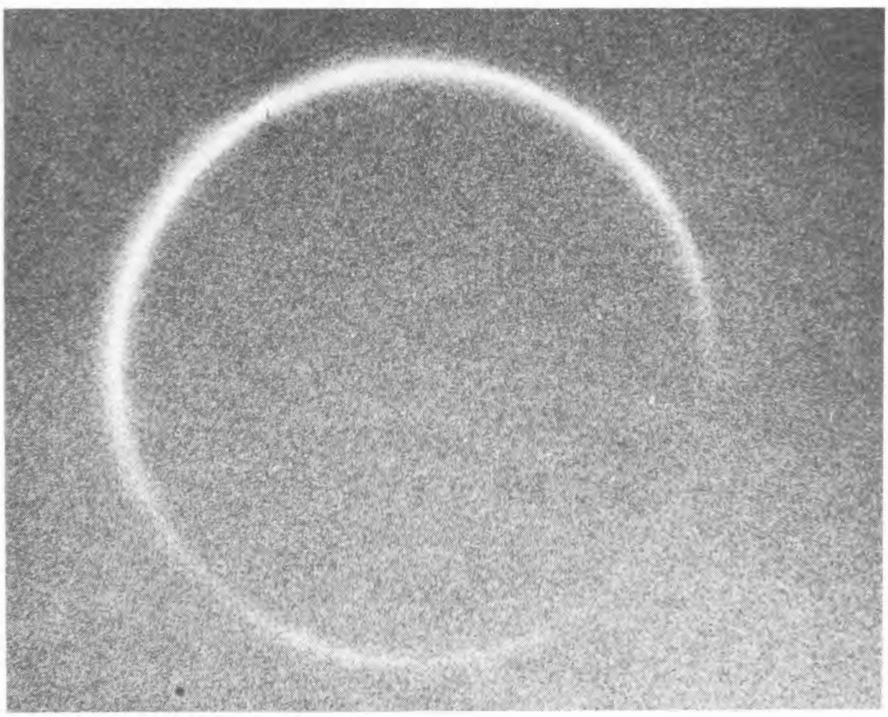
The Strolling Astronomer

The Journal Of The Association Of Lunar And Planetary Observers

Volume 18, Numbers 1-2 **January-February, 1964**
Published July, 1964



Photograph of Venus by Research Center, New Mexico State University. Taken by A. S. Murrell on June 20, 1964 at 17 hrs., 18 mins., U.T., 18 hours after inferior conjunction with the sun. Venus 2.33 degrees from center of sun. Seeing 6, transparency 6 or better. North at top and west in earth's sky at right. Photograph in red light, IV-E Eastman spectroscopic plate, OG-2 filter. Exposure 0.2 secs. 12-inch Cassegrain reflector, f: 66. See also text on pages 42 and 43.

THE STROLLING ASTRONOMER

Box 26
University Park, New Mexico
88070

Residence telephone 524-2786 (Area Code 505) in Las Cruces, New Mexico

ASSOCIATION OF LUNAR & PLANETARY OBSERVERS
ALPO

Founded In 1947

IN THIS ISSUE

SOME LATITUDE ESTIMATES OF THE NORTH EQUATORIAL BELT OF SATURN IN 1962 AND 1963, BY JOEL W. GOODMAN - PAGE 1

STATUS OF THE LUNAR SECTION SELECTED AREAS MAPPING PROGRAM, MARCH, 1964, BY PATRICK S. McINTOSH - - - - - - - - - - - - - - PAGE 3

LUNAR METEOR SEARCH PROJECT, FEBRUARY, 1962-DECEMBER, 1963, BY K. CHALK - PAGE 4

VENUS SECTION REPORT: EASTERN APPARITION, 1962, SECOND PORTION, BY WILLIAM K. HARTMANN - - - - - - - - - - - - - - - - - - - PAGE 6

THE INTERPRETATION OF LUNAR CRATER MORPHOLOGY: POLYGONAL CRATERS, BY F. J. MANASEK - - - - - - - - - - - - - - - - - PAGE 10

A GENERIC CLASSIFICATION OF LUNAR DOMES, BY JOHN E. WESTFALL - - - - - - - - - - PAGE 15

INDEX OF VOLUME 17 (1963) OF THE STROLLING ASTRONOMER, BY DALE P. CRUIKSHANK AND WILLIAM K. HARTMANN - PAGE 20

A FURTHER NOTE ON LINNÉ, BY PATRICK MOORE - - - - - - - - - - - - - - - - - - - PAGE 25

MERCURY IN 1961 AND 1962 - PART I, BY GEOFFREY GAHERTY, Jr. - - - - - - - - - - - PAGE 27

BOOK REVIEWS - PAGE 31

MORE ACTIVITY SUSPECTED NEAR ARISTARCHUS, BY PATRICK S. McINTOSH - PAGE 35

OBSERVATIONS OF LUNAR RILLES NEAR HASE, IN PETAVIUS, AND BESIDE THE CAUCHY FAULT, BY C. A. WOOD - - - - - - - - - - PAGE 36

NATIONAL AMATEUR ASTRONOMERS 1964 CONVENTION - PAGE 38

ANNOUNCEMENTS - PAGE 40

COMET TOMITA-GERBER-HONDA - - - - - - - - - - - - - PAGE 42

OBSERVATIONS AND COMMENTS - - - - - - - - - - - - - PAGE 42

SOME LATITUDE ESTIMATES OF THE NORTH EQUATORIAL BELT OF SATURN IN 1962 AND 1963

By: Joel W. Goodman, A.L.P.O. Saturn Recorder

Summary. Data are presented which compare three methods of recording the latitudes of features on Saturn. The methods are micrometry, photography, and sketching. The results suggest that careful sketching can provide latitude values in good agreement with those obtained by the other two techniques. However, observers must be cognizant of, and take measures to rectify, systematic errors in their draftsmanship.

A systematic record of the latitudes of planetary features can provide information concerning the following: (1) periodic variations in latitude of atmospheric features; cyclic variations. (2) variation of latitude with longitude; non-parallelism of feature to equator. (3) influence on latitude of extraordinary phenomena -- Disturbances and the like. For these reasons the Saturn Section of the A.L.P.O. is attempting to stimulate interest in a program of latitude determinations of features on Saturn. Such a venture requires no elaborate equipment, as the data presented will indicate, although more reliable estimates can be derived using sophisticated instrumentation.

The methodology applicable to latitude determination has been described previously[1]. Briefly, the techniques consist, in order of decreasing reliability, of direct measurement of features on the disk with a filar micrometer, measurements from photographs of the planet, and careful freehand sketching with particular attention to the positioning of features on the sketch. Measurements in all instances must be reduced to Saturnicentric latitudes, which is accomplished by applying the Crommelin formulae[1].

During the apparitions of 1962-3 and 1963-4, several good quality photographs of Saturn were obtained by ALPO members. In addition, the Recorder had the good fortune to secure use of the 12-inch Clark refractor and its filar micrometer at Lick Observatory on several occasions during 1963. Measurements were made on two dates and were attempted on a number of others when, however, seeing conditions did not permit the requisite high magnifications. It is worth noting that conditions were more than satisfactory for ordinary visual observing and photography on a number of occasions when the micrometer was useless. Sketches by ALPO observers were selected on the basis of correspondence with dates of the photographs and of the micrometric determinations in order to allow a comparison between thethree methods. No other bias was applied in selecting the sketches so that they should represent average efforts with regard to accuracy of position. Measurements on photographic prints and sketches were made with a metric ruler graduated in millimeters and a hand magnifier, estimating to 0.1 mm. Photographic negatives were measured with a Gaertner measuring machine, which is accurate to ± 0.02 mm.

The results of the measurements are shown in Table I. Though too limited in number to be more than suggestive, the values should be encouraging to observers who carefully sketch the planet. Latitudes of the north and south edges of the NEB from sketches made by Binder, Cyrus, and Hicks agree remarkably well with those resulting from photographs by Milon and Pope. Agreement to within ± 2° is considered within the combined experimental errors involved in measuring the positions of features on the sketches and photographs. [The NEB is well shown on the front cover photograph for our Nov.-Dec., 1963 Str. A. - Editor.]

In some instances it appears that observers may draw features either too narrow or too wide or tend to displace them north or south of their true positions, here considering the photographs and micrometric values as reference standards. Budine on two occasions placed the belt about 7° south of its position as determined by the other methods. Such systematic discre-

Table I

Saturnicentric Latitudes of the North Equatorial Belt of Saturn

Date	U.T.	Observer	Method	Saturnicentric Lat. S. edge	Saturnicentric Lat. N. edge
July 7, 1962		Milon, D.	Photo	+ 13°	+ 23°
	7:50-8:25	Binder, A.	Sketch	+ 13	+ 23
Aug. 3, 1962	5:40	Pope, T.	Photo	+ 10	+ 22
	3:02-3:17	Cyrus, C.	Sketch	+ 10	+ 21
	5:10	Hicks, T.	Sketch	+ 12	+ 22
	2:45	Lund, J.	Sketch	+ 8	+ 18
	3:40-3:45	Rippen, G.	Sketch	+ 12	+ 30
Aug. 10, 1963	8:00 (approx.)	Goodman, J.	Photo	+ 10	+ 18
	3:55	Cooke, D.	Sketch	+ 10	+ 14
Aug. 11, 1963	8:00-9:00	Goodman, J.	Micrometer	+ 6	+ 18
	5:00	Budine, P.	Sketch	- 1	+ 11
Sept.15, 1963	7:30-8:30	Goodman, J.	Micrometer	+ 13	+ 24
	8:45 (approx.)	Goodman, J.	Photo	+ 11	+ 22
	1:10	Budine, P.	Sketch	+ 5	+ 18
	3:00	Delano, K.	Sketch	+ 17	+ 27
Sept.28, 1963	7:00 (approx.)	Goodman, J.	Photo	+ 9	+ 22

pancies do not indicate carelessness since the breadth of the belt is in excellent agreement with reference values and the deviations in latitude are not random, although the consistency is based on only two samples. Delano, on the other hand, placed the belt north of its reference position on Sept. 15, 1963; and Rippen drew the belt considerably broader than depicted by other observers on August 3, 1962.

It should be noted that while the dates of the observations correspond, the times do not. Comparison therefore necessitates the perhaps unwarranted assumption that variation of latitude with changing longitude is negligible. Arguing against this assumption are the values obtained by Goodman for the south edge of the NEB on successive nights (August 10 and 11, 1963), using photography and micrometry, respectively, which differed by 4°. The longitude of the central meridian of Saturn at the same time on consecutive dates would differ by about 120° in low latitudes. Thus, the values from sketches which deviate markedly from values derived from other techniques employed at different times may not necessarily be erroneous.

Perhaps the best way of determining whether or not systematic errors in positioning features on sketches are being made, provided that facilities are available, would be to photograph the planet either immediately before or immediately after a sketch is made. Then a direct comparison of positions can be established; and the observer can, through an awareness of the problem, rectify his errors.

The question may be asked: since photography is coming into increasing use by amateur planetary observers, why rely on sketches for latitude determinations? The reasons are twofold: first of all, the number of sketches submitted to the Section Recorder far outweighs the number of photographs. The dates for which photographs are available are sporadic and far between. Secondly, features which are too faint to be discernible on even the best amateur or professional photographs are often well within the visual limits of moderate apertures. The same shortcoming applies to filar micrometry since, in order to make the feature appear large relative to the micrometer thread, very high magnifications are mandatory. Features with low contrast, as are most of the markings on the disk of Saturn, become extremely elusive as magnification increases. Sketching, therefore, remains the only means of recording the majority of Saturn's features. During 1963, none of the photographs of the planet which were submitted to the ALPO showed belts other than the NEB.

Reference

1. Goodman, J.W., Str. A., 17, pg. 77 (1963).

STATUS OF THE LUNAR SECTION SELECTED AREAS MAPPING PROGRAM, MARCH, 1964

By: Patrick S. McIntosh, A.L.P.O. Lunar Recorder

At the date of this writing, a total of 38 visual observations of the Aristarchus-Herodotus region has been submitted. A list of the contributors appears below. An examination of these observations has resulted in the following remarks and suggestions for making the mapping program more effective.

1. The volume of observations is still inadequate for compiling a reliable master chart. There is insufficient overlapping of observations of small detail.

2. Most of the observations are made during sunrise on the region. There is a definite need for observations at sunset as well. Observers should also try to observe the fine detail in bright and dark structure in the region when the sun is high. Seldom does anyone study an object far from the terminator.

3. There is need for many more observers, especially for observers with telescopes 8 inches in aperture and larger. More than half the observations so far have been submitted by two observers! An increase in the number of observers would not only increase the volume of observations but would also provide better checks on the personal, subjective factors in each observation. Each observer sees different detail because of differences in the size and quality of the telescopes, the differences in observing conditions, and the differences in eyesight. Added to this are the differences in ability to interpret what is seen and the immense differences in artistic style in representing the interpreted observation. By combining observations made by many observers one would hope that most of the variables would cancel each other and that something of the true nature of the lunar feature would remain. Few amateur astronomers realize how few other amateurs are doing serious observing. It is easy to make an important contribution simply because there are so few contributors. Every owner of a telescope 6 inches in aperture or larger should be aware that he has the potential to add some valuable information to man's store of knowledge about the moon.

4. The accuracy in the placing of details on the outline chart could be better. It had been hoped that an outline chart prepared from photographs would assure reasonable uniformity in the observed positions. The most obvious errors occur in the placing of the dark bands on the interior walls of Aristarchus. This may indicate that there are serious errors in positions of other features as well. Perhaps the outline chart is not so helpful as anticipated. All observers are encouraged to criticize the outline form. Is it a convenient size? Is it difficult to match with the observed appearance of the region? Should the observing form be made more pictorial and less of an outline?

5. The most frequent criticism made of the submitted observations is that they do not include enough detail that is new. This situation appears to be a result of the observer's attempting to map the entire selected area during a single observing session. It would be better if the observer instead concentrated on a single mountain peak, or a portion of a crater rim,

or the arrangement of bright features in one small portion of the mapping region. It is far better to spend an hour determining the true nature of an object a few kilometers in diameter and to do it with good accuracy than to spend that hour on an area hundreds of kilometers across and hence end up with a sketch which shows less than an average photograph.

6. A few observers have made their observations outstanding by including detailed notes of explanation and interpretation. The observing form asks that these notes be added to the back of the form, but this Recorder would recommend that they be put on a separate sheet. So few people can draw what they see that such notes invariably add a great deal of information to the observation. Each feature worthy of comment should be labelled with a number, letter, or Greek symbol and this label then used in the notes. The notes should give an indication of how sure the observer is of what he has recorded as well as a verbal description of the feature.

In the next issue of The Strolling Astronomer I will present a provisional master chart of the Aristarchus-Herodotus region based on the limited number of observations on hand. Some of the outstanding individual observations will be included.

Contributors to the Lunar Mapping Program

Name	City	Telescope	No.Observations
Larry Anthenien	San Jose, California	6" refl.	1
Orville Brettman	Elgin, Illinois	5" refr.	1
Rev.Kenneth J.Delano	New Bedford, Mass.	8" refl.	4
Harry D. Jamieson	Muncie, Indiana	10" refl.	11
Patrick S. McIntosh	Sunspot, New Mexico	4" refr.	2
George W. Rippen	Madison, Wisconsin	6", 12" refls.	2
Ken Schneller	Cleveland, Ohio	8" refl.	1
William Snyder	Pittsburgh, Pa.	4" refl.	1
John E. Westfall	Mount Rainier, Md.	4" refr.	13
José Olivarez	Mission, Texas	17" refl.	2

LUNAR METEOR SEARCH PROJECT, FEBRUARY,1962-DECEMBER,1963

By: K. Chalk, A.L.P.O. Lunar Meteor Search Recorder

During the past two years the response of ALPO members to this project has been most encouraging. A total of 16 members have written to me expressing interest, and of these 12 have continued to submit reports. Some of these were participating in the program while it was co-ordinated by Mr. Adams; others have begun only recently. Among the newer observers is a group headed by W. Cable of the Edmonton Centre of the Royal Astronomical Society of Canada. The Montreal Centre has continued to lend its support as well. The hoped-for expansion of the observations into other time zones has taken place to some extent, and the writer hopes that this trend will continue.

A. The following is a list of observers, their apertures, and the amount of time contributed to the search by each person or group:

1. Eastern Time Zone

K. Brasch, Montreal	8"	1^h	04^m
C. Bridgen, "	4"	2	05
E. Bridgen, "	4"	0	51
K. Chalk, "	6",8"	3	29
G. Gaherty, "	6"?,8"	3	09
C. Good, "	3"	3	39
C. Papacosmas,"	6"	1	06
K. McNamara, "	4"	1	00
G. Wedge, "	6",8"	1	32

Eastern Time Zone (continued)

V. Williams,	Montreal	6"	10^h 12^m	
I. Williamson,	"	3"	8 06	
D. Zackon,	"	8"	2 39	
K. Zorgo,	"	5"	0 50	
Mme.J-P. Jean,	"	3½"	5 52	(entire team; see below).
K. Delano,	Mass.	3½", 8"	12 46	
M. Payne,	"	2½"	2 35	
W. Snyder,	Pa.	4"	2 42	
R. Yajko,	"	3"	4 20	

2. Central Time Zone

R. Adams,	Missouri	3",6",10"	20^h 55^m

3. Mountain Time Zone

W. Cable,	Alberta	4"	11^h 10^m	(team:see below.)
E. Stong,	"	6"	0 50	
G. Solberg,	New Mexico	6"	2 32	

4. Pacific Time Zone

R. Bales,	Oregon	10"	1^h 32^m

Total time of observations: 107 hours, 41 mins.
Positive reports: 9
Nights observed: 62 out of 71 scheduled.
Additional observation: December 30, 1963 lunar eclipse: W. Haas, 12½" telescope, 45 minutes.

Note:1. The team of the Centre Francais de Montreal is listed here as a group since its observations were for the most part carried out at a single station. Participating were: Jean, Lebrun, Mailloux, Rousseau, Buist, O'Keefe, LeMay, Laforest, Damas, Gabroil, Lehire, and Grignon.

2. The Edmonton, Alberta team consisted of Cable, Tackaberry, Salmon, and Rhodes.

3. The following have written to me expressing interest but have not reported observations: Jones, (Va.); Nelson, (Calif.); Dalton, (N.J.); Sitler, (Pa.); and Werner, (Ohio).

It has not been possible for me to spend the necessary time to determine the number of hours of observing time with each size of telescope (a relevant factor since the looked-for phenomena would be faint and thus less likely to be seen with small telescopes.) Therefore, in this report telescope size is only considered when positive reports are evaluated.

B. Positive Reports Received:

1. May 8, 1962. Mr. A. Rousseau, observing with a 3½" refractor, noted a bright point in the center of the dark area of the moon at 1:35 U.T. At this time the writer and K. Brasch were both observing with 8" telescopes, and G. Gaherty with a 6" refractor; none reported seeing anything at the time. As the phenomenon seen in the three-inch should have been visible in the larger telescopes, it must have been a flash of terrestrial origin, or a spurious effect within the telescope.

2. May 8, 1962. Mr. R. Adams reported seeing a trail of magnitude 8-9 about 6' in length, with a duration of about ½ sec. No other reports were received covering this time interval, but the trail seems unexpectedly long for a lunar meteor. The object was probably, but not definitely, terrestrial in origin.

3. June 9, 1962. Damas, with a 3½", saw a magnitude 8 trail, last-

ing 1 second, on the equator near the dark limb of the moon (or else a trail along the equator; it is not clear which) at 3:54 U.T. No one else was observing at the time, and it is difficult to evaluate the report.

4. Sept. 5, 1962. The writer observed a very faint point of light in the region of the crater Walter. This appeared at 0:48, 0:50, and 0:55 and was considered possibly evidence of vulcanism, or perhaps light on a high mountain peak, since it was not far from the terminator. The only other observer at the time was I. Williamson, using a 3" refractor, which could not have shown the phenomenon.

5. Oct. 8, 1962. R. M. Adams suspected activity in Aristarchus or Copernicus in the hour of 1:00-2:00 U.T., but was uncertain about this. No other observations covered this period; however, this area has shown evidence of activity of some sort in the past. Adams was using a 10" reflector at 57X.

6. Nov. 15, 1962. Adams, working with a 10" reflector, reported a bright point near Delisle at 1:30 U.T., of magnitude 4-5, lasting ½ second. Again there were no other observations made at the time. The object appears rather brighter than would be expected of a lunar meteor.

7. Dec. 2, 1962. K. J. Delano observed at 23:43 U.T. a magnitude 7 trail 2 minutes long in Mare Vaporum. He was using a 3½" Questar at 80X. In Montreal at the time Brasch, with an 8", Williams with a 6", and Williamson with a 3" saw nothing so that we may assume a terrestrial meteor.

8. April 29, 1963. Michael Payne observed a fast meteor crossing the moon at 1:40 U.T. This was obviously earthbound.

9. June 28, 1963. Adams reported a magnitude 3-4 flash of duration 1-2 secs. near the Spitzbergen Mountains, at 2:35 U.T. No other observations were being made at the time, but a terrestrial origin seems probable for a flash of this brightness. Adams was using a 10" reflector.

Of the nine reports listed above, it seems probable that 6 were terrestrial in origin, 2 probably lunar (but not meteoritic), and one (no. 6) is questionable.

The Lunar Meteor Search depends on the existence of simultaneous observations of a flash or trail to establish its lunar origin, for a terrestrial meteor will appear to be in line with the moon only to one observing station. For this reason the Recorder would like to hear from interested readers, especially in the Central Time Zone. They will receive upon request a supply of report forms and a copy of the year's observing schedule* Those who can are urged to make lunar meteor searches during the total phase of the lunar eclipse on December 19, 1964. Totality will find the moon well placed on a dark sky in Europe and over most of the United States and Canada.

VENUS SECTION REPORT: EASTERN APPARITION, 1962, SECOND PORTION

By: William K. Hartmann, 1962 A.L.P.O. Venus Recorder

(concluded from November-December, 1963 issue)

Part 7: Phase and Dichotomy

The terminator was described as straight or very nearly straight in 29 observations by 20 observers. These observations were analysed by the method described in an earlier paper[11]. Dichotomy was found to have occurred on Aug. 25.4, 1962, U.T. ± 3.3 days. This was 6.9 ± 3.3 days earlier than the predicted date, corresponding to a discrepancy in phase angle i of about $3\overset{\circ}{.}9 \pm 2\overset{\circ}{.}0$. The measures of accuracy here are the very familiar standard deviations.

* This schedule for August-December, 1964 appears on page 40 of this issue.

This result is very similar to that of the preceding morning apparition[14] of 1961, when the corresponding figures were 6.2 ± 2.3 days and $3^{\circ}.8 \pm 1^{\circ}.4$ (note that an error in the i values on page 106 of the preceding report[14] is corrected here). Because observers made more careful notes than in the 1960-61 evening apparition the analysis could be restricted to fewer observations closer to dichotomy, and the standard deviation was reduced.

Among observers who made extended series of observations to fix the time of dichotomy should be mentioned (in chronological order): Hartmann (Aug. 23.0), Cruikshank (Aug. 23.5), Eastman (Aug. 24.8), Williams (Aug.27.0), and Mackal (Aug. 28.0). These individual determinations average 5.9 days earlier than predicted dichotomy, well within one standard deviation of the above determination.

Moore, in the 1962 B.A.A. Venus Section Report[15], gives Aug. 19, 1962 as the best determination, based on reports of several observers, but especially on micrometric measures by J. S. Glasby with a 13-inch reflector. The difference between the B.A.A. result (13 days early) and the A.L.P.O. result (7 days early) is surprisingly large. Possibly England's more northern latitude, Venus' southern heliocentric latitude, and poor transparency may have been contributing factors, causing the English observers to have lost more of the extreme terminator. The 1961 morning apparition results of the B.A.A. and the A.L.P.C. were in better accord.

Figure 1 brings up to date the A.L.P.O. Venus Section observations of dichotomy from 1951 through 1962, and graphically illustrates Schroeter's effect.

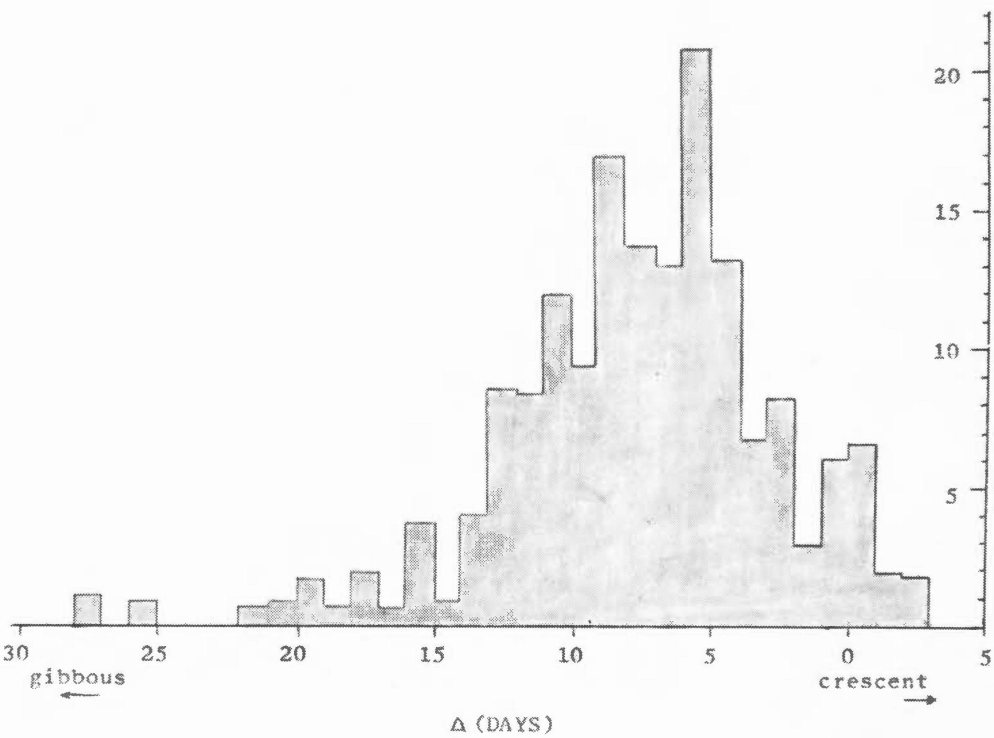


FIGURE 1. The "Schroeter Effect", as shown in the A.L.P.O. records of the dichotomy of Venus, 1951-62. The weighted number of observations of a straight terminator (average weight unity) is plotted against the number of days Δ from geometric dichotomy. See also text of article by William K. Hartmann in this issue.

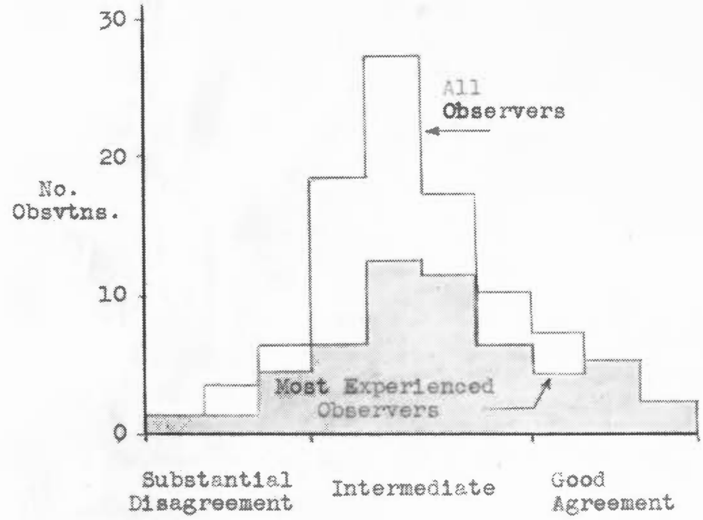


FIGURE 2. Subjective rating of degree of agreement between visual observations of Venus and ultraviolet photographs plotted against number of observations. See text of Mr. Hartmann's article.

Part 8: Confirmation of Detail on Venus

The extensive series of ultraviolet photographs made by the writer with the assistance of C. R. Chapman, D. P. Cruikshank, and C. A. Wood as part of a program at the Lunar and Planetary Laboratory allowed the most significant study yet made of the reliability of A.L.P.O. observations of detail on Venus. The results indicate that the typical drawing of visually observed dusky shadings on Venus simply cannot be trusted to represent accurately the markings which so often can be photographed at short wavelengths in the central parts of the image. We are not dealing with markings which are unique to the visual region because individual markings have been traced photographically on occasion from the UV into the visual region.

The unreliability of typical observations was established by the following test: Photographs showing detail at about 3200Å and 3600Å were available from 26 nights. From these same nights 96 drawings showing detail were available. These were rated subjectively according to their compatability with the photographic detail. The results are presented in Fig. 2. Only about 16% of the observations suggested that the detail had been accurately observed, while another 10% showed major details contradictory to those photographed. A similar test using 52 observations by 9 observers whose care and accuracy has been established (in part by work in other sections) showed about 23% agreeing with the photographs and 12% seriously disagreeing. The remaining observations are more or less equivocal.

Graphical studies reveal no significant correlation between the agreement of visual observations with UV photographs and: (1) visually estimated conspicuousness of the markings, (2) aperture, (3) seeing. However, there was apparently a positive correlation between the prominence of the markings on the UV photographs and the agreement of the visual drawings with the photographs.

Taken together, these results are rather discouraging. They imply that even the most trustworthy observers (e.g. Clark R. Chapman, who had perhaps the best record of agreement with the UV photos) record genuine

FIGURE 3. Examples of partial agreement between visual drawings of Venus and near-simultaneous ultraviolet photographs. Darkest markings on drawings lie near darkest ones on photographs.

FIGURE 3a. Venus. Clark R. Chapman. August 6,1962. 2^h 30^m, U.T. 36-inch refl.at 16 inches. 400X. Seeing 3-5. Transparency 4. Conspicuousness of shadings = 5.

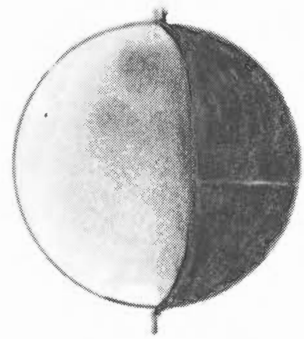


FIGURE 3b. Venus. Earl F. Hicks. August 6, 1962. 3^h 15^m, U.T. 5-inch refr. 127X. Seeing 1-2. Transparency 4. Conspicuousness of N cap = 7.

FIGURE 3c. Sketch of Venus from ultraviolet photographs by Dale P. Cruikshank. Made without knowledge of the visual observations here shown for comparison. 3200-3600 Å. August 6, 1962. About 2^h 0^m, U.T. 36-inch refl. at 16 inches. Extreme terminator not recorded.

FIGURE 4. Examples of good to fair agreement between visual drawings of Venus and ultraviolet photographs. Note that the similarity of the images is as good as is often found between simultaneous drawings of Jupiter. (See Str.A., Vol. 16, pg. 61.)

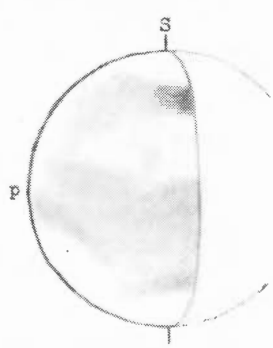


FIGURE 4a. Venus. William K. Hartmann. August 7, 1962. 1^h 43^m, U.T. 36-inch refl. at 16 inches. 400X. Seeing 3. Transparency 5.

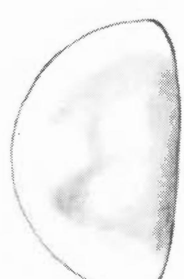


FIGURE 4b. Venus. Clark R. Chapman. August 7, 1962. 2^h 15^m,U.T. 36-inch refl. at 16 inches. 400X. Blue filter. Seeing 2-3. Transparency 4.

FIGURE 4c. Sketch of ultraviolet photographs of Venus. 3200- 3600 Å. August 7, 1962. About 1^h 56^m, U.T. 36-inch refl. at 16 inches. Extreme terminator not recorded.

markings only 1/5 of the time. The writer still supports the statement that detail can be occasionally seen on Venus; but given a set of observations,it is nearly impossible to identify the valid ones without photographs. Still, it must be remembered that everything said thus far here in Part 8 refers only to markings in the central portions of the image. Photographic effects, especially at the cusps and along the extreme terminator, limit the reliability of the photographs in those regions. Therefore, the results of this section are applicable only to Part 2 of this paper, which discussed "Markings on the Disk, Exclusive of Cusp Areas". The conclusion is that in the visual parts of Table 1 the "signal to noise" ratio is very low. Because cusp bands and caps often present the greatest contrasts on Venus, visual observations of them may be more reliable.

In Figs. 3-6 are given examples comparing visual observations with photographs. Most were chosen to show examples of good cases of agreement and are thus not representative. For a more random choice of observations see the 1960-61 report[16]. Because reproduction of the UV photographs has always been difficult, pencil copies have been used instead. These were prepared by D. P. Cruikshank without knowledge of the accompanying observations.

In summary, the seven ideas listed at the end of the 1960-61 report (ref. 16, pp. 174-175) remain valid. In particular, visual detail can occasionally be detected. But from this 1962 report it appears that not much can be learned from detailed drawings because the valid ones are scarce and difficult to identify. <u>I suggest that observations of Venus under average conditions proceed according to the following plan</u>: Draw the phase with the greatest possible accuracy. Write down whether you think the accuracy is good enough for phase measures to be made from the drawing. Draw carefully but only in broad detail any suspected markings. Record relative intensity and conspicuousness estimates for all markings, including caps and bands. Cusp cap data will be useful in statistical studies. Don't concentrate on fine details,which probably aren't real anyway. Instead, use the remaining time to record relative sizes and brightnesses of markings, especially cusp caps, and to write down notes on the appearance of the dark side and the terminator.

[The Editor is not in full agreement with Mr. Hartmann's argument in Part 8. The criterion applied to test the validity of the visual observations is that the perfect visual observer would duplicate a simultaneous ultraviolet photograph of Venus. Is such true, even if ultraviolet detail can occasionally be recorded in visual wavelengths? An analogous procedure would be to to test the reliability of visual observers of Mars by comparing their drawings to ultraviolet photographs of that planet. It would be concluded that absolutely perfect visual data was of very poor quality since the ultraviolet photographs normally show chiefly cloud systems over Mars, while the visual observer primarily records surface markings. (There would be, of course, no need to try to apply this test to visual data on Mars.)

It may still be, of course, that Mr. Hartmann is absolutely correct in his opinion that drawings of Venus are usually inaccurate and unreliable. It may even be that other methods of study will fully confirm his conclusions.]

The references for this paper have already been published on pages 254 and 255 of the previous (Nov.-Dec., 1963) issue.

<u>THE INTERPRETATION OF LUNAR CRATER MORPHOLOGY: POLYGONAL CRATERS</u>

By: F. J. Manasek

<u>ABSTRACT</u>: Several theories of polygonal lunar crater formation are critically analysed. The possible role of the grid system and compressive forces are discussed, and the conclusion is reached that no one theory can satisfactorily account for the development of polygonal craters. The work of Jaggar on terrestrial caldera is believed, by the author, to have great

FIGURE 5. Example of good agreement between a visual drawing of Venus and ultraviolet photographs taken some hours later.

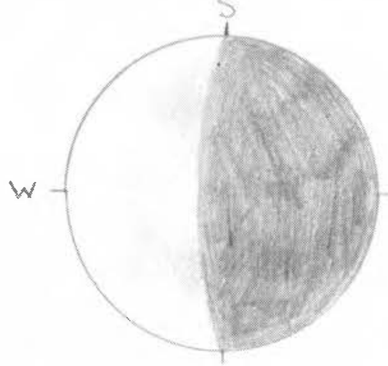


FIGURE 5a. Venus. C.A. Anderson. August 26, 1962. $19^h\ 15^m$, U.T. 6-inch refl. 122X. Seeing good. Transparency average.

FIGURE 5b. Sketch of Venus from ultraviolet photographs by Dale P. Cruikshank. 3200 - 3600 Å. August 27, 1962. About $1^h\ 40^m$, U.T. 36-inch refl. at 16 ins. Extreme terminator not recorded.

FIGURE 6. Example of serious disagreement between visual drawing and ultraviolet photographs. The north cusp band in the drawing is spurious.

Drawing:

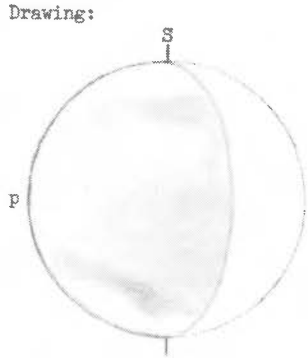


FIGURE 6a. Venus. William K. Hartmann. July 13, 1962. $2^h\ 24^m$, U.T. 36-inch refl. at 16 inches. 400X. Seeing 2-3. Transparency 5.

FIGURE 6b. Sketch of Venus from ultraviolet photographs by Dale P. Cruikshank. July 13, 1962. About $2^h\ 25^m$, U.T. 36-inch refl. at 16 inches. Extreme terminator not recorded. Markings inconspicuous on photographs.

importance in the question of lunar crater development in that it suggests that polygonality may be characteristic of engulfment and need not be the result of modifying influences.

In recent years a great deal of the lunar literature has been involved with the grid system and its relation to other aspects of lunar topography. The morphology of lunar craters, especially their polygonal outlines, has also been discussed at great length. Emphasis has been placed on the polygonal shapes of craters, and much speculation has evolved concerning the cause of this characteristic.

Most current literature on lunar dynamics places a great emphasis on the role of crustal stress in determining the final shape of lunar features. Spurr's[1] concepts of appression and oppression, in modified forms, have found increasing support as observational confirmation of the grid system appears to relate it to the shape of craters. Essentially, it has been postulated[2] that the polygonal aspects of many lunar craters are the result of deformation by surface stress and that the non-circular shape represents a distorted crater which is a measure of the force and direction of the stress (primarily compressive). These concepts have been used in efforts to assign relative ages (pre-and post-stress era) to different craters. For this to be a valid approach the following requirements must hold:

1. Crater formation must be a symmetrical process, forming circular craters in a stress-free surface.

2. Stress is the only major factor determining non-circularity.

3. All craters in existence before the period of stress must be deformed (i.e., polygonal), and all craters formed after this era are circular.

4. Either the mechanism of formation of all craters was the same, or different mechanisms produced similar (circular) craters.

Another approach to the problem posed by polygonal craters regards the grid system as an interlacing of geological boundaries which tended to inhibit crater growth. Thus, a crater could expand more or less symmetrically until it encountered a portion of the grid complex where its progress would be stopped or slowed, or the direction of local growth modified. This would cause the crater to assume an angular outline at the intersection with the grid, and a straight wall would result if a straight component of the grid was encountered. This approach requires fewer assumptions than the first and explains certain observations (such as the fact that the degree of deformation is relative to crater diameter and not an absolute value) that the author feels are not satisfactorily explained by the deformation theory. It still has the basic weakness of relating the grid system to polygonal craters, a causal relationship which, as it is important to remember, has been merely assumed.

Still another approach to the problem can be based upon a series of observations made by the American geologist Jaggar[3] of the Hawaiian caldera Halemaumau and Kilauea. These caldera bear a very close relationship to lunar objects and develop by means of engulfment. Their growth is irregular and has frequently led to polygonal outlines in the absence of any structures analogous to the lunar grid system. Growth of a crater need not be circular, as has been tacitly assumed by compression proponents.

Lastly, the physical role of surrounding terrain may be considered. A mountain or other raised area of land adjacent to a growing crater appears to influence the direction of growth in such a manner as to cause the caldera to enlarge in a direction away from the mountainous mass. This would also result in a crater with angular components in its wall.

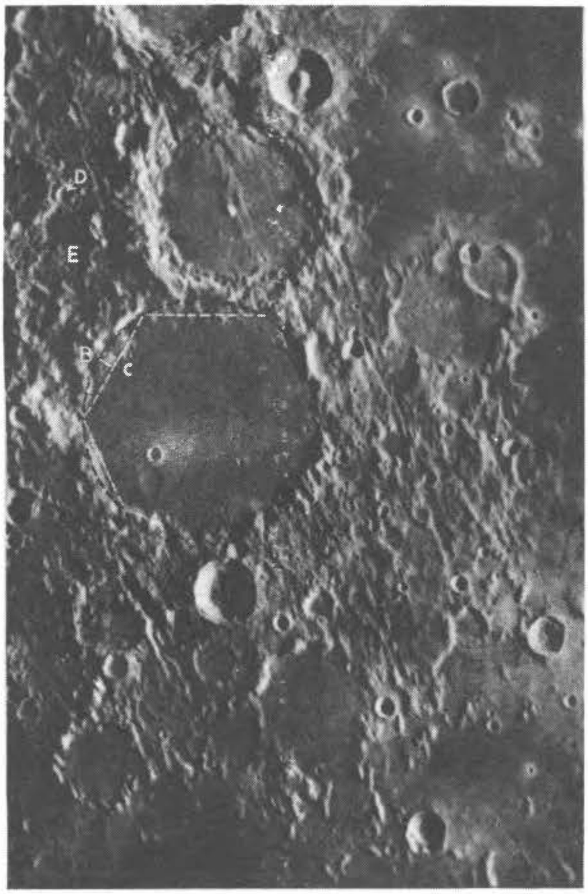


FIGURE 7. Print from a photograph in the Kuiper Photographic Lunar Atlas. Contributed by F. J. Manasek. Ptolemaeus-Alphonsus region of moon. Lunar south at top, lunar west (IAU sense) at right. The letters B,C,D, and E are explained in the text of Mr. Manasek's article. Ptolemaeus is the very large, gray plain a little left of center. Alphonsus is directly above Ptolemaeus and has a bright central peak. Late afternoon solar lighting.

It is the purpose of this paper to compare these mechanisms on as many points as possible and to relate observational evidence on as quantitative a basis as possible.

The currently popular compression-distortion theory suffers from several inconsistences. If it is to be assumed that, in a given lunar region, a compressive (shrinkage) force altered a population of predominantly round craters with a wide range of diameters to a population of predominantly polygonal craters by shifting their walls, then the walls of every crater present during the compressive phase should be displaced by the same amount. This absolute distortion is not observed; quite to the contrary the distortion is relative to the crater diameter. The Ptolemaeus region (Figure 7) is used to illustrate these points since it offers striking examples of the type of crater under discussion. The degree to which a crater deviates from a circle was determined by superimposing a circle on the crater so that the floor becomes, as closely as possible, an inscribed polygon. The amount of wall distortion B-C can then be measured and amounts, in the case of Ptolemaeus, to about 8 kms. If this were truly to represent a wall displacement caused by crustal shrinkage, then one would expect to find no polygonal craters with diameters less than 8 kms., these having been obliterated by the crustal shrinkage. However, craters of this size are present; they are polygonal and their "deformation" is less than 8 kms. It appears unlikely that a general crustal shrinkage could produce deformations differing so greatly in magnitude as those of craters D and E (Figure 7). It is equally difficult to postulate different forces acting on these adjacent craters. A similar situation is seen in Ptolemaeus and Alphonsus.

Ptolemaeus is clearly polygonal; yet Alphonsus deviates much less from a circle than does Ptolemaeus. Is this to be interpreted as evidence placing Alphonsus in the post compression era?

The apparent absence of polygonal craters of small size (less than 15 kms. diameter) has been utilized in an attempt to assign relative ages to the different sized craters. A recent study[4] has shown that the regular outlines of the smaller sized craters is not absolute; close examination of a large population of small craters reveals a great number of polygonal objects. The percentage of polygonal craters found in a given size grouping appears to be related very closely to regional topography. When this is considered along with the fact that the deviation of the walls is not an absolute value, it appears that attempting to assign ages to craters on the basis of their shapes is a groundless procedure.

The observed correlation of straight portions of crater walls with the lunar grid system may be too close to be fortuitous. The same holds true for the approximate alignment of polygonal craters in a specific field. The latter has been cited as evidence in favor of the compression-distortion theory, but while strongly suggestive of a common controlling mechanism, is not specific evidence for this mechanism.

If the grid system can be postulated as having exerted an effect (possibly retaining) on the developing craters, then many of the observed situations can, in the writer's opinion, be better explained than by the mechanism just described. A crater's polygonal aspects would not then be necessarily indicative of its age, but would rather strictly be a function of size and position within the grid system. If the crater was large enough to intersect a section of the grid, it would conform to the grid outline at the region of contact. If the crater had enough energy to expand and fill the entire grid-enclosed area, it would assume a polygonal aspect, the precise shape depending upon the nature of the grid system in that particular region. A crater with enough energy to bridge the grid system would expand to the next boundary, once again assuming the outlines of that region. A crater small enough to be located entirely within a grid unit may grow uniformly and not be polygonal but rather round or oval. If the grid system can be considered as having exerted a directive influence in modifying the direction of engulfment, the completeness and continuity of the system would be an important aspect in determining the shapes of craters. A fault in the surface would permit the energy of the caldera (present in the form of molten rock) to be dissipated along the line of fracture, causing the crater to grow along the fault rather than across it.

The lunar surface contains many non-circular craters which are asymmetrical in one region only. It is apparent that crustal shrinkage is not involved in the formation of these outlines. Craters in this group have in common one particular feature: most of the crater lies in the lunabase regions, and one side of it borders a mountainous region of lunarite. The side bordering the lunarite is usually less convex, and the crater looks as though it failed to enlarge in that direction.

It may be concluded from objects such as these that enlargement (probably by the mechanism of engulfment) occurred in the direction where the least material was to be removed and the melting point of the rock was lower. The latter speculation is based upon the supposition that the lunabase is a lave type rock and the lunarite is a higher melting point substance, such as granite. The implications of this observation are important; namely that the interaction of a landform and a growing crater becomes very complex when small craters in mountainous regions are considered.

It is important to realize that relatively new craters formed in an area already strewn with rubble and upheavals would not be round, but irregularly polygonal. They might also be younger than craters formed in a relatively flat area and which might be more nearly circular.

The geologist Jaggar studied the Hawaiian caldera for many years and recorded, among other things, their shapes. These caldera enlarge by the process of engulfment, and it is obvious that polygonal outlines can be formed without any external forces acting either to deform the mature crater or to alter it during growth. The various processes occurring during the formation of a calderon are adequate to account for many features of lunar craters. Jaggar observed the formation of central mountains, concentric craters, and internal terracing. He specifically noted with regard to the large lava filled lakes with raised edges that: " . . . . perfect circularity is rarely achieved . . . frequently [they] tend to hexagonal or pentagonal outline . . . "

The series of Jaggar's observations, which are too detailed and lengthy to review completely here, point to an interesting fact. The process of engulfment is not a uniform mechanism acting equally in all directions. The very pronounced morphological similarities of these craters with numerous lunar features make it difficult to disregard the possibility that the polygonal aspects of lunar craters may be nothing more than the normal result of the crater-building process.

It is essential to consider other morphological data also, especially since it is unlikely that similarly appearing characteristics of lunar craters are the result of a single mechanism acting on all craters in a like manner and since more than one mechanism was probably acting at the same time. An observational approach to the problem presented by a consideration of multiple mechanisms would be a very tedious procedure since it requires that each crater be analyzed separately, not only with regard to its own morphology but in relation to the surrounding terrain which in turn must be examined for features which might have influenced crater development. The problem is compounded when the consideration is made that the "normal" shape of the crater may be polygonal rather than round.

Summary

An attempt has been made in this paper to present evidence relevant to the various mechanisms of polygonal crater formation that have been postulated. The merits of each hypothesis have been discussed in the light of observational evidence. The complexity of the origins of the polygonal craters has been discussed. The fact that it is somewhat ingenous to consider only a single mechanism such as crustal compression has been mentioned. Current dating techniques based on the polygonal nature of craters have been discussed, and flaws in the method have been enumerated.

References

1. Spurr, J.E., Geology Applied to Selenology, 4 vols. U.S.A. Science Press, Business Press, Rumford Press.
2. Fielder, Gilbert, Structure of the Moon's Surface, New York, 1961. Pergamon Press.
3. Jaggar, T.A., Origin and Development of Craters, Baltimore, Md., 1947. Waverly Press.
4. Manasek, F.J.,"A Study of Polygonality among Small Lunar Craters and a Possible Interpretation in Terms of Local Lunar Terrain," Str. A.,Vol. 17, Nos. 9-10, 1963.

A GENERIC CLASSIFICATION OF LUNAR DOMES

By: John E. Westfall, A.L.P.O. Lunar Recorder

Introduction

With the inauguration of an ALPO program of lunar dome studies, it becomes imperative, firstly to agree upon a working definition for a lunar dome, and secondly, to establish a procedure for the systematic classification of these features. This paper is intended as a suggestion toward these ends; it is to be expected that, as more lunar dome data become available, this classification scheme will be revised.

Mr. L.J. Robinson, in his article on the classification of lunar features, has laid the foundations for this study[1]. Some of his recommendations are here accepted; others are modified, while the system has been made more detailed in order to make it more useful for the study of a single type of feature. Lunar students interested in dome classification should also refer to Leonard Abbey's and Ernst Both's thought-provoking article on the subject[2]. In addition, the writer expresses his appreciation to the Lunar Dome Recorders, Harry Jamieson and José Olivarez, for their invaluable comments and suggestions given during the preparation of this paper.

Definitions

Dome: A discrete, regular swelling whose ratio of major axis: minor axis, when corrected for foreshortening, does not exceed 2:1, and whose maximum slope, not including secondary features, does not exceed 5°. Under high illumination, domes are indistinguishable from their surroundings. Domes may exhibit secondary features, such as pits, clefts, ridges, and hills, as long as any single such feature does not occupy more than a quarter of the area of the dome.

Dome Complex: Any object similar to a dome but which has two or more contiguous swellings or an irregularly vertical profile.

The definitions above differ somewhat from Mr. Robinson's. These differences are, in order:

(i) "Discrete" <u>vice</u> "single": The new term includes the meaning of the previous term and, in addition, prevents portions of other features (for example,swellings on a ridge) from being identified as domes.

(ii) The maximum elongation for a dome has been increased from 1.5:1 to 2:1 as it is felt that the higher ratio will still make it unlikely that a ridge will be interpreted as a dome and yet makes it less likely that exceptional domes will be ignored.

(iii) The additional stipulation that dome slopes may not exceed 5° is provided to prevent confusion between domes and hills, cones, or peaks.

(iv) The phrase, "The surface of a dome shall appear dark under a low sun", is deleted because: (a) this characteristic is debatable for some domes, and (b), under low lighting, the darkening for a dome as a whole is difficult to determine because different portions of a dome are illuminated by light striking the surface at different angles.

(v) The additional stipulation that any single secondary feature will not cover more than one quarter of the dome's surface should not result in the rejection of any true dome, but should help to differentiate between domes and such features as cratercones.

Classification

This proposed system of classification is generic and empirical,rather than genetic and interpretative. This classification is intended partly as a useful tool for cataloguing domes, and partly as a first step towards the statistical analysis of dome characteristics, in order to answer such questions as: Are central pits more common on isolated domes than on domes in dome complexes? Such questions must be answered if we are to arrive at a valid theory for the orogeny of domes.

Domes are here described by six criteria: broad category, surroundings, position, plan, profile, and surface detail (secondary features). These categories are further subdivided and are given letters and numbers as shown below:

Broad Category

D: Dome
DC: Dome Complex

Surroundings

U: Uplands
W: Maria
UW: Uncertain or intermediate between Uplands and Maria.

Position

Orthogonal absolute Xi and Eta coördinates of the center of the object are given in parentheses, in units of thousandths of the lunar radius, preceded by the Roman numeral number of the quadrant of the moon.

Plan

Major Axis

1: Less than 5 kms.
2: 5 kms. to 20 kms.
3: 20 kms. to 35 kms.
4: Over 35 kms.

Border

a: Circular (Major Axis:Minor Axis = 1.00 - 1.25)
b: Elliptical (Major Axis:Minor Axis = 1.26 - 2.00)
c: Polygonal
d: Irregular
e: Too ill-defined to classify, or variable (i.e., dependent on aperture, etc.)

Profile

Maximum Slope

5: Gentle (under 2°)
6: Moderate (2° - 5°)

Cross Section

f: Hemispherical
g: Flat summit (platykurtic)
h: Sharp summit (leptokurtic)
i: Multiple summit (more than one summit, but of a single type; for example, three hemispherical summits)
f': Hemispherical - Asymmetric
g': Flat summit - Asymmetric
h': Sharp summit - Asymmetric
i': Complex summit (more than one summit, of more than one type; for example, one flat and one sharp summit)

Surface Detail

Type

7: Depression (pit, craterlet, or saucer)
8: Elevation (hill, ridge, or peak)
9: Cleft or valley
0: No observable surface detail

Position

j: Central
k: Off-center
m: On margin
n: Transversal (linear feature crossing entire dome)
p: More than one such feature

Application

Although it is an easy matter to devise schemes for classifying lunar features, the actual use of such schemes at the telescope, or with lunar photographs, is more difficult. Of the categories listed above, probably those concerning plan and profile are the most difficult to decide by observation.

The horizontal dimensions of a circular dome can be determined by comparison with a circular crater of known diameter. Away from the center of the disc, however, foreshortening makes it difficult to determine the true ellipticity of a dome since even a circular dome will appear elliptical. In such a case, it is sufficient for cataloguing purposes to estimate the ellipticity of a dome by comparing its outline with that of a craterlet as close to the dome as possible.

The maximum slope of a dome may be found by noting the colongitude at which a black shadow is first or last observed, from which the approximate maximum slope may be computed by the formula:

$$\sin \text{Slope} = \sin A = \cos B \sin (L + C),$$

where A is the altitude of the sun at the dome, B is the selenographic latitude of the dome, L is its selenographic longitude, and C is the solar colongitude.

Near the lunar limb, relief displacement of apparent position makes a symmetric dome appear asymmetric by displacing the summit of the dome. Any elevations or depressions on the dome are also displaced. This apparent displacement is expressed by the formula:

$$d = \frac{h \tan r}{1{,}000},$$

where d is the apparent displacement limbwards in kilometers, h the altitude above the dome's base in meters, and r is the dome's distance, in selenocentric arc, from the moon's apparent center. For example, a dome 500 meters high and 80° from the moon's apparent center (i.e., 10° from the limb) would have its summit displaced 2.8 kilometers towards the limb.

As an aid to dome interpretation, the sketches in Figure 8 illustrate the telescopic appearance of the several plan and profile categories.

In classifying domes, it is particularly important to distinguish between domes and other types of lunar features. The transition between a dome and another type of formation can be said to occur when one or more of the dome's plan or profile characteristics becomes excessive, as shown in the table below:

Plan (Border) :
- b - Ratio of Major Axis: Minor Axis exceeds 2:1 (A Ridge)
- d - Extremely irregular (A Mound)
- e - Too ill-defined to classify

Profile (Maximum Slope):
- 6 - Exceeds 5° (A Hill or Peak)

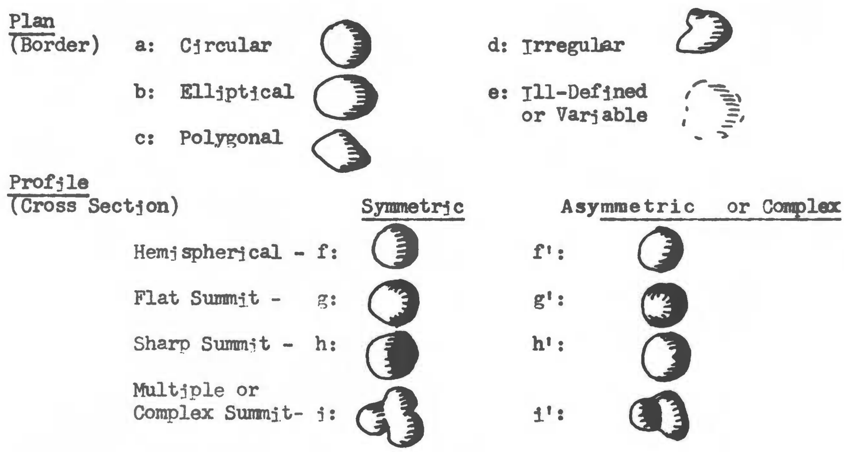


FIGURE 8. Sketches of telescopic appearance of lunar dome plan and profile categories in classification scheme proposed by John E. Westfall. No foreshortening, lighting by low sun to left. See also text.

(Cross Section): g - Extremely platykurtic (flat summit, steep sides; (a Plateau)

h - Extremely leptokurtic (unformly steep sides,little variation or curvature in slope; (a Cone, Peak, or Hill)

Examples

Below are eight examples of the application of the proposed dome classification system to selected lunar domes. (East and west are used in the IAU sense):

Name or Location	Classification	Written Description
N of Wallace D	DW(II094318)2d/5f/7k	Dome in mare. Medium-sized, with an irregular outline. Gentle, hemispherical profile, with a depression located off-center.
W of Milichius	DW(II151177)2a/6g/7k	Dome in mare. Medium-sized,with a circular outline. Moderately steep sides, with a relatively level summit, containing a depression off center.
NW of Hortensius	DW(II472125)2a/6g/7j	Dome in mare. Medium-sized, with a circular outline. Moderately steep sides, with a relatively level summit, containing a central depression.
W of Arago	DCW(I339109)3d/5i/7p8p	Dome Complex in mare. Fairly large, with an irregular outline. Gentle, with a multiple summit. Contains several depressions and several elevations.

NW of Linné	DW(II53511)4c/6g/8p	Dome in mare. Large with a polygonal outline. Moderately steep sides, with a relatively level summit containing several elevations.
Rümker	DCW(II643649)4d/6i'/7k8p	Dome Complex in mare. Large with an irregular outline. Moderately steep sides and a complex summit. Contains an off-center depression and several elevations.
NW of Petavius B	DW(IV776318)2d/5f/7p	Dome in mare. Medium-sized, with an irregular outline. Gentle slopes, with an asymmetric hemispherical profile. Contains several depressions.
NW of Piccolomini	DU(IV450389)2a/6h/9k	Dome in uplands. Medium-sized, with a circular outline. Moderately steep slopes, with a sharp summit. Contains an off-center cleft or valley.

[1]L.J. Robinson. "A Suggested Classification for Lunar Topography". Str. A., 17,3-4 (Mar-Apr., 1963), pp. 49-55.

[2]Leonard B. Abbey, Jr. and Ernst E. Both. "An Atlas of Lunar Domes". Str. A., 12, 7-9 (Jul-Sep., 1958), pp. 96-101.

[3]Joseph Ashbrook. "Steep Places on the Moon". Str. A., 17, 7-8 (Jul.-Aug., 1963), pp. 136-137.

INDEX OF VOLUME 17 (1963) OF THE STROLLING ASTRONOMER

By: Dale P. Cruikshank and William K. Hartmann

Author Index

		Pages
Ashbrook, Joseph	Dimensions of the Linné Craterlet	26 - 28
--------------	An Analysis of Schmidt's Observations of Linné	85 - 89
--------------	Steep Places on the Moon	136 -137
--------------	Recent Lunar and Planetary Work in Switzerland	209 -210
Bartlett, James C., Jr.	Piton - A Lunar Proteus	3 - 12
---------------	Variations in the South Equatorial and North Equatorial Belts of Jupiter, 1941-1963	235 -237
Binder, Alan	Mars Observations, 1962-1963	217 -220
Brasch, Klaus R.	A Study of the Phase of Venus, 1960-1962	173 -178
Capen, Charles F.	Observations of Comet Pereyra	178 -181
Chalk, Kenneth	Theoretical Aspects of the Lunar Meteor	19 - 23
Chapman, Clark R.	The Art of Lunar Drawing	45 - 49
--------------- (and C. A. Wood)	A Request for Observations of Central Peaks	162 -163
Chapman, Clark R. (and J.E. Westfall and H.D. Jamieson)	A.L.P.O. Lunar Section Report: October, 1962 - December, 1963	221 -227
Cruikshank, Dale P.	On the Venus Cusp Effect Reported by Brinton and Moore	1 - 2

Cruikshank, Dale P.	Mercury's Libration in Longitude	72 - 73
--------------	Mercury, Part I: The Blunted Cusp Effect and Terminator Irregularities	129 - 132
--------------	Aims of the A.L.P.O. Venus Section in 1963-1964	151 - 153
--------------	A Review of some A.L.P.O. Venus Studies	202 - 208
-------------- (and W. K. Hartmann)	Index of Volume 16 (1962) of The Strolling Astronomer	107 - 112
Giffen, Charles H.	A New Simultaneous Observing Program	29 - 34
--------------	Foundations of Visual Planetary Astronomy. I	59 - 72
--------------	Simulated Visual Dichotomy Observations - Preliminary Report	89 - 91
--------------	Foundations of Visual Planetary Astronomy. II	113 - 120
Glenn, William H.	Observing the Moon's Shadow and the Degree of Darkness at the Total Solar Eclipse of July 20, 1963	55 - 59
Goodman, Joel W.	Observing Programs of the A.L.P.O. Saturn Section	77 - 82
--------------	Saturn in 1962	91 - 97
Haas, Walter H.	The Coming San Diego Convention of the A.L.P.O.	82 - 83
------------	Colors in the Aristarchus Region: New Observations, Old Observations, and Comments	213 - 216
------------	Computing the Central Meridian of Jupiter	237 - 241
------------	The Total Lunar Eclipse of December 30, 1963	255 - 259
Hartmann, William K.	A Note on Phase Anomalies of Venus	2 - 3
--------------	Venus Section Report: Western Apparition, 1961	99 - 107
--------------	Venus Section Report: Eastern Apparition, 1962	248 - 255
-------------- (and D.P. Cruikshank)	Index of Vol. 16 (1962) of The Strolling Astronomer	107 - 112
Hédevári, Péter	On the Ancient Astronomy, Chronology, and Cosmology of India	158 - 161
Herring, Alika K.	Kepler	220 - 221
Hodgson, Richard G.	The 1963 Approach of Minor Planet Betulia	1
Hurlburt, H.M.	Improvement of the Image Contrast in a Newtonian Telescope	153 - 158
Jamieson, Harry D.	An Observation of the Southwest Inner Wall (IAU sense) of Aristarchus	241 - 242
-------------- (and J. E. Westfall and C. R. Chapman	A.L.P.O. Lunar Section Report: October, 1962 - December, 1963	221 - 227
Jean, Madame Jean Pierre	Lunar Meteor Search (abstract)	18 - 19
Johnson, Craig L.	A Report on the Total Solar Eclipse of July 20, 1963	133 - 136
Manasek, Francis J.	Klein's "New" Crater - Another Lunar Puzzle (abstract)	18
--------------	The Eleventh A.L.P.O. Convention	166 - 167
--------------	A Study of Polygonality among Small Lunar Craters and a Possible Interpretation in terms of Local Lunar Terrain	200 - 202
Meisel, David D.	The July 20, 1963 Solar Eclipse: Preliminary Report	120 - 123
--------------	Scientific Results of a Total Solar Eclipse Expedition to Moose River, Ontario, on July 20, 1963	182 - 187
--------------	A.L.P.O. Comets Section Report for 1961. Parts II and III	227 - 232

Meisel, David D.	A.L.P.O. Comets Section Report for 1962-1963. Part I	232 - 234
Moore, Patrick	Lunar-Type Terrestrial Vulcanoids	23 - 26
Newell, John K.	Optical Study of Clear Air Turbulence	12 - 18
Olivarez, José	A Note on the Darwin Dome as Seen in Small and Large Apertures	34 - 35
Peterson, Keith	Plato and its Mysteries (abstract)	99
Reese, Elmer J.	Jupiter in 1962-1963: Rotation Periods	137 - 150
--------------	Mean Latitudes of Jupiter's Belts in 1962	150 - 151
Rippen, George W.	Temperature Structure of the Atmosphere of Mars	188 - 197
Robinson, L.J.	A Suggested Classification for Lunar Topography	49 - 55
Rost, Carlos E.	Astronomy and the General Public (abstract)	98
Sato, Takeshi	On the Latitude Abnormality of the South Equatorial Belt North on Jupiter in 1961	197 - 200
Westfall, John E. (and C. R. Chapman and H. D. Jamieson)	A.L.P.O. Lunar Section Report: October, 1962 - December, 1963	221 - 227
Wood, Charles A. (and C. R. Chapman	A Request for Observations of Central Peaks	162 - 163
Young, James W.	Pluto During 1964	246
Zackon, David	Mercury Transit 1960 (abstract)	98 - 99

Subject Index

ALPO
- Abstracts 97-99, 212 (numbers given refer to pages)
- Conventions
  - Astronomical League 39, 83
  - Denver 211-212, 247-248
  - Montreal 97
  - San Diego 39, 82-83, 166-167
- Correction to Strolling Astronomer 40, 211
- Index to Strolling Astronomer 16 107-112
- Members 39, 40-42, 127-128, cover issue Nos. 7-8, 163-164, 168, 211, 246
- Staff 40, 83, 126-127, 164-165, 208, 211, 247

Asteroids
- Betulia (1580) 1, 127

Astronomy
- Historical 158-161
- General 98 (abstract)

Atmosphere
- Earth, turbulence 12-17
- Moon 20-21

Book Reviews (Reviewer's name in parentheses)
- "A Hold Fizikája" (G. Toth) 75-76
- "Astronomy of the 20th Century" (J.R. Smith) 123-124
- "Consolidated Catalog of Selenographic Positions" (J.E. Westfall) 37
- "Cosmic Rays" (T.E. Schmidt) 161-162
- "The Photographic Story of Mars" (R.W. Gordon) 209
- "Pictorial Guide to the Moon" (A.K. Herring) 243
- "The Planet Mercury" (R.W. Gordon) 209
- "Problems of Extra-galactic Research" (K.J. Delano) 124
- "Reviews of Contributions of the American Museum-Hayden Planetarium, New York" (J. R. Smith) 38-39
- "Solar Research" (P. S. McIntosh) 76-77
- "Soviet Science of Interstellar Space" (F.C. Trusell) 77

Book Reviews (cont'd)
"Splendor in the Sky" (G. S. Hawkins) 124-125
"Star Gazing with Telescope and Camera" (J.R. Smith) 74
"Der Sternhimmel 1963" (K. R. Brasch) 75
"Der Sternhimmel 1964" (K. R. Brasch) 245
"A Survey of the Moon" (J.E. Westfall) 243-245
"The Syetem of Minor Planets" (R.G. Hodgson) 74
"Table of A.D. Lunations and Chinese Intercalary Months" (J.R. Smith) 38-39
"Table of B. C. Lunations" (J. R. Smith) 37
"Vistas in Astronomy, Vol. 5" (P.S. McIntosh) 125

Comets
Alcock (1963b) 232-234
Burnham (1959k) 234
Humason (1961e) 232-234
Ikeya (1963a) 232-234
Literature recommended 39
Pereyra (1963e) 178-182 (photographs 179-180)
Section Report 227-234
Seki (1961f) 228-232
Seki-Lines (1962c) 232-234
Wilson (1961d) 228-229, 232-234

Earth
Volcanoes 23-26

Jupiter
Central Meridian transit determinations 237-241
Colors 235-237
Drawings 145, 171, 199
Handbook 125
Intensities 235-237
Latitudes 150-151, 197-200, 210
Observing 63, 67, 137-150, 151
Red Spot 137-150, 151, (drawing, cover issue Nos. 9-10), 199, 210, 216
Request for observations 246
Rotation periods 137-150, 210
Section Report 137-150
Simultaneous Observations 33, 81-82, 113
Transits 137-150

Lunar Meteors
Observations 18-19
Theory of lunar meteors 19-23

Mars
Atmosphere 188-197, 217-220
Clouds 217-220 (drawing 219)
Drawings 219
Map 218
Observing 63, 67, 210, 217-220
Polar caps 217 (map 218)
Simultaneous observations 31
Surface markings 217-220

Mercury
Cusps 129-132
Drawings 130
Libration 72-73, 131-132
Map 130
Observing 63, 66-67
Simultaneous Observations 33, 81, 113
Terminator 132
Transit 98-99 (abstract)

Meteors

Lunar 18, 19-23

Moon

Central peaks 162-163
Classification of features 49-50
Colors 171-172, 212, 213-216, 241
Dome survey program 224-225
Eclipses 55-59, 73, 212, 225-227, 255-259
Features (listed individually by name)
Arago domes 42 (drawing 43), 169
Aristarchus 40-41 (outline sketch 41),171-172 (sketch 172), 213-216, 241-242
Beaumont A 210
Bohnenberger A 210
Bohnenberger B 210
Cassini 169 (sketch 170)
Flamsteed (drawing, cover issue Nos. 1-2), 42
Fracastorius Y 210
Herodotus 40-41 (outline sketch 41), 171-172 (sketch 172), (drawing 242)
Hyginus 18
Jansen 42 (drawing 43)
Kepler 220-221 (drawing 221)
Linné 26-28, 85-89, 210
Longomontanus 42
Mare Nectaris 210
Mare Vaporum 18
Milichius 42 (drawing 43)
"new crater" near Hyginus 19
Piton 3-12
Plato 99 (abstract)
Posidonius (drawing 47)
Schröter's Valley 212, 213-216
Sinus Roris 167 (sketch 170)
Mapping program 40, 222-223
Nomenclature 35-36, 83, 211
Observing and drawing 45-49, 63
Occultation of Saturn 97
" of stars 173
Request for observations 42-44
Section news 40
Section Report 221-227
Topography 136-137, 162-163, 164, 200-202, 210
Training program 48-49, 83, 126, 223-224, 246
Volcanic activity 127-128, 241
Volcanoes 23-26

Neptune

Observing 63

Observing

Methods 31-32, 153-158, 164, 237-241
Observing Manual 247
Telescopes 153-158 (photograph 168)
Theoretical aspects 59-72, 113-120

Pluto

Observing 246 (finding chart 245)

Satellites

of Jupiter, observing 32
of Saturn, observing 81, 169

Saturn

Belts 78-80, 94-95
Divisions in Rings 80-81, 95-97

Saturn (cont'd)
Globe 78-80, 92-95 (drawings 93, 96, photographs 96, cover issue Nos. 11-12)
Intensity estimates 78-81, 92-97
Latitude measures 94
Observing 63-69, 77-82, 92-97
Occultation by Moon 97
Occultation of stars by Rings 81
Rings 80-81, 95-97
Satellites 81, 169
Section Report 91-97
Simultaneous Observations 33, 81-82, 113
Zones 92-94

Sun
Eclipse (photographs cover issue Nos. 5-6, 122, 134-135), 120-123, 133-136, 182-187, (drawing 183)

Venus
Cusp bands 101-102, 207, 251-253
Cusp caps 101-102, 151, 206-207, 251-253
Cusps 1, 2-3, 105, 206-207, 251-253
Dark markings 100-101, 151-152, 203, 205-206, 249-251
Dark side 102-104, 151-152, 253-254
Dichotomy 89-91, 106, 151, 173-178
Drawings 103-105
Illuminated atmosphere and Ashen Light 104, 151-152, 203-204, 253-254
Limb band 204-205
Observations requested 151-153
Observing 63, 66-67, 99-107
Phase 151, 173-178, 207
Photographs 105
Schröter Effect 173-178
Section Report 99-107, 248-255
Simulated observations 89-91
Simultaneous Observations 33
Terminator 106, 254

Acknowledgment by Editor. We express our considerable thanks to Messrs. Cruikshank and Hartmann for their very useful contribution in preparing this index. We would prefer to publish it other than as text in a later volume, though costs in time and money are thus reduced. If demand should be large enough, the index could be furnished as a reprint.

A FURTHER NOTE ON LINNÉ

By: Patrick Moore

(Paper read at the Eleventh A.L.P.O. Convention at San Diego, California, August 22-24,1963)

Of all the features of the Moon, Linné, on the Mare Serenitatis, is one of the most famous. Since I have been paying a good deal of attention to it, I am going to return to the old topic - but, I hope, with a difference. I do not propose to go over the well-worn history of Linné; suffice it to recall that this object has been suspected of having altered drastically from a deepish crater (as recorded by Beer and Maedler and by Schmidt in 1843 and earlier) to something more in the nature of a pit on a white spot (as recorded by numerous observers since 1866, when Schmidt announced the disappearance of the old crater.) Arguments have raged ever since, and each observer will have personal views about the matter. Some astronomers consider that no change has taken place; others are sure that something really did occur between 1843 and 1866. The latter is the view, for instance, of Nikolai Kozirev, as he told me when I was talking to him about it in 1960. My own ideas have been somewhat modified in the light of recent events, and I want to say a little about Linné in its present form.

In 1952, F. H. Thornton, using his fine 18-inch Calver reflector, described Linné as a pit standing on a dome, and surrounded by a white nimbus. In the following April (1953) I was over at Meudon Observatory, using the 33-inch refractor there, and confirmed Thornton's description; I showed the small pit slightly westward* of the exact center of the dome, but H. P. Wilkins - who was with me - placed it symmetrically. And that, I thought, was a definite observation so that no problems as to the modern form of Linné remained. Nothing could be less like the deep crater described by Maedler. About that time, I wrote a book called Guide to the Moon. In it I dealt with Linné, and gave my view that the evidence in favor of change was "absolutely conclusive".

In 1954 W. H. Steavenson examined Linné with the 25-inch refractor at Cambridge University (England) and described it, in a letter to me dated April 18, as "a small deep crater, a little over 1 mile in diameter, having a west wall considerably higher than the east, giving the appearance of a hemispherical dome when seen under a very low light. This small crater is at the center of a low mound or swelling, some 4 miles in diameter, and vanishing soon after the terminator has passed it".

I made a habit of looking at Linné on every possible occasion, but without any thought of seeing any change there; I am not even quite sure why I kept up the observations except that I am naturally inquisitive. Then, on 1961 March 23, I had a decided shock. I was using my 8.5-inch reflector at 300X, and at $19^h\ 20^m$, U.T. conditions were fairly good; the terminator lay near Calippus. I looked casually at a crater in the Mare Serenitatis, and took it for Bessel. Then, suddenly, I realized that it was not Bessel at all, but Linné. In my observation book I noted that it was "a distinct crater, with interior shadow and strong outer shadow cast by the east wall". The diameter was about one-quarter of that of Bessel. Clouds then came up, but cleared at $20^h\ 15^m$, and I had a similar view with my 12.5-inch reflector, which could not be used earlier because of inconvenient trees. Meanwhile I had telephoned my colleague Peter Cattermole, who immediately observed with his 6.5-inch reflector and confirmed the appearance; his surprise was fully equal to mine. The next night was cloudy, but on March 25, 23^h, with the 12.5-inch reflector, Linné was completely normal.

It was only after this observation that I found that Gilbert Fielder, using an 18-inch reflector on 1955 September 8, at $1^h\ 30^m$, had seen Linné in a sunset view "almost like a normal craterlet, with a bright part to the east (which might be interpreted as an eastern ringwall) and a shadowed (slightly smaller, perhaps) part to the west of this".

The next development came from E.E. Hill, in Devon, on 1961 December 15, who was using a 12.5-inch reflector. He too saw Linné as a deep normal crater, with shadow. The same thing was seen on the following night, though not so clearly, and again in 1962, January 12. Since then, I have seen nothing of the sort; and Linné has always assumed its regular aspect.

Let me say immediately that I have no doubt whatsoever that the apparent changes are purely optical, and I do not for one moment suppose that Linné has undergone any radical alteration since 1866. There must be something very unusual in the slope of the surface in this area, and I suspect that the familiar Linné structure lies at an angle, so that the inclination is not normally measurable and yet can produce these odd effects when the lighting and libration conditions are exactly right for them. I do not claim to be a good observer, but my observation of 1961, March 23 was really so definite that I would be reluctant to discard it; fortunately there are independent confirmations from Cattermole (at the same time) and Fielder and

*In this paper Mr. Moore uses lunar east and west in the classic astronomical sense, where Mare Crisium is in the west hemisphere.

Hill (at different times,though it should be added that Hill made the crater rather smaller than I did). It seems incontestable that Linné can occasionally give the appearance of a perfectly normal crater, similar to Bessel though somewhat smaller - which is how Maedler described it, as well as Schmidt before 1843.

To me, these observations cast doubt on the evidence in favor of change between 1843 and 1866, and it seems that my phrase "absolutely conclusive" was ill-advised; I was guilty of the all-too-common fault of jumping to conclusions without having checked the observations sufficiently carefully. Of course, I do not suggest that a radical change at that period is ruled out, but I do now feel that we must be somewhat cautious about it.

It may be added that there are a few other features on the Moon very much like Linné; and in particular I have been looking at the white spot closely west of Picard, in the Mare Crisium - numbered 7 on a chart I published many years ago. It seems to be a slightly smaller edition of Linné, and like Linné it has a white nimbus which has been suspected of variation in size; there are suggestions, for instance, that in each case the nimbus becomes slightly brighter and larger after a lunar eclipse, though I have looked for this effect at several eclipses and have failed to see it. [Here is a project for observers of the December 19, 1964 total lunar eclipse. - Editor]

I suggest that it is well worth while keeping Linné under very frequent observation so that when it assumes its crater-like form the exact conditions of illumination and libration may be noted; only in this way can we find out the precise cause of this peculiar behaviour.

MERCURY IN 1961 AND 1962 - PART I

By: Geoffrey Gaherty, Jr., A.L.P.O. Mercury Recorder

I. Introduction

This report covers A.L.P.O. observations for the period from 5 January 1961 to 25 November 1962. Observations were received for all but two of the twelve apparitions of Mercury occurring between these dates. Table I lists the observers,and Tables II and III give the distribution of drawings and intensity estimates (indicated respectively in the pairs of figures in the tables). In addition, Klaus Brasch and William K. Hartmann contributed composite drawings which are indicated in the tables by the letter "C".

Table I. Observers

Observer	Station	Instrument
Joseph A. Anderer	Chicago, Ill.	6" refl.
Larry Anthenien	San Jose, Calif.	6" refl.
L. Bartha	Budapest, Hungary (Urania Obs.)	8" refr.
Alan Binder	Tucson, Ariz. (Steward Obs.)	4.3" refr.
Klaus R. Brasch	Rosemere, Que., Canada	8" refl.,4.3" refr.
Clark R. Chapman	Buffalo, N.Y.	10" refl.
Doug Cooke	San Diego, Calif.	6" refl.
Dale P. Cruikshank	Tucson, Ariz. (Steward Obs.)	4.3" refr.
Roger De King	Liverpool, N.Y.	2.4" refr.
Geoffrey Gaherty,Jr.	Montreal, Que., Canada	6", 4.3" refr.
Walter H. Haas	Edinburg, Texas	12.5" refl.
William K. Hartmann	Tucson, Ariz., (Steward Obs.)	12.5"refl.,4.3"refr.
Craig L. Johnson	Boulder, Colo.(Sommers-Bausch Obs.)	10.5" refr.
George Lovi	Brooklyn, N.Y. (Brooklyn College Obs.)	7" refr.
Tod Markin	Lakeland, Fla.	6" refl.
George W. Rippen	Madison, Wisc.	6" refl.

Tom Thorpe	North Hollywood, Calif.	8" refl.
George E. Wedge	Montreal, Que., Canada	6" refr.
Gary A. Wegner	Bothell, Wash.	10" refl.
Fred Wyburn	Red Bluff, Calif.	4" refr.

TABLE II
Observations in 1961

Elongation	Feb. 6(E)	Mar. 20(W)	Jun. 1(E)	Jul. 19(W)	Nov. 7(W)	Totals
Period	Jan. 26 - Feb.14	Mar. 20 - Apr.23	May 14 - Jun. 7	Jul. 19 - Jul.28	Nov. 3 - Nov.17	
Anthenien	1, 0		6, 2	1, 1	4, 1	12, 4
Brasch	2, 0		2, 0			4, 0
Chapman	3, 0		2, 1	3, 1	1, 0	9, 2
De King				1, 0		1, 0
Gaherty				1, 1		1, 1
Haas			2, 2			2, 2
Hartmann					3, 3 C	3, 3 C
Johnson		2, 2	1, 0			3, 2
Lovi			1, 0			1, 0
Markin			9, 0		2, 0	11, 0
Rippen					2, 2	2, 2
Wedge				1, 0		1, 0
Wegner	7, 6					7, 6
Totals	13, 6	2, 2	23, 5	7, 3	12, 6 C	57, 22

TABLE III
Observations in 1962

Elongation	Jan. 21(E)	Mar. 3 (W)	May 13 (E)	Jul. 1(W)	Sep. 10(E)	Totals
Period	Jan. 14 - Jan.30	Feb. 21 - Mar.13	Apr. 29 - May 24	Jul. 3 - Jul. 10	Aug. 14 - Sep. 6	
Anthenien	11, 10	6, 5	16, 7	4, 1	2, 0	39, 23
Bartha			1, 0			1, 0
Binder	8, 8					8, 8
Brasch			5, 4 C			5, 4 C
Chapman	1, 0				1, 0	2, 0
Cooke			1, 1			1, 1
Cruikshank	6, 3					6, 3
Gaherty			1, 1			1, 1
Hartmann	C					C
Markin	2, 0		3, 0	3, 0		8, 0
Rippen	2, 0					2, 0
Thorpe			1, 0			1, 0
Totals	30, 21 C	6, 5	28, 13 C	7, 1	3, 0	74, 40

II Drawings

Six drawings are reproduced in Figure 9, including two composite drawings. The physical data for each are given in the caption of Figure 9. The diameter (Dia), phase (k), phase angle (i), and heliocentric longitude (H.L) are taken from the Ephemeris. The libration in longitude (λ) is obtained from Heath's table[1]; from it are calculated the longitudes of the central meridian (CM) and the visible terminator (T) in terms of the longitude system of Antoniadi's map[2]. Seeing (S) and transparency (Tr) are given on the usual scales. The observer's instrument is abbreviated as follows: (Diameter of objective in inches) (refLector or refRactor) x (magnification), with the filter used (if any) in parentheses.

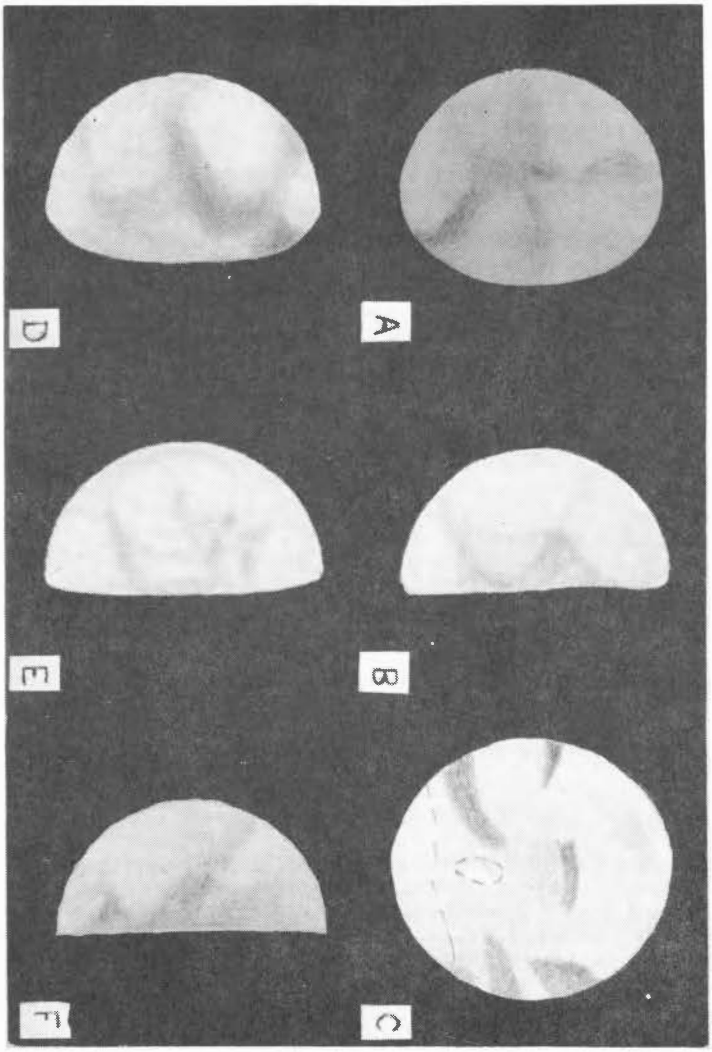


FIGURE 9. Sample A.L.P.O. Drawings of Mercury. Physical data below. See also text.

	Date	Time U.T.	Dia	k	i	H.L.	λ	CM	T	S	Tr	Observer	Instrument
	1961												
A	Jan.29	21:45	5".8	.80	53°	16°	-18°	71°	108°	5	4	Chapman	10Lx400(23A)
B	Feb. 6	22:30	7.1	.52	89	65	- 4	93	94	3½	4½	Brasch	8Lx375(Red)
C	Apr.20	18:40	5.2	.91	34	344	-23	-11	- 67	5½	5	Johnson	10½Rx400
	1962												
D	Jan.16,18,19,20,21,23,27(Composite)							~100	~100	4½	4	Hartmann	4¼Rx206
E	May 6,8,10,11,12(Composite)							~70	~70	2½	3½	Brasch	8Lx300(Red)
F	Sep. 6	22:00	6.6	.62	75	266	- 4	79	94	2½	3½	Chapman	10Lx280

These drawings are representative of the best work being done by the A.L.P.O. observers. It is especially pleasing to note the excellent agreement between different observers (e.g., A and E) and the consistency of single observers (e.g., A and F). All three of these drawings were made near the same central meridian; note the large difference in the longitude of the terminator. Drawing A was made at a time when the libration was very favorable, much detail beyond the edge of Antoniadi's map being exposed. Drawing C shows Mercury unusually close to full (k = .91); note the bright spot Argyritis just north of center and the large bright area on the northern cusp. Part II of this report will include additional drawings.

III. The Observed Phase

The observed phase on all drawings received for 1961 has been measured, and the results are plotted in Figures 10 and 11. The theoretical phase is shown by the solid curve. There is a general tendency for the observed phase to be less than the predicted, i.e., most observers tend to underestimate the phase. Analyzing this effect under various conditions, we get the following:

Condition	No. Observations	Underestimated	Overestimated
All observations	62	71%	29%
Evening apparitions alone	36	72	28
Morning apparitions alone	26	69	31
Planet theoretically gibbous	39	82	18
Planet theoretically crescent	23	52	48

Thus there seems to be no significant difference between evening and morning apparitions. The observed phase tends to agree better with theory when the predicted phase is less than 0.5. On the whole, the agreement between the observations and the theoretical phase is fairly good in view of the difficulties involved: 48% of the observations fall within $\pm$ 0.05, and 73% within $\pm$ 0.10, where the unit is the apparent area of the whole disc regarded as circular.

IV. Intensity Observations

An encouraging number of observers responded to my request for more intensity estimates; almost half the drawings were accompanied by such observations. Unfortunately, they are so heterogeneous that a detailed analysis is not possible. The principal difficulty is the lack of a common standard scale of intensities to facilitate comparison of the estimates of different observers. In addition, some observers fail to make complete observations; often estimates are made of prominent features only, without any indication of the general surface brightness.

To avoid these problems in the future, it is suggested that all observers adopt a single scale. One especially suited for Mercury has been in use for many years and has much to recommend it. This is a scale from 0 to 5, where 0 indicates the darkest markings and 5 the brightest ones. The average surface brightness is standardized at 3.0, and the markings are rated accordingly. A rough guide to the intensities of commonly observed features would be:

	Average	Extremes
Dark markings along terminator	1.0 - 2.0	0.5 - 2.5
Cusp caps	3.0 - 4.0	2.5 - 4.5
Bright markings on limb	3.5 - 4.0	3.0 - 4.5

It should be noted that 0 is not taken as "sky black" since Mercury is seldom, if ever, observed against a dark sky.

V. Discussion

The Mercury Section is still largely dependent on drawings for its work. The analysis of these drawings is made difficult by the great variation in their quality. The most serious error into which observers fall is in attempting to interpret detail just beyond the resolving power of the optical system. The resulting drawings show fine structure in the form of sharp dark lines and spots. Such detail shows little or no consistency. The only agreement is in the broad outlines - which is not surprising since the broad outlines were probably all that were seen in the telescope!

A word should be said about composite drawings. This technique[3] is very useful provided it is carried out properly, i.e. care should be taken to calculate central meridians and terminator longitudes in order to make a meaningful composite. In any case, I prefer to receive the original observations as well as the composite since the individual drawings are needed for other purposes such as phase measurements and comparison with simultaneous drawings by other observers.

Part II of this report will deal with simultaneous observations and will include a detailed analysis of the unusually well observed apparition of January 1962.

In conclusion, I would like to thank all the A.L.P.O. members who have contributed to this report and to apologize to them and to the Editor for my delay in preparing it. I would appreciate receiving any unreported Mercury observations made during 1963 so that work may begin on the next report. Finally, I would encourage anyone with a good eastern or western horizon to attempt observations of Mercury; though the difficulties are great, the conscientious observer will be well rewarded. Report forms are yours for the asking.

References

1. Heath, M.B.B., "The Libration of Mercury", J.B.A.A., 69 (1959), p.48.
2. Antoniadi, E. M., La Planète Mercure (Paris, 1934), Plate I.
3. Cruikshank, Dale P., "Some Observations of Mercury in June, 1960, and Some Comments on a Composite Drawing Technique", Str.A., 15 (1961), p. 46.

BOOK REVIEWS

Leben auf anderen Sternen, by Joachim Herrmann. Photographs, sketches, and graphs, 190 pages. C. Bertelsmann Verlag, Gütersloh, 1963. In German.

Reviewed by Klaus R. Brasch

Leben auf anderen Sternen? (Life on other Planets?) is the German counterpart to similar works in English and French, currently available as paperbacks. The title is really a misnomer, however; for the book includes much more than the usual fact and fancy discussion on the nature of life and its possible universality. Although writing in a popular vein, the author attempts to provide the reader with as wide a technical background as possible in order to equip him better for a meaningful discussion on so vast a topic.

The book begins with an enlightening historical account of the beginning and later development of speculations on extraterrestrial life. The earliest "Science Fiction" stories show that man has been toying with such ideas since the beginning of civilization. From an early mixture of fantasy, mythology, and theology, human thought has, with increasing scientific knowledge, gradually developed a more mature outlook on the possibility of life outside the Earth.

In dealing with the question of life in general, its origin, and possible universality, two principal factors must come under consideration. First, if possible, an adequate definition of life must be established. The difficulty here lies in trying to differentiate between the animate and the inanimate. No one for example, would classify self-reproducing crystals as

(text continued on page 34)

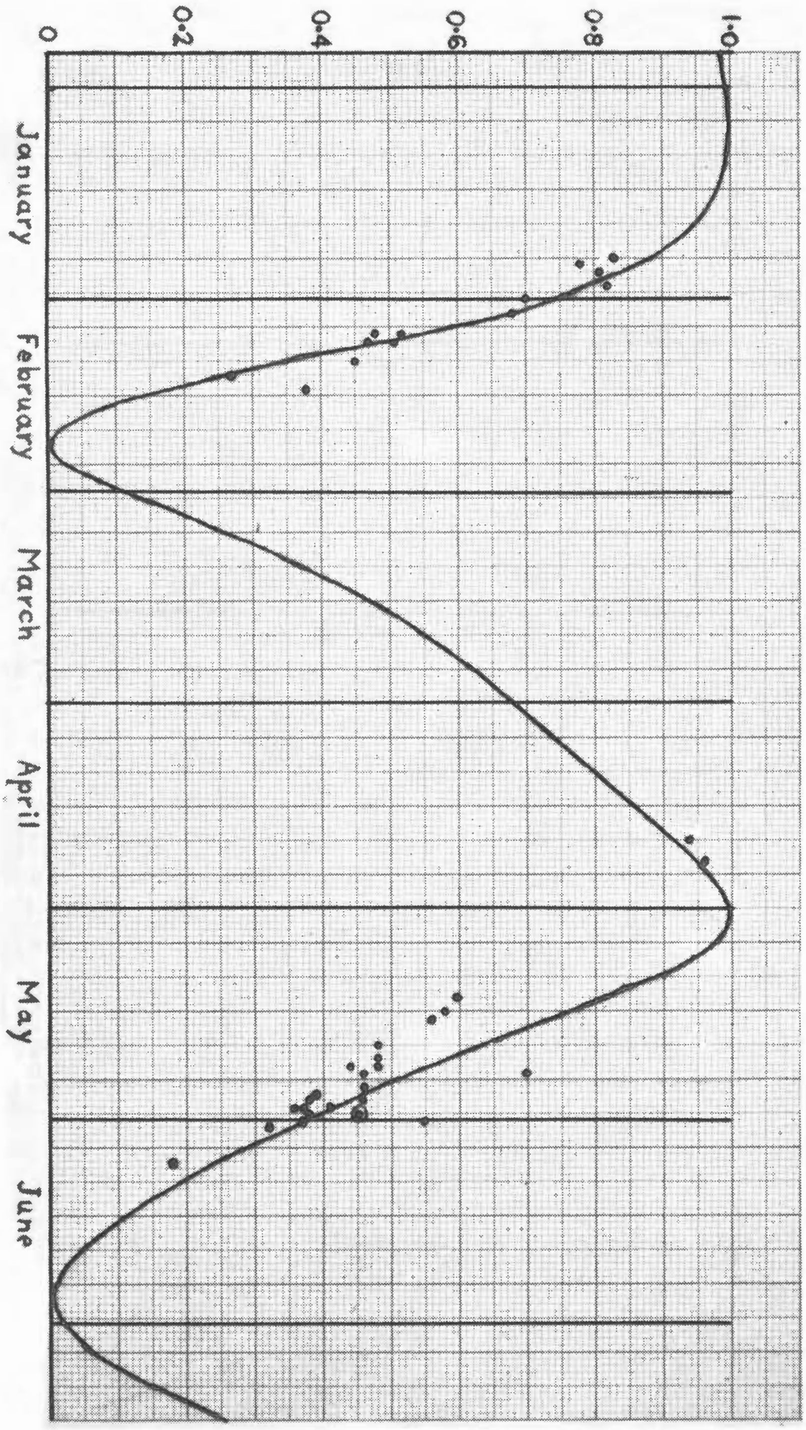


FIGURE 10. ALPO Phase Observations of Mercury, January-June, 1961. The solid curve is the geometric value of K, the illuminated portion of the disc. The plotted points are the observed values of K measured on drawings. See section III of Mr. Gaherty's Mercury Report in this issue.

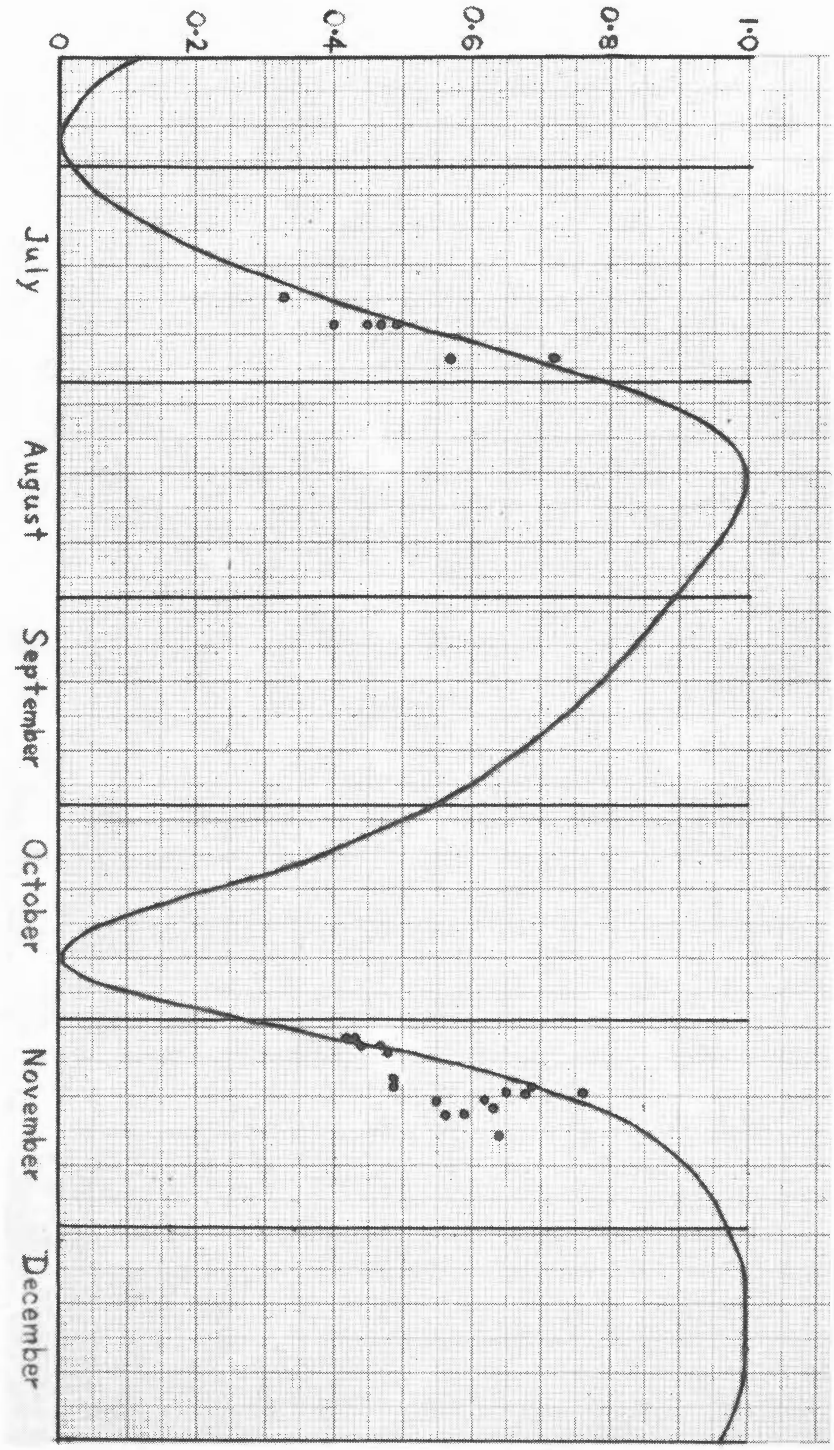


FIGURE 11. ALPO Phase Observations of Mercury, July-December, 1961. A continuation of Figure 10.

living organisms, and yet the simplest viruses are but a short step above that stage. A second major consideration to be kept in mind concerns the possible varied manifestations that living matter might exhibit; i.e., can elements and compounds other than oxygen, carbon, and water act as fundamental organic building blocks? Unfortunately, the chapter dealing with the above key factors only hints at their importance, not fully conveying to the lay reader both the scientific and philosophic complications inherent in these considerations. Similarly, in dealing with the origin of life on the Earth, from the complex molecular to the cellular stage, the author fails adequately to convey the elements of time and complexity involved in this process (e.g., no proper mention of DNA**and its function).

Subsequent chapters discuss members of the Solar System, other than the Earth, as possible abodes of life. This is well done. By means of a lively text, sprinkled with interesting details on the peculiarities of each planet, the major satellites, the Sun, the Moon, etc., a concise but clear portrayal of the Solar System is given.

The remaining chapters deal, perhaps somewhat superficially, with the probable plurality of planetary systems, interstellar communication attempts, and finally space travel. Throughout, the treatment of these topics strikes a happy medium between extreme optimism and pessimism when considering the probability of meeting with success in our present and future endeavors to explore the universe. On the whole, _Leben auf anderen Sternen?_ is a very fine contribution.

Life Beyond the Earth, by V. A. Firsoff. Hutchinson & Co., 178-202 Great Portland St., London, 1963, 320 pages, 42 shillings net. Also: Basic Books, New York, 1964, $7.50.

Reviewed by Dennis A. Wentraub

The most recent offering to the growing number of books and articles dealing exclusively with the nature of other-world life is presented by a British amateur astronomer of unusual talent and distinctively original thought. V. A. Firsoff* examines in depth the nature of terrestrial life, the prospects of life beyond earth, and the environments which would be encountered by such an exobiologic phenomenon.

As the author says in the introduction, "The object of the present work is to discuss the problems of astrobiology in their entirety from a wider standpoint of generalized organic chemistry". In keeping with this aim, Firsoff commences his largely bio-chemical discussion with the nature of the living, as opposed to the non-living, and in the five logically progressive chapters that comprise the book expands his effort to conclude with life in the universe as a whole. The book is illustrated with twenty-eight photographs and six tables and drawings; a twenty-six page appendix mathematically treats certain concepts that are mentioned briefly in the text. Two postcripts concern recent astronomical disclosures which have a bearing on the material presented in the main text. An erratum, correcting errors made in computing the densities of Pluto, Iapetus, and Titania,is also included.

Part 1, "What is Life", deals with physico-chemical considerations of life. After reviewing the basic concepts of chemistry, the author proceeds to relate these concepts to life as we know it. The chemistry on page 18 may be fairly technical for those who have had little connection with college chemistry. Heredity and evolution are also considered. The author's chemically oriented definition of life climaxes the chapter, and the chapter summary (page 31) reviews and emphasizes the main points of the preceding pages. The reader may well wish to ponder Mr. Firsoff's remarks about the

*Mr. Firsoff is the author of _Strange World of the Moon_, _Surface of the Moon_, and _Our Neighbor Worlds_, among others, and a frequent contributor to various astronomical journals.

**Deoxyribonucleic acid, the highly complex, self-replicating chemical compound which acts as the basic hereditary agent.

possibility of "neutrino organisms".

In Part 2, "Life on Earth", the origin of terrestrial life, and extra-terrestrial life by inference, is discussed. Those aspects of earthly life which are most remote from human experience are mentioned, suggesting the variety of such forms that may exist in other parts of the universe. In this latter respect, sub-sections of chapter two dealing with the various modes of sensory "perception" and the "Mind" are extremely interesting.

The limitations placed on life with respect to temperature, pressure, the need for a liquid solvent, and the degree of atmospheric transparency to various radiations are considered in "Life Beyond Earth", Part 3. Alternatives for carbon as a life-building chain and the possible chemical aspects of life at contrasting environmental extremes are also discussed thoroughly. Once again the individual with some knowledge of chemistry, other than that provided by the author in the first chapter, will profit. Hints to the nature of extra-terrestrial life as indicated by traces of suspected organisms on meteorites are also reviewed.

In many respects the last two chapters will be appreciated most by amateur astronomers. Mr. Firsoff's exhaustive analysis of the surface and atmospheric conditions of the various bodies of our Solar System assembles the most recent research findings and certain conjectured theories; "Planetary Environments of the Solar System" is a most absorbing fourth chapter.

In the final chapter the author discusses how planetary systems arise, what evidence there is to the existence of other planetary systems, what can be conjectured about them, and the influence of stellar environments on planets. Mr. Firsoff's lucid explanations of opposing cosmological theories and the proposal of his own ideas will be welcomed by the amateur. A book well worth reading!

MORE ACTIVITY SUSPECTED NEAR ARISTARCHUS

By: Patrick S. McIntosh, A.L.P.O. Lunar Recorder

Two reports of activity near Aristarchus have been received by Lunar Recorder Patrick S. McIntosh. It is noteworthy that the two events occurred during a new crescent moon while Aristarchus was shrouded in night. The reports were within the same 25-hour period.

At 23:58 U.T. on March 16, 1964 Adolfo Lecuona observed a "sudden red glow" near the SW (IAU) rim of Aristarchus while observing the crescent moon from Madison, New Jersey. He had been observing the crescent moon with 225X magnification, and the apparent drift of the moon across the sky had brought the faintly illuminated dark portion of the moon into view. When the "glow" occurred, Mr. Lecuona changed to 90X and observed for another half hour, but without seeing any more activity. The phenomenon was described as "relatively bright; quite unlike anything I have ever seen before". The seeing was rated as 6 (good to excellent), and the colongitude of the moon was 310°. Mr. Lecuona is 15 and has been observing for over three years.

On the night of March 17-18 in St. Perersburg, Florida David J. Earl and his younger brother were timing an occultation of a star by the dark limb of the moon when at 00:59:20 U.T. on March 18 a flash was suspected in the Aristarchus region. They were using a 2.4-inch Tasco refractor with a 35X ocular. They could not say more precisely where the flash occurred because of the small image size with the low power. Mr. Earl emphasized the possibility of error in this observation because of the brevity of the event. The recorded time is considered accurate to ±20 seconds since their timepiece had been calibrated to the local time standard just half an hour earlier. The seeing at this time was very good, and the earthshine on the dark side of the moon was bright. Colongitude was 323°, with terminator lying between the craters Atlas and Hercules. David Earl is 18 and has been observing about seven years. His brother is 15 and has two years of observing experience. The flash was seen by the younger Earl.

These reports differ from Lowell Observatory and Japanese reports of some months earlier in that the March reports indicate very short, flash-like activity. The Lowell and Japanese reports were of sustained emission lasting from 20 minutes in one case to 1½ hour in another.

The brevity of these events makes it difficult to interpret them in terms of degassing or volcanic activity. Perhaps both observers saw the impact of a meteorite on the moon or a telescopic meteor in the earth's atmosphere. These last two possibilities are also hard to accept in view of the slim chance that the meteors would both appear to be in the vicinity of, or in the line of sight to, the very same lunar crater. [Observations of this kind should be very encouraging to participants in the A.L.P.O. Lunar Meteor Search program, whose studies involve close and prolonged watches of the earthlit moon for anything unusual. Persons wishing to join this effort should write to the Recorder, Mr. Kenneth Chalk, at the address given on the back inside cover. Improved qualitative and quantitative observational coverage of the earthshine can hardly fail to help explain such reports as those which Mr. McIntosh describes. - Editor]

OBSERVATIONS OF LUNAR RILLES NEAR HASE, IN PETAVIUS, AND BESIDE THE CAUCHY FAULT

By: C. A. Wood

In this paper lunar east and west are used in the old, non-IAU sense, where Mare Crisium is in the west hemisphere of the moon and Oceanus Procellarum is in the east hemisphere.

Rilles near Hase. The two rilles shown here (Figure 12) were seen at the telescope; and later a photograph, Yerkes 482, was found which confirmed their existence. For greatest positional accuracy the chart was traced from the photo, with the sketch and notes made at the telescope used to interpret uncertainties. The rille which strikes S-SW from Hase D is about 3.9 kms. wide, shallow and suspected of having a convex floor. Near Marinus C there is a slightly narrower en echelon segment, which terminates in craters as does the main rille. The end-of-the-rille-crater on the inner slope of Hase D seems to be elongated at an angle of about 60° to the other foreshortened craters in the area. Since there is a similarly placed crater on the rim of Adams which is not so elongated, the shape of the rille-crater in Hase D must be intimately dependent on the rille.

The second rille (Figure 12), which tends N-S, varies in width from about 1.7 kms. at an elongated bulge near the south end to about 1.2 kms. where, surprisingly, the older-looking rille interrupts it. This rille also has a crater at each end. It is not known whether the rille breaks the crater wall in any of these cases. The rille is "new" looking and very deep, being almost completely enshadowed at the time of observation while the larger rille was shadow-free.

Another interesting linear structure in the area is the graben-like depression trending S 70° W called the Snellius Valley. Like the Rheita Valley, it is radial to the Mare Nectaris. It is well shown in Plates 6 and 7 of Miyamoto and Matsui's Photographic Atlas of the Moon. There appears to be an en echelon fragment (the strange crater N of Marinus E) about 64 kms. from the west end.

For other drawings of this area see Ford's artistically excellent one (The Moon, Vol. 7, No. 1) and Cattermole's modernistic but questionable effort (The Moon, Vol. 6, No. 2).

Rilles in Petavius. The telescopic view was so different from Wilkins' drawing (The Moon - Wilkins and Moore, p. 174) that a sketch was made on sheet A6a of the Kuiper Photographic Lunar Atlas (Figure 13). D. W. G. Arthur and E.A. Whitaker have unpublished drawings which confirm these rilles.

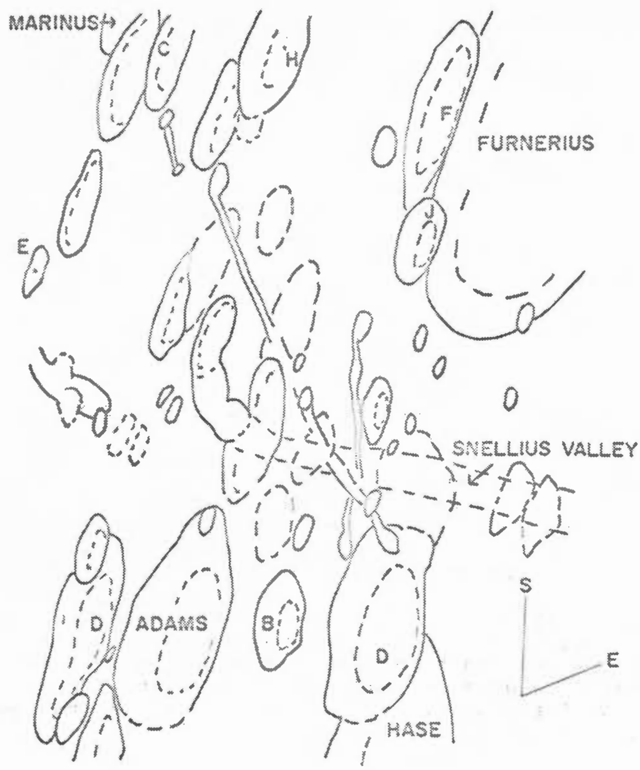


FIGURE 12 (above). Rilles near Hase. C. A. Wood. December 2, 1963. $7^h\ 30^m - 8^h\ 30^m$, U.T. D. P. Cruikshank's 12-inch refl. 305X. Seeing 6 - 8 (variable). Transparency 4 (limiting magnitude). Colongitude 105°. Outlines traced from Yerkes photograph 482. Libration in longitude + 3°.8. See also text of Mr. Wood's article.

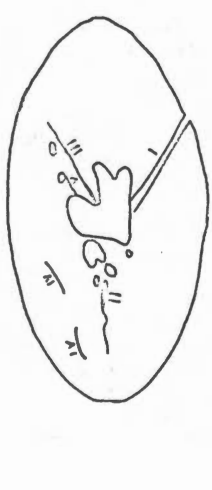


FIGURE 13 (left). Rilles in Petavius. Sketch by C. A. Wood. December 2, 1963. $6^h\ 30^m - 7^h\ 0^m$, U.T. D. P. Cruikshank's 12-inch refl. 305X. Seeing 5 - 7. Transparency 4 (limiting magnitude). Colongitude 104°. Libration in longitude + 3°.8. See also text of Mr. Wood's article. Lunar south at top, lunar west (old sense) at left.

The rille Petavius II starts on the E side of a small hill and then zigzags N. The S end is wider than the rest of the rille. Rille III is thinner and goes from within the central mountain mass to and slightly beyond the S side of a small crater, not the N side as Wilkins says. No. V parallels III for a short distance. According to Whitaker, IV is continuous; therefore, even though the two parts were seen separated, both have been labeled IV. (Refer to Figure 13 for the aspects discussed.)

The central mountain mass is very complicated, and only the general outline is shown. It is made up of many individual peaks tightly clumped, with a smooth flat floor separating each. A very bright spot, suggestive of a small pit, was seen on the southernmost large peak.

Wilkins' map is amazingly poor; every rille except I is misplaced or nonexistent. It is significant that although a 30" reflector was used, only 320X was employed. Obviously bad seeing, in the writer's opinion.

Rille beside Cauchy Fault. Observation on September 7, 1963 near 12^h 0^m, U.T. 16-inch Kitt Peak reflector at 800X. Seeing 7. Transparency 5 (limiting magnitude). Colongitude 139°. A brief but revealing look at the Cauchy Fault showed that there is a thin sinuous rille running about 2 kms. distant from the down-throw (S) side of the fault. The extent of the rille was not noted carefully, but it does not run the entire length of the fault. D.W.G. Arthur (JBAA, 70, p. 301) has drawn it as a step fault, and the Air Force LAC chart 61 is ambiguous.

Postscript by Editor. We thank Mr. Wood for his description of these lunar observations. A.L.P.O. Lunar Section workers could very well imitate some of the techniques described above in order to improve the quality of our lunar studies. Readers are invited to study the three lunar areas described by Mr. Wood; large apertures and good seeing may be needed to improve on his report.

NATIONAL AMATEUR ASTRONOMERS 1964 CONVENTION

THEME: "NEW ADVANCES IN ASTRONOMY"

August 27 - 31 Denver, Colorado

Special Bulletin and Registration Information

Lodging and meal arrangements for the convention are based upon the time table enclosed. Please note the excellent package accommodation plan available, which includes eleven meals in the Residence Hall Dining Room and the two banquets in addition to the five nights' lodging

The dormitory rooms accommodate two persons, and the rate quoted is per person. Only a very limited number of single accommodations will be available.

Families desiring motel accommodations may indicate details as to price range, number of persons, arrival times, etc. on the back of the Registration Form. These accommodations at one of the many excellent motels in the vicinity of the University will be arranged.

The registration fee must be paid in advance, but fees for accommodations and field trips may be paid at the registration desk at convention time. Of course, much waiting time will be saved during registration if all the fees are paid in advance.

If you pre-register for any of the field trips, please note that the first High Altitude Observatory trip on Friday conflicts with the National Bureau of Standards trip and that the second High Altitude trip on Saturday conflicts with the Air Force Academy tour and Chuck Wagon Dinner. This arrangement is made necessary because of the limited number of persons (60) that may visit the observatory while their vital solar research work is in progress.

The High Altitude trip is an all-day excursión. Box lunches will be arranged for these persons on the package plan.

Every effort is being made to assure efficient and rapid registration at convention time. Your early pre-registration will assist in that effort. Please fill in the form correctly and mail back as soon as possible.

A package containing descriptive literature and maps will be mailed to every delegate in July.

The registration form may be secured from National Amateur Astronomers Convention Registration, 1591 South Cherry Street, Denver 22, Colorado. General information is available from the Convention Chairman, Mr. Ken Steinmetz, 1680 W. Hoye Place, Denver(80223), Colorado.

Tentative Convention Time Table
(Mountain Standard Time - 24 Hour System)

Thursday August 27	0900	Registration and checking in begins in lobby of Johnson-McFarlane Residence Hall. Facilities will be available until 2200 to accommodate late arrivals.
	*1800	Supper will be served in residence hall dining room.
	2000	Meetings of regional councils. Chamberlin Observatory will be open throughout evening for observing.
Friday August 28	*0700	Breakfast will be served in residence hall dining room.
	0830	First chartered bus trip to High Altitude Observatory at Climax begins. (Seven hours - limited to sixty persons.)
	0900	First general convention meeting begins in Student Union. Welcome address by organizations.
	*1130	Lunch served in residence hall dining room.
	1300	Field trip to National Bureau of Standards time-frequency laboratories and radio telescope installation at Boulder - limited to 400 persons.
	*1830	Informal buffet banquet in Student Union. Astronomical entertainment.
Saturday August 29	*0700	Breakfast served in residence hall dining room.
	0830	Second chartered bus trip to High Altitude Observatory at Climax begins. (Seven hours - limited to 60 persons).
	0900	Convention meeting at Student Union - technical papers.
	*1130	Lunch served in residence hall dining room.
	1300	Chartered bus field trip to U.S. Air Force Academy and Colorado Springs area followed by chuck wagon dinner at Garden of Gods with entertainment.
Sunday August 30	*0700	Breakfast served in residence hall dining room.
	0830	Third chartered bus trip to High Altitude Observatory at Climax begins. (Seven hours - limited to sixty persons.)
	0900	Convention meeting in Student Union - technical papers.
	*1200	Lunch served in residence hall dining room.
	1400	Meetings of AAVSO, ALPO, AL, and WAA and other special groups.
	*1730	Supper served in residence hall dining room.
	1930	Chamberlin Observatory open and amateur telescopes set up in park. Special tour through Goto Planetarium arranged on demand.
Monday August 31	*0700	Breakfast served in residence hall dining room.
	0830	Fourth and final chartered bus trip to High Altitude Observatory at Climax begins. (Seven hours - limited to sixty persons.)

Monday	0900	Convention meeting in Student Union - technical papers.
August 31	*1200	Lunch served in residence hall dining room.
(cont'd.)	1330	Wind-up of technical papers and general meeting of convention in Student Union.
	*1830	Banquet in Student Union with noted guest speaker, presentation of awards, and concluding remarks.
Tuesday Sept. 1	*0700	Breakfast served in residence hall dining room followed by check out of rooms.

*Meals included in package plan in addition to five nights' lodging.

ANNOUNCEMENTS

Sustaining Members and Sponsors. As of July 5, 1964 there are in these classes of membership:

Sponsors - W.O. Roberts,Jr.; David P. Barcroft; Philip and Virginia Glaser; Charles H. Giffen; John E. Westfall; Joel W. Goodman; the National Amateur Astronomers, Inc.; James Q. Gant,Jr.; David and Carolyn Meisel; Clark R. Chapman.

Sustaining Members - Grace E. Fox; Ken Thomson; Sky Publishing Corporation; Joseph Ashbrook; Charles F. Capen; Kenneth J. Delano; Craig L. Johnson; Geoffrey Gaherty, Jr.; Dale P. Cruikshank; Charles L. Ricker; James W. Young; Charles M. Cyrus; Alan McClure; Elmer J. Reese; George E. Wedge.

Sustaining members pay $10 per year; sponsors, $25. Of these amounts, $4 pays for a subscription to this magazine; and the remainder is a gift to help support the work and activities of the A.L.P.O.

In Memoriam. We have learned with sorrow from Ruth M. Burke, the Corresponding Secretary of the Eastbay Astronomical Society, of the death of Chester J. Smith, long an active observing amateur in Oakland, California. He built a superb mounting for his 9.5-inch refractor and presented the instrument to the Eastbay Society. It is to be housed in a Smith Observatory on the grounds of Chabot Science Center. Mr. Smith generously assisted in carrying out several major projects with the telescopes of Chabot Observatory. In 1957 and 1958 he served as Assistant Jupiter Recorder of the A.L.P.O. His frequent and valued observational contributions were repeatedly mentioned in this periodical in the 50's.

Offer of Aid with Architectural Problems. Writing on June 9, 1964, Mr. Dicran Levon Gedickian, one of our newer members, said in part: "Since professionally I am an Architect, I would like to make my services available for advice concerning any architectural problems other members may have in reference to mountings, structures, etc." We thank Mr. Gedickian for this kind offer. His professional address is 80 East Palisade Avenue, Englewood, New Jersey.

Lunar Meteor Search Schedule for Remainder of 1964. Mr. Kenneth Chalk has communicated the following schedule of search dates and times in 1964:

August 12, 13, and 14	8:00 - 9:00 P.M.
September 11, 12, and 13	7:30 - 8:30 P.M.
October 11, 12, and 13	6:30 - 7:30 P.M.
November 9, 10, and 11	6:00 - 7:00 P.M.
December 8, 9, and 10	6:00 - 7:00 P.M.

The above are all ordinary surveys of the earthshine, and the times are local standard times. In addition, searching is scheduled for $2^h\ 0^m$ to $3^h\ 0^m$, U.T. on December 19, 1964, during the approximate total phase of the lunar eclipse on that date. Strict adherence to this schedule is necessary if the lunar meteor search data are to attain their greatest value.

Mr. Chalk's current report on this program is on pp. 4 - 6 of this issue, and Mr. McIntosh's note on pp. 35 - 36 would suggest that attentive watchers of the earthshine may occasionally sight yet other phenomena about which we want to learn more.

Appeal for Material for A.L.P.O. Exhibit at Denver. Mr. Clark Chapman has agreed again to take charge of our Convention Exhibit. He sends this appeal to members:

"Once again we are trying to gather material for an exhibit of the work of A.L.P.O. members. This year the convention is being held in conjunction with the other amateur groups in Denver, and we should try especially hard to develop a picturesque and interesting exhibit. In the past, exhibits have included drawings of the moon and planets, photographs, maps and charts, and even diagrams or set-ups of instruments found to be especially useful to lunar and planetary work. Practically anything representing your own work on the moon, planets, or comets could be interesting to others if thoughtfully prepared. We would like to be able to exhibit something from every active member, and we especially look forward to seeing the series of drawings or photographs from our more prolific observers. Most important would be comprehensive contributions from each and every observing Section of the A.L.P.O.

"Time is growing short, but it is hoped that members will work especially hard and carefully during the next couple weeks to prepare neat exhibits of their work. It would save a considerable amount of effort for me and those helping if neat labels could be lettered by the individual exhibitors. If you have any preferences for the arrangement of your drawings and photographs, please make it clear. If there are any members attending the convention who would be interested in helping to set up the exhibit, volunteers would be especially welcome.

"Please try to send exhibit material by August 15th, if possible, to:

Mr. Clark R. Chapman
Lunar and Planetary Lab., University of Arizona,
Tucson, Arizona.

Please note that this is a summer address only, and in October my address will revert to 94 Harper, Buffalo 26, N.Y. All exhibit material will be returned to the exhibitors during the month following the convention, if so requested. We look forward to seeing a large and well-organized A.L.P.O. Exhibit in late August in Denver. With the help of every one of you, we can surely make an excellent impression on the many amateurs attending this second National Amateur Astronomers Convention".

A.L.P.O. Twelfth Convention at Denver. We shall hold this year's meeting as part of the National Amateur Astronomers Convention on August 28-31. The article on pp. 38-40 carries many details of this large meeting. We are anxious to have a good A.L.P.O. Exhibit and would hence underscore Clark Chapman's appeal in the paragraphs above. About a dozen A.L.P.O. papers have so far been accepted for the program; authors represented include Meisel, Goodman, Rippen, Milon, Chapman, Moore, and Cruikshank - surely indicating a good cross-section of the better work of the A.L.P.O. Curiously, several papers will discuss the Schroeter Effect on the observed phases of Venus and Mercury from different points of view.

The Editor personally invites all members who can to attend this coming meeting at Denver - the program, the fellowship with other amateurs, and the setting in the majestic Rocky Mountains will provide a truly memorable experience.

New Addresses for Staff Members. Several A.L.P.O. Recorders have recently changed addresses, as follows:

1. David D. Meisel
   5633 Selby Court
   Worthington, Ohio 43085

2. Charles H. Giffen
Institute for Advanced Study
Princeton, New Jersey 08540

3. Clark R. Chapman
94 Harper
Buffalo 26, New York

Request for Observations of June 24-25, 1964 Total Lunar Eclipse. A number of reports on this eclipse have arrived, and a descriptive article is planned for our next issue. Readers are requested to send in quickly any unreported observations. These are the more needed because of poor sky conditions at several stations. They may also help us to plan programs better for the more favorable total lunar eclipse on December 18-19, 1964.

COMET TOMITA-GERBER-HONDA

Mr. Dennis Milon has forwarded an ephemeris of this newly discovered comet computed by Mr. Michael McCants. Several times in the past ephemerides communicated by Mr. McCants have arrived, to our regret, a few days too late for publication. Elements adopted for Comet Tomita-Gerber-Honda were, relative to 1950.0 coordinates: epoch June 30.604, 1964; ascending node $309\overset{\circ}{.}240$; argument of perihelion $58\overset{\circ}{.}471$; inclination $161\overset{\circ}{.}779$; and perihelion distance 0.4998 astronomical units. In the table below r is the distance from the sun in astronomical units, delta the distance from the earth, and CES ang. the comet-earth-sun angle.

Date (1964)	R A	Dec	R	Delta	CES Ang.	Magn.
July 20	$9^h\ 54\overset{m}{.}67$	$+20°46\overset{'}{.}4$	.677	1.389	$27\overset{\circ}{.}5$	7.4
22	56.60	20 12.7	.708	1.459	26.2	7.7
24	58.18	19 42.2	.740	1.527	24.8	8.0
26	59.50	19 14.4	.773	1.592	23.3	8.3
28	10 0.63	18 48.8	.806	1.655	21.8	8.6
30	10 1.62	18 25.0	.839	1.715	20.2	8.8
August						
1	10 2.49	18 2.9	.873	1.772	18.6	9.1
11	10 5.92	16 29.5	1.045	2.025	10.5	10.1
21	10 8.62	15 15.1	1.216	2.223	3.6	11.0
31	10 10.92	14 12.4	1.383	2.374	8.2	11.7

There is, of course, little hope of finding a faint comet less than 20 degrees from the sun in the sky.

These visual observations may be of interest:

Observer	Date	U.T.	Total Magnitude	Comments
Milon	1964, June 14	$10^h\ 30^m$	5.4	
Milon	June 16	11 0	5.3	
Milon	June 18	11 0	4.8	bluish, tail 3/4 degrees.
McCants	July 1	3 0	4.5	2-degree tail.

OBSERVATIONS AND COMMENTS

Venus as a Ring of Light. The illustrations on the front cover and in this article will show the curious aspect of Venus as a complete ring of light. The cause of this appearance is the diffuse reflection of sunlight in the atmosphere of the planet.If Venus is a thin crescent, the horns are regularly obviously prolonged much beyond a semicircle by this twilight arc; and when Venus is nearly enough between the earth and the sun (but not at most inferior conjunctions), the two horns join to form a complete ring.

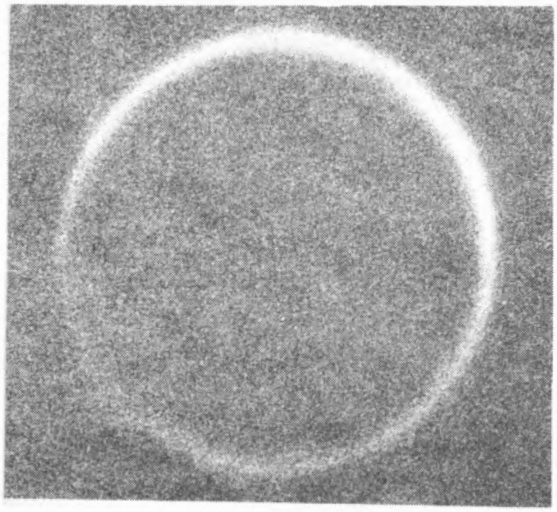


FIGURE 14. Photograph of Venus on June 19, 1964 at 17^h0^m, U.T. by B.A. Smith. Red light, IV-E Eastman spectroscopic plate, OG-2 filter. Exposure 0.2 seconds. 12-inch Cassegrain, f:66, 14X enlargement on original print here used. Seeing 5. Venus $1^\circ.83$ from center of sun only six hours before inferior conjunction. North at top, west (in earth's sky) at right. Photograph made available by Research Center, New Mexico State University.

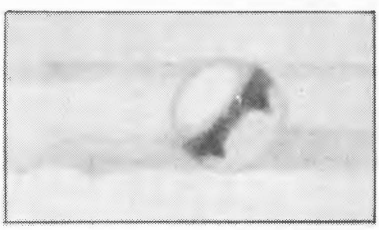


FIGURE 15. Drawing of Ganymede (Jupiter III) by Elmer J. Reese with Clyde W. Tombaugh's 16-inch reflector at 524X. January 7, 1964, 0^h25^m, U.T. Conditions very favorable. Satellite in transit and projected on South South Temperate Belt of Jupiter.

The achievement of the Research Center astronomers in photographing Venus so well on the brilliant sky very near the sun will be appreciated by those who have observed visually at inferior conjunction: it is a common experience to fail to see the planet at all for some time, even when it is well centered in the eyepiece. Variations in brightness on these photographs along the twilight arc (roughly the lower half of the ring) result from irregularities in the planet's atmosphere. The graininess of the background results, of course, from the emulsion selected to show the high contrasts here required.

Drawing of Ganymede. Figure 15 will interest students of detail on the tiny discs of the satellites of Jupiter. It must be appreciated that the large aperture of 16 inches and the excellent seeing here allowed Mr. Reese an excellent view. Meaningful confirmation of the detail with smaller instruments and mediocre seeing cannot be expected. We understand that much of the detail drawn was confirmed by Dr. Clyde Tombaugh.

Unusual Appearances in Theophilus? A substantial number of reports of abnormal appearances on the moon have arrived in recent months. One may suspect that the lunar activity recorded by Kozyrev in Alphonsus in 1958 and by Greenacre and others in the Aristarchus region in 1963 has here played a role. Of many examples that could be cited, we here present two reports about the large lunar crater Theophilus.

On December 21, 1963 near 23^h, U.T. Mr. William Snyder found the shadow cast by the central peak ill-defined at its edge. The colongitude was 343°.7. He observed for 15 minutes with a 4-inch reflector at 110X, seeing fair and transparency variable. Clouds then interfered. When they departed two hours later, the shadow was dark and sharp. Mr. Snyder had never before witnessed an ill-defined shadow in 4 years of lunar observing.

It is difficult to evaluate this observation. Simultaneous observations by others, either visual or photographic, might confirm or refute it. One could wish that a larger aperture had been employed. Careful comparisons of the affected Theophilus shadow to other shadows of similar size might have strengthened the evidence.

The second report was forwarded to us by Joseph Ashbrook; the observer was Professor Sally H. Dieke of Goucher College in Baltimore. Between about 1^h5^m and 1^h15^m, U.T. on May 17, 1964 Professor Dieke and others during a public night with the Goucher College 6-inch refractor at 125X saw "a crescent of crimson color" between the illuminated west rim (IAU sense) of Theophilus and the still shadowed floor. The colongitude was 335°.1. The effect did not reappear during the next hour and one-half. It had not been present at 0^h50^m, U.T.

Lacking known other observations of the color on May 17, one may tend to suspect the chromatic aberration of a refractor, particularly in an area adjacent to the brilliant inner wall.

The Strolling Astronomer

SUBSCRIPTION RATES

Single Issue (in stock)	$1.00
6 Months - - - - -	2.50
1 Year - - - - -	4.00
2 Years - - - - -	7.00

SPECIAL MEMBERSHIPS

Sustaining Members	$10 per year
Sponsors	$25 per year

ADVERTISING RATES

Full Page Display Ad	**$40.00**
Half Page Display Ad	**22.50**
Quarter Page Display Ad	**15.00**
Classified or Listing (per column inch)	**4.00**

Discount of 10% on 3-time insertion.

NOTICE: **In order to facilitate the reproduction of drawings in future issues readers are requested to exaggerate contrasts on drawings submitted. Extremely faint marks cannot be reproduced. Outlines of planetary discs should be made dark and distinct. It is not feasible to reproduce drawings made in colors. Following these precepts will permit better reproductions.**

STAFF

EDITOR

Walter H. Haas
Box 26
University Park, New Mexico

SECRETARY

Atty. David P. Barcroft
Box 26
University Park, New Mexico

LIBRARIAN

E.Downey Funck
Box 156
Boca Raton, Florida

BOOK REVIEW EDITOR

J. Russell Smith
The Skyview Observatory
1465 Del Rio Blvd.
Eagle Pass, Texas

COUNSELLOR

Dr. Lincoln LaPaz
Director, Institute of Meteoritics
University of New Mexico
Albuquerque, New Mexico

MERCURY RECORDER

Geoffrey Gaherty, Jr.
2800 Hill Park Road
Montreal 25, Quebec, Canada

VENUS RECORDER

Dale P. Cruikshank
Lunar and Planetary Laboratory
University of Arizona
Tucson, Arizona

MARS RECORDER

Ernst E. Both, Curator of Astronomy
Buffalo Museum of Science
Buffalo 11, New York

ASSISTANT MARS RECORDER

Klaus R. Brasch
224 Montée Sanche
Rosmere, Quebec, Canada

JUPITER RECORDER

Philip R. Glaser
200 Albert Street
Waukesha, Wisconsin

ASSISTANT JUPITER RECORDERS

Elmer J. Reese
Research Center
New Mexico State University
University Park, New Mexico

Charles H. Giffen
Institute for Advanced Study
Princeton, New Jersey

SATURN RECORDER

Joel W. Goodman
Dept. of Microbiology
University of Calif. School of Medicine
San Francisco 22, California

ASSISTANT SATURN RECORDER

Thomas A. Cragg
Mount Wilson Observatory
Mount Wilson, California

URANUS-NEPTUNE RECORDER

Leonard B. Abbey
Box 22236
Emory University
Atlanta 22, Georgia

COMETS RECORDER

David D. Meisel
5633 Selby Court
Worthington, Ohio

LUNAR METEOR SEARCH RECORDER

Kenneth Chalk
3489 Grey Avenue
Montreal 28, Quebec, Canada

LUNAR RECORDERS

John E. Westfall
3104 Varnum St.
Mount Rainier, Maryland

Patrick S. McIntosh
Sacramento Peak Observatory
Sunspot, New Mexico

Clark R. Chapman
(Lunar Training Program)
94 Harper
Buffalo 26, New York

Harry D. Jamieson
(Lunar Dome Survey)
2706 Ethel St.
Muncie, Indiana

José Olivarez
(Assistant for Lunar Dome Survey)
804 St. Marie
Mission, Texas