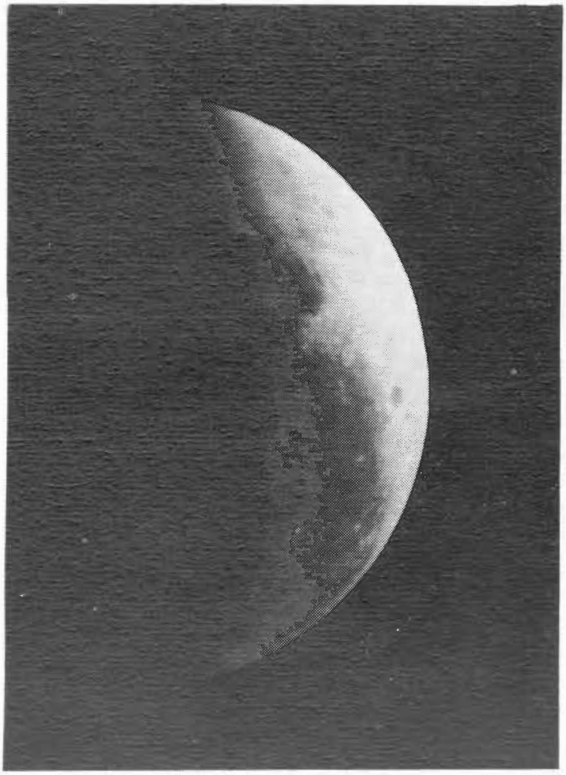
The Strolling Astronomer

ASSOCIATION OF LUNAR AND PLANETARY OBSERVERS

Volume 14, Numbers 3-4 — March-April, 1960

Published April, 1960



Two photographs of total lunar eclipse on March 13, 1960, by Carlos E. Rost at Santurce, Puerto Rico, with a 6-inch Catadioptric Fecker Reflector of 90 inches equivalent focal length. Camera a Praktica FX-2 Reflex. Panatomic X 35mm. Kodak film. Left photograph at $9^h\ 29^m$, U. T., 14 minutes after end of totality, exposure 2 seconds. Right photograph at $9^h\ 40^m.5$, U. T., exposure 1.5 seconds. See also page 64.

THE STROLLING ASTRONOMER

Pan American College
Observatory
Edinburg, Texas

In This Issue

ANNOUNCEMENTS

Enclosures in January-February, 1960, Issue. Readers may well have been puzzled by the mention of two leaflets at the bottom of page 32 as being enclosed in our preceding issue when they actually found only one, which related to a Summer Institute for Secondary School Students at Pan American College. The second leaflet arrived too late for inclusion in the previous issue and is hence enclosed in this present one. We thank the Optical Society of America for the supply of these leaflets for our members and for the information which they carry.

Error in January-February, 1960, Issue. On page 25, line 24, the times which were challenged in a footnote should have been 02:00 and 03:00, U. T. The complete sentence should then read: "Stations 1, 5, and 16 searched on July 13 from 02:00 to 03:00, U. T., with incomplete overlapping coverage."

New Mercury Recorder. Mr. Owen Ranck has asked to be relieved of his post as Mercury Recorder of the A.L.P.O. We have secured as the new Mercury Recorder:

Geoffrey Gaherty, Jr.
636, Sydenham Avenue
Montreal 6, Quebec
Canada

Mr. Gaherty is a very active observing amateur in the Montreal Centre and is the first A.L.P.O. staff member outside of the United States. We thank him for accepting this position and ask all Mercury observers and would-be observers to cooperate closely with him.

We also thank Mr. Ranck very much for his loyalty and generous service in assisting the A.L.P.O. while he was Mercury Recorder.

Astronomical League 1960 Great Lakes Region Convention. Mr. Joseph Maple, 20116 California, St. Clair Shores, Michigan, who is Publicity Chairman for the Detroit Astronomical Convention Committee, has sent us the following circular letter:

"The Detroit Astronomical Society will host the 1960 Great Lakes Region Convention, and we hope this monthly letter will help to interest you in meeting with us this summer.

"The convention will be held in Detroit, Michigan, from Saturday, July 30, through Sunday, July 31, 1960. Our headquarters will be the Henrose Hotel immediately adjoining the new Civic Center Development.

"We would like to have each society or organization represented by at least one paper and/or exhibit. Since the convention is early in the year, and time is short, we would appreciate knowing of your intentions as early as possible, not later than June 1. This is especially true for the papers as the proceedings 'may' be printed. Notify us of your intention to submit a paper by writing our program chairman. He is:

E. C. Balch
96 Farrand
Highland Park 3, Michigan

"Our exhibit chairman is:

Edward Fifield
19326 Montrose
Detroit 35, Michigan

"Thank you for your co-operation and see you at the best Regional Convention ever."

1960 A.L.P.O. Conventions. Readers are reminded that the Sixth Convention of the A.L.P.O. will be held at San Jose, California, on August 24, 1960, just before the annual Convention of Western Amateur Astronomers and that our Seventh Convention will be held at Haverford, Pennsylvania, on September 5, 1960, as part of the National Convention of the Astronomical League. Every member who can is most heartily invited to attend one or the other of these meetings--or even both! We also need a goodly number of papers and many astronomical exhibits, and it is time to be thinking about them. Papers which do not come in early enough may have to be omitted from the published Proceedings of the two Conventions. We would like very much to present two totally different programs of papers at San Jose and Haverford. With your help these two nearly simultaneous meetings can greatly stimulate fruitful lunar and planetary astronomy on both the Atlantic and Pacific Coasts.

Note on Jupiter Observations. Current work on Jupiter should be mailed to the Assistant Jupiter Recorder, Mr. Elmer J. Reese, R. D. 2, Box 396, Uniontown, Penna. Mr. Phillip W. Budine regrets very much that he cannot continue longer as Jupiter Recorder because of increasing lack of sufficient time. His successor has not yet been chosen.

JUPITER IN 1959: SECOND INTERIM REPORT

By: Phillip W. Budine

I. Introduction.

The Observations. This report is based on observations submitted by 25 members of the A.L.P.O. Jupiter Section from May 19, 1959, to August 16, 1959. A total of 365 observations was made of the Giant Planet.

The Observers. The cooperating observers are listed below, where d. denotes the number of drawings which the observer made.

Bartlett, Dr. James C., Jr., Baltimore, Maryland, 4½-in. refl., 5-in. refl., 45d.
Budine, Phillip W., Binghamton, New York, 2.4-in. refr., 4-in. refr., 16d.
Bukowski, James, Oxnard, Calif., 4-in. refl., 7d.
Colburn, James I., Oxnard, Calif., 4-in. refl., 12d.
Constanten, Tom C., Las Vegas, Nevada, 3-in. refl., 3¼-in. refr., 10d.
Cruikshank, Dale P., Des Moines, Iowa, 8¼-in. refr. (Drake University Municipal Observatory), 40-in. refr. (Yerkes Observatory), 22d.
Doucet, René, Quebec, Canada, 5-in. refr., 17d.
Goodman, Joel W., Brooklyn, New York, 8-in. refl., 2d.
Jensen, Carlos M., Salt Lake City, Utah, 3¼-in. refr., 12d.
Johnson, Craig L., Boulder, Colorado, 4-in. refl., 10-in. refr., 6d.
Krohley, Thomas M., Huntington Station, New York, 6-in. refl., 2d.
Luecke, Rich, Chicago Heights, Illinois, 6-in. refl., 9d.
McIntosh, Patrick S., Robinson, Illinois, 8-in. refl., 15d.
Palmroos, Franklin, Binghamton, New York, 2.4-in. refr., 12d.
Pepernik, John L., Binghamton, New York, 2.4-in refr., 8d.
Gaherty, Geoffrey, Jr. (Royal Astronomical Society of Canada), Montreal, Quebec, Canada, 8-in. refl., 5d.
Ranck, Owen C., Milton, Penna., 4-in. refr., 5d.
Reese, Elmer J., Uniontown, Penna., 6-in. refl., 3d.
Richards, T. J., Wellington, New Zealand, 5-in. refr., belt latitude measurements, 1 observation.
Rost, Carlos E., Santurce, Puerto Rico, 6-in. refl., satellite phenomena & photographs, 37 observations.
Smith, J. Russell, Eagle Pass, Texas, 8-in. refl., 16-in. refl., 5d.
Starbird, James E., Topeka, Kansas, 6-in. refl., 24d.
Sullivan, Joseph W., Jr., Binghamton, New York, 3-in. refr., 5d.
Vitous, Joseph P., Berwyn, Illinois, 8-in. refl., 40d.
Ward, Michael M., Houston, Texas, 4¼-in. refl., 15d.

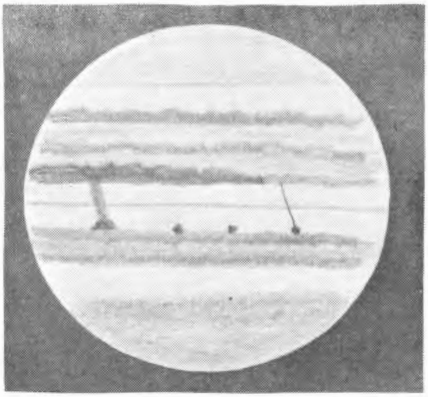


FIGURE 1. JUPITER.
J. C. Bartlett. 5-in. refl.
May 30, 1959. $4^h\ 30^m$ U.T.
C.M.$_1$ = 127°. C.M.$_2$ = 188°.
Dark section in SEB_n.

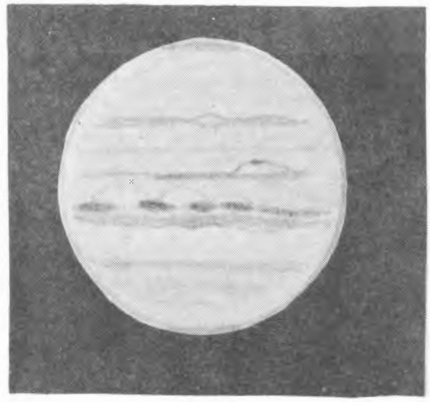


FIGURE 2. JUPITER.
J. W. Goodman. 8-in. refl.
May 31, 1959. $2^h\ 27^m$ U.T.
C.M.$_1$ = 210°. C.M.$_2$ = 265°.
Note "bright rift" in STB and dark spot in SEB Z.

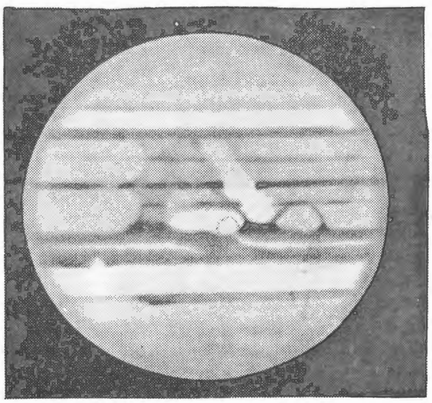


FIGURE 3. JUPITER.
E. J. Reese. 6-in. refl.
June 4, 1959. $3^h\ 57^m$ U.T.
C.M.$_1$ = 177°. C.M.$_2$ = 200°.
Note bright spot in EZ.

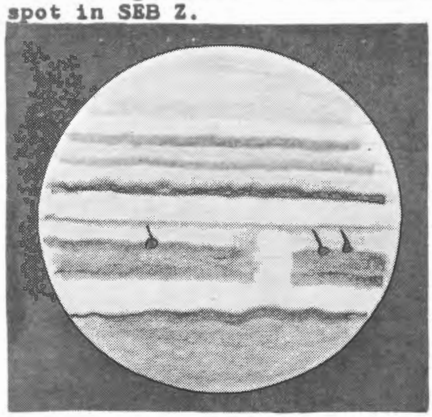


FIGURE 4. JUPITER.
J. C. Bartlett. 5-in. refl.
June 4, 1959. $3^h\ 59^m$ U.T.
C.M.$_1$ = 178°. C.M.$_2$ = 201°.

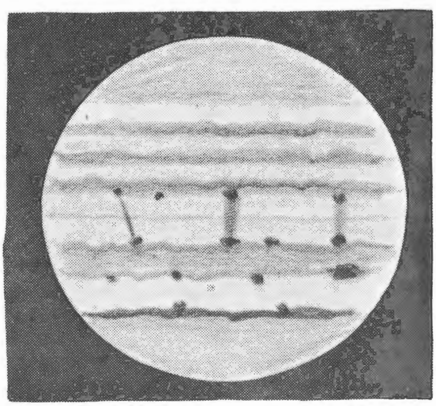


FIGURE 5. JUPITER.
J. C. Bartlett. 5-in. refl.
June 21, 1959. $2^h\ 39^m$ U.T.
C.M.$_1$ = 295°. C.M.$_2$ = 189°.
Note dark spots in NNTB.

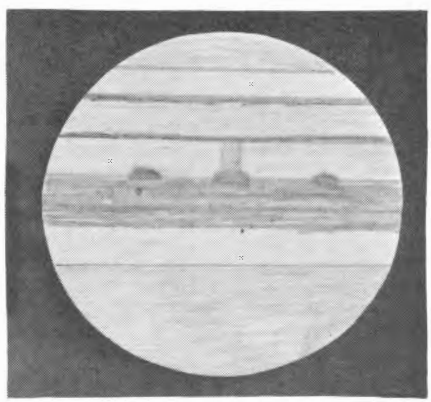


FIGURE 6. JUPITER.
J. Starbird. 6-in. refl.
June 23, 1959. $2^h\ 50^m$ U.T.
C.M.$_1$ = 257°. C.M.$_2$ = 136°.

II. Description.

General. The brightest zone on the planet was still the combined NTrZ-NTeZ. The NEB and the SEB_n were the most prominent belts. The NTB was very thin and faint, when observed at all. The STB darkened in early August and was the third most conspicuous belt. The STrZ was very dull and was usually recorded as of an orange color during the period of this report.

Polar Regions. The NPR was recorded as darker than the SPR all during the period. Most observers recorded these areas as grey. However, during August Budine noted a blue tint quite regularly in the NPR. Cruikshank observed many bright spots in the NPR during June.

S. S. S. Temperate Belt. This belt was very faint and thin. It was located in the center of the SPR. It was noted by a few observers to be more prominent in August.

S. S. Temperate Belt. It was observed in July to vary in intensity along its width. Budine noted this aspect on July 9. Vitous observed this belt double on July 4. This belt was bordering the SPR. Among observers who recorded it often were Vitous, Budine, Starbird, Cruikshank, and McIntosh.

S. Temperate Zone. It was the second most prominent zone on Jupiter and was recorded white by all observers. During early August the zone was noted as being slightly dull on occasions. Pepernik noted this dullness often in August. Also, in early August Doucet observed festoon activity in the STeZ. Dusky sections were noted in this zone during July.

The long-enduring bright areas (FA, BC, DE) were observed quite often during the period covered by this report. Area FA was observed during June by Luecke, McIntosh, and Cruikshank. In July it was observed by Vitous and in August by McIntosh. Area BC was observed during July by McIntosh and in August by McIntosh. Area DE was observed by McIntosh during June, July, and August.

During June, Starbird noted a very dusky section in the STeZ at about 282° (II).

S. Temperate Belt. It was the third most prominent belt on the planet. Many times this belt was observed to vary in intensity. It was observed to be broken up into sections by Bartlett during June. Budine observed dark spots in this belt on many occasions.

A very interesting feature was observed in this belt by Goodman on May 31, 1959. This feature was the appearance of a "bright rift" in the STB located at 277° (II). A bright rift usually appears in the STB when the bright areas BC and FA come close together, as they were during this apparition. This appearance of these three objects was observed by Cruikshank on June 9, 1959, when FA, the "bright rift" and BC were all close together near the central meridian at 271° (II). The "bright rift" was observed during June by Cruikshank and during July by J. Russell Smith.

Dark sections were observed in the STB by Bartlett, Gaherty, Vitous, Ward, McIntosh, and Budine.

S. Tropical Zone. This zone was very dusky during the period covered by this report. Many observers recorded it as having a red-orange color. Bright ovals were observed in this zone by Bartlett during August. Near the end of July Doucet observed festoon activity in the STrZ. Dusky sections were observed in the STrZ during June and July by Budine and Reese.

S. Equatorial Belt. Its northern component, the SEB_n, was the second most prominent belt on Jupiter. The south component, the SEB_s, was very faint and was recorded by only a few observers regularly. The

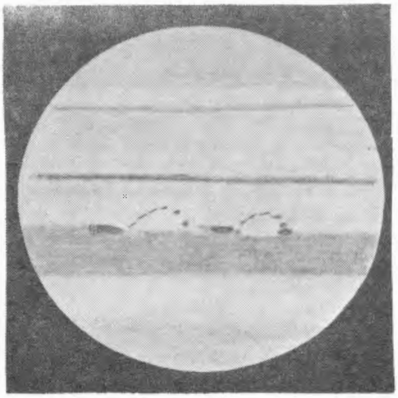


FIGURE 7. JUPITER.
R. Luecke. 6-in. refl.
June 29, 1959. 4^h 35^m U.T.
C.M.$_1$ = 189° C.M.$_2$ = 21°

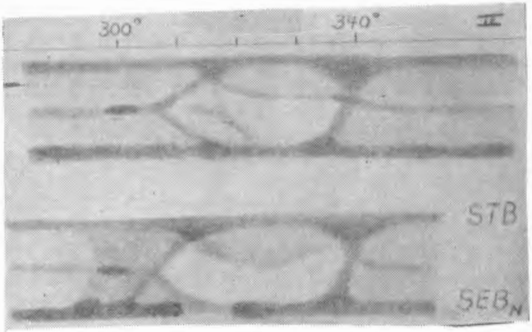


FIGURE 8. JUPITER.
E. J. Reese. 6-in. refl.
June 29, 1959 (top).
July 4, 1959 (bottom).
Red Spot Hollow.

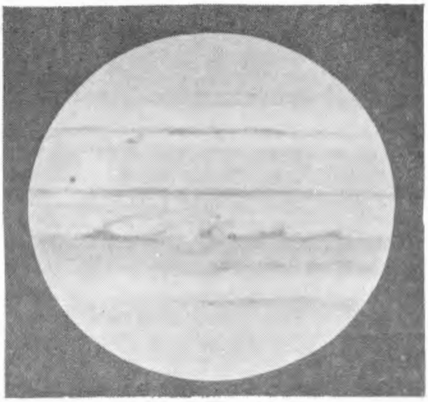


FIGURE 9. JUPITER.
J. P. Vitous. 8-in. refl.
July 4, 1959. 2^h 40^m U.T.
C.M.$_1$ = 188° C.M.$_2$ = 343°
Note dark spot in SEB Z.

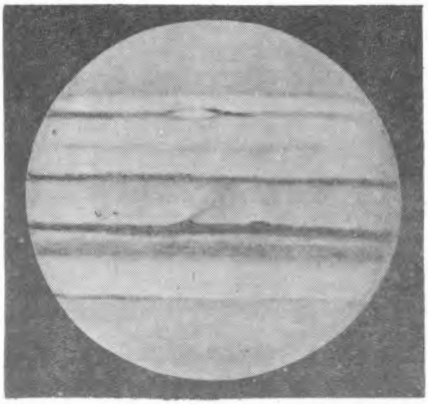


FIGURE 10. JUPITER.
J. R. Smith. 8-in. refl.
July 6, 1959. 2^h 05^m U.T.
C.M.$_1$ = 123° C.M.$_2$ = 262°
Note bright rift in STB.

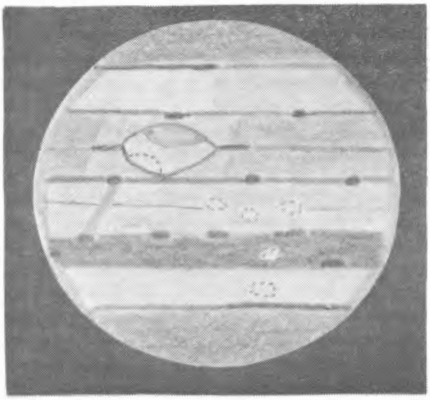


FIGURE 11. JUPITER.
P. W. Budine. 4-in. refr.
July 9, 1959. 2^h 00^m U.T.
C.M.$_1$ = 233° C.M.$_2$ = 350°
Note Red Spot Hollow.

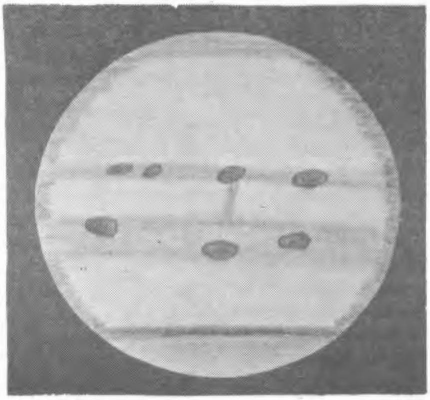


FIGURE 12. JUPITER.
F. Palmroos. 2.4-in. refr.
July 26, 1959. 2^h 00^m U.T.
C.M.$_1$ = 36° C.M.$_2$ = 24°

SEB was double all during the period covered by this report. The SEB Z was very dull and was usually red in color. The SEB_s was of a reddish color and was faint during this period.

SEB Z. During August bright spots were observed in this zone by Bartlett. The most interesting feature in this zone was the appearance of a small dark spot, seen in late May by Goodman. This very dark spot was one of the best observed features of the apparition. It was observed by several observers with 8-inch telescopes or larger. The "spot" at first appeared to resemble an early-stage development of a major SEB Disturbance, but little change developed in the spot. The "dark spot" was observed in May by Goodman, during June by Cruikshank, during July by Vitous and Gaherty, and during August by Goodman, Vitous, and Gaherty. Goodman and Cruikshank show the spot to be connected to the SEB_n by a festoon on some occasions. During August the spot was located near the preceding end of the Red Spot Hollow.

SEB_n. This belt was the second most prominent belt on Jupiter. During the later part of May and in early June a long dark section developed in the SEB_n. This disturbance was first observed by Bartlett and Starbird in May and in June by Sullivan and Vitous. Budine on every occasion observed dark spot activity in this belt, illustrating that the SEB_n was very active during the 1959 apparition.

Equatorial Zone. The EZ was very dull during this apparition. It was usually reported fourth among the zones in the order of conspicuousness. During the later part of the period it was reported as being brighter than the STrZ. Bright spots were common in the EZ and were reported often by Budine, Reese, Luecke, Pepernik, and McIntosh. Large conspicuous bright ovals were observed in the EZ by the following observers: Bartlett and Reese during June, Johnson in July, and McIntosh in August. Festoon activity in the EZ was considerable, and festoons were recorded often by Bartlett, McIntosh, Pepernik, and Vitous.

The Equatorial Band was quite prominent and was observed regularly by Bartlett and McIntosh. Ward, Budine, and Reese observed the EB to have a broken appearance at times.

N. Equatorial Belt. All observers agree that this belt was the most prominent belt on Jupiter. On a few occasions it was observed double, but most of the time it was seen as a very dark single belt. In June a very bright gap was observed in the NEB by Bartlett and Budine. Bright spots in the NEB were seen often by Budine during May. In August a bright oval was observed on the north edge of the NEB by McIntosh. Dark spots were recorded by most observers on the south edge of the NEB.

The most interesting thing about the NEB was the appearance of a "highlight" of the 1958 apparition, the so called "Barge." The "Barge" was first observed by Bartlett and Jensen in June. During July it was not observed well. However, in August it was recorded by Vitous, Jensen, Bartlett, and Ranck. The "Barge" was seen as a very dark elongated spot on the NEB_n, projecting also into the NTrZ.

N. Tropical Zone. This zone was the brightest and most conspicuous zone on the planet. It was recorded white in color by all observers. Budine and Pepernik noted bright spots on a few occasions.

N. Temperate Belt. The NTB was very thin and faint during the period. Most observers failed to record it. Those who did are Budine, Bartlett, Ranck, Bukowski, Constanten, and Johnson. In May Johnson observed the NTB as double.

N. N. Temperate Belt. The NNTB was much darker than the NTB. It was observed double in June by Bartlett. During July Bartlett noted spot activity in this belt. As in 1958, many observers falsely recorded this belt as the NTB, but transits and latitude measurements have proven that it actually is the NNTB.

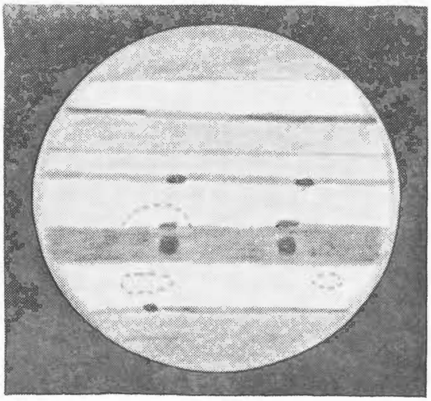


FIGURE 13. JUPITER.
P. W. Budine. 4-in. refr.
July 26, 1959. $2^h\ 40^m$ U.T.
$C.M._1 = 61°$ $C.M._2 = 48°$
Note bright spots in NTrZ.

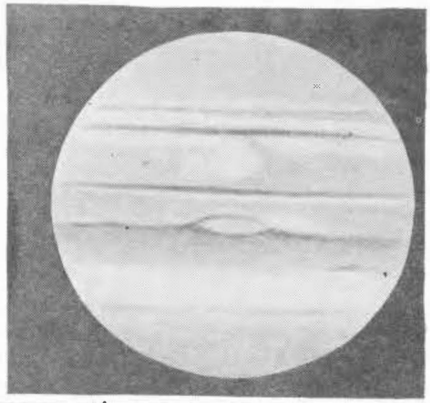


FIGURE 14. JUPITER.
J. P. Vitous. 8-in. refl.
August 2, 1959. $1^h\ 25^m$ U.T.
$C.M._1 = 39°$ $C.M._2 = 333°$
Note dark spot in SEB Z & Red Spot Hollow.

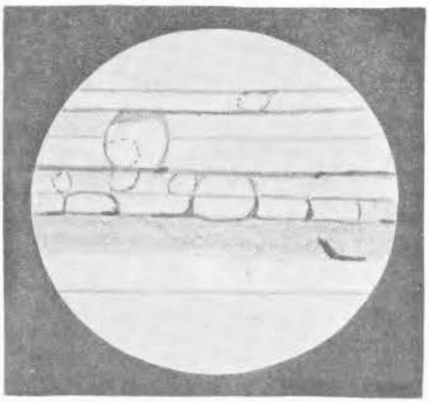


FIGURE 15. JUPITER.
P. S. McIntosh. 8-in. refl.
August 2, 1959. $1^h\ 38^m$ U.T.
$C.M._1 = 47°$ $C.M._2 = 341°$
Note "BC" and Red Spot Hollow.

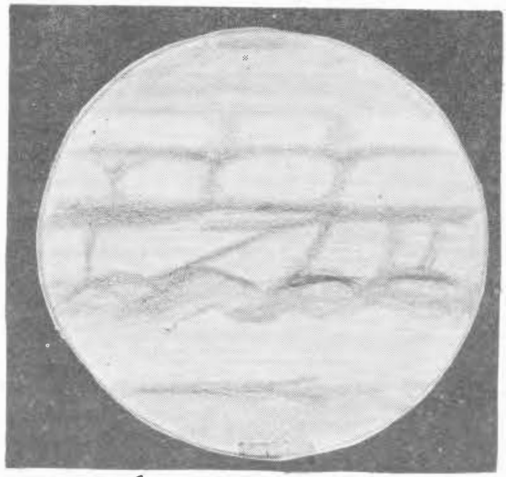


FIGURE 16. JUPITER.
R. Doucet. 5-in. refr.
August 3, 1959. $0^h\ 30^m$ U.T.
$C.M._1 = 164°$ $C.M._2 = 90°$
Note festoons in STeZ and STrZ.

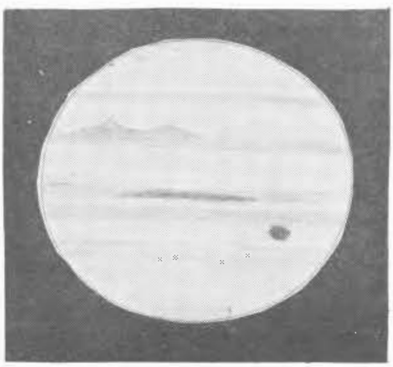


FIGURE 17. JUPITER.
O. C. Ranck. 4-in. refr.
August 3, 1959. $0^h\ 50^m$ U.T.
$C.M._1 = 176°$ $C.M._2 = 103°$
"Barge" is well shown.

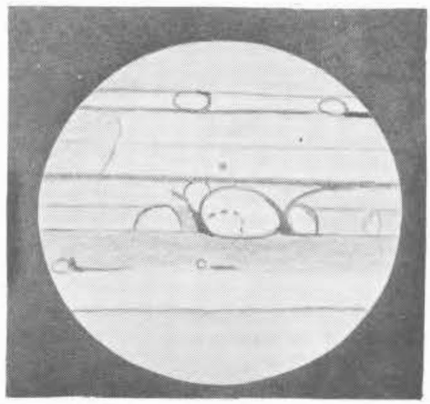


FIGURE 18. JUPITER.
P. S. McIntosh. 8-in. refl.
August 5, 1959. $1^h\ 09^m$ U.T.
$C.M._1 = 143°$ $C.M._2 = 54°$
Note "FA" and "BC", also bright spot in EZ.

N. N. N. Temperate Belt. The NNNTB was fainter than the NNTB and was located near the center of the NPR. It was observed often by Budine and Pepernik.

III. Order of Decreasing Conspicuousness of the Belts.

(1) NEB (2) SEB_n (3) STB (4) NNTB (5) SEB_s (6) SSTB (7) EB (8) NTB (9) NNNTB (10) SSSTB.

IV. Order of Decreasing Brightness of the Zones.

(1) NTrZ - NTeZ (2) STeZ (3) EZ (4) STrZ (5) SEB Z.

Sections III and IV are based on 80 sets of estimates by Bartlett, 18 sets by Budine, 7 sets by Bukowski, 6 sets by Colburn, 9 sets by Constanten, 4 sets by Krohley, 2 sets by Palmroos, 6 sets by Reese, 29 sets by Ward and 8 sets by Jensen. All estimates were made during the period May 19-August 16, 1959.

V. Red Spot and Hollow.

The appearance of this area was that of the Hollow during most of May and part of June. The Hollow was rather faint in May and showed a dull white color. Near the end of June, Reese observed a change in the Hollow with a faint Red Spot appearance on June 29. By July 4 the Red Spot had darkened and the appearance was half Hollow and half Red Spot. Reese observed the Red Spot Hollow at 325° (II). On July 9 Budine had a good view of the Red Spot region. He recorded the Hollow with the Red Spot in the south portion of the Hollow. He also recorded a bright spot in the NW portion of the Hollow. This bright spot was confirmed by other observers in July. During August the Red Spot was still seen by some observers to occupy part of the Hollow. It was recorded by Vitous, McIntosh, and Budine. Jensen recorded the Hollow as late as August 11, 1959. Many observers even with larger apertures failed to record the Red Spot Hollow region during the period here considered while observers such as Reese, Budine, Vitous, McIntosh, and Pepernik saw it often. Here is indeed a puzzle.

VI. Intensity and Color Estimates.

The following table of intensity and color estimates is based on 36 sets of estimates by Budine, 12 sets by Reese, 28 sets by Pepernik, and 32 sets by Jensen. The intensity scale and the abbreviations for colors are explained on page 104 of the September-October, 1959, Strolling Astronomer.

Feature	Budine		Reese		Pepernik		Jensen	
	I.	C.	I.	C.	I.	C.	I.	C.
SSTB	3.8	G	3.8	G	3.8	G	-	-
STB	3.5	Bl	3.2	G	3.5	Bl	3.4	G
SEB_s	4.0	R	3.9	Br	3.5	R	-	-
SEB_n	3.0	R	2.3	R	2.8	R-Br	3.0	R-Br
EB	4.0	G	3.9	Br	-	-	-	-
NEB	2.2	R-Br	2.3	O-Br	2.4	R-Br	2.1	R-Br
NNTB	3.0	G	3.2	G	3.0	G	.3.0	G
NNNTB	-	-	-	-	3.0	G	-	-
STeZ	7.0	W	7.0	W	7.5	W	7.0	W
STrZ	6.2	O	6.0	Oc	6.2	O	6.0	Y
SEB Z	5.0	R	4.5	Oc	5.5	O	-	-
EZ	6.0	Oc	5.5	O-Y	5.5	O-Y	6.0	Y
NTrZ-NTeZ	8.0	W	8.0	W	8.0	W	8.0	W
SPR	5.0	G	-	-	4.0	G	5.1	G
NPR	4.0	G	-	-	3.5	G	4.0	G
RSH	7.0	W	-	-	7.5	W	7.0	W

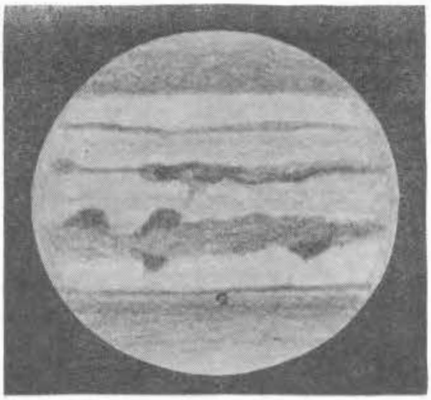


FIGURE 19. JUPITER.
C. M. Jensen. 3½-in. refr.
August 8,1959. 3^h 25^m U.T.
C.M.$_1$ = 339° C.M.$_2$ = 227°

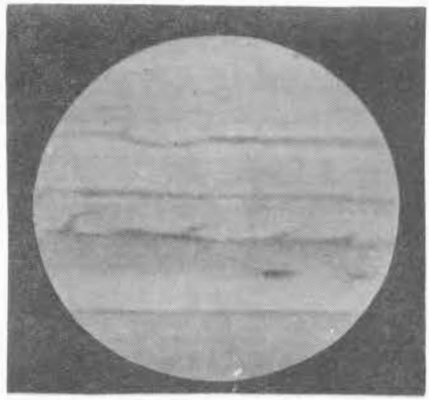


FIGURE 20. JUPITER.
J. P. Vitous. 8-in. refl.
August 10, 1959. 2^h 00^m U.T.
C.M.$_1$ = 243° C.M.$_2$ = 116°
"DE" is well shown.

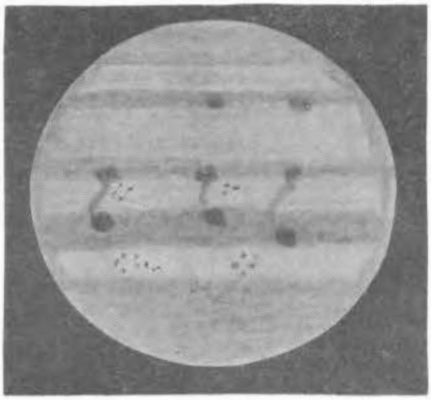


FIGURE 21. JUPITER.
J. L. Pepernik. 2.4-in. refr.
August 11, 1959. 2^h 00^m U.T.
C.M.$_1$ = 41° C.M.$_2$ = 266°
Note festoons in EZ.

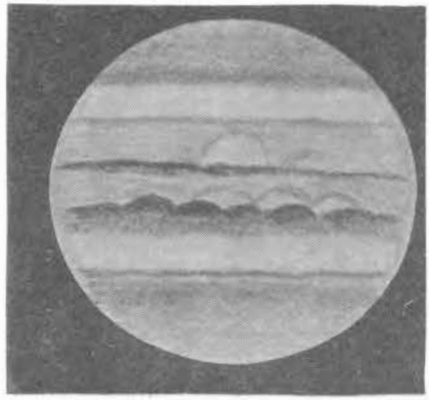


FIGURE 22. JUPITER.
C. M. Jensen. 3½-in. refr.
August 11, 1959. 3^h 34^m U.T.
C.M.$_1$ = 98° C.M.$_2$ = 322°
Note Red Spot Hollow.

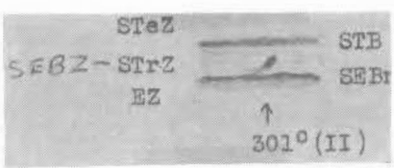


FIGURE 23. JUPITER.
G. Gaherty. 8-in. refl. July 28, 1959.
1^h 22^m U.T. C.M.$_2$ = 301°
Dark spot in SEB Z.

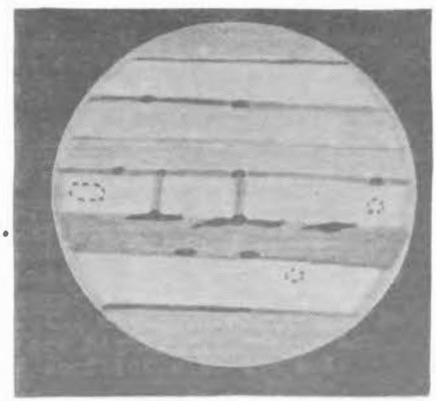


FIGURE 24. JUPITER.
P. W. Budine. 4-in. refr.
August 16, 1959. 1^h 00^m U.T.
C.M.$_1$ = 73° C.M.$_2$ = 260°
Note dark spots in STB.

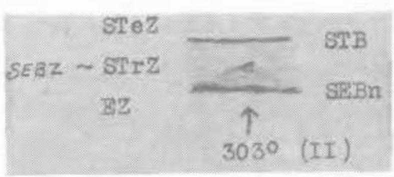


FIGURE 25. JUPITER.
G. Gaherty. 8-in. refl. August 14, 1959. 0^h 32^m U.T. C.M.$_2$ = 303°
Dark spot in SEB Z.

VII. Mean Latitudes of the Belts.

(This section written by T. J. Richards.)

The following latitudes are based on measurements of photograph no. AB/D5/34 of my collection. Data on the photograph are as follows:

June 25, 1959--10^h 06^m U.T.--5 in. refractor, Wellington College Observatory, New Zealand. 213X eyepiece. 35mm. camera photographing normal virtual image at infinity. Adox KB14 film, 4 sec. exposure. Developed with Beutler low-speed formula. C.M.$_1$ = 119°.0. C.M.$_2$ = 339°.9.

Reduction measurements were carried out with a low magnification travelling microscope from the Department of Physics, Victoria University of Wellington. Vernier accuracy was ±0.002 cm. Diameter (polar) of the photographic image was 0.206 cm. (Calculated diameter is 0.208 cm). All the latitudes calculated are zenographical. Errors quoted include the reading error (0.002 cm) and the standard deviation in the five sets of measurements which were taken of the photograph. I consider it very unlikely that the errors do not include the true value. Measurements were made of only the clearest features, but a great many more features were to be seen on the negative.

N edge NEB	S edge NEB	N edge SEB$_n$	Center STB
(+33°.4 ± 4°.5)	(+19°.5 ± 3°.2)	(-0°.6 ± 2°.7)	(-22°.1 ± 2°.2)

VIII. Visual Magnitude Estimates of Jupiter's Satellites.

Satellite magnitude estimates are by Tom C. Constanten using a 3½-inch refractor.

Satellite	Mag. Est.	Date			Time (UT)		S.	T.	Magnification
I	5.4	1959,	Aug.	11	3^h	35^m	8	5	96X
II	5.3	"	"	11	3	35	8	5	96X
III	5.0	"	"	11	3	35	8	5	96X
IV	6.0	"	"	11	3	35	8	5	96X
I	5.3	"	"	12	3	35	7	4	96X
II	5.7	"	"	12	3	35	7	4	96X
IV	5.9	"	"	12	3	35	7	4	96X
I	5.3	"	"	13	3	20	8	5	96X
III	5.0	"	"	13	3	20	8	5	96X
IV	5.7	"	"	13	3	20	8	5	96X
I	5.5	"	"	14	3	17	9	5	96X
II	5.3	"	"	14	3	17	9	5	96X
III	5.0	"	"	14	3	17	9	5	96X
IV	5.9	"	"	14	3	17	9	5	96X
I	5.5	"	"	15	3	10	7	5	96X
II	5.2	"	"	15	3	10	7	5	96X
III	5.0	"	"	15	3	10	7	5	96X
IV	5.9	"	"	15	3	10	7	5	96X
I	5.8	"	"	16	3	30	7	4	198X
II	4.8	"	"	16	3	30	7	4	198X
III	5.0	"	"	16	3	30	7	4	198X
IV	5.7	"	"	16	3	30	7	4	198X

IX. Observed Times of Satellite Phenomena in 1959.

Date	Phenomenon	To	Tc	To-Tc	Observer
May 25	II. Tr. I.	4:59	4:57	$2^m.0$	Colburn
May 25	I. Ec. R.	4:42	4:48	-6.0	"
May 29	III. Tr. I.	0:05.5	0:01	4.5	Rost
May 29	III. Sh. I.	0:48.5	0:52	-3.5	"
May 29	III. Tr. E.	2:00	1:59	1.0	"
May 29	III. Sh. E.	3:09	3:07	2.0	"

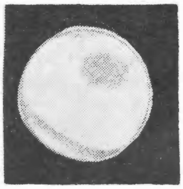


FIGURE 26. EUROPA.
C. L. Johnson.
4-in. refl. June 9, 1959. 3^h 30^m U.T. 375X.

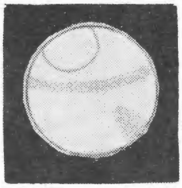


FIGURE 27. IO.
C. L. Johnson.
4-in. refl.
July 15, 1959. 3^h 35^m U.T. 481X.

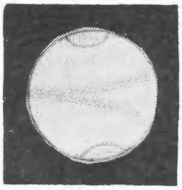


FIGURE 28. EUROPA.
C. L. Johnson.
4-in. refl. July 15, 1959. 3^h 40^m U.T. 481X.

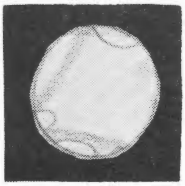


FIGURE 29. GANYMEDE.
C. L. Johnson.
4-in. refl. July 15, 1959. 3^h 50^m U.T. 481X.

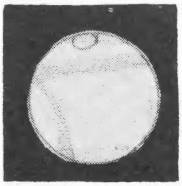


FIGURE 30. CALLISTO.
C. L. Johnson.
4-in. refl. July 15, 1959. 3^h 45^m U.T. 481X.

Note by Editor: It is usually supposed from the point of view of diffraction theory that the markings on the satellites of Jupiter are extremely difficult with an aperture of only 4 inches.

Date	Phenomenon	To	Tc	To-Tc	Observer
June 5	III. Tr. I.	3:16	3:18	-2.0	Reese
June 9	I. Tr. E.	5:23	5:24	-1.0	"
June 9	I. Tr. E.	5:24	5:24	0.0	Johnson
June 12	II. Sh. E.	1:56	1:56	0.0	Rost
July 2	I. Tr. I.	3:00	3:02	-2.0	Johnson
July 2	I. Sh. I.	3:57	3:57	0.0	"
July 9	I. Tr. I.	4:47	4:51	-4.0	"
July 10	I. Ec. R.	5:09	5:11	-2.0	"

Here To is the observed time, and Tc comes from A. E. N. A.

X. Comments.

Special thanks go to Dale P. Cruikshank, who observed diligently with the Yerkes 40" refractor and contributed valuable transit observations to the Jupiter Section. Also, thanks go to Joseph P. Vitous, who contributed four valuable full-color drawings of Jupiter. These drawings illustrated color activity very well.

A SIMPLE METHOD OF MAPPING LUNAR FEATURES, WITH NOTES ON THE GUERICKE--FRA MAURO GROUP OF CRATERS.

By: Ernst E. Both

The most common type of amateur work in connection with the moon is the drawing of lunar craters, largely for descriptive purposes. In a great many cases such drawings show little detail not recorded before; and, because they represent the lunar feature under one condition of solar illumination only, much detail is lost in the shadows with the result that such drawings are frequently useless. This does not mean that drawings are of no value altogether. On the contrary, they are an important training device for the beginning student of the moon; and if made by an expert draughtsman, they are very useful in studying the true nature of certain objects but only if several drawings are made under different conditions of illumination by the same observer. However, since such drawings invariably lack a grid- or reference system, they cannot be used for quantitative investigations.

If we are to obtain an accurate idea of lunar surface features, we must go beyond sketches and resort to cartographic representations. It is far more important to map one single crater thoroughly than to draw "pictures" of a hundred different ones. To make any claims to accuracy, maps of lunar features (and for that matter also drawings) must simply be based on photographs and must, of course, make use of measured positions. Since it is almost impossible for most amateurs to measure positions from photographs (lack of equipment and training), a simple yet fairly accurate method of mapping used by the author shall be described here.

First a limited area is selected for study. Measured positions, found in Blagg and Mueller's Named Lunar Formations (1935), are inserted on graph paper on a suggested scale of 100 inches to the moon's diameter. Next, diameters are drawn in terms of the moon's radius (found in the work cited for all craters listed, but the values given there ought to be checked with measures made by Young, Arthur, or Fauth). Now rough outlines must be supplied from photographs by projecting a transparency (or negative, which is more difficult to interpret) with a photographic enlarger onto the graph paper until the prominent detail has been carefully matched with the indicated diameters and measured points shown on the graph paper. In the absence of an enlarger, a slide- or opaque projector may be used. Care should be exercised in matching the photograph as closely as possible with the drawing.

This method allows for considerable accuracy in obtaining secondary positions (usually the errors do not exceed .001 or even .0005 lunar radii), in representing relative size, diameters, etc. Naturally there are definite faults: effects due to libration are not considered, and errors due to distortion caused by the enlarger are encountered. However, with some practice these drawbacks are easily overcome; and the method is far superior to any other which does not make use of rigorous computations. In the following table positions given in the Named Lunar Formations are compared with positions obtained in this manner. The scale used was 200 inches to the moon's diameter (errors increase in magnitude with increased enlargements due to distortion-increase):

			NLF	Both
2966	Ptolemaeus	D	-.044,-.144	-.045,-.143
2970c	"	K	-.080,-.143	-.081,-.143
2970	"	M	-.058,-.163	-.059,-.163
2970k	"	X	+.006,-.191	+.006,-.191
2970l	"	Y	+.013,-.162	+.013,-.163
2953a	Herschel	G	-.041,-.113	-.042,-.113
2949b	"	J	-.074,-.111	-.075,-.111

It is apparent from these few examples that the errors tend to be systematic so that adjustment may be made for points not previously measured if enough points of comparison are available. Again this method is superior to micrometric measures made directly at the telescope.

Once rough outlines have been obtained by projection from the photograph, they are compared with a positive print of sufficient resolution and of the same size, and corrections are made. All detail visible on the print is inserted. Finally the detail is checked at the telescope during as many lunations as necessary until all detail is correctly identified and recorded. The map can then be traced on regular drawing paper to show only the necessary grid.

The map of the Guericke-Fra Mauro group published here as Figure 31 was made in this manner. Photographs used were primarily Mt. Wilson

259, 260, and 261. Most of the detail shown was checked visually on August 13, 1959 ($2^h\ 00^m$ U.T., Colongitude 18°.33), October 11, 1959 ($0^h\ 50^m$ U.T., Col.17°.56), and December 8, 1959 ($23^h\ 15^m$ U.T., Col. 15°.13) with the 8-inch refractor of the Kellogg Observatory at the Buffalo Museum of Science, powers 175X, 375X, and 500X. The frequency of visual work was not considered satisfactory to represent all features seen. Particularly the northeastern section of the map is lacking in detail. Nevertheless, the number of objects represented with sufficient accuracy warrants the publication of the map at this time. Since the following discussion was not intended to be a monograph of the Guericke group, no attempt has been made to present an exhaustive bibliography on the subject. For the same reason much detail has been omitted from the map, particularly a number of very fine and doubtful rills and minor hills, as well as small craterlets.

The northern portion of the Mare Nubium is characterized by a group of partially destroyed and distorted rings. A complex system of rills together with a large "dome" make this area one of the more interesting sections of the Mare Nubium and also one which deserves closer study. The discontinuous walls of Guericke have three major openings leading into the surrounding plains. Where the wall opens toward the south, a number of hills and some debris fan out to the southwest as well as to the southeast. At the foot of these hills lies Guericke B (10.8 miles, all diameters measured from photographs by the author), elongated slightly east-west, with an almost central hill and parts of a concentric inner ring, reminiscent of the ring dikes found in Hesiodus A and Marth. At the northwestern base of B lie the wall remnants of a ruined crater about 9 miles in diameter.

The western wall opening of Guericke leads to three very shallow and confluent craterlets, having a combined length of 5.4 miles. Inside Guericke, slightly west of the crater D, is a shallow, circular depression (at -.241, -.203 on Figure 31), visible distinctly only near the terminator (up to a solar altitude of 6° or 8°), which is bordered on its southwestern rim by a group of 4 or 5 low hills (the exact nature of these objects is doubtful, and they may partly be a dome with some surface modification). From the nearly central depression runs a shallow "valley" northward, which leads to the destroyed rings between Guericke and Parry. To the west of the point where this "valley" opens into the ring-remnants is the crater Guericke J, which has a curious elliptical appendage extending to the north, whose short axis measures 5.9 miles, but the major axis is nearly twice that (10.8 miles). A small crater (1.6 miles) lies in the northern part of the floor, where the walls are lowest.

A very narrow opening leads from Guericke into the ruined ring F (12.4 miles). The walls of this object are more or less continuous with one major break occurring in the southeast. This opening points to one of the larger domes found on the moon (center at -.302, -.234). This dome has a diameter of 33.5 miles and is a prominent object when very close to the terminator. But even under a high sun it can easily be recognized because of its brightness, which is clearly contrasted by the darker mare material surrounding it. The western base (angle of slope between 1°.5 and 2°) was described by Maedler as having "a gentle, convex slope, whose shadow becomes apparent only right at the terminator." He represented this general area quite well on a special map appended to his book, without realizing, however, its true nature. Maedler also remarks that this might be the area called "Insula Melos" by Hevelius. Somewhat to the north of the dome's center is a hill, Opelt alpha; the height of this dome (according to an estimate by Maedler) is about 600 ft., perhaps even 850 ft., although some isolated hills may be as high as 1800 ft.

The considerable surface modifications of this feature are in general characteristic of lunar domes of this size: a number of hills to the north and east of the center; a rill, consisting partly of blow-holes, which cuts the dome almost in half and emanates from the environs of Opelt; and another short rill seeming to cut the dome in a direction northeast-southwest, intersecting the main rill near the center. On the western slope lies the small crater Opelt K (3.5 miles), and north of it are a few minor hills. These modifications make exact slope and height determinations quite difficult. As with other domes of this size, the outline is not circular; expecially in the east, it merges with short ridge-fragments, hills, crater ruins, and craterlets. On the whole the dome has the appearance of a shield and may be compared with the object west of Vitruvius (The Strolling Astronomer, Vol. 13, pp. 137-140, 1959.)

The only interesting feature between Guericke and Parry (aside from Parry A and the ruins north of Guericke) is a small craterlet (1 miles, at -.261, -.172) on top of a distinct cone whose base diameter is 3.7 miles. Parry itself needs no special comments. Attention need only be drawn to the distinct craterlet between the southwestern wall and r_{17} inside Parry (1.7 miles, at -.260, -.143), which is not shown on any map or drawing consulted, even though it is prominent on most photographs. The very bright area directly north of Parry A may also be mentioned.

The nature of the ruins between Parry and Guericke is noteworthy: apparently the flooding of Mare Nubium proceeded northward, displacing the more durable material in that direction and forcing the greatest opening always to occur in the north wall (for example the ruin Parry M, measuring 16.5 miles). An appression toward the east must have taken place at the same time, as is evident from the systematic dislocation of the material in that direction, the course of the major rill r_1, as well as the dislocation of Parry's eastern wall. The sudden bending of r_{17} in the west, after leaving Parry, is also interesting. Parenthetically it may be remarked that the northern opening of Parry M is centered directly toward the Mare Imbrium.

Guericke L, called a "bright spot" in Named Lunar Formations, is simply a low hill. Guericke E (2.7 miles) is the center of a minor ray system. Parry B is not a crater but a bright spot with a very minute blow-hole in the center, and may be a low dome. A similar spot is directly north of B at -.223, -.136 on Figure 31.

Bonpland (34.5 miles) is the least impressive and most destroyed crater in this group. Its southern wall consists of a number of low fragments. In the east the floor rises very gradually over a distance of 7 miles to what is left of the "wall." This area appears quite rough under low illumination, a situation which is repeated in Fra Mauro on a larger scale. On the outside of Bonpland's east wall starts a low ridge leading to the south and branching into two arms a short distance from its starting point.

The peculiar modifications which the walls of Fra Mauro have undergone make this crater particularly interesting. The rim of the eastern wall is almost on the same level with the debris outside. Similar debris has "filled" the floor on the inside (in the east) in the form of minute elevations, a number of "grooves" and many small scars, as well as craterlets, the level being higher than in the west, where the floor of Fra Mauro has merged with the mare. From the west wall opening a disconnected row of some 10 or more craterlets leads to the triple mountain mass Lalande eta.

The rill system associated with Parry, Bonpland, and Fra Mauro deserves closer attention. The numbering used here was adopted from that of Koenig in his edition of Krieger's studies. Krieger (after Schmidt) was the first to offer a fairly accurate and complete representation of this area.

Rill r_1 commences at -.262, -.208 (northeast outer wall of Guericke F) and leads to the southern wall of Parry A. It continues at the northern wall base of this crater, breaks through Parry epsilon and connects with Parry E, going along the eastern wall base of Parry into Fra Mauro and stops west of Fra Mauro E at -.284, -.102. According to Wilkins it continues essentially straight to some point around -.288, -.040, while Krieger has about what the present map shows. Slightly north of E (erroneously marked "A" by Wilkins) it bends sharply to the east and connects with r_2.

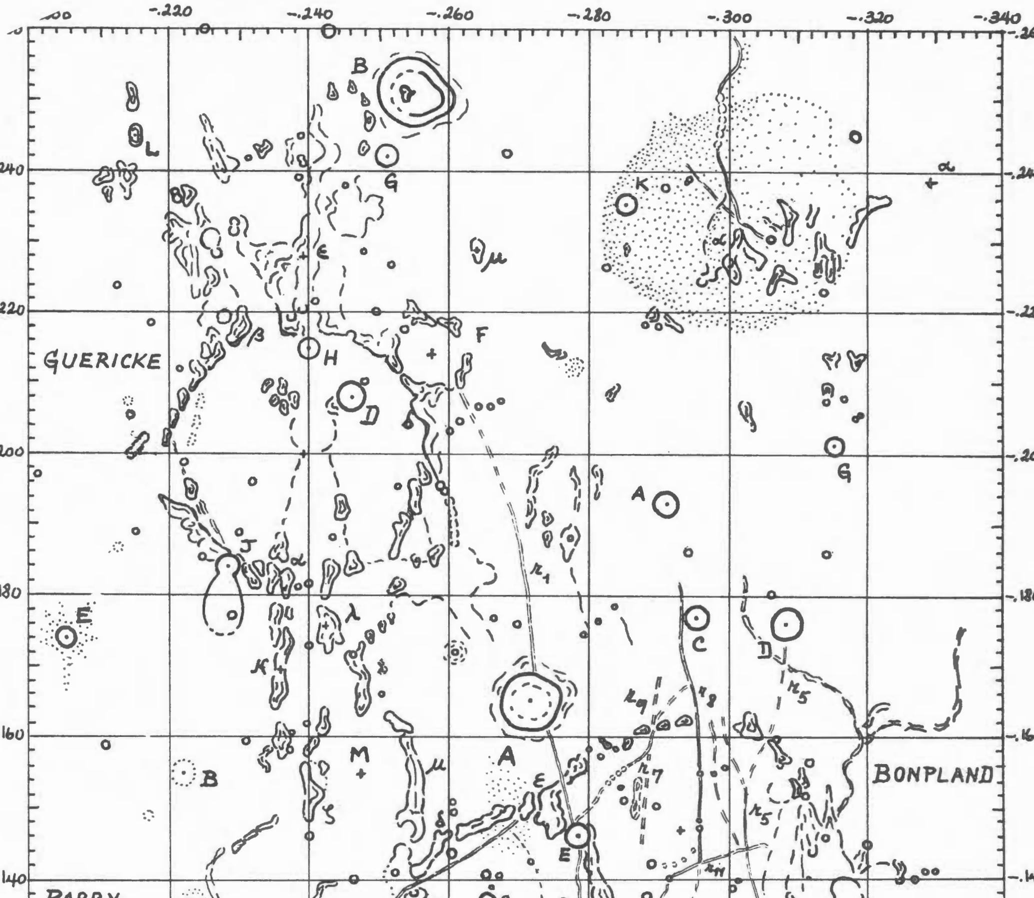


FIGURE 31. Chart of Guericke--Fra Mauro group of craters by Ernst E. Both. Refer to text of article by Dr. Both in this issue. Note the scales for rectangular lunar coordinates xi (horizontal) and eta (vertical).

Rill r_2 runs almost straight to the northern wall of Fra Mauro. Its passage through the northern wall is not entirely clear: Wilkins has it going straight to -.294, -.076 at the base of the wall, but according to Krieger it cuts through the peak at -.291, -.080 and then continues beyond Fra Mauro (how far beyond is not clear since Krieger's map ends just north of Fra Mauro). The author's observations would indicate that both Krieger and Wilkins have part of the truth in the sense that this rill seems to fork just before reaching the hill near the north wall. The eastern branch, consisting partly of small blow-holes, winds around the eastern base of the peak, disappearing near -.292, -.070. The existence of the western branch was suspected several times (Schmidt has r_2 continue straight northward to some point near the western foot of this peak, and Fauth shows the same).

Rill r_5: the course of this rill is uncertain. Schmidt, Krieger, Fauth, and Herring omit it entirely. Goodacre has it start at the northern base of Bonpland D (at -.308, -.174 on this map) and go to a point at -.302, -.148 inside Bonpland, then curving northeast and stopping at the base of a hill at -.304, -.133, much as shown on the author's map. Wilkins shows the same, with the exception that it continues beyond that hill into Fra Mauro to a point somewhere near -.318, -.106. This continuation could not be verified either from photographs or visual observation. However, a number of shallow "grooves" in this part of Fra Mauro may well look like rills at times. The two southern branches inside Bonpland were suspected and seem to be indicated vaguely on some photographs.

Rill r_6: most authorities agree on the course of this rill. It starts inside Bonpland at a small craterlet at -.291, -.140, traverses the large peak Bonpland alpha and meets r_1 inside Fra Mauro at -.283, -.112. This is the situation shown by Krieger, Fauth, Herring (in part), and the author, but strangely neither by Goodacre nor Wilkins, who omit it entirely. The only question is the mode of traversal of Bonpland alpha. Krieger, Fauth, and Herring indicate that this rill cuts through alpha, but photographs which show the rill clearly do not seem to support this. According to the author's observation alpha may be crossed by a delicate, disconnected ridge, which simulates a rill at times. If this be the case, r_6 would stop at the southern base of alpha to resume at its northern base, without cutting the peak.

Rill r_7: shown by Krieger (although his representation does not correspond fully to the actual situation) and Herring, but omitted by Goodacre, Fauth, and Wilkins. It starts at the southern base of Parry E, crosses the southwestern section of Bonpland's floor (consisting here of at least 4 blow-holes), passes between two low hills in the southern "wall" of Bonpland and probably connects with r_8.

Rill r_8 starts south of Bonpland C (how far south is problematical), passes that crater on its western base (Krieger, Goodacre, Fauth, and Wilkins have it start at the northern base of Bonpland C, but see Mt. Wilson photograph 259 or 261), continues northward into Bonpland sensibly straight, ending at -.296, -.142. This situation is shown by Schmidt, Krieger, Goodacre, and the author; but Wilkins has it continue into Fra Mauro, and Herring seems to support this. Such a continuation may be indicated on Mt. Wilson 260, but the author always thought this continuation (r_{15} on the map) to be in the nature of a disconnected and shallow "groove" rather than a rill (at least the part inside Fra Mauro).

To the east of Fra Mauro E, at -.292, -.104, is a distinct craterlet not shown by any of the selenographers mentioned but very definite on Mt. Wilson photograph 260. To the south of Fra Mauro D is a short chain of craterlets.

Rill r_9 is shown by Schmidt, Krieger (number VIII), Goodacre, Wilkins, and Fauth, but not by Herring. It starts somewhere near -.289, -.166 outside of Bonpland and ends near -.287, -.146, its course being fairly straight in a north-south direction. Goodacre and Wilkins would have it start inside the southern wall of Bonpland.

Rill r_{11} connects r_6, r_8, and r_5, running from the northwest (-.291, -.140) to the southeast (-.306, -.146). It is shown by Krieger and Herring, but not by Schmidt, Goodacre, Fauth (although mentioned in his text), or Wilkins. It is indicated on Mt. Wilson 260.

Rill r_{17} starts near Parry epsilon (bright area!) and crosses the southwestern floor of Parry, leaving this crater at a point southeast of Parry F where it bends northwest, stopping somewhere near -.237, -.118. At a theoretical continuation of this end-point, at -.225, -.105, lies a short crater chain consisting of three blow-holes. This rill is shown by all the selenographers mentioned, although its course outside of Parry as represented on the map of Wilkins does not correspond to the actual situation (see Mt. Wilson 260). The short row of blow-holes seems to have been noticed only by Krieger, although it is well shown on photographs. Near full phase this row is quite bright.

The lunar literature is rich in reports of unconfirmed detail and almost equally rich in demands that such detail be confirmed; but unfortunately it is almost devoid of attempts to confirm such detail. It is hoped that A.L.P.O. members will make an attempt either to refute or to confirm detail shown on this map, and to add to it.

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THE FIGURE OF THE MOON

By: Karl Engel

(Based on a paper read at the Fifth A.L.P.O. Convention at Denver, Colorado, August 28-31, 1959.)

At the Nationwide Amateur Astronomers Convention in Denver, Aug., 1959, the writer reported on an attempt to trace the figure of the moon by a statistical survey of available measurements of absolute heights.[1] A detailed account will be given here.

If the moon were a plastic and homogenous body, the demands of all gravitational and centrifugal forces exerted on it would be balanced by the figure of a very slightly ellipsoidal sphere with the longest axis directed toward the center of the earth. Laplace first noticed that the facial center of the moon was actually higher than ideally expected, but he ascribed the excessive bulge to accidental distortion when the moon solidified. H. Jeffries regarded it as a frozen tidal bulge that originated at an evolutionary stage in the relationship between earth and moon when the two bodies were in closer proximity than they are at present. According to calculations applied by Jeffries, as reviewed by R. B. Baldwin[2], for an isostatically balanced moon the semi-axis in the direction of the earth's center should be 125 feet longer than the radius of a perfect sphere with the same volume as the moon; the semi-axes in the east-west direction and in the polar direction should have been shorter than this radius by 36 feet and 89 feet, respectively. Actual relations can be determined approximately from observed moments of inertia of the moon about its gravitational center. Such calculations indicate that the semi-axis in the direction of the earth is significantly greater than the value for an isostatic sphere, or about 2100 feet greater than the radius of the mean sphere, which is a very large deviation, indeed.

Over the years, determined efforts have been made to trace a continuance of the apparent swelling over the face of the moon by different methods. For regions not too near the limb, or not too greatly foreshortened, the most satisfactory determinations of absolute heights are made by the method used by J. Franz. By comparing photographic plates of parallactic views of the moon, or by measuring the libratory changes of selected surface markings, ie., small craters, their displacement from a central point of reference can be found. The amplitude of the arc described by a selected craterlet depends on its true height, or on the radius of the moon at the observed point; and the value of this radius can be calculated.

Franz made a large number of such determinations from photographs by the Lick Observatory, and he combined them in a survey of the visible surface.[3] In his findings, negative deviations from the ideal sphere overbalance positive deviations, resulting principally from his choice of a now obsolete and too high value for the mean radius. A chart, his summary, reveals differences in level between large areas of some of the <u>maria</u> and compact crater-bearing regions, but gives no indication of a systematically declining facial bulge. Efforts of others in this direction have had no better success.

A long continued, unsuccessful search for the answer to a complex problem often suggests that the basic question itself was wrongly posed, or that a new approach may be required.

A chain of <u>maria</u>, which begins at the northeastern limb and crosses to the southwestern limb, appears to point to the existence of a special polarity. Any full moon photograph will show this chain well. Franz in 1905 [4] proposed such an idea. He grouped together all of the <u>maria</u> and perceived in them a chain that extended over to the normally averted side of the moon, over parts made accessible to view through librations. He placed the southerly pole of the system at $\lambda = -15^\circ\ 46'$, and $\beta = -69^\circ\ 5'$, near the crater Moretus.

On hypothetical considerations of his own regarding the origin of the moon's surface features[5], the writer inferred that the more oblique chain of nearly circular <u>maria</u> was formed through processes of spontaneous solidification from a global surface layer of magma. From small-scale analogies with crystallizing melts it was further inferred that structures of the character of these <u>maria</u> were initiated in a relatively greater depth of magma than genetically related crater structures. The sweeping chain of <u>maria</u> suggests that a circumferential swelling, or tidal belt, existed at the time of surface solidification. Under the simplest expectation, assuming a one-time plastic moon, such a belt, if preserved, might reveal itself in a surface level which slopes away systematically from the approximate center line of the chain of <u>maria</u> toward the corresponding poles. The polar axis of such a system must be tilted with respect to our three normal axes of the moon, and we may decipher kryptic features only from their projection on the plane of vision. One would hardly look for such a projection without a reasoned, or specific motive; such features are easily overlooked.

To examine the validity of such reasoning, a topographic survey was made using recently revised measurements of Franz. The measurements of Franz have been, in recent years, the special concern of members of the staff of the Observatory at the University of Vienna. Prof. J. Hopmann has critically reviewed 150 measurements.[6] He accepts with a few, specific reservations the accuracy of the observations; but he finds that the mathematical reduction was based on an unsatisfactory assumption of a spherical moon and, even more seriously, on an obsolete hypothesis of the moon's libration which led to inaccurate selenographic definition of selected points. He consequently recalculated the measurements.

More recently, the same data have been further revised by Prof. G. Schrutka-Rechtenstamm;[7] and these were the basis of a statistical analysis.

The 150 surface points that have been recalculated were mapped with the aid of the reported rectangular coordinates. Different experimental systems of latitudinal circles, orthographically projected on the map, were superimposed in turn. Measured heights that fell within zonal belts of five, and where necessary ten, latitudinal degrees were listed; and the zonal mean levels were calculated. These were graphically plotted against the mean latitudinal location of the zone. By trial and error, the system was found which presented the most consistent topographic trends.

Hemispheric trends became readily apparent over a wide range of latitudinal ordinate systems. The most promising of these (see Figure 32) has its southerly pole approximately at $\lambda = -53^\circ$, and $\beta = -75^\circ$, or a small distance southeast of the crater Wargentin. The northerly pole is on the averted side of the moon, 15° beyond the limb. The pertinent data for this system, taken from Prof. Schrutka-Rechtenstamm's work, are listed in Table I. The level of reference is a mean sphere with a radius of 1,738.0 kms. The distribution of the zonal mean levels over the surface of the moon, a special profile of the sphere enormously exaggerated in vertical directions, is graphically presented in Figure 33.

Discussion of Findings. The map revealed some excessive heights and some unusual depressions. Where these are distinctly isolated occurrences, they owe their existence quite obviously to special, local conditions during their formation; and such measurements might justifiably be omitted from consideration. They are relatively few, however; and they affect trends in larger groups very little. None were omitted. Zonal belts of five latitudinal degrees were chosen where possible. If the number of measurements available was less than four, zones of ten degrees extent in latitude were listed.

The most readily apparent regularity, well defined in a great variety of ordinate systems, is a trench occupied by the chain of maria, approximately 30 degrees of latitude, or 900 kms. wide, and rather uniformly 2.4 kms. lower than its northern and southern rims. The trench has distinctly descending sides (actually the slopes are merely $1^\circ 20'$). It is rimmed, north and south, by well defined hemispheric (and presumably global) bulges. If zonal mean levels of mountainous areas only were plotted, they would form an apparently continuous line corresponding to a circumferential bulge. The trench appears to have been formed in secondary developments from this bulge by the processes which formed the surface crust. The approximate center line of the trench, however, does not follow the line of a great circle, but of a small circle roughly 10° of latitude north of the center of the assumed full bulge.

The bulge reaches a maximum height of 2.5 kms. above the mean sphere. Apparently it does not slope from crests to poles, but extends merely over about 40 latitudinal degrees on either side of the equator of reference. It terminates in the southern hemisphere in a recognizable constriction dipping 0.8 kms. below the mean sphere. The pole appears to be at the level of the mean sphere. A corresponding northerly constriction is also indicated, but the data for the area in question are rather meager.

A truly symmetrical facial bulge is not recognizable. Prof. Hopmann has pointed out that the large dome-like swelling extending from the center into the southwestern hemisphere may be regarded as a key feature of an oblique triaxial ellipsoid. He finds no reason for believing that a counterpart exists on the averted side of the moon. The swelling has no apparent symmetry relation to the sphere as a whole, and its origin may be ascribed to special, not global, conditions at the time of its formation.

The data as assembled in the plot did not bear out the initial preconceived idea of a simple circumferential bulge but revealed features with global symmetry relations, but more complex. The smoothness of the

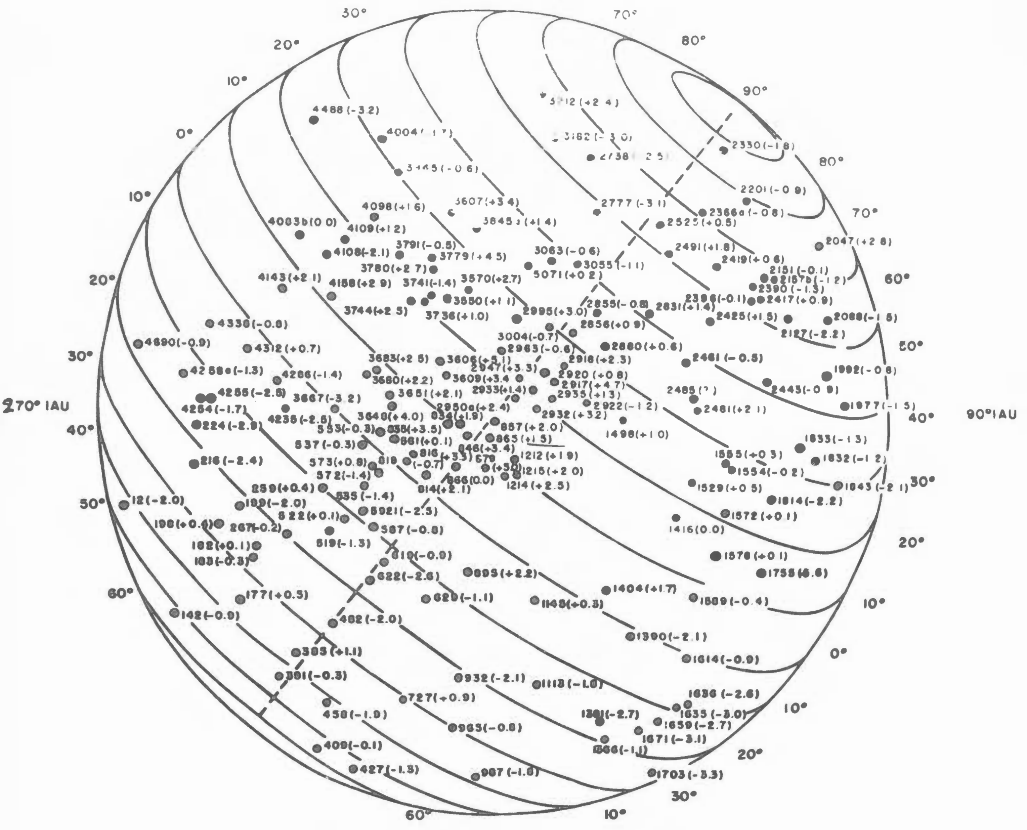

FIGURE 32. Chart of 150 selected lunar points measured for heights by J. Franz. Refer to paper by Dr. Karl Engel in this issue.

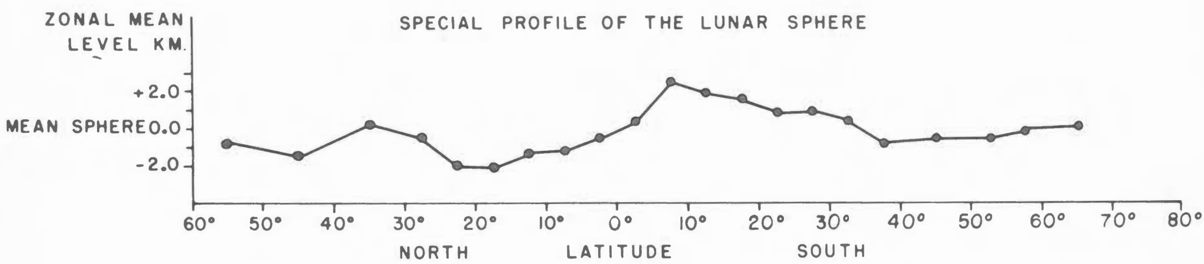

FIGURE 33. Special profile of the lunar sphere, plotting latitudinal zonal mean levels in kilometers against latitudes. Refer to text of Dr. Engel's paper. The points plotted are average latitudes and average levels from Table I.

plot, notwithstanding its complexity, encourages the belief that the interpretation is not forced but is based on factual relations. Admittedly, the 150 measurements constitute neither an ample nor even a fair sample of the moon's topography; the central portion has been too heavily favored. The inferences here drawn are therefore tentative, and it is hoped that they will be supported or refined by additional and new measurements suitably selected. If confirmed, these findings hold important implications regarding the early history of the moon.

The plain existence of a hemispheric chain of maria is irreconcilable with the hypothesis that these structures originated through the impact of meteorites, which could only have produced a haphazard distribution. Whatever the origin of the maria, a methodical arrangement speaks for processes that grew out of conditions existing on the moon itself.

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TABLE I

Zonal Belt Latitudes	IAU No.	Formations (proceeding from West to East)	Coordinates XI	Coordinates ETA	Height in kms.
80-70° south	2330	Drebbel	-0.5703	-0.6543	-1.8±1.0
70-60° south	2366a	Vitello Xi	-0.5232	-0.5041	-0.8±1.1
	2201	Palmieri A	-0.6328	-0.5331	-0.9±0.7
	2047	Byrgius A	-0.8166	-0.4151	+2.0±0.4
65° (mean)			Zonal mean level*		+0.8
60-55° south	3212	Maginus H	-0.1062	-0.7926	+2.4±0.8
	2390	Gassendi Alpha	-0.6538	-0.3156	-1.3±1.9
	2151	Mersenius C	-0.6758	-0.3374	-0.1±1.1
	2157b	Mersenius S	-0.6900	-0.3282	-1.2±0.8
57.5° (mean)			Zonal mean level		-0.35
55-50° south	3182	Tycho Central Mt.	-0.1422	-0.6870	-3.0±1.1
	2738	Heinsius A	-0.2313	-0.6379	-2.5±1.9
	2525	Campanus Centr. Mt.	-0.4109	-0.4683	+0.5±1.0
	2491	Agatharchides	-0.4364	-0.3942	+1.8±1.1
	2419	Gassendi J	-0.5592	-0.3674	+0.6±1.2
	2396	Gassendi Zeta	-0.6718	-0.2824	-0.1±0.9
	2417	Gassendi G	-0.6718	-0.2873	+0.9±1.6
	2127	Billy	-0.7441	-0.2383	-2.2±1.0
	2088	Sirsalis F	-0.8426	-0.2344	-1.5±1.5
52.5° (mean)			Zonal mean level		-0.5

* The zonal mean levels in this table are weighted averages.

Zonal Belt Latitudes	IAU No.	Formations (proceeding from West to East)	Coordinates XI	Coordinates ETA	Height in kms.
50-40° south	2777	Hesiod A	-0.2531	-0.5010	-3.1±1.9
	2425	Herigonius	-0.5425	-0.2302	+1.5±1.1
	1992	Damoiseau E	-0.8467	-0.0901	-0.8±1.3
	2831	Darney	-0.3857	-0.2513	+1.4±1.1
	2443	Flamsteed	-0.6953	-0.0776	-0.9±0.8
	1977	Lohrmann A	-0.8875	-0.0125	-1.5±0.7
45° (mean)			Zonal mean level		-0.55
40-35° south	3063	Birt	-0.1373	-0.3800	-0.6±1.3
	3085	Nicollet	-0.1997	-0.3727	-1.1±0.8
	2855	Guericke B	-0.2543	-0.2509	-0.8±0.6
	2461	Euclid	-0.4877	-0.1281	-0.5±1.6
37.5° (mean)			Zonal mean level		-0.85
35-30° south	4004	Nicolai A	+0.2956	-0.6744	-1.7±0.6
	3845	Büsching E	+0.2532	-0.5970	-0.6±1.2
	3607	E. Pickering	+0.1219	-0.0497	+3.4±1.6
	3485a	Werner D	+0.0505	-0.4547	+1.4±1.3
	3071	Thebit A	-0.0794	-0.3672	+0.1±0.8
	2856	Guericke C	-0.1958	-0.1998	+0.9±1.5
	2880	Parry A	-0.2708	-0.1648	+0.6±0.6
	2481	Landsberg A	-0.5164	+0.0037	+2.1±1.5
	1833	Reiner A	-0.7778	+0.0898	-1.3±1.4
	1832	Reiner	-0.8118	+0.1206	-1.2±0.8
32.5° (mean)			Zonal mean level		-0.2
30-25° south	3779	Abenezra A	+0.1674	-0.3870	+4.5±2.4
	3570	Argelander D	+0.0745	-0.3023	+2.7±1.0
	2995	Alphonsus Alpha	-0.0458	-0.2304	+3.0±1.4
	3004	Davy A	-0.1331	-0.2111	-0.7±1.0
	2918	Lalande A	-0.1686	-0.1151	+2.3±1.4
	1498	Gambart A	-0.3208	+0.0172	+1.0±0.8
	1555	Kepler A	-0.5844	+0.1247	+0.3±1.0
	1554	Kepler	-0.6085	+0.1415	-0.2±1.0
	1814	Marius A	-0.7012	+0.2182	-2.2±0.5
	1843	Galilei	-0.8731	+0.1822	-2.1±1.3
27.5° (mean)			Zonal mean level		-0.25
25-20° south	4488	Janssen K	+0.4657	-0.7199	-3.2±0.4
	4098	Pons B	+0.3110	-0.4807	+1.6±1.1
	3791	Sacrobosco C	+0.2514	-0.3900	-0.5±1.1
	3780	Abenezra B	+0.1638	-0.3548	+2.7±1.3
	3741	Albufeda B	+0.1688	-0.2879	-1.4±1.3
	3550	Airy A	+0.1278	-0.2924	+1.1±1.3
	3736	Albufeda A	+0.1794	-0.2822	+1.0±1.0
	2963	Ptolemaeus A	-0.0138	-0.1476	-0.6±1.5
	2947	Herschel C	-0.0550	-0.0869	+3.3±1.4
	2920	Lalande C	-0.1191	-0.0971	+0.8±0.9
	2917	Lalande	-0.1488	-0.0774	+4.7±1.9
	2933	Mösting A	-0.0900	-0.0555	+1.4±0.4
	2935	Mösting C	-0.1401	-0.0311	+1.3±2.4
	2922	Turner	-0.2282	-0.0239	-1.2±0.9
	1529	Milichius	-0.4949	+0.1741	+0.5±1.0
	1572	Bessarion	-0.5851	+0.2561	+1.3±3.2
22.5° (mean)			Zonal mean level		-0.2
20-15° south	4109	Polybius B	+0.3891	-0.4308	+1.9±0.9
	4108	Polybius A	+0.4323	-0.3908	-2.1±2.0
	3744	Albufeda F	+0.2178	-0.2784	+2.5±0.8
	3606	Hipparchus C	+0.1421	-0.1284	+5.1±1.4
	2950a	Flammarion A	-0.0431	-0.0338	+2.4±1.7
	2932	Mösting	-0.1016	-0.0116	+3.2±0.7
	1416	Tobias Mayer A	-0.4575	+0.2635	+0.0±1.2
	1578	Brayley	-0.5596	+0.3566	+0.1±1.4
17.5° (mean)			Zonal mean level		+3.1

Zonal Belt Latitudes	IAU No.	Formations (proceeding from West to East)	Coordinates XI	Coordinates ETA	Height in kms.
15-10° south	4083b	Piccolomini L	+0.4890	-0.4398	0.0±1.0
	4158	Beaumont D	+0.4219	-0.2930	+2.9±1.0
	3609	Hipparchus G	+0.1288	-0.0870	+3.6±0.9
	834	Rhaeticus A	+0.0906	+0.0306	+1.9±1.4
	857	Bruce	+0.0069	+0.0207	+2.0±2.3
	865	Chladni	+0.0199	+0.0700	+1.5±2.1
	1212	Bode	-0.0420	+0.1173	+1.9±1.0
12.5° (mean)			Zonal mean level		+2.1
10-5° south	4143	Rosse	+0.5450	-0.3064	+2.1±1.6
	3683	Alfraganus C	+0.3092	-0.1862	+2.5±1.3
	3680	Alfraganus	+0.3242	-0.0841	+2.2±1.0
	3651	Theon Junior	+0.2726	-0.0415	+2.1±3.4
	835	Rhaeticus B	+0.1189	+0.0286	+3.5±1.4
	846	Triesnecker	+0.0631	+0.0732	+3.4±1.4
	879	Ukert	+0.0241	+0.1348	+5.0±1.9
	1215	Bode B	-0.0529	+0.1524	+2.0±1.5
	1214	Bode A	-0.0197	+0.1567	+2.8±1.4
	1589	Diophantus	-0.4981	+0.4634	-0.4±1.0
7.5° (mean)			Zonal mean level		+2.15
5-0° south	3667	Moltke	+0.4094	-0.0098	-3.2±1.3
	553	Dionysius	+0.2973	+0.0487	-0.3±1.1
	561	Cayley	+0.2601	+0.0690	+0.1±1.2
	816	Silberschlag	+0.2160	+0.1085	+3.3±2.5
	819	Silberschlag A	+0.2271	+0.1210	-0.7±1.0
	866	Hyginus	+0.1086	+0.1354	0.0±2.2
	814	Boscovich Alpha	+0.1836	+0.1598	+2.1±2.7
	1404	Lambert Gamma	-0.2830	+0.4458	+1.7±1.5
2.5° (mean)			Zonal mean level		+0.2
0-5° north	4312	Gutenberg A	+0.6340	-0.1563	+0.7±0.7
	4286	Isidorus D	+0.5587	-0.0740	-1.4±1.0
	537	Manners	+0.3409	+0.0800	+0.3±1.6
	573	Sosigenes A	+0.3138	+0.1353	+0.8±1.8
	572	Sosigenes	+0.2990	+0.1516	-1.4±1.1
	1145	Archimedes A	-0.0983	+0.4701	+0.3±0.8
	1390	Carlini	-0.3387	+0.5548	-2.1±1.5
	1614	Mairan E	-0.4773	+0.6122	-0.9±1.1
2.5° (mean)			Zonal mean level		-0.3
5-10° north	4338	Bellot	+0.7278	-0.2151	-0.6±1.5
	4235	Censorinus	+0.5394	-0.0068	-2.5±1.6
	259	Jansen B	+0.4414	+0.1853	+0.4±0.9
	535	Maclear	+0.3379	+0.1827	-1.4±1.8
	592	Taquet A	+0.3354	+0.2475	-2.5±1.3
	587	Taquet	+0.3148	+0.2862	-0.8±0.9
	895	Aratus	+0.0725	+0.4006	+2.2±0.8
	1636	Sharp B	-0.4843	+0.7305	-2.6±0.6
	1635	Sharp A	-0.4561	+0.7379	-3.0±0.4
7.5° (mean)			Zonal mean level		-1.8
10-15° north	4258a	Messier G	+0.7932	-0.0938	-1.3±1.
	4255	W. H. Pickering	+0.7298	-0.0347	-1.8±0.9
	4254	Messier	+0.7380	-0.0326	-1.7±0.7
	522	Plinius Beta	+0.3856	+0.2642	+0.1±1.4
	613	Bessel	+0.2855	+0.3699	-0.9±0.8
	629	Linné	+0.1809	+0.4650	-1.1±1.
	1638	Foucault	-0.4072	+0.7699	-2.7±1.4
12.5° (mean)			Zonal mean level		-1.4

Zonal Belt Latitudes	IAU No.	Formations (proceeding from West to East)	Coordinates XI	Coordinates ETA	Height in kms.
15-20° north	4690	Langrenus M	+0.9029	-0.1595	-0.9±1.2
	224	Taruntius G	+0.7591	+0.0326	-2.9±1.2
	519	Dawes	+0.4236	+0.2959	-1.3±0.6
	622	Bessel A	+0.3254	+0.4184	-2.6±1.5
	1113	Pico Beta	-0.1037	+0.6844	-1.8±0.9
	1381	Maupertuis A	-0.2646	+0.7724	-2.7±1.3
	1671	Bouguer	-0.3570	+0.7304	-3.1±0.5
	1366	Condamine A	-0.2919	+0.8124	-1.1±1.0
17.5° (mean)			Zonal mean level		-2.15
20-25° north	216	Taruntius A	+0.7582	+0.1265	-2.4±0.9
	199	Proclus A	+0.6539	+0.2307	-2.0±1.1
	267	Vitruvius A	+0.5299	+0.3050	-0.2±1.1
	932	Cassini C	+0.1014	+0.6650	-2.1±1.2
	1703	Pythagoras Alpha	-0.3974	+0.8941	-3.3±0.7
22.5° (mean)			Zonal mean level		-2.3
25-30° north	198	Proclus	+0.7018	+0.2774	+0.4±0.5
	182	Macrobius A	+0.6102	+0.3346	+0.1±0.5
	183	Macrobius B	+0.6107	+0.3572	-0.3±1.0
	482	Posidonius A	+0.4188	+0.5247	-2.0±1.3
	965	Egede A	+0.1134	+0.7827	-0.8±0.8
27.5° (mean)			Zonal mean level		+0.1
30-40° north	177	Tralles A	+0.6495	+0.4608	+0.5±1.1
	385	Maury	+0.5885	+0.6034	+1.1±1.1
	727	Eudoxus A	+0.2395	+0.7167	+0.9±1.0
	987	W. C. Bond B	+0.0553	+0.9059	-1.8±1.1
35° (mean)			Zonal mean level		+0.2
40-50° north	12	Hansen A	+0.8381	+0.2312	-2.0±0.8
	391	Cepheus A	+0.5472	+0.6562	-0.3±0.8
	458	Hercules C	+0.4355	+0.7237	-1.9±0.8
45° (mean)			Zonal mean level		-1.4
50-60° north	142	Hahn A	+0.8155	+0.4951	-0.9±0.8
	409	Endymion G	+0.4566	+0.8325	-0.1±0.8
	427	Thales	+0.3645	+0.8805	-1.3±0.5
55° (mean)			Zonal mean level		-1.0

Added Comments. Some time has elapsed since the preceding paper was written, and it seems advisable to reexamine especially those implications that relate to features on the far side of the moon.

In a recent issue of The Journal of the International Lunar Society (Vol. I, No. 5, 1959), Gilbert Fielder has discussed limitations of Franz's basic method for measuring absolute heights and has pointed especially to the difficulties in defining precisely the selenographical longitude of measured points. The revision of Franz's data by the astronomers of the Vienna Observatory was based on the recognition of errors of definition, and the data were rectified within definable limits. They were apparently tolerable limits; for the revised data gave a surprisingly orderly, and not a preconceived, mean hemispheric profile of the moon. There can be no doubt that additional, carefully prepared data are highly desirable; but it seems now unlikely that they would seriously conflict with the main features of this profile.

Most sharply defined, in outline and in contrast with adjacent levels, is the depressed, hemispheric belt of maria. With greater local variations but still clearly defined, there is the oblique, hemispheric bulge. The tilt of the corresponding polar axis may be slightly, but not radically, different. Of great theoretical interest, but supported by meager data so far, are the two constrictions between the hemispheric bulge and the poles. The maria of the chain, in general, are encircled by massive and, quite unusual for the moon, even precipitous mountains. It would appear that these maria fulfill, on a very large scale, the demands of Schroeter's Rule for craters; i. e., the adjacent mountains, planed down to the prevailing hemispheric level, would approximately fill the circular depressions. The great southern area of Oceanus Procellarum and of the contingent Mare Nubium and Mare Humorum, which show no departure from the prevailing level, might be likened to the "flooded," or "ruined" craters. Notwithstanding the large size of the area, these structures may be regarded as sporadic, or products of special conditions, whereas the chain of the depressed maria and the parallel bulge are products of global conditions. A more or less consistent continuation of the chain of maria on to the far side of the moon may well be expected.

The writer, of course, looked expectantly to the publication of the recent Russian photographs of the averted side. Those published so far (see discussion by Ernst Both, Sky & Telescope, Vol. XIX, No. 2, Dec., 1959, page 73), have been somewhat disappointing; perhaps we unjustifiably compare them with the excellent photographs of the visible side, taken at leisure, with the best equipment at hand. Comments are frequently heard about an unexpected scenic monotony, a scarcity of large areas of contrasting shades, or a relative lack of mare regions, expecially in the northern hemisphere. Large dark areas, however, do exist near the southern limb, the continuation of Mare Australe, and the newly discovered large Sea of Dreams. This region, unfortunately, is severely foreshortened. Tentatively the newly discovered dark areas may be regarded as a continuation of the oblique chain of maria; the new photographs do not conflict with expectations but, vaguely so far, support them. We must await a more complete survey that will relate the still unexplored portion of the moon to the visible features on the eastern limb. A photograph of the far side centered approximately on the oblique equator suggested in this paper perhaps would reveal most clearly the major, and most easily recorded, features.

The writer disregarded some obvious and far reaching implications of his findings, hoping to confirm these first by further topographic analysis, espcially of the region near the limb. Pending the completion of such work, a brief preliminary discussion may be permitted on the assumption that the newly discovered hemispheric profile is global in extent.

It is found that the moon deviates appreciably from a sphere, and that it has a complex, nonetheless symmetrical figure. Positive, not negative, deviations are the most easily comprehended. The figure might be compared to a rotund lemon with a distinct equatorial bulge. The axis lies oblique in relation to the conventional axis and to the line of sight to the moon.

From its aspects of symmetry one may infer that the figure of the moon was the product of a dynamic equilibrium, of fluctuating forces capable of inducing great tidal changes on a responsive, or still plastic, surface. It is now a petrified figure that does not directly respond to present equilibrium demands on the moon, but can only complicate the balance. It speaks of far-off foreign influences that shaped it. One may assume that at a critical stage in its history before complete solidification, the moon was dominated by a body different from and superior to the earth, in all probability the sun. Partnership with our own planet came later. Moon and earth should be regarded as companion planets, which is not a new idea.

The two symmetrical constrictions of the moon's kryptic figure, the negative deviation from sphericity of the chain of maria, and the apparent displacement of the chain from an equatorial circle--these are extremely interesting features that can be related to the steps of the process of surface solidification. It is a complex process, and explanations must be deferred.

AN OCCULTATION OF BD-21°5359 BY SATURN ON APRIL 30-MAY 1, 1960

By: Thomas A. Cragg

The star BD-21°5359 (magnitude 9.0) will be occulted by Saturn on April 30-May 1, 1960 (UT). Since Saturn is so close to its stationary point, accurate prediction for the timing of the various critical aspects is impossible. The critical times, as well as they can be ascertained, are as follows:

Star at outer edge of Ring A (ingress)	April 30	04^h (UT)
Star in Cassini's Division (ingress)	30	07
Star at limb of Saturn (ingress)	30	15
Conjunction, Star and Saturn	May 1	$01^h\ 11^m$
Star at limb of Saturn (egress)	1	11
Star in Cassini's Division (egress)	1	15+
Star at outer edge of Ring A (egress)	1	18

Since it is obvious that one observer in one location cannot possibly observe the whole occultation, a "team effort" for a widely scattered group, like the A.L.P.O., is required if any appreciable accomplishments are to be expected.

Figure 34 is a diagram illustrating the orientation of the planet and the apparent path of the star through the Saturnian system. The parallax has not been considered in the diagram since it would be quite different for various observers in different locations. The horizontal parallax of Saturn at the time of the occultation is about 1" of arc.

From past occultations observed there are a few points which observers should be aware of when working on this one.

1. A 9th magnitude star is very hard to see very near the rings. In fact, even an 8th magnitude star cannot be seen in Ring B, except where it might fall on a division, in a 12-inch telescope.

2. Timing any event observed is MOST important. In this case, since Saturn is moving only 1" of arc per hour, timing to the nearest 6 minutes will give positions to 0".1 of arc, while timing to the nearest half minute will yield 0".01 of arc accuracy for positions.

3. Of particular interest are any brightenings of the star seen when it is behind the ring system.

4. Observations should begin several hours ahead of time and should continue for several hours after egress to allow for errors in the predicted times, and to look for evidence of Ring D.

Some elaboration on a few of these points is probably in order. First, the timing should be as good as the observer can make it. WWV time signals are of course best. Of great importance is the timing of two events of some easily measureable points, such as ingress upon Ring A and ingress on the ball. Perhaps Cassini's Division can be used for one of the two reference time events. This procedure is very important since subsequent timing of any other event can then be tied in with the known positions of easily measured details. Secondly, a tape record (preferably with WWV time signals superposed) of the observer's comments is certainly the easiest way to record particular events of interest as they are seen. This makes it possible for the observer to have a complete record of everything that went on without having to leave the eyepiece, especially when something of interest is happening.

In looking for evidence of Ring D one must be extremely careful with the varying brightness of the star as the rings approach. Figure 35 shows how the apparent brightness of the star would appear with and without Ring D.

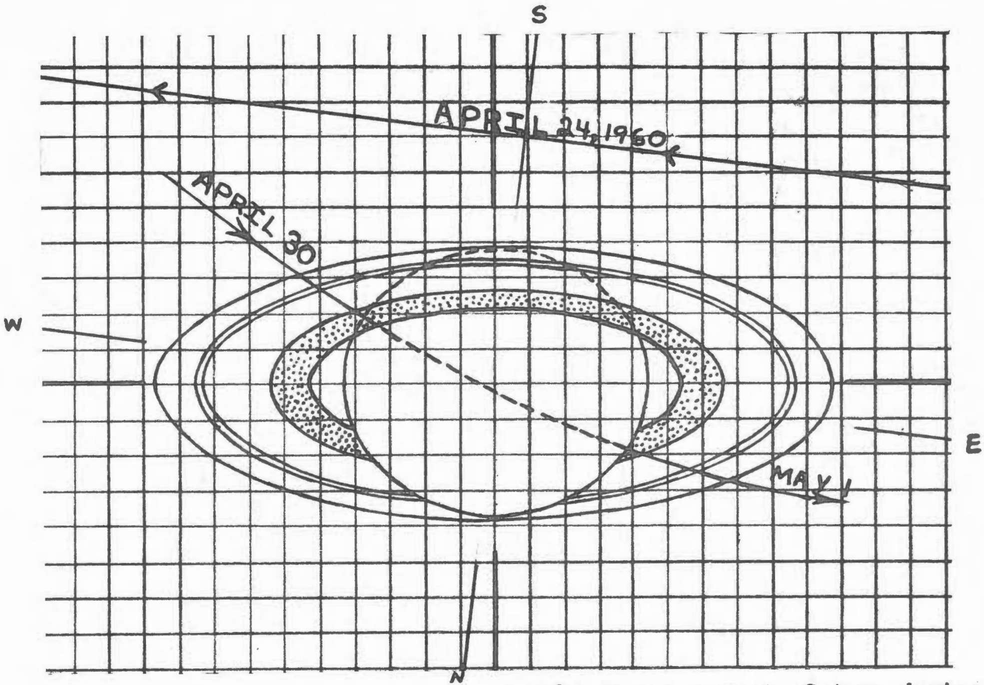

FIGURE 34. Chart of path of BD-21°5359 relative to Saturn during its occultation on April 30-May 1, 1960. Upper line shows relative path of star near earlier conjunction on April 24, 1960. Arrow shows direction of motion. Chart contributed by Mr. Thomas A. Cragg. See also text of Mr. Cragg's article. Scale: 1 square = 2 seconds of arc.

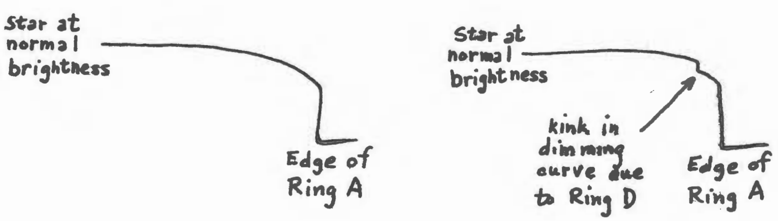

FIGURE 35. Apparent light-curves of star as Saturn's rings approach.
Left figure. No ring exterior to Ring A. A gradual dimming before drop in light at outer edge Ring A.
Right figure. An outer dusky ring, Ring D, exists adjacent to Ring A. A decrease in light of star at outer edge Ring D before it reaches outer edge Ring A.

As a sort of preview, this star will be about 6" of arc south of Saturn on April 24, 1960 at $01^h\ 57^m$ (UT). It will still be far enough away so as not to be too seriously affected by the proximity of Saturn--at least not nearly so much as it will be when very close. It may be of interest to see how Saturn's moons compare in brightness with the star on the 24th since it will be passing through a number of their orbits.

As a further warning, by all means make every effort to obtain the use of the largest telescope available as this star will be very tough to see with even a 12-inch instrument.

Postscript by Editor. I can only underscore Mr. Cragg's appeal to those who can use telescopes 12 inches in aperture and more to make every effort to observe this occultation. It must be stressed again that accurate timing is important. The cooperation of A.L.P.O. members scattered over the whole world is essential in order to obtain as complete a picture as possible of the whole phenomenon, in particular to have a thorough search for the lesser divisions in the rings. Since the observable part of the phenomenon in the United States will occur on a Saturday morning (April 30) and a Sunday morning (May 1), it can be watched with less inconvenience for most people than if it were in the middle of the week.

OBSERVATIONS AND COMMENTS

Capuanus. We invite the attention of readers to Figure 36, a lunar drawing by Mr. Clark Chapman of Buffalo, New York. As usual, colongitude is the lunar eastern longitude of the sunrise terminator and has approximate values of 0° at First Quarter, 90° at Full Moon, 180° at Last Quarter, and 270° at New Moon. Capuanus is located on Section VII of the Wilkins map of the moon, on the south shore of the Mare Nubium. Mr. Chapman regards his sketch as an accurate representation of the features for shape, position, and shading; but the inferior seeing concealed the finest detail. Note the six low, rounded domes, five on the floor and one outside. These domes are not new "discoveries," though observers disagree considerably on their numbers and positions; but their existence was not known to the observer when he made his drawing.

Linné. Mr. Frank Vaughn of Madison, Wisconsin, supplies the folowing notes about this ever-interesting feature and its morning shadow: "On January 24, 1956, I made this observation with a 10-inch reflector at colongitude 45°.9 in fair to good seeing. 'At intervals a somewhat crescentic shadow stands out beautifully, despite the high solar lighting. The east inner wall is brilliant, and its outline is clearly seen at intervals.

"On April 23, 1956, I made these notes with a 10-inch reflector, see also Figure 37. 'There is a definite though very narrow (N.-S.) shadow from the high west wall of the craterlet. Noon on Linné is only about 32 hours away so that this peak must be nearly vertical on the east side, as I have suspected before.

"I have observed Linné many times since 1940 under fair to excellent conditions. The craterlet seems to me to consist of a very small depression (about 1.5 miles diameter) with a steep, clifflike west promontory, the whole situated within a larger shallow crater (about 4 miles in diameter). The above details in general can be seen under good conditions in a telescope of moderate size, perhaps 6 inches of aperture or above. Needless to say, the high-sun west wall shadow requires considerable magnification.

"Some earlier observers have seen Linné when very near the sunrise terminator as a low mound with a small craterlet centered on it. I believe this may well be a misidentification with craterlet B (Goodacre-Wilkins) which is well positioned on the Goodacre 1931 chart, but poorly on Wilkins' large map. This mounded craterlet lies near Linné to the northwest and is a much more conspicuous object than Linné itself at this colongitude, which shows itself merely by the tiny shadow of the high portion (remnant?) of the west wall. See Figure 38. One has in fact to do a little work to be sure of identification at this time. A few hours later the characteristic white spot is visible, and identification easy. The approximate scale of miles on Figure 38 will indicate the delicacy of the object thus close to the morning terminator."

The Editor can confirm that the morning shadow in the west part of the Linné craterlet remains visible under surprisingly high solar illumination. The latest colongitude at which he ever saw it was 59°.0 on

FIGURE 36. Lunar Crater Capuanus.
Clark Chapman. 10-inch reflector. 260X.
November 11, 1959. $1^h\ 30^m$, U.T.
Seeing 1-4, usually near 4, on a scale of 0 to 10.
Transparency 3 on a scale of 0 to 5.
Colongitude = 35°6.

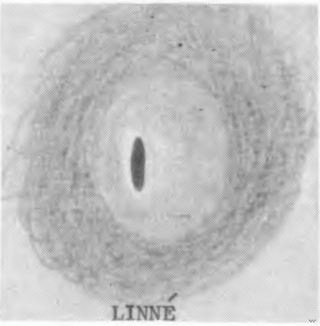

FIGURE 37. Lunar Crater Linné.
Frank R. Vaughn. 10-in. reflector.
350X. April 23, 1956. $4^h\ 40^m$, U.T.
Seeing 4-6. Transparency 3.5.
Colongitude = 62°4.

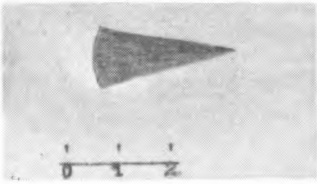

FIGURE 38. Lunar Crater Linné.
Frank R. Vaughn.
8-inch reflector. 500X.
February 4, 1960. $1^h\ 0^m$, U.T.
Seeing 4-8.
Colongitude = 349°1.

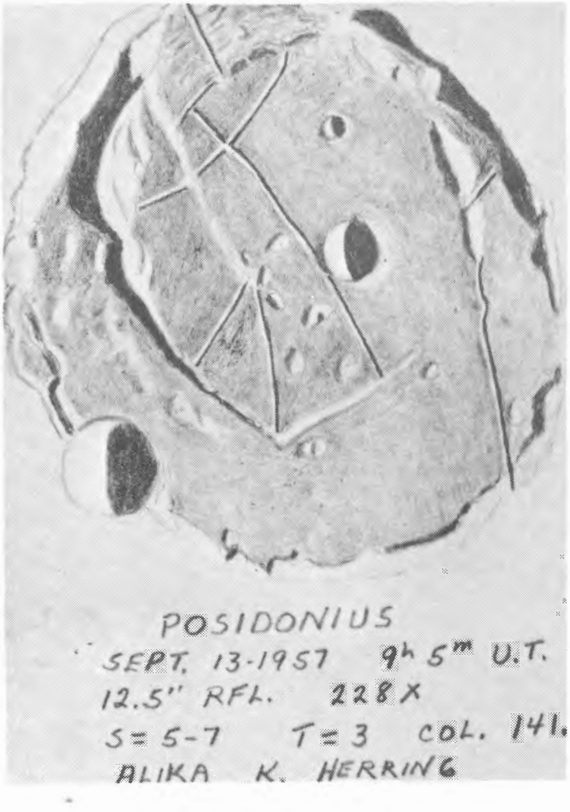

FIGURE 39.

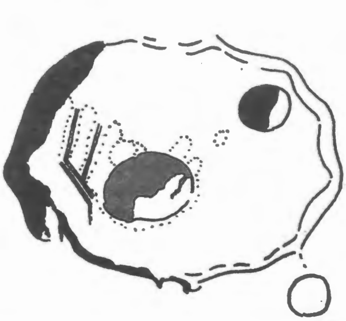

FIGURE 40. Lunar Crater Cassini.
Ernst E. Both.
January 6, 1960. $23^h\ 15^m$, U.T.
8-inch refr. 175X, 375X, 500X.
Observing conditions very favorable.* Colongitude = 7°7.
Drawing incomplete, intended chiefly to show clefts west and south of Cassini A.

June 26, 1942, using an 18-inch refractor in good seeing. The Editor, however, in this observation and some others with the 18-inch refractor subsequent to colongitude 41° did not feel entirely certain that the apparent shadow was black enough to be genuine shadow.

Solar Eclipse of October 2, 1959. Several of our members saw this phenomenon as a partial eclipse. Carlos E. Rost at Santurce, Puerto Rico, made a careful series of sketches over a period of almost an hour; and R. M. Baum at Chester, England, has made a drawing of the appearance at maximum eclipse for his station.

Posidonius. Mr. Alika Herring has contributed the drawing of this ring-plain here reproduced as Figure 39 and the following discussion:

"The appearance of lunar detail at any one time is largely dependent on the conditions of illumination which may prevail at the moment, and as a consequence may be greatly altered or modified by subsequent changes in angle or direction. For this reason it is sometimes unwise to form positive conclusions as to the exact nature of certain details which may be based on a single observation. A good example of why this is so may be found in the accompanying drawing of Posidonius. Attention is directed to the white streak which originates at the end of the ridge in the southern part of the floor and extends to near the center of the crater. At the time this drawing was made this feature appeared to me only as a white streak and nothing else, with no hint or indication of any possible elevation one way or another. Yet on a subsequent occasion, under a grazing angle of sunset illumination, I distinctly saw a low ridge which lay coincident with the position of this streak. To further compound the problem, the Wilkins map shows a cleft in the very same position!

"I have never seen this cleft so I cannot state just what relationship it may have with the ridge and/or the light streak. The true nature of the details in this area is therefore somewhat obscure, and further observations are obviously going to be necessary to clarify the situation. I would therefore be happy to hear from other observers who may in the future make observations that might contribute to a solution to the problem. Apertures of 8 inches or more would probably be necessary for the most effective results, and detailed sketches made therewith would be of the utmost value.

"The short cleft entering the interior from the south rim is 'new' to me in the sense that it is not shown on any of the lunar maps I have available. During a later observation, also made under low sunset illumination and exceptionally good seeing conditions, I was able to resolve this cleft into a chain of very minute craterlets."

Clefts in Cassini. Dr. Ernst E. Both has contributed the following notes, which should be read in conjunction with Figure 40 on page 61: "In 1958 Alika K. Herring drew attention to two 'conspicuous clefts lying west and south' of Cassini A, and he indicated the apparent lack of references to these clefts in the standard literature (The Strolling Astronomer, vol. 12, nos. 10-12, Oct.-Dec., 1958, cover picture and pp. 154-155). On January 6, 1960, while mapping some detail east of Triesnecker, I chanced to look at Cassini and was immediately aware of the clefts mentioned and drawn by Herring. At that time I vaguely remembered Herring's observations; and I observed, therefore, the ring-plain very carefully for about 30 minutes. After I was satisfied with what I had seen, I made the sketch published here, observing conditions having been very favorable that night: seeing 2-3, transparency 2 (on a scale of 1-5, with 1 representing very clear skies). In addition to the clefts shown by Herring, I also observed two connected with them but cutting through the ridges west of Cassini A in a N-S. direction. Unfortunately I had to leave the telescope and was not able to make a 'finished' drawing.

"Later that night I looked up Herring's drawing and notes, and also searched through the literature available to me, with the following results: Herring's more northerly cleft is shown on a drawing by G. P. B. Hallowes, dated March 23, 1915 (7th Lunar Report, B.A.A. Memoirs, vol. 20, pt. 3, 1916,

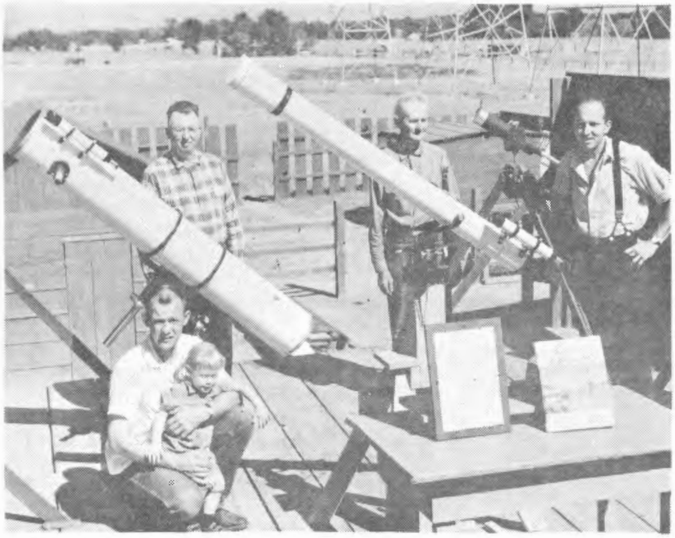

FIGURE 41. Mount Lassen, California Amateur Astronomers at Red Bluff, California. Left to right: Art Goodwin and small daughter; Myral Peterson, president; Fred Wyburn, secretary; and Robert Minch. Telescopes are 3-inch refractor (right), 4-inch Unitron refractor (center), and 8-inch Vaughn reflector (left). There are 27 members altogether.

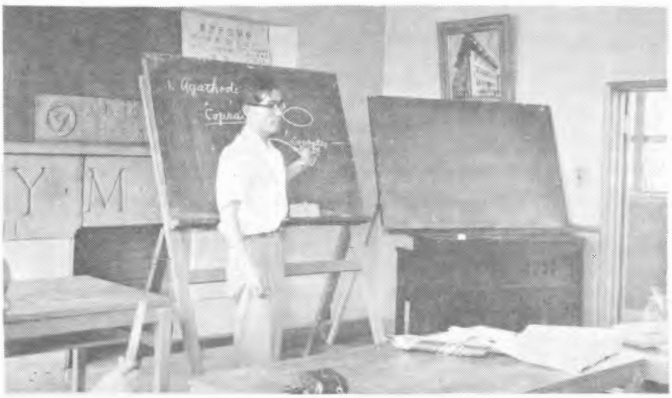

FIGURE 42. Tsuneo Saheki delivering paper on Martian nomenclature to meeting of Oriental Astronomical Association at Kobe, Japan, on August 23, 1959. Mr. Saheki is Director of the Mars Section of the O.A.A. Photograph by Takeshi Sato.

FIGURE 43. Takeshi Sato speaking about Jupiter to meeting of Oriental Astronomical Association at Kobe, Japan, on August 23, 1959. Photograph by a friend of Mr. Sato's.

plate VII), while the clefts running N.-S. seem to have been observed by J. N. Krieger in 1898. The latter observation is mentioned by Koenig in his edition of Krieger's work: 'Two of these valleys [i.e. the valleys running N.-S. between the ridges west of Cassini A], that between 19 and 20, and that situated between 20 and 21 [the numbers evidently refer to the ridges mentioned] appeared on January 12, 1898, as deeply cut by clefts, which were parallel to one another and were bent in the same direction in the center of their short course' (R. Koenig, ed., JOH. NEP. KRIEGERS MONDATLAS, vol. I, 1912, p. 363). Unfortunately Koenig did not publish the drawing he mentions so that it is difficult to decide whether the bend refers to Herring's clefts.

"The story of the Cassini clefts indicates two very real needs of observational selenography: (1) the great importance of confirmatory observations, and (2) the need for an extensive and critical bibliography of lunar features (on the latter the remarks of Dr. J. Ashbrook in Sky & Telescope, vol. XV, no. 6, April, 1956, p. 265, ought to be read with care)."

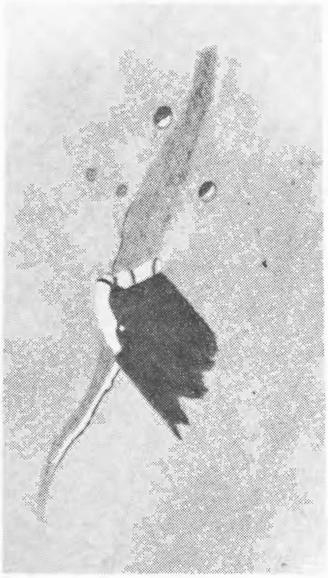

FIGURE 44: Lunar Mountain Piton.
Leif J. Robinson.
10-inch refl. 420X.
March 6, 1960. $4^h 45^m$, U.T.
Seeing 4-6. Transparency 3 (variable cirrus).
Colongitude = 8°.2.

Piton. Mr. Leif J. Robinson of Torrance, California, has contributed the drawing of this mountain here published as Figure 44. Piton lies near the northwest shore of Mare Imbrium and is on Section XV of the Wilkins map of the moon. Mr. Robinson remarks: "Wilkins states in his book The Moon that Martz believed he saw a bright streak running from the north base of the mountain. In seeing 6 on the usual scale and with fair transparency this streak was found to be a very fine cleft. It was very easy to observe even when the seeing became as poor as 4, but I doubt that it would remain visible for much more than one or two hours--the shadow in this cleft was a mere hairline and almost like the Martian 'canals.'" We invite our readers to try to confirm this feature; a moderate aperture of 8 inches or more and good seeing will presumably be necessary.

Total Lunar Eclipse on March 13, 1960. We invite attention to the two photographs of this event by Mr. Carlos E. Rost on the front outside cover. They are among the best prints of several dozen exposures made by Mr. Rost during the eclipse. Bad weather was evidently widespread in the United States on March 13; and we have received only about a dozen observational reports, many of them lists of umbral contact times with small telescopes. These reports will be discussed in a future issue.

Impact of Lunik II on September 13, 1959. We have several times in recent issues spoken of apparent observations or attempted observations of the impact of Lunik II on the lunar surface on Sept. 13, 1959. The best evidence for an actual observation of this impact known to us is the remarkably concordant and quite independent observations by Wilkins and Moore, p. 32 of our Jan.-Feb., 1960, issue. On Jan. 24, 1960, Mr. John D. Bestwick, the Secretary of the Lunar Section of the British Astronomical Association, wrote in part as follows: "We had a few dubious lunar impact sightings, but nothing really certain apart from the ones by Wilkins and Moore. I was observing at the time, but I cannot say that I saw a flash; I suspect that I found the remains of an impact cloud. Several other people seem to have seen a cloud; but they disagree as to the exact spot, within a few hundred miles or so!" Mr. Bestwick's telescope was presumably a 12-inch reflector. Lunar Missile Survey observers should note the great difficulty of seeing such impacts on the sunlit moon with even 12 inches of aperture.

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