, reputation, and scope of interest
of the institution in the particular area of endeavor.

5. The terms of the members of each Scientific Council
should be finite, with ability to reappoint or replace as deemed appropriate
by the Trustees.

6. The Council shall be responsible for the formulation and approval
of all policy relating to the technical or scientific programs of the activity,
including the selection and recommendation of the activity director to the
Trustees for confirmation. It shall also be responsible for the review
and evaluation of the program. When deemed necessary or important for
the improvement of the scientific program, they should recommend changes
in administrative or management policy to the Trustees for action.

7. Corporate financial resources, as recommended by the
Scientific Council, and approved by the Trustees, should be made available
to the Council for the development of the program at the activity. It is not
intended that these funds be used for normal operating expenses, but rather
for capital investment if required or as a reserve for taking reasonable
risks in program development where ultimate reimbursement is likely.
The Council should submit an annual budget request to the Trustees for
such corporate funds as they might require during the year, stating the
purposes for which the funds are to be devoted. Interim emergency requests
can be made if absolutely essential in the opinion of the Council.
This concept has been reviewed and endorsed by the Advisory Committee, and it is expected that the formation of the Scientific Council for the Lunar Science Institute will be completed by mid-spring.
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<th>No.</th>
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<th>Accepted Date:</th>
<th>Published Date:</th>
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LSI Contributions

5. AUTHOR: Ralph Morganstern
TITLE: "Comment on the Spin Precession of the Schiff Satellite in the Brans-Dicke Theory"
SUBMITTED To: Physical Review D 15
Date: July 21, 1970
ACCEPTED: October 23, 1970
REPRINTS ORDERED: October 30, 1970
REPRINTS RECEIVED: March 11, 1971

6. AUTHOR: A. E. Ringwood
TITLE: "Core-Mantle Equilibrium: Comments on a Paper by R. Brett"
SUBMITTED To: Geochimica et Cosmochimica Acta
Date: September, 1970
ACCEPTED: September, 1970
REPRINTS ORDERED: March 22, 1971
REPRINTS RECEIVED: April 28, 1970

7. AUTHOR: A. E. Ringwood
TITLE: "Petrogenesis of Apollo 11 Basalts and Implications for Lunar Origin"
SUBMITTED To: Journal of Geophysical Research
Date: September, 1970
ACCEPTED: Date unknown
REPRINTS ORDERED: October 30, 1970
REPRINTS RECEIVED: December 29, 1970

8. AUTHOR: Luciano B. Ronca
TITLE: "Ages of the Lunar Mare Surfaces"
SUBMITTED To: The Geological Society of America Bulletin
Date: September, 1970
ACCEPTED: December 16, 1970
PUBLISHED: June 1971, Vol. 82, pp. 1743-1748
REPRINTS ORDERED: March 29, 1971
REPRINTS RECEIVED: August 3, 1971
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<td>9</td>
<td>TITLE: &quot;Micrometeorite Craters on Lunar Rock Surfaces&quot;</td>
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<td>SUBMITTED To: Journal of Geophysical Research</td>
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<td>ACCEPTED: May 12, 1971</td>
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<td>TITLE: &quot;Relationships Between Geomorphic Index, Lunar Stratigraphy, Ages of the Maria, and Hot Spots&quot;</td>
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<td>SUBMITTED To: Geological Society of America for the GSA Annual Meeting Program (1970)</td>
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<th>11</th>
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<td>TITLE: &quot;Two Populations of Aliphatic Hydrocarbons of Teratoma and Habituated Tissue Cultures of Tobacco&quot;</td>
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<th>12</th>
<th>AUTHOR: J. L. Laseter, John D. Weete</th>
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<td>TITLE: &quot;Fatty Acid Ethyl Esters of Rhizopus Arrhizus&quot;</td>
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<td>16</td>
<td>T. Thompson, R. Shorthill, S. Zisk, H. Masursky, G. Tyler</td>
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<td>17</td>
<td>W. von Engelhardt, Friedrich Hörz, D. Stöffler</td>
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LSI Contributions

21  AUTHOR: S. Fred Singer
    TITLE: "How Did Venus Lose Its Angular Momentum?"
    SUBMITTED To:
    Date: August 5, 1970
    ACCEPTED: September 21, 1970
    REPRINTS ORDERED: November 23, 1970
    REPRINTS RECEIVED: January 15, 1971

22  AUTHOR: Ki-iti Horai, Gene Simmons
    TITLE: "Thermal Property Measurements on Lunar Material Returned by Apollo 11 and 12 Missions"
    SUBMITTED To: Lucas, John W., ed., Thermal characteristics of the Moon, MIT Press, 1972. (Progress in Astronautics and Aeronautics, v.28)
    Date: December 18, 1970
    ACCEPTED: March 10, 1971
    PUBLISHED: pp. 243-267
    REPRINTS ORDERED: February 17, 1972 (limited supply only)
    REPRINTS RECEIVED: April 18, 1973

23  AUTHOR: Ki-iti Horai, A. Nur
    TITLE: Reply to P. S. Naidu's comments on a paper by K. Horai & A. Nur, "Relationship Among Terrestrial Heat Flow, Thermal Conductivity, and Geothermal Gradient"
    SUBMITTED To: Journal of Geophysical Research
    Date: January 6, 1971
    ACCEPTED: January 15, 1971
    REPRINTS ORDERED: March 29, 1971
    REPRINTS RECEIVED: July 14, 1971
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<td>24</td>
<td>David R. Criswell</td>
<td>&quot;Electric Fields and Motion of Lunar Fines&quot;</td>
<td>EOS Transactions of the American Geophysical Union</td>
<td>January 7, 1971</td>
<td>March, 1971</td>
<td>April 1971, Vol. 52, No. 4, p. 266</td>
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<td>K. L. Currie</td>
<td>&quot;The Origin of Igneous Rocks Associated with Shock Metamorphism as Suggested by Geochemical Investigations of Canadian Craters&quot;</td>
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<td>C. S. Beals</td>
<td>&quot;Crustal Thickness and the Forms of Impact Craters&quot;</td>
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<td>40</td>
<td>Jack Green</td>
<td>&quot;Copernicus as a Lunar Caldera&quot;</td>
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LSI Contributions

41

AUTHOR: Rex V. Gibbons, Thomas J. Ahrens
TITLE: "Shock Metamorphism of Silicate Glasses"
SUBMITTED To: Journal of Geophysical Research, special issue on "Meteorite Impact and Volcanism"
Date: January 1971
ACCEPTED: February 25, 1971
REPRINTS ORDERED: July 23, 1971
REPRINTS RECEIVED: August 19, 1971

42

AUTHOR: D. J. Guppy, Robin Brett, D. J. Milton
TITLE: "Liverpool and Strangways Craters, Northern Territory: Two Structures of Probable Impact Origin"
SUBMITTED To: Journal of Geophysical Research, special issue on "Meteorite Impact and Volcanism"
Date: January 1971
ACCEPTED: February 25, 1971
PUBLISHED: August 10, 1971, Vol. 76, No. 23, pp. 5387-5393
REPRINTS ORDERED: July 23, 1971
REPRINTS RECEIVED: August 19, 1971

43

AUTHOR: J. D. Kleeman
TITLE: "The Formation of Diaplectic Glass by Experimental Shock-Loading of Orthoclase"
SUBMITTED To: Journal of Geophysical Research, special issue on "Meteorite Impact and Volcanism"
Date: January 1971
ACCEPTED: March 1, 1971
REPRINTS ORDERED: July 23, 1971
REPRINTS RECEIVED: August 19, 1971

44

AUTHOR: Gary Lofgren
TITLE: "Spherulitic Textures in Glassy and Crystalline Rocks"
SUBMITTED To: Journal of Geophysical Research, special issue on "Meteorite Impact and Volcanism"
Date: January 1971
ACCEPTED: March 1, 1971
PUBLISHED: August 10, 1971, Vol. 76, No. 23, pp. 5635-5648
REPRINTS ORDERED: July 23, 1971
REPRINTS RECEIVED: August 19, 1971
LSI Contributions

45. AUTHOR: Aaron C. Waters, Richard V. Fisher
   TITLE: "Base Surges and Their Deposits: Capelinhos and Taal Volcanoes"
   SUBMITTED To: Journal of Geophysical Research, special issue on "Meteorite Impact and Volcanism"
   Date: January 1971
   ACCEPTED: March 1, 1971
   REPRINTS ORDERED: July 23, 1971
   REPRINTS RECEIVED: August 19, 1971

46. AUTHOR: Jehan Rondot
   TITLE: "Impactite of the Charlevoix Structure, Quebec, Canada"
   SUBMITTED To: Journal of Geophysical Research, special issue on "Meteorite Impact and Volcanism"
   Date: January 1971
   ACCEPTED: March 1, 1971
   PUBLISHED: August 10, 1971, Vol. 76, No. 23, pp. 5414-5423
   REPRINTS ORDERED: July 23, 1971
   REPRINTS RECEIVED: August 19, 1971

47. AUTHOR: Donald P. Elston and G. Robert Scott
   TITLE: "Pueblito de Allende Penetration Craters and Experimental Craters Formed by Free Fall"
   SUBMITTED To: Journal of Geophysical Research, special issue on "Meteorite Impact and Volcanism"
   Date: January 1971
   ACCEPTED: March 2, 1971
   REPRINTS ORDERED: July 23, 1971
   REPRINTS RECEIVED: August 19, 1971

48. AUTHOR: L. B. Ronca
   TITLE: "The Ages of the Lunar Seas"
   SUBMITTED To: Proceedings of the National Academy of Sciences
   Date: January 1971
   ACCEPTED: February 27, 1971
   PUBLISHED: June 19, 1971, Vol. 68, No. 6, pp. 1188-1189
   REPRINTS ORDERED: May 11, 1971
   REPRINTS RECEIVED: July 16, 1971
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<td>K. Nakamura, K. Horai</td>
<td>&quot;Iceland, from the New Global Tectonic Point of View (A review in Japanese)&quot;</td>
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<td>Kagaku (Science)</td>
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<td>April 1, 1971, Kagaku, Vol. 41, No. 4, pp. 185-198</td>
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<td>None will be ordered (30 free to the authors)</td>
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<td>51</td>
<td>L. B. Ronca</td>
<td>&quot;The Geomorphic Evolution of the Lunar Surface&quot;</td>
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<td>52</td>
<td>John G. Dennis</td>
<td>&quot;Ries Structure, Southern Germany, A Review&quot;</td>
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<td>53</td>
<td>Dieter Stöffler</td>
<td>&quot;Coesite and Stishovite in Shocked Crystalline Rocks&quot;</td>
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LSI Contributions

54
AUTHOR: Wolf v. Engelhardt
TITLE: "Detrital Impact Formations"
SUBMITTED To: Journal of Geophysical Research, special issue on "Meteorite Impact and Volcanism"
Date: January 1971
ACCEPTED: March 9, 1971
REPRINTS ORDERED: July 23, 1971
REPRINTS RECEIVED: August 19, 1971

55
AUTHOR: Dieter Stöffler
TITLE: "Progressive Metamorphism and Classification of Shocked and Brecciated Crystalline Rocks at Impact Craters"
SUBMITTED To: Journal of Geophysical Research, special issue on "Meteorite Impact and Volcanism"
Date: January 1971
ACCEPTED: March 9, 1971
PUBLISHED: August 10, 1971, Vol. 76, No. 23, pp. 5541-5551
REPRINTS ORDERED: July 23, 1971
REPRINTS RECEIVED: August 19, 1971

56
AUTHOR: Neville L. Carter
TITLE: "Static Deformation of Silica and Silicates"
SUBMITTED To: Journal of Geophysical Research, special issue on "Meteorite Impact and Volcanism"
Date: January 1971
ACCEPTED: March 9, 1971
REPRINTS ORDERED: July 23, 1971
REPRINTS RECEIVED: August 19, 1971

57
AUTHOR: Thomas J. Ahrens, Edward S. Gaffney
TITLE: "Dynamic Compression of Enstatite"
SUBMITTED To: Journal of Geophysical Research, special issue on "Meteorite Impact and Volcanism"
Date: January 1971
ACCEPTED: March 11, 1971
PUBLISHED: August 10, 1971, Vol. 76, No. 23, pp. 5504-5513
REPRINTS ORDERED: July 23, 1971
REPRINTS RECEIVED: August 19, 1971
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<th>Published Date</th>
<th>Reprints Ordered Date</th>
<th>Reprints Received Date</th>
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62 AUTHOR: Nils-Bertil Svensson
TITLE: "Lappajärvi Structure, Finland: Morphology of an Eroded Structure"
SUBMITTED To: Journal of Geophysical Research, special issue on "Meteorite Impact and Volcanism"
Date: January 1971
ACCEPTED: March 14, 1971
PUBLISHED: August 10, 1971, Vol. 76, No. 23, pp. 5382-5386
REPRINTS ORDERED: July 23, 1971
REPRINTS RECEIVED: August 19, 1971

63 AUTHOR: John S. Rinehart, Ronald Greeley
TITLE: "Seismic Wave Velocity Patterns in Some Pahoehoe Basalt Flows"
SUBMITTED To: Journal of Geophysical Research, special issue on "Meteorite Impact and Volcanism"
Date: January 1971
ACCEPTED: March 16, 1971
PUBLISHED: August 10, 1971, Vol. 76, No. 23, pp. 5765-5769
REPRINTS ORDERED: July 23, 1971
REPRINTS RECEIVED: August 19, 1971

64 AUTHOR: Wolfgang E. Elston
TITLE: "Evidence for Lunar Volcano-Tectonic Features"
SUBMITTED To: Journal of Geophysical Research, special issue on "Meteorite Impact and Volcanism"
Date: January 1971
ACCEPTED: March 19, 1971
REPRINTS ORDERED: July 23, 1971
REPRINTS RECEIVED: August 19, 1971

65 AUTHOR: P. Jakes, A.J.R. White
TITLE: "Major and Trace Element Abundances in Volcanic Rocks of Orogenic Areas"
SUBMITTED To: Geological Society of America Bulletin
Date: April 1, 1971
ACCEPTED: May, 1971
REPRINTS ORDERED: January, 1972
REPRINTS RECEIVED: February 21, 1972 (limited supply only)
LSI Contributions

66

AUTHOR: Dr. John D. Weete
TITLE: "Total Fatty Acids of Habituated and Teratoma Tissues of Tobacco"

SUBMITTED
To: Lipids
Date: April 5, 1971
ACCEPTED: June 2, 1971
PUBLISHED: September, 1971, Vol. 6 (9), pg. 684
REPRINTS ORDERED: September 3, 1971
REPRINTS RECEIVED: February 10, 1972

67

AUTHOR: Dr. R. E. Morganstern
TITLE: "A Cosmological Upper Limit on the Variation of G"

SUBMITTED
To: Nature
Date: May 21, 1971
ACCEPTED: June 17, 1971
REPRINTS ORDERED: July 19, 1971
REPRINTS RECEIVED: December 7, 1971

68

AUTHOR: S. Fred Singer
TITLE: "Origin of the Moon by Capture and Its Consequences"

SUBMITTED
To: EOS Transactions, American Geophysical Union
Date: September, 1970
ACCEPTED: September, 1970
PUBLISHED: September, 1970 Vol. 51, No. 9, pp. 637-641
REPRINTS ORDERED: April 15, 1971
REPRINTS RECEIVED: June 3, 1971

69

AUTHOR: R. E. Morganstern
TITLE: "Exact Solutions to Brans-Dicke Cosmologies in Flat Friedman Universes"

SUBMITTED
To: The Physical Review D
Date: April 19, 1971
ACCEPTED: May 21, 1971
PUBLISHED: August 15, 1971, Vol. 4, No. 4, pp. 946-954
REPRINTS ORDERED: June 15, 1971
REPRINTS RECEIVED: January, 1972
LSI Contributions

74
Author: Petr Jakes, A.J.R. White
Title: "Hornblendes from Calc-alkaline Volcanic Rocks of Island Arcs and Continental Margins"
Submitted To: American Mineralogist
Date: July 11, 1971
Accepted: Expected Publication Date: May-June 1972
Published: American Mineralogist, 57, 887-902, 1972
Reprints Ordered: April 14, 1972
Reprints Received: August 7, 1972

75
Author: Ki-iti Horai
Title: "Cross-covariance Analysis of Heat Flow and Gravitational Field of the Earth"
Submitted To: Tectonophysics
Date: January, 1972
Accepted: July 1972
Expected Publication Date: 
Published: 
Reprints Ordered: 
Reprints Received: 

76
Title: "Lunar Apennine-Hadley Region: Geological Implications of Earth-Based Radar and Infrared Measurements"
Submitted To: Science
Date: June, 1971
Accepted: July, 1971
Expected Publication Date: August 20, 1971
Published: August 27, 1971, Vol. 173, pp. 808-812
Reprints Ordered: August 10, 1971
Reprints Received: October 26, 1971

77
Author: John D. Weete
Title: "Aliphatic Hydrocarbons of the Fungi"
Submitted To: Phytochemistry
Date: August 10, 1971
Accepted: September 24, 1971
Expected Publication Date: July, 1972
Published: Vol. 11, 1201-1205 (1972)
Reprints Ordered: January 4, 1972
Reprints Received: April 10, 1972
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<th>NO.</th>
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<th>ACCEPTED:</th>
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<th>PUBLISHED:</th>
<th>REPRINTS ORDERED:</th>
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</tr>
</thead>
</table>
82  AUTHOR: Z. Kopal  
TITLE: The effects of viscous friction on axial rotation of celestial bodies  
SUBMITTED TO: Astrophysics and Space Science  
DATE: December 1971  
ACCEPTED: February 9, 1972  
EXPECTED PUBLICATION DATE:  
PUBLISHED: 16 (1) 3-51, April 1972  
REPRINTS ORDERED: February 14, 1972  
REPRINTS RECEIVED: August 9, 1972

83  AUTHOR: J. A. Kong  
TITLE: Reflection coefficients for acoustic waves interacting with stratified media  
SUBMITTED TO: Journal of the Acoustical Society of America  
DATE: October 1971  
ACCEPTED: December 1971  
EXPECTED PUBLICATION DATE: May 1972  
PUBLISHED: 51, 1765-1767, 1972  
REPRINTS ORDERED: January 5, 1972  
REPRINTS RECEIVED: August 4, 1972

84  AUTHOR: Z. Kopal  
TITLE: Cosmic influences on the early history of the lunar surface  
SUBMITTED TO: Moon  
DATE: December 1971  
ACCEPTED: March 1972  
EXPECTED PUBLICATION DATE: May 1972  
PUBLISHED: 5, 200-205, 1972  
REPRINTS ORDERED: March 2, 1972  
REPRINTS RECEIVED: October 13, 1972

85  AUTHOR: Z. Kopal  
TITLE: Effects of viscous friction on the precession and nutation of celestial bodies  
SUBMITTED TO: Astrophysics and Space Science  
DATE: January 1972  
ACCEPTED: April 10, 1972  
EXPECTED PUBLICATION DATE:  
PUBLISHED: 16, 347-371, 1972  
REPRINTS ORDERED: April 10, 1972  
REPRINTS RECEIVED: November 20, 1972

86  AUTHOR: Z. Kopal  
TITLE: Lunar Geophysics Conference, Proceedings  
SUBMITTED TO: Moon  
DATE: January 1972  
ACCEPTED: February 1972  
EXPECTED PUBLICATION DATE: Spring, 1973  
PUBLISHED: MOON 4, 3-249, 271-504; 5, 3-160 (1972)  
REPRINTS ORDERED: June 29, 1972  
REPRINTS RECEIVED: May 20, 1973
87  AUTHOR: J. D. Weete
SUBMITTED: TO: Space Life Sciences
DATE: February 1972
ACCEPTED: February 29, 1972
EXPECTED PUBLICATION DATE: May 1972
PUBLISHED: Space Life Sciences, 4, 3-138, 1973
REPRINTS ORDERED: February 28, 1973
REPRINTS RECEIVED: July 30, 1973

88  AUTHOR: Carolyn Watkins
TITLE: "Lunar Science Conference Three" Revised abstracts
SUBMITTED: TO: Published by the Lunar Science Institute
DATE:
ACCEPTED:
EXPECTED PUBLICATION DATE:
PUBLISHED:
REPRINTS ORDERED:
REPRINTS RECEIVED: Copies for sale only at $15.00 each

89  AUTHOR: S. K. Runcorn
TITLE: High pressure physics and planetary interiors conference, March 1-3, 1972, Proceedings
SUBMITTED: TO: Physics of the Earth & Planetary Interiors
DATE:
ACCEPTED:
EXPECTED PUBLICATION DATE:
PUBLISHED: v.6, 1-209 (December 1972)
REPRINTS ORDERED: September 13, 1972
REPRINTS RECEIVED: April 3, 1973

90  AUTHOR: Kopal, Z.
TITLE: Tidal evolution in close binary systems
SUBMITTED: TO: Astrophysics and Space Science
DATE: March 15, 1972
ACCEPTED:
EXPECTED PUBLICATION DATE: August 1972
PUBLISHED: v.17, 161-185(1972)
REPRINTS ORDERED: July 20, 1972
REPRINTS RECEIVED: January 22, 1973
91  AUTHOR:  Reid, A.M. et al, Jakes, P.
TITLE:  Major element compositions of lunar rocks as inferred from glass compositions in the lunar soils
SUBMITTED:  
TO:  Lunar Science Conference III, Proceedings
DATE:  May 1, 1972
ACCEPTED:  
EXPECTED PUBLICATION DATE:  October 1972
PUBLISHED:  v.1, 363-378 (1972)
REPRINTS ORDERED:  May 3, 1972
REPRINTS RECEIVED:  November 27, 1973

92  AUTHOR:  Compston, W., et al
TITLE:  Apollo 14 mineral ages and the thermal history of the Fra Mauro formation
SUBMITTED:  Lunar Science Conference III, Proceedings
TO:  May 1, 1972
DATE:  
ACCEPTED:  
EXPECTED PUBLICATION DATE:  October 1972
PUBLISHED:  v.2, 1487-1501 (1972)
REPRINTS ORDERED:  May 3, 1972
REPRINTS RECEIVED:  March 28, 1973

93  AUTHOR:  Gose, W.A., et al
TITLE:  Magnetic properties of Apollo 14 breccias and their correlation with metamorphism
SUBMITTED:  Lunar Science Conference III, Proceedings
TO:  
DATE:  May 1, 1972
ACCEPTED:  
EXPECTED PUBLICATION DATE:  October 1972
PUBLISHED:  v.3, 2387-2395 (1972)
REPRINTS ORDERED:  May 3, 1972
REPRINTS RECEIVED:  

94  AUTHOR:  Pearce, G.W. et al.
TITLE:  Remanent magnetization of the lunar surface
SUBMITTED:  
TO:  Lunar Science Conference III, Proceedings
DATE:  May 1, 1972
ACCEPTED:  
EXPECTED PUBLICATION DATE:  October 1972
PUBLISHED:  v.3, 2449-2464 (1972)
REPRINTS ORDERED:  May 3, 1972
REPRINTS RECEIVED:  February 23, 1973
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<th>PUBLISHED:</th>
<th>REPRINTS ORDERED:</th>
<th>REPRINTS RECEIVED:</th>
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</table>
99  AUTHOR:  Arkani-Hamed, Jafar  
TITLE:  Viscosity of the moon, Part I  
SUBMITTED:  
TO:  MOON  
DATE:  May 1972  
ACCEPTED:  June 9, 1972  
EXPECTED PUBLICATION DATE:  
PUBLISHED:  MOON 6, 100-111 (1973)  
REPRINTS ORDERED:  November 16, 1972  
REPRINTS RECEIVED:  April 17, 1973

100  AUTHOR:  Kopal, Zdenek  
TITLE:  Tidal evolution in close binary systems, II  
SUBMITTED:  Astrophysics and Space Science  
TO:  
DATE:  June 1972  
ACCEPTED:  
EXPECTED PUBLICATION DATE:  
PUBLISHED:  Astrophysics & Space Science 18, 287-305 (1972)  
REPRINTS ORDERED:  October 13, 1972  
REPRINTS RECEIVED:  April 24, 1973

101  AUTHOR:  Lindsay, John F.  
TITLE:  Sedimentology of clastic rocks returned from the moon by Apollo 15  
SUBMITTED:  
TO:  Geological Society of America. Bulletin  
DATE:  December 1971  
ACCEPTED:  May 17, 1972  
EXPECTED PUBLICATION DATE:  
PUBLISHED:  83, 2957-2970, 1972  
REPRINTS ORDERED:  June 14, 1972  
REPRINTS RECEIVED:  December 4, 1972

102  AUTHOR:  Criswell, D.R.  
TITLE:  Magnetospheric control of Pc 1 Micropulsation  
SUBMITTED:  
TO:  Proceedings of the Sub-LE Downlink Satellite Communications Conference, June 6-9, 1972, Naval Research Laboratory  
DATE:  
ACCEPTED:  June 15, 1972  
EXPECTED PUBLICATION DATE:  
PUBLISHED:  
REPRINTS ORDERED:  
REPRINTS RECEIVED:  
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<th>Accepted</th>
<th>Expected Publication Date</th>
<th>Published</th>
<th>Reprints Ordered</th>
<th>Reprints Received</th>
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</thead>
</table>
108 AUTHOR: Brett, Robin
TITLE: Lunar Science
SUBMITTED TO: Essays in Physics, v. Academic Press
DATE: ACCEPTED:
EXPECTED PUBLICATION DATE:
PUBLISHED: REPRINTS ORDERED: N.A. -- Book; probably no reprints will be available
REPRINTS RECEIVED:

109 AUTHOR: Ronca, Luciano B.
TITLE: Filling of the lunar mare basins
SUBMITTED TO: The Moon
DATE: August 10, 1972
ACCEPTED: August 23, 1972
EXPECTED PUBLICATION DATE: April 1973
PUBLISHED: MOON 7, 239-248, 1973
REPRINTS ORDERED: December 26, 1972
REPRINTS RECEIVED: June 7, 1973

110 AUTHOR: Reid, Arch M.; Warner, Jeff; Ridley, W.I.; Brown, R.W.
TITLE: Major element composition of glasses in three Apollo 15 soils
SUBMITTED TO: Meteoritics
DATE: September 1972
ACCEPTED:
EXPECTED PUBLICATION DATE:
PUBLISHED: 7 (3) 395-415, 1972
REPRINTS ORDERED: September 21, 1972
REPRINTS RECEIVED: October 30, 1972

111 AUTHOR: Shorthill, Richard W.
TITLE: Infrared atlas charts of the eclipsed moon
SUBMITTED TO: The Moon
DATE: September 1972
ACCEPTED: September 1972
EXPECTED PUBLICATION DATE: Spring 1973
PUBLISHED: MOON 7, 22-45, 1973
REPRINTS ORDERED: January 23, 1973
REPRINTS RECEIVED: June 15, 1973

112 AUTHOR: Criswell, David R
TITLE: Photoelectrons and lunar limb shocks
SUBMITTED TO: Symposium on Photon and Particle Interactions with Surfaces in Space, September 1972
DATE: ACCEPTED: September 1972
EXPECTED PUBLICATION DATE:
PUBLISHED: REPRINTS ORDERED: 11, 1972
113  AUTHOR: Criswell, David R.
TITLE: Horizon glow and the motion of lunar dust

SUBMITTED
To: Symposium on Photon and Particle Interactions with Surfaces in Space, September 1972
ACCEPTED: September 1972
Expected publication date:
PUBLISHED:
REPRINTS ORDERED: June 28, 1973
REPRINTS RECEIVED:

114  AUTHOR: Laseter, J. L. and Weete, J. D.
TITLE: Volatile terpenoids from aeciospores of Cronartium Fusiforme

SUBMITTED
To: Phytochemistry
Date: June 1972
ACCEPTED: September 23, 1972
Expected publication date:
PUBLISHED: v.12, 387-390 (1973)
REPRINTS ORDERED: October 16, 1972
REPRINTS RECEIVED: March 5, 1973

115  AUTHOR: Laseter, J.L., Lawler, G.W., Walkinshaw, C.H., Weete, J.D.
TITLE: Fatty acids of slash pine tissues

SUBMITTED:
To: Phytochemistry
Date: July 1972
ACCEPTED: September 6, 1972
Expected publication date: 6-8 months
PUBLISHED: Phytochemistry 12, 817-821, 1973
REPRINTS ORDERED: January 17, 1973
REPRINTS RECEIVED: April 24, 1973

116  AUTHOR: Arkani-Hamed, Jafar
TITLE: Viscosity of the Moon, Part II: During Mare Formation

SUBMITTED
To: Moon
Date: July 6, 1972
ACCEPTED: October 1972
Expected publication date:
PUBLISHED: MOON 6, 112-124, 1973
REPRINTS ORDERED: December 12, 1972
REPRINTS RECEIVED: April 23, 1973
117  AUTHOR: Arkani-Hamed, Jafar  
TITLE: Density and stress distribution in the moon  
SUBMITTED  
To: Moon  
Date: October 5, 1972  
ACCEPTED: October 16, 1972  
Expected publication date: April 1973  
PUBLISHED: MOON 7, 84-126, 1973  
REPRINTS ORDERED: January 3, 1973  
REPRINTS RECEIVED: June 20, 1973  

TITLE: Major element composition of Luna 20 glasses  
SUBMITTED  
To: Earth and Planetary Science Letters  
Date: October 3, 1972  
ACCEPTED: October 26, 1972  
Expected publication date: December 1972  
PUBLISHED: v.17, 7-12 (1972)  
REPRINTS ORDERED: October 30, 1972  
REPRINTS RECEIVED: March 22, 1973  

TITLE: Apollo 15 green glasses  
SUBMITTED  
To: Physics of Earth and Planetary Interiors  
Date: September 1972  
ACCEPTED: September 1972  
Expected publication date:  
REPRINTS ORDERED: April 3, 1973  
REPRINTS RECEIVED: August 20, 1973  

120  AUTHOR: Lindsay, J.F.  
TITLE: Ventifact evolution in Wright Valley, Antarctica  
SUBMITTED:  
To: Geological Society of America. Bulletin  
Date: August 1972  
ACCEPTED: October 30, 1972  
Expected publication date  
PUBLISHED: GSA Bulletin 84, 1791-1798, 1973  
REPRINTS ORDERED: (through LaTrobe University)  
REPRINTS RECEIVED: July 25, 1973  

Change 1, Jan. 1974
121  AUTHOR: Brinkmann, R. T.
TITLE: Jovian satellite-satellite eclipses/occultations

SUBMITTED
   To: Icarus
   Date: May 1972
ACCEPTED: November 6, 1972
Expected publication date
PUBLISHED: Icarus 19, 15-29, 1973
REPRINTS ORDERED: March 1, 1973
REPRINTS RECEIVED: July 16, 1973

122  AUTHOR: Lindsay, J. F.
TITLE: Reversing Barchan dunes in lower Victoria Valley, Antarctica

SUBMITTED:
   To: Geological Society of America. Bulletin
   Date: August 9, 1972
ACCEPTED: November 7, 1972
Expected publication date:
PUBLISHED: GSA Bulletin 84, 1799-1806, 1973
REPRINTS ORDERED: (through LaTrobe University)
REPRINTS RECEIVED: July 25, 1973

123  AUTHOR: Ridley, W. I., Baker, I.
TITLE: Petrochemistry of a unique cordierite-bearing lava from St. Helena Island, South Atlantic

SUBMITTED
   To: American Mineralogist
   Date: October 1972
ACCEPTED: November 20, 1972
Expected publication date:
REPRINTS ORDERED: August 10, 1973
REPRINTS RECEIVED: November 27, 1973

124  AUTHOR: Simonds, C.H.
TITLE: Sintering and hot pressing of Fra Mauro composition glass and the lithification of lunar breccias

SUBMITTED:
   To: American Journal of Science
   Date: August 1972
ACCEPTED: November 1972
Expected publication date:
PUBLISHED: American J. of Science 273, 428-439, 1973
REPRINTS ORDERED: February 28, 1973
REPRINTS RECEIVED: May 29, 1973

Change 1 - Jan 1974
125 AUTHOR: Strangway, D.W., Gose, W.A., Pearce, G.W., Carnes, J.G.
TITLE: Magnetism and the history of the moon

SUBMITTED:
To: Magnetism and Magnetic Materials Conference, 18th, AIP
Date: November 27, 1972
ACCEPTED: November 1972
Expected publication date: Spring 1973
REPRINTS ORDERED:
REPRINTS RECEIVED: None available

126 AUTHOR: Reid, A.M., Ridley, W.I., Harmon, R.S., Jakes, P.
TITLE: Major element chemistry of glasses in Apollo 14 soil 14156

SUBMITTED:
To: Geochimica et Cosmochimica Acta
Date: April 1972
ACCEPTED: November 1972
Expected publication date:
PUBLISHED: GCA 37, 695-699, 1973
REPRINTS ORDERED:
REPRINTS RECEIVED: April 24, 1973

127 AUTHOR: Gose, W.A., Strangway, D.W., Pearce, G.W.
TITLE: Determination of the intensity of the ancient lunar magnetic field

SUBMITTED:
To: Moon
Date: November 1972
ACCEPTED: December 1972
Expected publication date: April 1973
REPRINTS ORDERED: January 4, 1973
REPRINTS RECEIVED: July 16, 1973

128 AUTHOR: Weete, J.D., Lawler, G.C., Laseter, J.L.
TITLE: Total lipid and sterol components of Rhizopus Arrhizus: Identification and metabolism

SUBMITTED:
To: Archives of Biochemistry and Biophysics
Date: October 1972
ACCEPTED: December 1972
Expected publication date:
PUBLISHED: Archives of Biochem & Biophys 155, 411-419, 1973
REPRINTS ORDERED: March 1, 1973
REPRINTS RECEIVED: May 15, 1973
AUTHOR: Criswell, D.R.
TITLE: Photoelectrons and solar wind/lunar limb interaction

SUBMITTED:
To: Moon
Date: November 13, 1972
ACCEPTED: December 20, 1972
Expected publication date: April 1973
PUBLISHED: MOON 7, 202-238, 1973
REPRINTS ORDERED: December 22, 1972
REPRINTS RECEIVED: June 20, 1973

AUTHOR: Ridley, W.I.
TITLE: Apollo: the scientific payoff

SUBMITTED:
To: New Scientist
Date: December 1972
ACCEPTED: December 1972
Expected publication date:
PUBLISHED: 56, 646-649, December 14, 1972
REPRINTS ORDERED: January 3, 1973
REPRINTS RECEIVED: August 22, 1973

TITLE: Luna 20 soil: abundance and composition of phases in the 45-125 micron fraction

SUBMITTED:
To: Geochimica & Cosmochimica Acta
Date:
ACCEPTED: January 1973
Expected publication date:
PUBLISHED: GCA 37, 1011-1030, 1973
REPRINTS ORDERED: March 6, 1973
REPRINTS RECEIVED: June 8, 1973

AUTHOR: Arkani-Hamed, J.
TITLE: On the thermal history of the moon

SUBMITTED:
To: The Moon
Date: December 19, 1972
ACCEPTED: January 1973
Expected publication date:
PUBLISHED: The MOON 6, 380-383, 1973
REPRINTS ORDERED: April 13, 1973
REPRINTS RECEIVED: November 26, 1973
133  AUTHOR: Arkani-Hamed, J.  
TITLE: Effect of a giant impact on the thermal evolution of the moon  
SUBMITTED:  
TO: The Moon  
DATE: January 1973  
ACCEPTED: January 1973  
Expected publication date:  
PUBLISHED:  
REPRINTS ORDERED: April 2, 1973  
REPRINTS RECEIVED:  

134  AUTHOR: Fredriksson, K., Noonan, A., Nelen, J.  
TITLE: Meteoritic, lunar and lornar impact chondrules  
SUBMITTED:  
TO: The Moon  
DATE: December 4, 1972  
ACCEPTED: January 1973  
Expected publication date: April 1973  
PUBLISHED: MOON 7, 475-482, 1973  
REPRINTS ORDERED: February 21, 1973  
REPRINTS RECEIVED: September 20, 1973  

135  AUTHOR: Moutsoulas, M.  
TITLE: COSPAR-IAU-LSI Colloquium on lunar dynamics and observational coordinate systems; abstracts  
SUBMITTED  
TO:  
DATE:  
ACCEPTED:  
Expected publication date:  
PUBLISHED: Separate, published by LSI  
REPRINTS ORDERED: n.a.  
REPRINTS RECEIVED: Limited distribution  

136  AUTHOR: Laseter, J.L., Evans, R., Walkinshaw, C.H., Weete, J.D.  
TITLE: Gas chromatography-mass spectrometry study of sterols from slash pine tissues  
SUBMITTED:  
TO: Phytochemistry  
DATE: November 1972  
ACCEPTED: February 1973  
Expected publication date  
REPRINTS ORDERED: May 30, 1973  
REPRINTS RECEIVED: September 24, 1973  

Change 1 - Jan 1974
NO. 137  AUTHOR: Ridley, W.I., Hubbard, N.J., Rhodes, J.M., Wiesmann, H., Bansal, B.
TITLE: Petrology of lunar breccia 15445 and petrogenetic implications

SUBMITTED:
TO: Journal of Geology
DATE: March 1973
ACCEPTED: March 1973
Expected publication date: July 1973
PUBLISHED:
REPRINTS ORDERED: September 21, 1973
REPRINTS RECEIVED:

138  AUTHOR: Moutsoulas, Michael
TITLE: Selenographic Control

SUBMITTED:
TO: THE MOON
DATE: May 1973
ACCEPTED: June 1973
Expected publication date:
PUBLISHED: The MOON 8, 461-468, 1973
REPRINTS ORDERED: August 14, 1973
REPRINTS RECEIVED:

139  AUTHOR: Weete, John D
TITLE: Sterols of the fungi; distribution and biosynthesis

SUBMITTED:
TO: Phytochemistry
DATE: Sept. 1972
ACCEPTED: May 1973
Expected publication date:
PUBLISHED: Phytochemistry 12, 1843-1864, 1973
REPRINTS ORDERED: June 14, 1973
REPRINTS RECEIVED: September 17, 1973

140  AUTHOR: Arkani-Hamed, J.
TITLE: Lunar mascons as consequences of giant impacts

SUBMITTED:
TO: The Moon
DATE: May 1973
ACCEPTED: June 1973
Expected publication date:
PUBLISHED:
REPRINTS ORDERED:
REPRINTS RECEIVED:

Change 1 - Jan 1974
141 AUTHOR: Gose, W. A.
TITLE: Time dependent magnetization of fine-grained iron in lunar breccias
SUBMITTED:
  TO: Earth & Planetary Science Letters
  DATE: February 1972
  ACCEPTED: June 18, 1973
  Expected publication date:
  PUBLISHED: E&PSL 20, 100-106, 1973
  REPRINTS ORDERED: July 26, 1973
  REPRINTS RECEIVED: December 14, 1973

TITLE: Geology and petrology of basalts from Leg 6 of the Deep Sea Drilling Project
SUBMITTED:
  TO: Journal of Petrology
  DATE: September 1972
  ACCEPTED: June 21, 1973
  Expected publication date:
  PUBLISHED:
  REPRINTS ORDERED:
  REPRINTS RECEIVED:

143 AUTHOR: Dunlop, D.J.
TITLE: Theory of the magnetic viscosity of lunar and terrestrial rocks
SUBMITTED:
  TO: Reviews of Geophysics and Space Physics
  DATE: April 1973
  ACCEPTED: July 13, 1973
  Expected publication date:
  PUBLISHED:
  REPRINTS ORDERED: October 12, 1973
  REPRINTS RECEIVED:

144 AUTHOR: Lindsay, John F.
TITLE: Evolution of lunar soil grain-size and shape parameters
SUBMITTED:
  TO: Proceedings of the 4th Lunar Science Conference
  DATE: June 1973
  ACCEPTED: July 1973
  Expected publication date: December 1973
  REPRINTS ORDERED: December 5, 1973
  REPRINTS RECEIVED:

Change 1 - Jan 1974

TITLE: Glass compositions in Apollo 16 soils 60501 and 61221

SUBMITTED: TO: Proceedings of the 4th Lunar Science Conference
DATE: June 1973
ACCEPTED: July 1973
Expected publication date: December 1973
REPRINTS ORDERED: December 5, 1973
REPRINTS RECEIVED:


TITLE: Petrology of Apollo 16 poikilitic rocks

SUBMITTED: TO: Proceedings of the 4th Lunar Science Conference
DATE: June 1973
ACCEPTED: July 1973
Expected publication date: December 1973
REPRINTS ORDERED: December 5, 1973
REPRINTS RECEIVED:

147 AUTHOR: Warner, J.L., Simonds, C.H., Phinney, W.C.

TITLE: Apollo 16 rocks, classification and petrogenetic model

SUBMITTED: TO: Proceedings of the 4th Lunar Science Conference
DATE: June 1973
ACCEPTED: July 1973
Expected publication date: December 1973
REPRINTS ORDERED: December 5, 1973
REPRINTS RECEIVED:

148 AUTHOR: Dunlop, D.J., Gose, W.A., Pearce, G.W., Strangway, D.W.

TITLE: Magnetic properties and granulometry of metallic iron in lunar breccia 14313

SUBMITTED: TO: Proceedings of the 4th Lunar Science Conference
DATE: June 1973
ACCEPTED: July 1973
Expected publication date: December 1973
REPRINTS ORDERED: December 5, 1973
REPRINTS RECEIVED:

Change 1 - Jan 1974
149  AUTHOR: Arkani-Hamed, Jafar
    TITLE: On the Formation of Lunar Mascons
    SUBMITTED
      To: Lunar Science IV Proceedings
      Date: June 1973
      ACCEPTED: July 1973
      Expected publication date: December 1973
    PUBLISHED: Proceedings v.3, 2673-2684, 1973
    REPRINTS ORDERED: December 5, 1973
    REPRINTS RECEIVED:

150  AUTHOR: Neukum, Gerhard
    TITLE: Crater Populations on Lunar Rocks
    SUBMITTED
      To: Lunar Science IV Proceedings
      Date: June 1973
      ACCEPTED: July 1973
      Expected publication date: December 1973
    PUBLISHED: Proceedings v.3, 3255-3276, 1973
    REPRINTS ORDERED: December 5, 1973
    REPRINTS RECEIVED:

151  AUTHOR: Manka, Robert
    TITLE: Lunar Ion Energy Spectra and Surface Potential
    SUBMITTED
      To: Lunar Science IV Proceedings
      Date: June 1973
      ACCEPTED: July 1973
      Expected publication date: December 1973
    PUBLISHED: Proceedings v.3, 2897-2908, 1973
    REPRINTS ORDERED: December 5, 1973
    REPRINTS RECEIVED:

152  AUTHOR: Pearce, G. W., Gose, W. A., Strangway, D. W.
    TITLE: Magnetic Studies on Apollo 15 and 16 Lunar Samples
    SUBMITTED
      To: Lunar Science IV Proceedings
      Date: June 1973
      ACCEPTED: July 1973
      Expected publication date: December 1973
    PUBLISHED: Proceedings v.3, 3045-3076
    REPRINTS ORDERED: December 5, 1973
    REPRINTS RECEIVED:

Change 1 - Jan 1974
153  AUTHOR: Apollo Soil Survey
TITLE: Phase chemistry of Apollo 14 soil sample 14259

SUBMITTED:
To: Modern Geology
Date:
ACCEPTED: August 1973
Expected publication date:
PUBLISHED:
REPRINTS ORDERED:
REPRINTS RECEIVED:

154  AUTHOR: Ridley, W.I., Watkins, N.D., MacFarlane, D.J.
TITLE: Oceanic islands: Azores

SUBMITTED
To: Plenum Pub. Co. as chapter in OCEAN BASINS AND MARGINS
Date:
ACCEPTED: August 1973
Expected publication date:
PUBLISHED:
REPRINTS ORDERED October 16, 1973
REPRINTS RECEIVED:

155  AUTHOR: Rehfuss, D.E., Larson, H.K.
TITLE: Cross-hatching at Silver Spur

SUBMITTED:
To: NATURE
Date: April 1973
ACCEPTED: September 1973
Expected publication date:
REPRINTS ORDERED: September 26, 1973
REPRINTS RECEIVED: January 2, 1974

156  AUTHOR: Ridley, W.I., Reid, A.M., Brett, P.R.
TITLE: Lunar Petrology Conference Summary

SUBMITTED
To: EOS
Date:
ACCEPTED: October 1973
Expected publication date:
PUBLISHED: EOS 55, 4-8, 1974
REPRINTS ORDERED: November 20, 1974
REPRINTS RECEIVED:
157 AUTHOR: Smyth, J.R.
TITLE: Experimental study on the polymorphism of enstatite

SUBMITTED
To: American Mineralogist
ACCEPTED: October 12, 1973

158 AUTHOR: Middlehurst, B.
TITLE: Moonquakes and transient events

SUBMITTED
To: Bulletin of the Atomic Scientists
Date: June 1973
ACCEPTED: October 1973

159 AUTHOR: Middlehurst, B., Chapman, W.B., Frisillo, A.L.
TITLE: Moonquake controlling forces and tides

SUBMITTED
To: Icarus
Date: May 1973
ACCEPTED: November 1973

160 AUTHOR: Strangway, D.W., Gose, W.A., Pearce, G.W., McConnell, R.K.
TITLE: Lunar magnetic anomalies and the Cayley formation

SUBMITTED
To: Nature Physical Science
Date: October 1973
ACCEPTED: November 1973

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161 AUTHOR: Laseter, J.L., Weete, J.D., Walkinshaw, C.H.
TITLE: Lipid composition of slash pine tissue cultures grown with lunar and earth soils
SUBMITTED
To: Space Life Sciences
Date: October 1973
ACCEPTED: November 1973
Expected publication date:
PUBLISHED:
REPRINTS ORDERED: November 9, 1973 (Telcon to JLL)
REPRINTS RECEIVED:

162 AUTHOR: Volborth, A.
TITLE: Oxygen in the moon's crust; a review
SUBMITTED
To: Bulletin of the Atomic Scientists
Date: April 1973
ACCEPTED: November 1973
Expected publication date: February 1974
PUBLISHED:
REPRINTS ORDERED:
REPRINTS RECEIVED:

163 AUTHOR: Rennilson, J.J., Criswell, D.R.
TITLE: Surveyor observation of lunar horizon glow
SUBMITTED
To: The Moon
Date:
ACCEPTED: November 1973
Expected publication date: Spring 1974
PUBLISHED:
REPRINTS ORDERED: November 16, 1973
REPRINTS RECEIVED:

164 AUTHOR: Pearce, G.W., Simonds, C.H.
TITLE: Magnetic properties and mode of formation of Apollo 16 samples
SUBMITTED
To: Journal of Geophysical Research
Date:
ACCEPTED: November 1973
Expected publication date:
PUBLISHED:
REPRINTS ORDERED:
REPRINTS RECEIVED:
165  AUTHOR: Strangway, D.W., editor  
TITLE: Geophysical and Geochemical Exploration of the Moon and Planets; Conference Proceedings, January 1973  
SUBMITTED  
To: The Moon  
Date:  
ACCEPTED:  
Expected publication date: v.9/1-2  
PUBLISHED:  
REPRINTS ORDERED: January 3, 1974  
REPRINTS RECEIVED: 

166  AUTHOR: Jakes, P., Taylor, S.R.  
TITLE: Excess Europium content in prevambrian sedimentary rocks and continental evolution  
SUBMITTED  
To: Geochimica et cosmochimica acta  
Date:  
ACCEPTED: December 1973  
Expected publication date:  
PUBLISHED:  
REPRINTS ORDERED:  
REPRINTS RECEIVED: 

167  AUTHOR: Rehfuss, D.E.  
TITLE: Hypervelocity impact heating of porous aluminum  
SUBMITTED  
To: Journal of Applied Physics  
Date: August 1973  
ACCEPTED: January 1974  
Expected publication date:  
PUBLISHED:  
REPRINTS ORDERED:  
REPRINTS RECEIVED: 

168  AUTHOR: Rehfuss, D.E.  
TITLE: Glass production differences for equal-diameter impact craters  
SUBMITTED  
To: The Moon  
Date: October 1973  
ACCEPTED: January 1974  
Expected publication date:  
PUBLISHED:  
REPRINTS ORDERED: January 14, 1973  
REPRINTS RECEIVED: