The Lunar Science Institute

Semi-Annual Status Report

under

Contract No. NSR 09-051-001

for the period

15 July 1973 - 31 December 1973

Respectfully submitted,

February 5, 1974

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 Universitat, Gottingen, 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 temperatures; 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 Armalcolites 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:

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

*Post Apollo Lunar Science, Summer Study 1972, page 1.*
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.
LSI CONTRIBUTIONS

1. **AUTHOR:** Harold C. Urey  
   **TITLE:** "Early Temperature History of the Moon"  
   **SUBMITTED**  
   To: Science  
   Date: Date unknown  
   **ACCEPTED:**  
   Date: Date unknown  
   **PUBLISHED:** September 19, 1969, Vol. 165, p. 1275  
   **REPRINTS ORDERED:** September 12, 1969  
   **REPRINTS RECEIVED:** December 5, 1969

2. **AUTHOR:** Friedrich Hörz, W. L. Quaide  
   **TITLE:** "Debye-Scherrer Investigations of Experimentally Shocked Silicates"  
   **SUBMITTED**  
   To: MOON  
   Date: April 1972  
   **ACCEPTED:** April 1972  
   **PUBLISHED:** Moon 6, 45-82 (1973)  
   **REPRINTS ORDERED:** July 28, 1972  
   **REPRINTS RECEIVED:** April 17, 1973

3. **AUTHOR:** Friedrich Hörz, J. B. Hartung, D. E. Gault  
   **TITLE:** "Micrometeorite Craters and Related Features on Lunar Rock Surfaces"  
   **SUBMITTED**  
   To: Earth and Planetary Science Letters  
   Date: October 10, 1970  
   **ACCEPTED:** January 14, 1971  
   **PUBLISHED:** March 1971, Vol. 10, No. 4, pp. 381-386  
   **REPRINTS ORDERED:** February 10, 1971  
   **REPRINTS RECEIVED:** April 28, 1971

4. **AUTHOR:** Luciano B. Ronca  
   **TITLE:** "The Relationship Between Lunar Hot Spots and the Geomorphic Index"  
   **SUBMITTED**  
   To: The Moon  
   Date: August 2, 1970  
   **ACCEPTED:** September 3, 1970  
   **REPRINTS ORDERED:** October 2, 1970  
   **REPRINTS RECEIVED:** March 1, 1971
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>Journal of Geophysical Research</td>
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<td>To:</td>
<td>Date: May 12, 1971</td>
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<td>PUBLISHED:</td>
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<td>AUTHOR: Luciano B. Ronca</td>
<td>TITLE: &quot;Relationships Between Geomorphic Index, Lunar Stratigraphy, Ages of the Maria, and Hot Spots&quot;</td>
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<td>AUTHOR: John D. Weete, S. Venketeswaran, J. Laseter</td>
<td>TITLE: &quot;Two Populations of Aliphatic Hydrocarbons of Teratoma and Habituated Tissue Cultures of Tobacco&quot;</td>
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<td>14</td>
<td>AUTHOR: J. L. Laseter, John D. Weete</td>
<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>
<td>&quot;A Comparison of Infrared Radar and Geologic Mapping of Lunar Craters&quot;</td>
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LSI Contributions

17 AUTHOR: W. von Engelhardt, Friedrich Hörz, D. Stößler
TITLE: "The Definition of Sdetite and Its Application to Impact Breccias"
SUBMITTED To: (Not yet submitted)
Date:
ACCEPTED:
PUBLISHED:
REPRINTS ORDERED:
REPRINTS RECEIVED:

18 AUTHOR: Friedrich Hörz, T. Foss
TITLE: "Meeting: Meteorite Impact and Volcanism"
SUBMITTED To: EOS Transactions of the American Geophysical Union
Date: December 15, 1970
ACCEPTED: December 28, 1970
REPRINTS ORDERED: January 25, 1971
REPRINTS RECEIVED: April 23, 1971

19 AUTHOR: Ralph E. Morganstern
TITLE: "Brans-Dicke Theory Under Transformation of Units and Three Tests"
SUBMITTED To: The Physical Review D
Date: January 7, 1971
ACCEPTED: March 25, 1971
PUBLISHED: v.3, 2946-2950 (1971)
REPRINTS ORDERED: April 8, 1971
REPRINTS RECEIVED: August 24, 1971

20 AUTHOR: S. Fred Singer, L. W. Bandermann
TITLE: "Where Was the Moon Formed?"
SUBMITTED To: Science
Date: July 23, 1970
ACCEPTED: August 27, 1970
REPRINTS ORDERED: October 27, 1970
REPRINTS RECEIVED: March 24, 1971
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LSI Contributions

24  AUTHOR: David R. Criswell  
    TITLE: "Electric Fields and Motion of Lunar Fines"  
    SUBMITTED To: EOS Transactions of the American Geophysical Union  
    Date: January 7, 1971  
    ACCEPTED: March, 1971  
    PUBLISHED: April 1971, Vol. 52, No. 4, p. 266  
    REPRINTS ORDERED: N/A  
    REPRINTS RECEIVED: N/A

25  AUTHOR: Ralph E. Morganstern  
    TITLE: "Brans-Dicke Cosmologies in Arbitrary Units: Solutions in Flat Friedmann Universes"  
    SUBMITTED To: The Physical Review D15  
    Date: January 7, 1971  
    ACCEPTED: March 25, 1971  
    PUBLISHED: July 15, 1971, Vol. 4, No. 2, pp. 278-282  
    REPRINTS ORDERED: April 8, 1971  
    REPRINTS RECEIVED: November 1, 1971

26  AUTHOR: Ralph E. Morganstern  
    TITLE: "Exact Solutions to Radiation Filled Brans-Dicke Cosmologies"  
    SUBMITTED To: The Physical Review D15  
    Date: January 22, 1971  
    ACCEPTED: March 25, 1971  
    REPRINTS ORDERED: April 8, 1971  
    REPRINTS RECEIVED: November 1, 1971

    TITLE: "Preliminary Chemical Analyses of Apollo 11 Lunar Samples"  
    SUBMITTED To: Proceedings of the Apollo 11 Lunar Science Conference  
    Date: Date unknown  
    ACCEPTED: Date unknown  
    REPRINTS ORDERED: April 7, 1971  
    REPRINTS RECEIVED: April 28, 1971
LSI Contributions

28  AUTHOR: S. Fred Singer  
TITLE: Comments on a paper by A. E. Ringwood, "Petrogenesis of Apollo 11 Basalts and Implications for Lunar Origin"  
SUBMITTED  
To: Journal of Geophysical Research  
Date: January 27, 1971  
ACCEPTED: September 24, 1971  
PUBLISHED: November 10, 1971, Vol. 76, #32, pp. 8071-8074  
REPRINTS ORDERED: September 28, 1971  
REPRINTS RECEIVED: December 21, 1971

29  AUTHOR: John D. Weete and Charles H. Walkinshaw  
TITLE: "Apollo 12 Lunar Material: Effects on Plant Pigments"  
SUBMITTED  
To: Canadian Journal of Botany  
Date: July 6, 1971  
ACCEPTED: September 29, 1971  
PUBLISHED: Vol. 50, 101-104, January 1972  
REPRINTS ORDERED: November 22, 1971  
REPRINTS RECEIVED: February 17, 1972

30  AUTHOR: Petr Jakes, A. J. R. White  
TITLE: "Composition of Island Arcs and Continental Growth"  
SUBMITTED  
To: Earth and Planetary Science Letters  
Date: May 12, 1971  
ACCEPTED: July 1, 1971  
PUBLISHED: Vol. 12, 224-230 (1971)  
REPRINTS ORDERED: July 30, 1971  
REPRINTS RECEIVED: February 15, 1972

TITLE: "Radio Interferometry Earth Sounding, Part II - Experimental Results"  
SUBMITTED  
To: Geophysics  
Date: February, 1972  
ACCEPTED:  
PUBLISHED: Geophysics 38, 581-599 (1973)  
REPRINTS ORDERED:  
REPRINTS RECEIVED: September 20, 1973

32  AUTHOR: Michael F. Sheridan  
TITLE: "Particle-Size Characteristics of Pyroclastic Tuffs"  
SUBMITTED  
To: Journal of Geophysical Research, special issue on "Meteorite Impact and Volcanism"  
Date: January 1971  
ACCEPTED: February 16, 1971  
PUBLISHED: August 10, 1971, "New Series" No. 23, pp. 5627-5634  
REPRINTS ORDERED: July 23, 1971  
REPRINTS RECEIVED: August 19, 1971
LSI Contributions

33

AUTHOR: R. A. De Hon
TITLE: "Cauldron Subsidence in Lunar Craters Ritter and Sabine"
SUBMITTED To: Journal of Geophysical Research, special issue on "Meteorite Impact and Volcanism"
Date: January 1971
ACCEPTED: February 17, 1971
REPRINTS ORDERED: July 23, 1971
REPRINTS RECEIVED: August 19, 1971

34

AUTHOR: Robin Holcomb
TITLE: "Terraced Depressions in Lunar Maria"
SUBMITTED To: Journal of Geophysical Research, special issue on "Meteorite Impact and Volcanism"
Date: January 1971
ACCEPTED: February 17, 1971
PUBLISHED: August 10, 1971, Vol. 76, No. 23, pp. 5703-5711
REPRINTS ORDERED: July 23, 1971
REPRINTS RECEIVED: August 19, 1971

35

AUTHOR: Francois Kraut, Bevan M. French
TITLE: "The Rochechouart Meteorite Impact Structure, France: Preliminary Geological Results"
SUBMITTED To: Journal of Geophysical Research, special issue on "Meteorite Impact and Volcanism"
Date: January 1971
ACCEPTED: February 17, 1971
REPRINTS ORDERED: July 23, 1971
REPRINTS RECEIVED: August 19, 1971

36

AUTHOR: Billy P. Glass
TITLE: "Investigation of Glass Recovered from Apollo 12 Sample No. 12057"
SUBMITTED To: Journal of Geophysical Research, special issue on "Meteorite Impact and Volcanism"
Date: January 1971
ACCEPTED: February 23, 1971
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<td>K. L. Currie</td>
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<td>&quot;Tuff Rings&quot;</td>
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<td>Jack Green</td>
<td>&quot;Copernicus as a Lunar Caldera&quot;</td>
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<td>&quot;Iceland, from the New Global Tectonic Point of View (A review in Japanese)&quot;</td>
<td>Kagaku (Science)</td>
<td>March 4, 1971</td>
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<td>April 1, 1971, Kagaku, Vol. 41, No. 4, pp. 185-198</td>
<td>None will be ordered (30 free to the authors)</td>
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<td>&quot;A Cosmological Upper Limit on the Variation of G&quot;</td>
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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
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
LSI Contributions

78

AUTHOR: Petr Jakes, Arch Reid
TITLE: "Petrology of a Portion of the Mare Fecunditatis Regolith"
SUBMITTED To: Earth and Planetary Science Letters
Date: December, 1971
ACCEPTED: December 1971
Expected Publication Date:
REPRINTS ORDERED: January 4, 1972
REPRINTS RECEIVED: August 25, 1972

79

AUTHOR: David W. Strangway, G. W. Pearce, W. A. Gose, R. W. Timme
TITLE: "Remanent Magnetization of Lunar Samples"
SUBMITTED To: Earth and Planetary Science Letters
Date: November 15, 1971
ACCEPTED: November 15, 1971
Expected Publication Date:
PUBLISHED: Vol. 13, 41-52, December 11, 1971
REPRINTS ORDERED: 3/14/72 (50 from D. Strangway)
REPRINTS RECEIVED: 3/14/72 (50 from D. Strangway)

80

AUTHOR: John A. Wood
TITLE: "Thermal History and Early Magmatism in the Moon"
SUBMITTED To: Icarus
Date: November 1, 1971
ACCEPTED: December 15, 1971
Expected Publication Date:
PUBLISHED: Icarus, 16, 229-240, 1972
REPRINTS ORDERED: December 29, 1971
REPRINTS RECEIVED: June 22, 1972

81

AUTHOR: A. M. Reid; Ridley, W.I.; Harmon, Russell S.; Warner, Jeff; Brett, Robin; Jakes, Petr; Brown R.W.
TITLE: Highly aluminous glasses in Lunar Soils and the Nature of the Lunar Highlands"
SUBMITTED: To: Geochimica Et Cosmochimica Acta
Date: March 22, 1972
ACCEPTED: March 22, 1972
Expected Publication Date:
PUBLISHED: Geochimica et Cosmochimica Acta, 36, 903-912, 1972
REPRINTS ORDERED: May 25, 1972
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<td>Z. Kopal</td>
<td>The effects of viscous friction on axial rotation of celestial bodies</td>
<td>Astrophysics and Space Science</td>
<td>December 1971</td>
<td>February 9, 1972</td>
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<tr>
<td>88</td>
<td>Carolyn Watkins</td>
<td>&quot;Lunar Science Conference Three&quot; Revised abstracts</td>
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<td>Copies for sale only at $15.00 each</td>
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<tr>
<td>90</td>
<td>Kopal, Z.</td>
<td>Tidal evolution in close binary systems</td>
<td></td>
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<td>July 20, 1972</td>
</tr>
</tbody>
</table>
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
NO.

95  AUTHOR: Criswell, D.
TITLE: Lunar dust motion

SUBMITTED:
TO: Lunar Science Conference III, Proceedings
DATE: May 1, 1972
ACCEPTED:
EXPECTED PUBLICATION DATE: October 1972
PUBLISHED: v.3, 2671-2680 (1972)
REPRINTS ORDERED: May 3, 1972
REPRINTS RECEIVED: February 27, 1973

96  AUTHOR: Beals, C.S.
TITLE: Lava-filled craters and the thermal history of the lunar surfaces

SUBMITTED:
TO: Nature
DATE: December 1971
ACCEPTED: April 4, 1972
EXPECTED PUBLICATION DATE:
REPRINTS ORDERED: May 25, 1972
REPRINTS RECEIVED: October 3, 1972

97  AUTHOR: Arkani-Hamed, J.
TITLE: Stress differences in the moon as an evidence for a cold moon.

SUBMITTED:
TO: MOON
DATE: May 1972
ACCEPTED: May 1972
EXPECTED PUBLICATION DATE:
PUBLISHED: MOON 6, 135-163 (1973)
REPRINTS ORDERED: July 19, 1972
REPRINTS RECEIVED: April 16, 1973

98  AUTHOR: Morganstern, R.E.
TITLE: Curved space cosmological bounds on the time-variation of G

SUBMITTED:
TO: NATURE PHYSICAL SCIENCE
DATE: February 1972
ACCEPTED: May 11, 1972
EXPECTED PUBLICATION DATE:
PUBLISHED: Vol. 237, 70-71, May 29, 1972
REPRINTS ORDERED: June 13, 1972
REPRINTS RECEIVED: October 10, 1972
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:
TO:  Astrophysics and Space Science
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-LF Downlink Satellite Communications Conference, June 6-9, 1972, Naval Research Laboratory
DATE:  June 15, 1972
ACCEPTED:
EXPECTED PUBLICATION DATE:
PUBLISHED:
REPRINTS ORDERED:
REPRINTS RECEIVED:
103  AUTHOR: Morganstern, R.E.
TITLE: Observational constraints imposed by Brans-Dicke cosmologies

SUBMITTED
TO: Physical Review D
DATE: April 1972
ACCEPTED: June 1972
REPRINTS ORDERED: April 19, 1972
REPRINTS RECEIVED: June 25, 1973

104  AUTHOR: Lindsay, John F.
TITLE: Development of soil on the lunar surface

SUBMITTED
TO: J. Sedimentary Petrology
DATE: January 1972
ACCEPTED: June 15, 1972
EXPECTED PUBLICATION DATE: December 1972
PUBLISHED: v. 42, 876-878 (1972)
REPRINTS ORDERED: September 19, 1972
REPRINTS RECEIVED: May 10, 1973

105  AUTHOR: Pearce, G.W., Williams, Richard J., and McKay, David S.
TITLE: Magnetic properties and morphology of iron produced by subsolidus reduction of synthetic Apollo 11 glasses

SUBMITTED
TO: Earth & Planetary Science Letters
DATE: June 1972
ACCEPTED: July 20, 1972
EXPECTED PUBLICATION DATE: v. 17, 95-104 (1972)
PUBLISHED: v. 17, 95-104 (1972)
REPRINTS ORDERED: August 8, 1972
REPRINTS RECEIVED: February 9, 1973

106  AUTHOR: Kong, J.A.
TITLE: Electromagnetic fields due to dipole antennas over stratified anisotropic media

SUBMITTED
TO: Geophysics
DATE: June 1972
ACCEPTED: June 1972
EXPECTED PUBLICATION DATE: December 1972
PUBLISHED: v. 37, 985-996 (1972)
REPRINTS ORDERED: September 20, 1972
REPRINTS RECEIVED: February 12, 1973

107  AUTHOR: Eglinton, G.; Maxwell, J.R.; Pillinger, C.T.
TITLE: Carbon chemistry of the moon

SUBMITTED
TO: Scientific American
DATE: April 1972
ACCEPTED: August 1972
EXPECTED PUBLICATION DATE: October 1972
PUBLISHED: 227, (4) 80-91, October 1972
REPRINTS ORDERED: 227, (4) 80-91, October 1972
REPRINTS RECEIVED: 227, (4) 80-91, October 1972
108  AUTHOR:  Brett, Robin  
TITLE:  Lunar Science  
SUBMITTED TO:  Essays in Physics, v.  
DATE:  
ACCEPTED:  
EXPECTED PUBLICATION DATE:  
PUBLISHED:  
REPRINTS ORDERED:  
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:  September 1972  
ACCEPTED:  
EXPECTED PUBLICATION DATE:  
PUBLISHED:  
REPRINTS ORDERED:  
REPRINTS RECEIVED:  

- 27 -
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  
DATE: 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
NO.

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
129
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

130
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

131
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

132
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 lunar 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
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
PUBLISHED: Proceedings v.1, 481-504, 1973
REPRINTS ORDERED: December 5, 1973
REPRINTS RECEIVED:

148  AUTHOR: Dunlop, D.J., Gose, W.A., Pearce, C.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:
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  
Expected publication date:  
PUBLISHED:  
REPRINTS ORDERED:  
REPRINTS RECEIVED:  

158  AUTHOR: Middlehurst, B.  
TITLE: Moonquakes and transient events  
SUBMITTED  
To: Bulletin of the Atomic Scientists  
Date: June 1973  
ACCEPTED: October 1973  
Expected publication date:  
REPRINTS ORDERED: October 24, 1973  
REPRINTS RECEIVED:  

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  
Expected publication date:  
PUBLISHED:  
REPRINTS ORDERED:  
REPRINTS RECEIVED:  

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  
Expected publication date:  
PUBLISHED: Nature physical science 246, 112-115, 1973  
REPRINTS ORDERED: November 19, 1973  
REPRINTS RECEIVED:  

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  
**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  
**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  
**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  
**ACCEPTED:** January 1974  
**EXPECTED PUBLICATION DATE:**  
**PUBLISHED:**  
**REPRINTS ORDERED:** January 14, 1973  
**REPRINTS RECEIVED:**