The ASSOCIATION OF LUNAR AND PLANETARY OBSERVERS

The Strolling Astronomer

Volume 14, Numbers 5-6

May-June, 1960

Published May, 1960

Drawing of lunar formation Ruemker by Alika K. Herring with 12.5-inch reflector at 325X on March 11, 1960, at 4 hrs., 45 mins., Universal Time. Seeing 4-5 (fair) and transparency 4 (clear). Colongitude 69.0 degrees. Refer to discussion by Mr. Herring on pages 95-96 of this issue.

THE STROLLING ASTRONOMER

Pan American College Observatory
Edinburg, Texas

IN THIS ISSUE

ANNOUNCEMENTS .... Page 65

THE 1958-59 APPARITION OF JUPITER, FINAL REPORT .... Page 66

AN ANALYSIS OF DR. LUGO'S "THE CAPTURE OF THE MOON" .... Page 80

CONCERNING THE METHODS AND GOALS OF THE A.L.P.O. .... Page 81

PROJECT PERSEIDS .... Page 83

JUPITER, SOLAR INDUCED CHANGES .... Page 84

AN AMATEUR IN A PROFESSIONAL ECLIPSE EXPEDITION .... Page 85

A GEOLOGICAL INTERPRETATION OF THE LUNAR SURFACE .... Page 88

BOOK REVIEWS .... Page 93

OBSERVATIONS AND COMMENTS .... Page 95

ANNOUNCEMENTS

Insert in March-April, 1960, Issue. The insert from the Optical Society of America mentioned on page 33 of our March-April, 1960, issue as being mailed out with that issue was not, through no fault of our own, sent to all our members. The number of inserts on hand for mailing was less than the number requested and less than the number which we were informed that we had received. It is suggested that interested A.L.P.O. members might write directly to Patricia R. Wakeling, Optical Society of America, Executive Office, 1155 Sixteenth Street, N.W., Washington 6, D.C. The subject of the insert was the availability of an English translation of the Russian scientific journal Optics and Spectroscopy (in Russian Optika i Spekstroscopiya).

Astronomical League National Convention and Seventh Convention of the A.L.P.O. The Astronomical League will hold its next National Convention at Haverford College, Pennsylvania, on September 3-5, 1960. Part of the program will consist of the Seventh Convention of the Association of Lunar and Planetary Observers at 9:00 A.M.-12:00 noon on September 5 (Labor Day Monday). Mr. Edwin F. Bailey, Franklin Institute, Philadelphia 3, Pennsylvania is the General Chairman for this Convention. Rooms will be available in the College Dormitories. Sessions for papers include a General Session, a Junior Session, and an Instrument Session. On Sunday, September 4, there will be a daylong bus tour of the Franklin Institute, the Edmund Scientific Laboratory, the Spitz Laboratories, and the Sproul Observatory. Several nearby observatories will hold open house on Saturday evening, September 3; and the final event will be the Honor Dinner on Monday evening. Registration will be $1.00 before August 15, then $1.50; checks should be made out to "General Convention Astronomical League," c/o Franklin Institute, Philadelphia 3, Pennsylvania.

We need papers soon for our A.L.P.O. program; and qualified members are urged to contribute. Should such a choice be necessary, preference will be given to papers by authors who are present. We also need material for our A.L.P.O. Exhibit. Please look over your records and select some suitable drawings, photographs, or charts; and mail them to David Meisel, 800-8th Street, Fairmont, West Virginia. Mr. Meisel will return such material to the contributors after the Convention. The Editor looks forward eagerly to meeting many of you at Haverford!

Southwest Regional Convention of the Astronomical League. This meeting will be held at Fort Worth, Texas, on June 10 and 11, 1960. The Fort Worth Astronomical Society, the Junior Astronomers of the Fort Worth Children's Museum, and the Astronomical Society of the Convair Recreational Association are joint hosts. A visit to the Convair Group's 19-inch reflector is planned for the night of Friday, June 10. Further information may be obtained from Dr. Herman C. Sehested, 815 Medical Arts Building, Fort Worth 2, Texas.

New Jupiter Recorder. The new Jupiter Recorder of the Association of Lunar and Planetary Observers is:

Philip R. Glaser
400 E. Park Ave.
Menomonee Falls, Wisc.

All current data on the Giant Planet should be mailed at regular intervals to Mr. Glaser at the above address. He also wishes to correspond with beginning observers desirous of initiating serious studies of Jupiter, and we are especially anxious to cooperate with individuals and groups carrying on such work in foreign countries in order to make our joint overall efforts on Jupiter more effective. Mr. Glaser's name will already be known to many readers of this periodical.

We most sincerely thank Mr. Phillip W. Budine for the very good work he did for the A.L.P.O. while he served as Jupiter Recorder. Mr. Budine initiated the use of observing-forms for the Jupiter Section, systematized the filing of the present and past records, published a number of worthy papers in The Strolling Astronomer, and carried on an intensive correspondence with a large number of observers and potential observers. The Jupiter Section can advance now as others build on the foundation which Mr. Budine so ably and unselfishly helped to make.

THE 1958-59 APPARITION OF JUPITER, FINAL REPORT

By: Phillip W. Budine

I. Introduction

The Observations. This final report on the 1958-59 apparition is based on observations submitted by 46 members of the A.L.P.O. Jupiter Section from December 10, 1958 to October 11, 1959. A total of 745 drawings of Jupiter's disc was received, as well as 206 pages of data about Jupiter and 142 pages of correspondence concerning Jupiter.

The Observers. The cooperating observers are as follows (d--drawings, t--transits):

Bartlett, Dr. James C., Jr., Baltimore, Maryland, 4½-in. refl., 5-in. refl., 5d., 6t.
Budine, Phillip W., Binghamton, New York, 2.4-in. refr., 4-in. refr., 25d., 30t.
Bukowski, James, Oxnard, California, 4-in. refl., 7d.
Chapman, Clark, Buffalo, New York, 10-in. refl., 6d.
Colburn, James, Oxnard, California, 4-in. refl., 20d.
Constanten, Tom C., Las Vegas, Nevada, 3-in. refl., 3½-in. refr., 42d., 141t.
Cooper, John, Edmonds, Washington, 4-in. refl., 17d.
Cruikshank, Dale P., Des Moines, Iowa, 8¼-in. refr. (Drake University Municipal Observatory), 40-in. refr. (Yerkes Observatory), 23d., 167t.
Doucet, René, Quebec, Canada, 5-in. refr., 16d.
Eastman, Jack, Manhattan Beach, California, 12½-in. refl., 15d., 54t.
Gaherty, Geoffrey, Quebec, Canada (Royal Astronomical Society of Canada), 8-in. refl., 4d., 149t.
Emig, Stuart and Stanley, Leavenworth, Washington, 3-in. refr., 8-in. refl., 10-in. refl., 20-in. refr., 29d.
Epstein, Eugene, Hollywood, California, 10-in. refl., 7t.
Glaser, Philip, Menomonee Falls, Wisconsin, 8-in. refl., 9d., 13t.
Goodman, Joel W., Brooklyn, New York, 8-in. refl., 2d.
Hartmann, William K., New Kensington, Pennsylvania, 8-in. refl., 13-in. refr., 31-in. refl., 18d., 61t.
Herring, Alika K., Anaheim, California, 12½-in. refl., 15d., 227t.
Jensen, Carlos M. Salt Lake City, Utah, 3¼-in. refr., 12d.
Johnson, Craig L., Boulder, Colorado, 4-in. refl., 8d., 1t.
Kaminski, Walter, New Berlin, Wisconsin (Milwaukee Astronomical Society), 13-in. refl., 5t.
Krohley, Tom, Huntington Station, New York, 6-in. refl., 1d.
Luecke, Rich, Chicago Heights, Illinois, 6-in. refl., 11d.
Lyle, Virginia, Pittsburgh, Pennsylvania, 4-in. refl., 23d.
McIntosh, Patrick S., Robinson, Illinois, 8-in. refl., 25d., 48t.
Meisel, David D., Fairmont, West Virginia, 8-in. refl., 8d.
Miller, Robert K., Freeland, Washington, 6-in. refl., 10-in. refl., 6d.
Mourao, Ronaldo Rogerio de Freitas, Rio de Janeiro, Brazil, 18-in. refr., 10d.
Newman, J. E., Roanoke, Virginia, 6-in. refr., 7d., 22 photographs.
Palmroos, Franklin, Binghamton, New York, 2.4-in. refr., 13d.
Pepernik, John L., Binghamton, New York, 2.4-in. refr., 18d.
Provine, Robert R., Tulsa, Oklahoma, 8-in. refl., 15d.
Quinn, Tom, Los Angeles, California, 8-in. refl., 2d.
Ranck, Owen C., Milton, Pennsylvania, 4-in. refr., 6d.
Reese, Elmer J., Uniontown, Pennsylvania, 6-in. refl., 3d., 521t.
Rost, Carlos E., Santurce, Puerto Rico, 6-in. refl., 56d., 192 photographs of Jupiter's satellites. Total observations are 248.
Sato, Takeshi, Hiroshima, Japan, 3-in. refl., 6-in. refl., 71d.

Smith, J. Russell, Eagle Pass, Texas, 8-in. refl., 16-in. refl., 7d., 6t.
Starbird, James, Topeka, Kansas, 6-in. refl., 40d.
Suler, Frank J., Richmond, Texas, 8-in. refl., 1d.
Sullivan, Joseph W., Jr., Binghamton, New York, 3-in. refr., 4-in. refr., 5d.
Vitous, Joseph P., Berwyn, Illinois, 8-in. refl., 40d.
Ward, William M., Houston, Texas, $4\frac{1}{4}$-in. refl., 22d.
Wegner, Gary, Bothell, Washington, 4-in. refl., 10-in. refl., 62d.
Wend, R. E., Milwaukee, Wisconsin, 13-in. refl., 1d., 3t.
Wurgel, René A., Union City, New Jersey, 3.5-in. refl., 1t.
Zuzze, Stephen, Fresh Meadows, New York (Observations submitted by W. Glenn, Chairman of the Observing Group of the Amateur Astronomers Association of New York), 6-in. refl., 8-in. refl., 19d.

II. Description

Polar Regions: During the apparition the NPR was usually recorded to be darker than the SPR. However, during August the SPR was sometimes recorded as darker than the NPR. Hartmann reported this aspect for August 20th. The polar regions were mostly a dusky grey in color, but blue tints were recorded in the NPR occasionally.

S. S. S. Temperate Belt: A thin faint belt located near the center of the SPR. During the early part of the apparition it was very faint. In June it was reported double by a few observers (Figure 8). Most observers recorded it to be darker during August.

S. S. Temperate Belt: This belt was seen bordering the SPR. The most outstanding marking observed in this belt was a bright white spot first seen on April 23rd by Eastman and Sato at 111° (II). This marking was also recorded on May 27th by Reese, on June 3rd by Herring, on June 8th and July 23rd by Cruikshank and Herring, on July 16th by J. R. Smith, on July 26th by Cruikshank, and on August 4th by Herring. Many dark spots were recorded in this belt by some observers. In June the white spot described above was located at 62° (II). On June 9th Budine noted several prominent dark spots in the S.S.T.B., but they were rather short-lived features and were not seen after this date. On July 25th Eastman observed this belt to be double. On August 5th the belt was very prominent to Pepernik, who employed a small telescope. Sato, who had been observing the belt quite regularly, remarked about its disappearance on August 14th. However, Miller observed the belt again on August 30th and also noted a festoon running from this belt across the STeZ and connecting to the STB. Typical views of the bright white spot in the SSTB may be seen in Figures 13 and 14. The double appearance of the SSTB may be noted in Figures 4, 6, and 8.

S. Temperate Belt: Recorded as the third most conspicuous belt on the planet. The outstanding feature of this belt was the appearance of a white rift in the middle of the STB. This bright rift was formed between the long enduring bright sections FA and BC, when these two bright areas were separated by only 18° of longitude on May 18, 1959, the date of opposition. During July the rift was seen near 230° (II) and during August near 232° (II). However on July 3rd Eastman found the bright rift at 259° (II). The rift was seen in May by Mourao, in June by Cruikshank and Vitous, and in July by Vitous. It was located at 283° (II) in May, 270° (II) in June, and 230° (II) in July. For some good views of the white rift in the STB see Figures 5, 7, 8, 11, 9, and 18.

The STB was observed double by several observers on many occasions. Eastman saw it double on April 12th, May 25th, July 1st, July 6th, July 20th, and July 25, 1959. Mourao observed a double STB on May 6th. Eastman saw a double STB on May 25th, and Sato observed it double preceding the bright area DE on the same date. On June 5th Budine observed a broken STB. Also, on June 9th the STB was seen broken by Bartlett. On July 6th a prominent wide dark section was seen in the STB at 216° (II) by Bartlett. On July 6th Eastman observed a double STB preceding DE, and on July 7th Vitous saw a double STB. For some views of the double STB see Figures 3, 4, 6, and 13. On July 23rd Bartlett observed a festoon running from the STB to the SEB_n. Many dark areas and spots were observed in the STB by Budine, Sato, Constanten, and Hartmann. Note that when Herring saw the STB double, he observed the south component to be darker than the north component.

S. Equatorial Belt South: The SEB_s was very faint during the apparition. Many observers failed to record it at all; but a few observers recorded it regularly--Reese, Budine, McIntosh, and Bartlett. As evidence for the changing conspicuousness of the SEB_s, we might examine the observations made by Sato. Prior to January Sato observed the faint SEB_s; but on January 19th he commented on its disappearance, on April 8th it reappeared, on May 10th a dark elongated area was seen in the SEB_s, and on August 14th it disappeared again. On May 31st Herring observed a double SEB_s. He also saw it double on May 14th, see Figure 4. Mourao found it double on May 10th following the Red Spot Hollow, and Herring found it double again on June 2 (see Figures 3, 4, and 8).

S. Equatorial Belt North: The SEB_n was the second most prominent belt on the Giant Planet. A prominent dark oval positioned at an angle from north to south was observed in this belt on March 10th by Sato. During June Bartlett found a long dark section in the SEB_n near 283° (II). Bright spots and dark spots were recorded in this belt occasionally.

N. Equatorial Belt: The most prominent belt on Jupiter during the entire apparition. It was usually recorded as double, but many observers saw it as a wide and dark single belt. There wasn't a day that went by without dark spot activity on the NEB_s; many festoons developed along the NEB_s and either terminated in the EB or else connected to the SEB_n. Some very bright white spots were recorded in the NEB_n. Sato observed a prominent white area in the NEB_n at 239° (II) on July 6th. Dark diagonal rods were seen in the NEB by Budine and McIntosh. Budine observed them on September 5th. A very prominent white gap was recorded in the NEB running diagonally from southwest to northeast at 126° (II) and was seen on June 9th by Bartlett, on June 12th by Provine, and on June 16th again by Bartlett. A dark area was seen during the apparition to project from the NEB_n into the NTrZ. This area was mistaken during most of the apparition for the "Barge" marking of 1958. Transits have proven that this feature is not the "Barge;" but is was a prominent marking seen in June by Cruikshank and Jensen, in August by Jensen, Pepernik, and Ranck, and in September by Constanten.

Equatorial Band: A faint E.B. was recorded by most observers; on some occasions it was not visible to some observers. On June 5th Bartlett saw a dark elongated area in the E.B. Hartmann on July 27th observed the E.B. to curve and to connect with a dark condensation in the NEB_s. On August 4th the E.B. was observed double by Bartlett.

N. Temperate Belt: This belt was extremely faint when visible. During most of the apparition it was not observed. It was recorded on a very few occasions by Budine, Bartlett, Ranck, Bukowski, Constanten, and Johnson. Sato found the NTB to be very prominent on October 8, 1959.

N.N. Temperate Belt: This belt was found bordering the NPR and was a dark, prominent belt. On July 20th Sato observed a dark projection from this belt into the NPR. Miller on August 6th saw the NNTB as a prominent belt, very wide with a dusky section.

N.N.N. Temperate Belt: This belt was recorded by several observers, and it was seen in the middle of the NPR. Budine observed it on June 9th, Pepernik saw it on August 5th, and Budine recorded it again on September 5, 1959.

S. Temperate Zone: This zone was the second most conspicuous zone on Jupiter during the apparition, being a bright white color. The prominent long enduring bright sections of the STeZ were observed well during the apparition. Section DE was observed in May by Herring and Sato, in June by Cruikshank, Sato, Herring, and Vitous, in July by McIntosh, Smith, Vitous, Meisel, and Sato, in August by McIntosh, Smith, and Vitous, and in September by McIntosh and Sato. Section DE may be

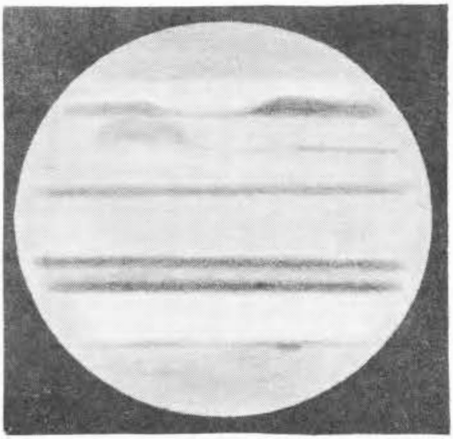

FIGURE 1. Jupiter.
Takeshi Sato.
6-inch refl. 192X.
March 14, 1959. $20^h\ 30^m$ U.T.
S = 3 T = 3.
$C.M._1 = 65°$. $C.M._2 = 349°$.

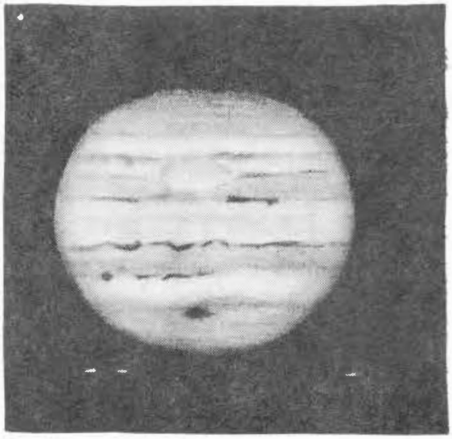

FIGURE 2. Jupiter.
R. R. de Freitas Mourao.
18-inch refr. 430X.
May 3, 1959. $1^h\ 30^m$ U.T.
S = 8 T = 3.
$C.M._1 = 70°$. $C.M._2 = 338°$.

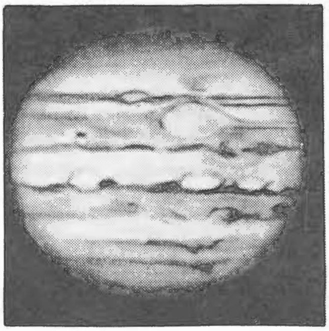

FIGURE 3. Jupiter.
R. R. de Freitas Mourao.
18-inch refr. 630X.
May 10, 1959. $1^h\ 40^m$ U.T.
S = 9 T = 4.
$C.M._1=103°$. $C.M._2=318°$.

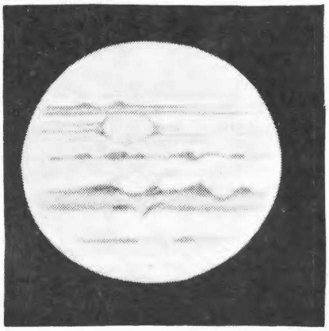

FIGURE 4. Jupiter.
Alika K. Herring.
12.5-inch refl. 236X.
May 14, 1959. $5^h\ 21^m$ U.T.
S = 4-6 T = 5.
$C.M._1=150°$. $C.M._2=333°$.

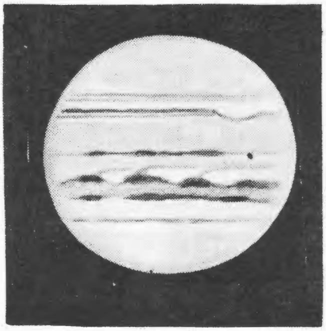

FIGURE 6. Jupiter.
Alika K. Herring.
12.5-in. refl. 236X.
May 15, 1959. $5^h\ 16^m$, U.T. S = 3-5 T = 5.
$C.M._1=305°$. $C.M._2=120°$.

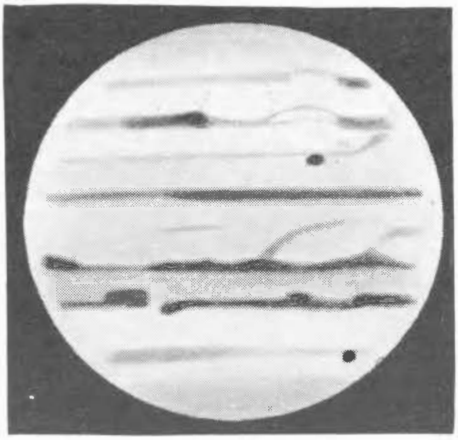

FIGURE 5. Jupiter.
Takeshi Sato.
6-inch refl. 192X.
May 14, 1959. $13^h\ 32^m$ U.T.
S = 5-6 T = 4.
$C.M._1 = 89°$. $C.M._2 = 269°$.

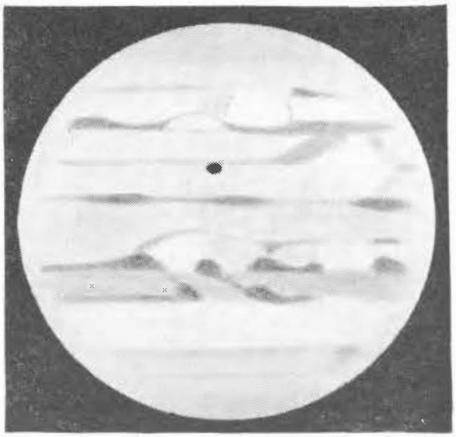

FIGURE 7. Jupiter.
Takeshi Sato.
6-inch refl. 192X.
May 19, 1959. $13^h\ 23^m$ U.T.
S = 3-5 T = 5.
$C.M._1 = 154°$. $C.M._2 = 296°$.

seen in Figures 13, 14, and 16. Section FA was observed in May by Herring and Sato, in June by Cruikshank and McIntosh, in July by Luecke, Mourao, and Vitous, and in August by Vitous and Suler. Section FA may be seen in Figures 1, 5; 7, 8, and 18. Section BC was observed in April by Budine, in May by Mourao and Herring, in June by Cruikshank, Vitous, McIntosh, and Sato, in July by McIntosh, Vitous, and Eastman, and in August by McIntosh. It may be seen in Figures 3, 4, 8, 10, 11, 18, and 24.

Section Fa and the RSH (Red Spot Hollow) were in conjunction on March 20th; and BC and the RSH were in conjunction on April 27, 1959.

A very dusky section was noted in this zone on September 26, 1959, by Stephen Zuzze. The dark area was located at 53° (II). This aspect indicates that toward the very end of the apparition the STeZ was fading.

S. Tropical Zone: This was a very dusky zone usually recorded as of a red color. On January 19th Sato commented that the STrZ, which had been a bright white zone, now was a very dusky zone. On April 28th Sato noted the change back to a white zone, and on May 1st the appearance as a dusky zone returned again. A very dusky section was reported in this zone by Hartmann on July 5th at 139° (II). Bartlett observed many large white ovals of material in the STrZ on August 16th. Near the end of the apparition, on October 8th, Sato reported the STrZ as bright again.

S. Equatorial Belt Zone: A highlight of the apparition was the appearance of a very dark condensation located just off the north edge of the SEB_s in the SEB Z. This spot was a prominent object and was recorded by many observers. It was first recorded by Mourao on May 5, 1959. Later in May it was observed by Goodman, Sato, and Bartlett, in June by Cruikshank, Hartmann, Gaherty, Herring, and Sato, in July by Cruikshank, Vitous, Gaherty, and Eastman, and in August by Vitous, Reese, and Budine. Many times the spot was seen embedded in a festoon running from the SEB_n to the SEB_s. Among observers recording this appearance were McIntosh, Cruikshank, Hartmann, Reese, and Budine. The SEB Z dark spot may be seen in Figures 3, 5, 7, 8, 11, 12, 23, and 24.

Equatorial Zone: Quite dusky during this apparition, but bright spots were noted by some observers in this zone. Much festoon activity was observed in the EZ. Usually the EZ was brighter north of the EB.

North Tropical Zone-North Temperate Zone: These zones were usually seen combined to form the most prominent zone on Jupiter. The area was a brilliant white. The absence of the NTB in most cases was the reason for this combined area.

III. Order of Decreasing Conspicuousness of the Belts

(1) NEB (2) SEB_n (3) STB (4) NNTB (5) SSTB (6) SEB_s (7) EB

(8) SSSTB (9) NNNTB (10) NTB.

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 148 estimates by Budine, 22 estimates by Bukowski, 80 estimates by Colburn, 204 estimates by Constanten, 176 estimates by Hartmann, and 218 estimates by Ward.

V. Red Spot and Hollow

During the very early part of the apparition, the Red Spot was seen as a faint, faded object located in the STrZ. On January 10th Johnson observed the preceding end of the RS at 307° (II). By January 27th the spot was very faint, and the appearance of a Hollow was developing; this Hollow was sen by Sato near the end of January. On March 14th

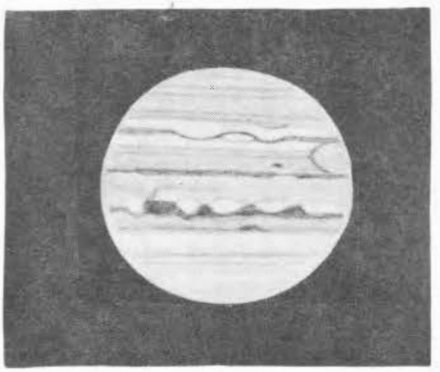

FIGURE 8. Jupiter.
Alika K. Herring.
12.5-inch refl. 236X.
June 2, 1959. 4^h 11^m U.T.
S = 4-7 T = 5.
C.M.$_1$ = 230°. C.M.$_2$ = 268°.

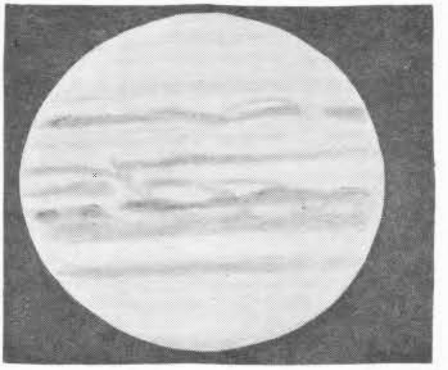

FIGURE 9. Jupiter.
David Meisel.
8-inch refl. 210X.
June 4, 1959. 4^h 55^m U.T.
S = 8 T = 4.
C.M.$_1$ = 212°. C.M.$_2$ = 235°.

FIGURE 10. Jupiter.
Geoffrey Gaherty, Jr.
8-inch refl. 180X, 240X.
June 5, 1959. 2^h 35^m U.T.
S = 2-3 T = 4.
C.M.$_1$ = 285°. C.M.$_2$ = 301°.

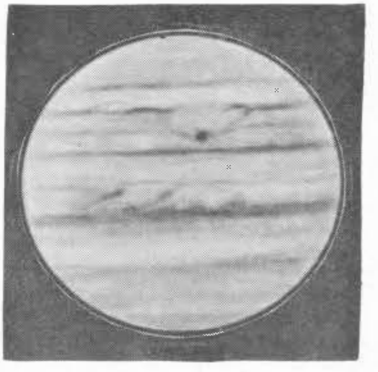

FIGURE 11. Jupiter.
Philip Glaser.
8-inch refl. 270X.
June 7, 1959. 3^h 38^m U.T.
S = 3-4 T = 4.
C.M.$_1$ = 279°. C.M.$_2$ = 279°.

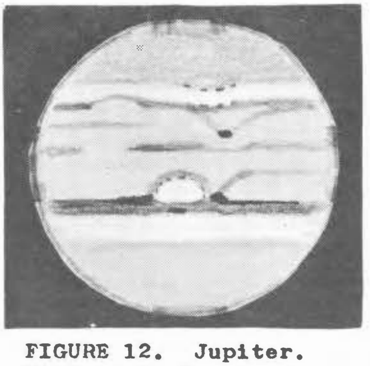

FIGURE 12. Jupiter.
William K. Hartmann.
8-inch refl. 214X, 250X.
June 7, 1959. 3^h 46^m U.T.
S = 5-8 T = 4-5.
C.M.$_1$ = 284°. C.M.$_2$ = 284°.

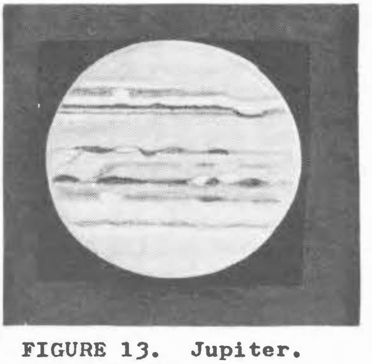

FIGURE 13. Jupiter.
Alika K. Herring.
12.5-inch refl. 236X.
June 8, 1959. 4^h 20^m U.T.
S = 3-5 T = 5.
C.M.$_1$ = 103°. C.M.$_2$ = 96°.

Sato observed the RSH and noted that the RS was partly visible. The RSH was in conjunction with STeZ section FA on March 20th; and on April 27, 1959, the RSH was in conjunction with BC. The SEB Z dark spot was preceding the RSH in June, being near 295° (II). Eastman had a good view of the RSH on July 27th. On July 28, 1959, Budine observed the RS to be partly visible, and he also noted two small bright areas in the northern section of the Hollow. McIntosh also noted bright areas in the Hollow on a few occasions. On August 21, 1959, he noted a bright area in the northwest portion of the Red Spot Hollow. The Red Spot Hollow was located during the apparition near 325° (II). By the end of the apparition the RS was completely gone, and a bright Hollow was observed. On October 11, 1959, Sato saw the Hollow and also observed the SEB Z dark spot to be located on the preceding shoulder of the Red Spot Hollow. The Red Spot Hollow was observed in January by Johnson and Sato, in March by Sato, in May by Cruikshank, Herring, and Mourao, in June by Gaherty, McIntosh, and Hartmann, in July by Budine, Epstein, Herring, McIntosh, Pepernik, and Jensen, in August by Vitous, Jensen, and McIntosh, in September by McIntosh, and in October by Sato.

The Red Spot may be seen on Figure 1; and the Red Spot Hollow may be seen on Figures 2, 3, 4, 7, 8, 10, 20, 21, and 24.

VI. Rotation Periods, 1959

[This Section of this paper is completely the work of Mr. Elmer J. Reese, the Assistant Jupiter Recorder. For a number of years Mr. Reese has reduced this very important portion of A.L.P.O. observational data and has published the results in this periodical.--Editor.]

Rotation periods of Jovian spots were derived in the usual way from visual central meridian transits. The longitudes obtained from the observed transit times are plotted on squared graph paper with the dates arranged vertically and the degrees of longitude horizontally. From an examination of these graphs, markings observed on successive dates can be identified and their drifts in longitude in 30 days established. The rotation periods corresponding to these drifts in longitude can be found with the aid of the conversion tables in appendix IV of B. M. Peek's The Planet Jupiter.

No major Disturbances were observed during the apparition and activity was about normal. Despite this lack of activity and the low altitude attained by Jupiter for observers located in north temperate latitudes, the apparition was very well observed and interesting results were obtained.

Seventeen observers contributed a total of 1,440 transits. Over fifty-two percent of these transits (751) formed usable drifts for 63 Jovian spots distributed in ten different currents. The great majority of the unused transits undoubtedly pertained to spots having a life span of less than 30 days.

We wish to extend special congratulations and thanks to Herring, Cruikshank, and Gaherty for their very substantial lists of transits, which form the foundation on which this report on rotation periods is based. It should be emphasized that quality is even more important than quantity when it comes to transit observations. Only objects definitely and distinctly seen should be used for transit work. A few erroneous or fictitious transit observations can be very confusing and detrimental when plotted on our longitude charts. With this in mind, we wish to congratulate such observers as Hartmann, Eastman, and McIntosh since over 90% of their transits were usable! Finally, we appreciate even a single transit observation since it may be the very one needed to strengthen a weak section of an otherwise good drift.

In the tables which follow, the first column gives an identifying number or letter to each object. The second column indicates whether the object was dark (D) or bright (W) and whether the preceding end (p),

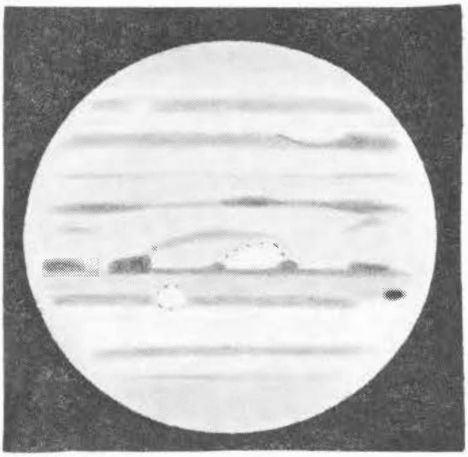

FIGURE 14. Jupiter.
Takeshi Sato.
6-inch refl. 192X.
June 25, 1959. 13^h 00^m U.T.
S = 4-5 T = 4
$C.M._1$ = 225°. $C.M._2$ = 85°.

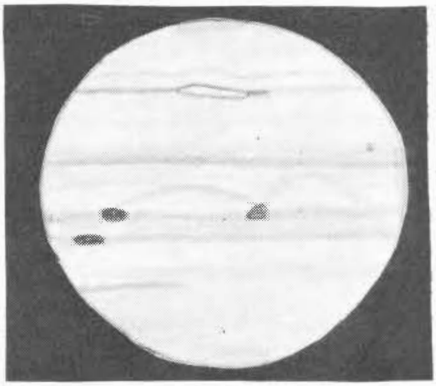

FIGURE 15. Jupiter.
Jack Eastman.
12.5-inch refl. 145X, 230X, 350X. July 3, 1959. 4^h 30^m U.T.
S = 6 T = 4.
$C.M._1$=97°. $C.M._2$=259°.

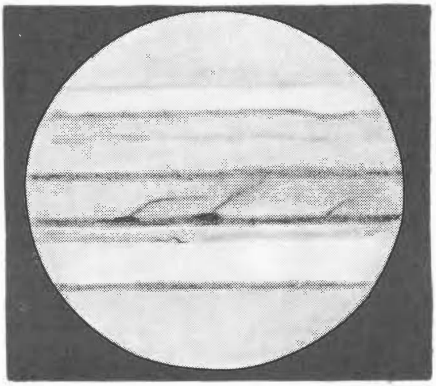

FIGURE 16. Jupiter.
J. Russell Smith.
8-inch refl. 180X, 192X.
July 7, 1959. 2^h 45^m U.T.
S = 4 T = 5.
$C.M._1$=304°. $C.M._2$=76°.

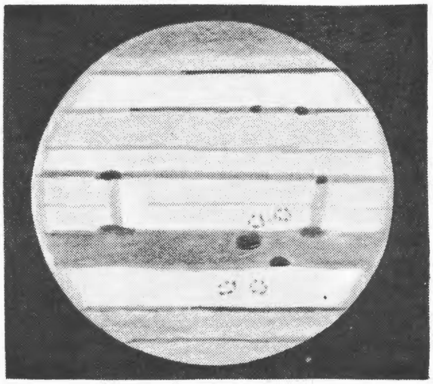

FIGURE 17. Jupiter.
Phillip W. Budine.
4-inch refr. 167X.
July 8, 1959. 2^h 00^m U.T.
S = 5 T = 4.
$C.M._1$=75°. $C.M._2$=200°.

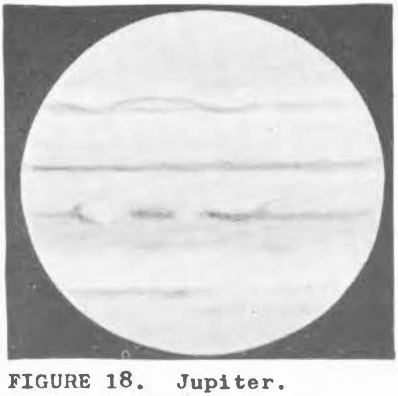

FIGURE 18. Jupiter.
Joseph P. Vitous.
8-inch refl. 162X, 209X.
July 18, 1959. 1^h 55^m U.T.
S = 4-5 T = 2-3.
$C.M._1$=211°. $C.M._2$=259°.

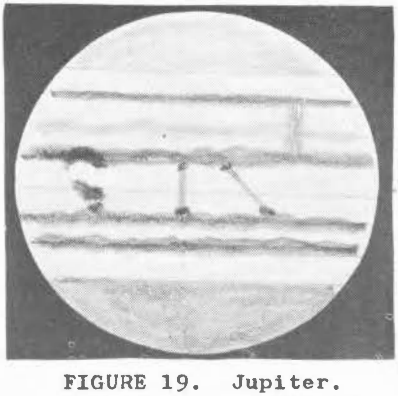

FIGURE 19. Jupiter.
James C. Bartlett, Jr.
5-inch refl. 110X, 180X.
July 23, 1959. 1^h 43^m U.T.
S = 5 T = 3.
$C.M._1$=272°. $C.M._2$=282°.

center (c), or following end (f) was being observed. The third column gives the first and last dates of observation; the fourth column, the longitudes on those dates. The fifth column gives the longitude at opposition, May 18, 1959. The seventh column indicates the number of degrees in longitude that the marking drifts in 30 days; the last column, the rotation period.

S. S. Temperate Current (SSTB), System II

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Wc	May 27-Aug.4	77° - 17°	--	11	$-26.^\circ1$	$9^h\ 55^m\ 5^s$

Several spots were observed from time to time near the latitude of the SSTB; however, only one object was observed often enough to yield a reliable rotation period. This small round spot apparently varied somewhat in latitude. On May 27 Reese found it in the southern part of the STeZ where it produced a small notch in the north edge of the SSTB. Herring, on June 3, also found the spot to be situated in the STeZ. On six occasions between June 8 and July 23, Cruikshank and Herring observed the white spot to lie directly on the SSTB. J. R. Smith described this feature as a notch in the north edge of the SPR shading on July 16. Cruikshank, using the 40-inch refractor on July 26, found the spot in the SSTeZ. The spot was back on the north edge of the SSTB on August 4, according to Herring. The drift line of this feature is very linear; hence the identification seems thoroughly reliable.

S. Temperate Current (S. edge STB, STeZ), System II

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
D	Wp	May 6-Aug. 29	150° - 67°	141°	21	$-21.^\circ7$	$9^h\ 55^m\ 11^s$
2	Wc	May 6-Aug. 29	160 - 76	151	19	-21.9	9 55 11
E	Wf	May 6-Sept. 8	170 - 78	161	24	-22.1	9 55 10
F	Wp	Apr. 22-Sept. 6	285 - 167	263	15	-25.8	9 55 05
5	Wc	Apr. 22-Aug. 25	294 - 185	271	7	-26.1	9 55 05
A	Wf	Apr. 22-Sept. 6	303 - 183	280	16	-26.4	9 55 05
B	Wp	May 2-Aug. 16	311 - 232	298	17	-22.4	9 55 10
8	Wc	Apr. 15-Aug. 16	334 - 243	307	15	-22.2	9 55 10
C	Wf	Mar. 24-Aug. 16	3 - 254	315	19	-22.6	9 55 10

Mean rotation period: $9^h\ 55^m\ 9^s$

The objects listed above pertain to the three long-enduring white areas in the northern part of the STeZ of which one, BC, has been under observation for 20 years. The overall length of each of these white areas is now only about 18°; however they remain fairly bright and well defined. Since early 1957 the rotation period of DE has been several seconds longer than that of FA, consequently the distance between these two features has been steadily diminishing.

Middle STB, System II

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Wc	June 1-July 27	274° - 230°	--	10	$-23.^\circ6$	$9^h\ 55^m\ 8^s$

This object was a short bright streak or rift which developed in the middle of the STB between the STeZ bright areas FA and BC, which were separated by only 18° of longitude on the date of opposition. It seems probable that the rift was under some physical influence of the bright areas in the STeZ. (It is interesting to recall that a similar bright rift developed in the middle of the STB between BC and DE when those

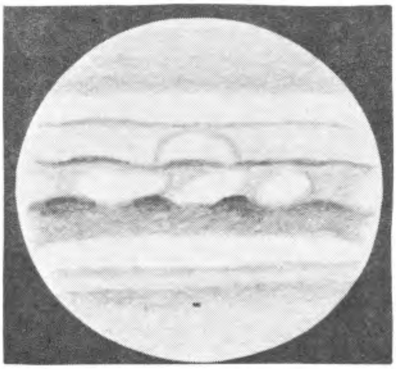

FIGURE 20. Jupiter.
Carlos M. Jensen.
3¼-inch refr. 96X.
July 23, 1959. 3^h 00^m U.T.
S = 5 T = 3.
C.M.$_1$=319°. C.M.$_2$=329°.

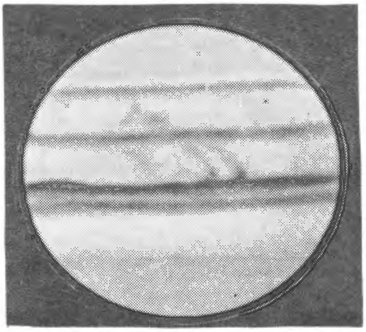

FIGURE 21. Jupiter.
Philip Glaser.
8-inch refl. 90X.
August 2, 1959. 1^h 45^m U.T.
S = 5 T = 5.
C.M.$_1$=51°. C.M.$_2$=345°.

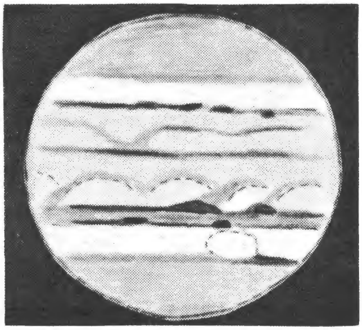

FIGURE 22. Jupiter.
William K. Hartmann.
13-inch refr. 245X.
August 6, 1959. 0^h 37^m U.T.
S = 6-7 T = 3-4.
C.M.$_1$=281°. C.M.$_2$=185°.

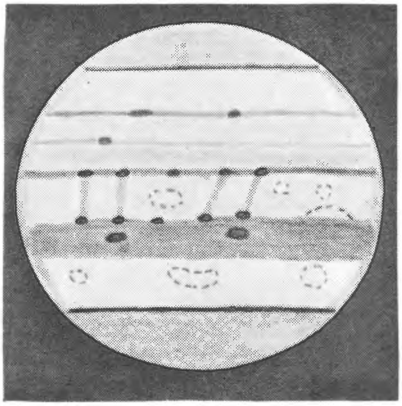

FIGURE 23. Jupiter.
Phillip W. Budine.
4-inch refr. 214X.
August 19, 1959. 1^h 35^m U.T.
S = 9 T = 4.
C.M.$_1$=208°. C.M.$_2$=12°.

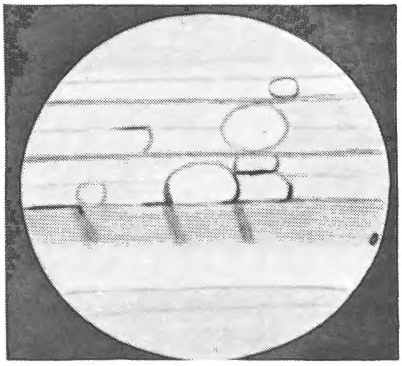

FIGURE 24. Jupiter.
Patrick S. McIntosh.
8-inch refl. 201X, 270X.
August 26, 1959. 0^h 49^m U.T.
S = 1 T = 1-2.
C.M.$_1$=204°. C.M.$_2$=315°.

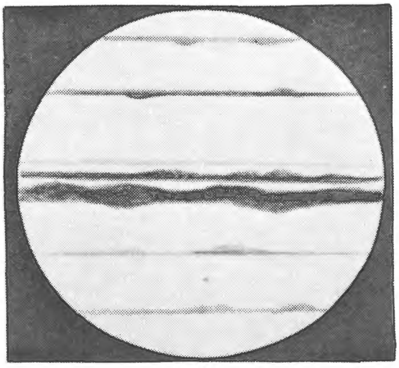

FIGURE 25. Jupiter.
Tom C. Constanten.
3¼-inch refr. 96X.
August 31, 1959. 2^h 46^m U.T.
S = 8-9 T = 5.
C.M.$_1$=344°. C.M.$_2$=56°.

bright areas were separated by only 27° in 1951. That rift is well shown near the east limb on a photograph taken with the 200-inch telescope on September 25, 1951.)

South Tropical Zone, System II

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Df	Apr. 5-June 5	57°-359°	17°	4	-28°5	9^h 55^m 02^s
2	Dp	Mar. 8-July 21	154 - 13	80	12	-31.3	9 54 58
3	Dp	Apr.17-July 27	219 -125	191	5	-27.9	9 55 02

Mean rotation period: 9^h 55^m 01^s

The brightness of the STrZ varied considerably in different longitudes. Although much of the variation was gradual, three fairly well defined boundaries were observed often enough to permit rotation periods to be determined. The best observed feature was the preceding end of a dusky section of the zone (No. 2). The brightest part of the zone lay between Nos. 1 and 2.

The drifts of the three objects listed above were nearly parallel and yield a mean rotation period of 9^h 55^m 01^s. One may search in vain through the records of the British Astronomical Association for such a short rotation period in the STrZ (excepting, of course, objects in the extreme southern part of the zone associated with the so-called Circulating Current). In recent years (since 1947), however, such short periods have been frequently displayed by dusky columns and sections in the STrZ in the hemisphere preceding the Red Spot region. Observations of these features were most numerous in 1947 and 1948. In 1947, 47 transits of 7 objects gave a mean period of 9^h 54^m 58^s. In 1948, 59 transits of 7 objects gave a mean period of 9^h 55^m 4^s

---

Red Spot Hollow, System II

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	p	Jan.10-Aug.14	307° - 310°	314°	15	+0°4	9^h 55^m 41^s
2	c	Apr.15-Aug.21	324 - 325	325	22	+0.2	9 55 41
3	f	Apr.15-Aug.21	336 - 336	336	24	0.0	9 55 41

Mean rotation period: 9^h 55^m $40^s.9$

Although the longitude (II) of the center of the Red Spot region showed an increase of 10° between the oppositions of 1958 and 1959, that region remained very nearly stationary throughout the appariton of 1959.

North Edge SEB_s, System II

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Dc	May 2-Aug. 14	292° - 303°	293°	29	+3°2	9^h 55^m 45^s

Although quite small, the one object listed above was one of the most interesting features of the apparition. It appeared as a small, very dark condensation in the SEB Z near the north edge of the very faint or invisible SEB_s. During June and July, Gaherty and Cruikshank found the condensation to be elongated in a northwest to southeast direction with a thin festoon trailing northwest from the spot and connecting with the SEB_n. Budine and Reese occasionally observed this condensation to be imbedded in a vertical dusky column extending from the SEB_n to the STB. The spot was moving slowly in the direction of increasing longitude, and, as the apparition drew to a close, was poised on the preceding shoulder of the Red Spot Hollow. The rotation period of this object was normal for the south edge of the SEB_s but abnormally long for the north edge of that belt. Was the object related to the dark object, H, on the south edge of the SEB_n prior to June, 1958, (Str. A., Vol. 13, p. 76)?

South Equatorial Current (SEB_n), System I

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Dc	May 2-July 1	20° - 33°	24°	5	+ 6°.5	9h 50m 39s
2	Df	May 25-July 22	62 - 97	58	6	+18.1	9 50 55
3	Wc	May 25-July 22	67 - 107	63	4	+20.7	9 50 58
4	Dp	May 25-July 22	73 - 117	68	6	+22.7	9 51 01
5	Df	May 5-Aug. 30	115 - 199	123	6	+21.5	9 50 59
6	Dp	May 5-July 15	127 - 179	137	6	+22.0	9 51 00
7	Df	May 14-July 27	169 - 219	172	6	+20.3	9 50 57
8	Wc	May 14-Aug. 8	175 - 236	178	7	+21.3	9 50 59
9	Dp	May 14-Aug. 1	181 - 240	184	9	+22.4	9 51 00
10	Dc	Mar. 8-July 30	195 - 285	239	6	+18.8	9 50 55
11	Df	Apr. 5-Aug. 13	223 - 301	245	13	+18.0	9 50 54
12	Wc	Apr. 5-Aug. 13	231 - 310	254	13	+18.3	9 50 55
13	Dp	Apr. 5-Aug. 13	238 - 319	262	18	+18.7	9 50 55
14	Dc	Apr. 5-June 28	250 - 300	275	6	+18.0	9 50 54
15	Df	Apr.15-Aug. 29	311 - 34	328	9	+18.3	9 50 55
16	Wc	Apr.15-Aug. 11	318 - 36	335	11	+19.8	9 50 57
17	Dp	Apr.15-Aug. 11	325 - 44	342	12	+20.1	9 50 57

Mean rotation period (without No. 1): $9^h\ 50^m\ 57^s$

The SEB_n displayed a number of fairly conspicuous breaks or gaps, which were similar to features seen in 1950. In 1959 the gaps yielded a mean rotation period of $9^h\ 50^m\ 57^s$, while in 1950 the mean period was $9^h\ 50^m\ 51^s$. Both of these apparitions followed by one year the outbreak of a major SEB Disturbance.

North Equatorial Current (S. edge NEB, N. part EZ), System I

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Dc	May 5-Aug. 20	38° - 17°	34°	9	- 5°.9	9h 50m 22s
2	Wc	July 15-Sep. 12	76 - 55	--	5	-10.7	9 50 16
3	Wc	July 1-Sep. 8	102 - 85	--	7	- 7.4	9 50 20
4	Dc	May 12-Sep. 8	128 - 98	127	12	- 7.6	9 50 20
5	Dc	June 29-Sep. 6	133 - 126	---	10	- 3.0	9 50 26
6	Wc	May 30-Aug. 1	148 - 138	---	11	- 4.8	9 50 24
7	Dc	May 3-Sep. 6	166 - 154	165	27	- 2.9	9 50 26
8	Wc	Mar. 24-Sep. 6	184 - 174	180	19	- 1.8	9 50 28
9	Dc	Mar. 8-Aug. 19	201 - 186	195	22	- 2.7	9 50 26
10	Wc	May 14-July 31	204 - 195	203	5	- 3.5	9 50 25
11	Dc	Apr. 5-July 4	217 - 209	211	7	- 2.7	9 50 26
12	Dc	Apr. 24-Aug. 8	252 - 252	257	9	0.0	9 50 30
13	Wc	Apr. 22-July 2	269 - 275	275	9	+ 2.5	9 50 34
14	Dc	Apr. 22-Aug. 8	280 - 280	286	16	0.0	9 50 30
15	Dc	May 20-July 28	313 - 301	313	14	- 5.2	9 50 23
16	Wc	July 5-Aug. 4	320 - 326	---	6	+ 6.0	9 50 38
17	Dc	Apr. 15-Aug. 29	332 - 334	335	12	+ 0.4	9 50 31
18	Wc	July 3-Aug. 29	339 - 345	---	4	+ 3.2	9 50 34

Mean rotation period: $9^h\ 50^m\ 26^s.5$

Considerable detail was frequently visible in the EZ and along the south edge of the NEB. This detail, however, was usually rather diffuse and lacking in contrast. Some observers had the impression that the detail in the EZ was subdued as though seen through an overlying orange haze.

Object No. 9 was a notably dark projection on the south edge of the NEB during June. At that time it was remarkably rectangular in shape with an equatorial festoon originating at each of its southern corners.

North Tropical Current (N. edge NEB), System II

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Dc	July 23-Sep. 2	1° - 354°	---	4	- 5°.1	$9^h\ 55^m\ 34^s$
2	Wc	May 29-Aug. 4	31 - 8	---	7	-10.3	9 55 27
3	Dc	May 29-Aug. 21	37 - 17	---	11	- 7.1	9 55 31
4	Wc	June 8-July 23	79 - 54	---	8	-16.7	9 55 18
5	Dc	Mar. 8-Sep. 13	165 - 120	149°	24	- 7.1	9 55 31
6	Wc	May 25-Aug. 22	162 - 143	164	23	- 6.4	9 55 32
7	Dc	May 8-Aug. 22	183 - 160	181	14	- 6.5	9 55 32
8	Dc	May 28-Sep. 8	233 - 170	239	13	-18.3	9 55 16

Mean rotation period: $9^h\ 55^m\ 27^s$

The North Tropical Current was fairly active with numerous small dark condensations and white notches along the north edge of the NEB. None of the dark condensations can be positively identified as a continuation of the "The Barge" of 1958.

N. N. Temperate Current (NNTB), System II

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Dp	May 8-Aug. 22	181° - 178°	181°	10	-0°.8	$9^h\ 55^m\ 40^s$
2	Df	July 11-Aug. 16	258 - 254	---	5	-3.3	9 55 36

Mean rotation period: $9^h\ 55^m\ 38^s$

The two objects listed above pertain to terminal ends of darker sections of the first dark belt north of the NEB. The mean rotation period of $9^h\ 55^m\ 38^s$ strongly indicates that this belt was the NNTB. If so, he NTB was either invisible or exceedingly faint during the apparition.

VII. Latitudes of the Belts in 1959

Mr. Mourao of Brazil has communicated some excellent measurements of Jupiter's belts. Very few observers contribute to this particular field of Jovian studies, so therefore Mr. Mourao's measurements are very valuable. He obtained 19 sets of measurements from May 17 to September 19, 1959. From these measurements the following mean latitudes for Jupiter's belts were obtained:

S.S.T.B. (center)	-36°.8	-40°.7	-40°.7
STB (center)	-29.3	-30.7	-30.7
SEB_s	-24.5	-23.2	-23.2
SEB_n	- 8.2	- 9.4	- 9.4
NEB_s	+ 6.7	+ 7.6	+ 7.6
NEB (center)	+14.0	----	----
NEB_n	+16.8	+17.4	+17.9
NTB (center)	+29.8	+29.4	+29.4
NNTB (center)	+37.2	+37.2	----

(The minus sign is for south latitude, the plus sign for north.)

The mean zenographic latitudes tabulated below are based on measures by E. J. Reese of three photographs taken by Mr. J. E. Newman with a 6-inch visual refractor. The photographs were taken on May 23, 1959, at $4^h\ 01^m$, on May 29 at $3^h\ 45^m$, and on June 6 at $3^h\ 30^m$ (U.T.):

STB (center)	-30°.7 ± 0°.7
SEB (N. edge)	- 7.2 ± 0.3
NEB (S. edge)	+ 6.2 ± 0.6
NEB (N. edge)	+20.2 ± 0.3
NNTB (center)	+33.8 ± 0.5

The mean deviation of the individual measures from the arithmetic mean for each belt is indicated.

Professor R. R. Mourao of the National Observatory in Brazil has also kindly communicated the following zenographic latitudes measured by him with a filar micrometer attached to the 18-inch Cooke refractor:

North Component of the NEB

1959,	May	16	+19°3	(20 measures)
" ,	"	18	+18.6	(" ")
" ,	June	4	+19.5	(" ")
" ,	"	20	+15.3	(" ")
" ,	July	15	+16.6	(" ")

South Component of the NEB

1959,	May	18	+6°7	(20 measures)
" ,	June	20	+6.8	(" ")
" ,	"	27	+6.7	(" ")
" ,	"	30	+8.7	(" ")
" ,	July	9	+7.9	(" ")
" ,	"	14	+8.2	(" ")
" ,	"	15	+7.8	(" ")
" ,	"	18	+7.4	(" ")

VIII. Visual Magnitude Estimates of Jupiter's Satellites

Mr. Tom C. Constanten has contributed an excellent report on mag nitude estimates of Jupiter's four bright satellites from August 16 to October 9, 1959. Mr. Constanten employed a 2.4" refractor, a 3" reflect and a 3¼" refractor. Below are some of Mr. Constanten's estimates:

Date		Time (U.T.)	I	II	III	IV
August	16, 1959	3:30	5.8	4.8	5.0	5.7
"	17	3:40	---	5.2	5.0	5.9
"	21	3:25	5.6	5.5	5.0	5.8
"	22	3:05	5.3	5.3	5.0	5.5
"	25	3:15	---	5.3	5.0	5.6
"	26	3:15	5.2	5.1	5.0	6.0
"	27	3:31	5.3	5.4	5.0	6.1
"	28	2:50	5.2	5.2	5.0	5.8
"	29	2:52	5.3	---	5.0	5.8
"	30	2:55	5.5	5.7	---	5.9
Sept.	1	2:35	5.5	5.3	5.0	6.1
"	16	2:40	5.4	5.5	5.0	5.9
"	20	2:15	5.3	5.2	5.0	5.8
"	21	2:20	5.2	5.5	5.0	5.8
"	22	2:04	5.3	5.2	5.0	5.7
"	25	2:09	---	5.6	5.0	6.1
"	26	2:05	5.5	5.4	5.0	5.8
"	27	1:55	5.5	5.5	5.0	6.1
"	28	1:45	5.3	5.4	5.0	5.9
Oct.	3	2:00	---	5.5	5.0	6.1
"	4	1:45	5.6	5.7	5.0	6.2
"	5	1:52	5.6	5.7	5.0	6.1
"	9	1:42	---	5.4	5.0	5.9

IX. Color and Intensity Table of Jupiter in 1959

(I. - Intensity Estimate and C. - Color Estimate)

Feature	Budine		Pepernik		Reese	
	I.	C.	I.	C.	I.	C.
SSTB	3.8	Bl-G	3.8	Bl	3.8	G
STB	3.5	Bl	3.5	Bl	3.5	G
SEB_s	3.7	R	3.8	R	3.5	Br

Feature	Budine		Pepernik		Reese	
	I.	C.	I.	C.	I.	C.
SEB_n	2.7	R-Br	2.8	R-Br	2.4	R
EB	4.0	G	---	----	3.9	Br
NEB	2.3	R-Br	2.4	R-Br	2.3	R-Br
NNTB	3.0	G	3.0	G	3.1	G
NNNTB	3.7	G	3.7	G	3.8	G
STeZ	7.0	W	7.3	W	7.0	W
STrZ	6.1	O	6.2	O	5.8	Oc
SEB Z	4.4	R	5.3	O	4.3	Oc
EZ	6.0	O	5.5	O	5.5	O
NTrZ - NTeZ	8.0	W	8.0	W	8.0	W
SPR	4.9	G	4.2	G	---	--
NPR	4.0	G	3.5	G	---	--
RSH	7.0	W	7.3	W	---	--

The abbreviations and numbers used in this table are explained in The Strolling Astronomer, Volume 13, p. 104 (September-October, 1959).

AN ANALYSIS OF DR. LUGO'S "THE CAPTURE OF THE MOON"

By: Robert M. Adams

In reference to Dr. Francisco Aniceto Lugo's article in The Strolling Astronomer, Vol. 13, Nos. 11-12, Nov.-Dec., 1959, it should be pointed out that many of his statements are open to scientific criticism, although it is not to be denied that the use of imagination and conjecture has its very valuable place in scientific progress.

The theory that the planets were built up as a result of an accretion of primeval debris is perhaps currently the most acceptable concept of the origin of planets. However, if this theory is accepted, it does not then follow that the moon was "much softer than the earth." Rather, according to A. C. B. Lovell (The Individual and the Universe, p. 36, Harper Bros., 1959) and others, high temperatures were restricted to the deep interiors because of pressure. The pits, craters, and dark comparatively level areas or "seas" on the moon are then interpreted as the result of numerous meteoritic impacts, which occurred a long time ago for the most part, when there was far more large debris in the Solar System. The dark areas are the result of impacts by large meteorites whose masses were made molten and spewed themselves over the surface due to the terrific forces involved.

I am afraid there is little merit in H. T. Wilkins' work used by Dr. Lugo as the basis for his article. As to the theory of the capture of the moon at a comparatively recent date, I do not think we can rely on primitive myth, tale, or legend--however similar these may be from tribe to tribe--to account for the phenomenon.

As a anthropologist I should like to point out that changes in our knowledge of the dating of early deposits containing implements and the theories about the cradle of civilization are not too different than they were 30 or 40 years ago. Science is necessarily slow-footed and extremely careful. It is spectacular to say that there were many civilizations some 12,000,000 years ago, but such statements are entirely conjectural. The classic dates of the Pleistocene worked out for the Alps and the terraces of the Somme and Seine rivers still hold--with the bare possibility of a million or two years of greater spread. Dr. Lugo mentions John Hurzeler and his researches. It is too early to comment much, but certainly there is no evidence whatsoever that there were civilizations 11,975,000 years ago. No scientific publication has yet reached the public (see Saturday Evening Post, Feb. 13, 1960, "And Now The Abominable Coalman"). The Italian lignite beds in which the bone remains (Oreopithicus) were found (an anthropomorphic creature showing manlike tendencies) can accumulate very rapidly under ideal conditions, and very possibly they may be correlated with the classical studies of the Alps and the Pleistocene terraces of France. Incidentally, no cultural materials have been found.

I am not trying to throw cold water on scientific theory. Progress is our knowledge of proximal astronomical, geological, and archaeological events is necessarily very slow, painstaking, and cautious. Deep deposits of recently formed peat and lignite in which remains of plants and bones are found are difficult to explore, and hermetically sealed limestone deposits which preserve bones are rare. Besides, there is a lot more money being expended on astronomy and so-called space age studies than on the exploration of relatively recent geological deposits (up to at least 20 million years ago). Every time unauthorized "treasure hunters" dig they destroy the associated and rare evidence, and this loss goes on all the time. The carbon dating methods are limited to about 25,000 years so that the piecing together of the jig saw puzzle of events within even the last 100,000 years will be a long and tedious process. Still, we must keep an open mind. I recall the day when it would have been unheard of to say that man lived in Missouri and Illinois more than 2 or 3 thousand years ago. Now, thanks to carbon dating, man goes back 10 thousand years in the Mississippi Valley, and the cave shelter deposits from which the human artifacts were taken (Modoc Rock Shelter, Illinois State Museum, 1956) have near duplications from a similar cave shelter across the Mississippi ("Archaeological Investigations in Jefferson County, Missouri," Transactions Academy of Science of St. Louis, Vol. XXX, No. 5, by Robert McCormick Adams). There is a strong implication that a geological event took place some 10,000 years ago: that either the post-glacial waters cleaned out previous deposits shortly before man arrived or else that the cave shelters themselves were formed at that time. Even so man's early cultural development still lies within a reasonable period of time--certainly not 12,000,000 years ago. The famed Chellean and Clactonian implements from the terraces of Europe are within 100,000 to 1,000,000 years ago. Statements about civilizations that existed 12 million years ago simply cannot be proved any more than the existence of the highly legendary Islands of MU and ATLANTIS.

Dr. Lugo is very hopeful that the Americas will prove to be a cradle of civilization as indeed Middle and South America were, but there is no good evidence at present to push back man's arrival to a very early date. Now with the government spending large sums of money on listening for intelligent signals from planets in the proximity of the stars within 16 light years away (National Radio Astronomy Observatory Project OZMA), perhaps we can spend money in getting down to those deep deposits in Italy or perhaps even in looking for remnants of "space ships" in really ancient stratigraphic layers--or are we all "crying for the moon"?

CONCERNING THE METHODS AND GOALS OF THE A.L.P.O.

By: Leif J. Robinson

In the Sept.-Oct., 1959, number of The Strolling Astronomer there appeared the statement, in a postscript to Mr. Herring's article, that "...yet we also feel that professional astronomers should encourage special lunar and planetary studies by advanced amateurs like Mr. Herring and others of similar demonstrated ability." In general the following is a résumé of my observations of the usefulness and quality of amateur endeavors in the fields of lunar and planetary observation.

Having been associated in an executive capacity for several years with one of the largest amateur astronomical associations in the United States, I have been in a position to study not only amateur astronomy but amateur astronomers as well. Following in this line I have found that novice amateurs, in many cases, tend to become cursory in the accuracy of their observations made at the telescope--either reporting more than is seen, due to false interpretation of difficult-to-see markings, or deliberately "doctoring" their reports to conform to that which was seen by "him" (an observer of fifteen years experience). Both effects are born out of conscious or unconscious frustration caused by the natural lack of initial ability.

But the seasoned observers are not free of sin either. Is it not more romantic to make a fine lunar or planetary drawing than to make a transit observation which will appear only in tabular form? Do not get the impression that I am saying that lunar or planetary drawings are not useful. I am only pointing to the fact that observers are applying themselves in a single direction only. In other words, which is more important--seeing the smallest details at the threshold of resolution with the necessary corresponding loss of accuracy or observing the larger details (with auxiliary equipment if necessary) for great accuracy? I believe that I shall find no objection in assuming that accuracy of both position and form is of paramount importance. Let me recapitulate: on the one hand we have the novice observers, without experience, and a tendency towards sensationalism; on the other, experienced observers who are, to a great extent, inefficiently using their observing hours.

It is my belief that the summation of objections enclosed in the final statement in the above paragraph is also a summation of the basic objections carried by the professional astronomer and causing his negative viewpoint towards the American amateur astronomer and his endeavors in the field of planetary and lunar observing. A moment's reflection will show that the European observers, in general, follow an observing program quite different from our own--emphasis being placed on the numerical side of amateur astronomy. It is this difference--numerical vs. pictorial--which, in my opinion, is the cause of the negative attitude the American professional has regarding the American amateur. This attitude is most regrettable, for due to the careless majority the deserving minority must do without--this is indeed a sad condition. In the following paragraphs I shall attempt to bring out some possible solutions to this problem.

The first and most obvious answer would be to use only the observations of the most competent observers. A major drawback here is that there are not enough competent observers to follow all the projects carried on by the A.L.P.O. To solve this dilemma we must create observers to fill the gaps. But how does one find and prove that an observer is competent? The A.A.V.S.O. indirectly solved this problem (I am referring to their Solar Section) without intending to do so. I shall explain. In order for a person to join this Section he must serve one year "apprenticeship." This year is used to determine his "k" factor. This "k" is necessary for the reduction of his sunspot counts to a common ground. In the course of this year of "apprenticeship" the observer gains facility in observing, in the use of his telescope, in the grouping of sunspots, etc. The net result is that at the end of this year the A.A.V.S.O. has a competent observer. I see no reason why the A.L.P.O. could not initiate a similar program.

Secondly, the seasoned observers should spend more time with such instruments as micrometers, photometers, and cameras. I am sure that the accurate mapping of a lunar crater with a micrometer as a guide would be a contribution a hundredfold greater than a very "pretty" picture of the same object! One might say that the average amateur does not have such equipment--but could this not be changed? I am quite sure that a rather professional micrometer can be constructed for less than $50.00--and what amateur has not spent that amount on the telescope in the first place? Let us not buy the car and refuse to buy tires for it. As a point in fact, I know an advanced amateur, who is well known to all the readers of this letter, who constructed a micrometer for $1.50--this micrometer is accurate to 4% on the lunar surface. I am sure that if the professional astronomer were able to see the amateurs working with this somewhat crude equipment, but obtaining useable results, he would be more inclined to offer his assistance to these dedicated persons.

Thirdly, standard forms should be made mandatory to prevent the possible omission of important data. No observation should be considered unless it is in this form. Also, the publication of doubtful or unconfirmed observations should be halted--observing detail on Uranus with a three-inch telescope is an awful lot to ask of such a small instrument.

Lastly, definite projects might be established to assure the continual patrol of all important objects. No major event should go un-measured or un-photographed.

The above are only a few suggestions which, if followed out, would lead to the acknowledgement of the amateur astronomer. The A.L.P.O. is a fine organization which is in capable hands; however, it must have a format resulting in useful work by competent observers. When the above is accomplished, I feel that the professional has no alternative but to recognize the fine work that the A.L.P.O. is capable of doing.

Postscript by Editor. The article above is actually a letter written to the Editor by Mr. Robinson on December 3, 1959. Mr. Robinson is Vice President of the Los Angeles Astronomical Society. His address is 1411 Amapola St., Torrance, Calif.

Mr. Robinson's discussion will have served its purpose very well if it stimulates some real thought among our members on the general subject treated. It is possible, of course, to react emotionally to such arguments. Thus one might say that professional astronomers are hardly planetary experts when they identify, as they sometimes do, the Crape Band on Saturn as the shadow of the rings for visitors to the observatory; and at least one properly highly-regarded professional does or did follow the curiously amateurish practice of identifying cloudy regions on Mars without computing the central meridian of longitude. We shall do much better, however, to think positively. For example, how may new observers of the moon and the planets be trained to become competent? What concrete procedures do we need to achieve a complete patrol of the moon and the bright planets? What sorts of controls will help us to recognize spurious markings on drawings? Incidentally, standard forms are in use already by the Jupiter Section and are being considered by some other Sections.

We should welcome helpful ideas and comments from our members.

PROJECT PERSEIDS

By: J. C. Marsh

Due to the Moon's apparent position near to that of the Sun and to the fact that the constellation Perseus is circumpolar in Great Britain and therefore observable all the year round, the Perseid Meteor Shower was particularly favorable in 1959. As the shower also coincided with the summer holidays, some members of the Croydon Group of the Junior Astronomical Society of Great Britain decided to organize an ambitious survey of the 1959 shower. The senior organizer of this project, George Teideman, contacted the Leeds and Burnley Groups of the J.A.S. and invited them to coöperate with the Croydon Group's activities, while the writer asked the National Capital Junior Astronomers of Washington, D. C., whether they would like to participate; all three groups did.

The Perseid Meteor Shower usually commences slowly and gradually increases in intensity to maximum; then after a fairly broad peak a rapid decline is observed until, three days after maximum, the shower is barely in evidence. On the assumption that the shower would follow its normal pattern of activity the Croydon Group decided to carry out their observational work from a spot situated some 2½ miles S.E. of Croydon: Shirley Hills. During the week ending before predicted maximum activity (August 12) it was decided to organize a scientific expedition, come-camping holiday, to a remote site situated near the village of Stapelfield in the County of Sussex, England. At Stapelfield the observers would be well away from all the industrial haze and artificial lighting effects of the town, and the conditions for observing meteors would therefore be ideal.

Although the weather was not too coöperative, at first, all went according to plan. Observations started on the night of July 26 and continued for 22 days. The program was extended for three days owing to the fact that the maximum activity of the shower unexpectedly occurred late (August 15: zenith hourly rate=27 between 01.00 - 02.00 hrs. and 36 after 02.00 hrs., G.M.T.).

Photographic observations were attempted but without success. Visual observations, however, were more successful; 172 meteors were recorded in this country, of which 131 have since been classified as Perseids. (At the time of writing, American observations are still arriving and have not yet been analysed.) It should be mentioned at this point that during the period of maximum activity (predicted) only 17 Perseid meteors were recorded by 5 observers.

Our own observers taking part in the project carried out the following classification of observational data:

1) The number of meteors appearing in a given area of the sky in a given time.

2) The identification, where possible, of the radiant to which each meteor belonged.

3) The time of the appearance of each meteor observed.

4) The position of each meteor path observed in the sky, given in relation to the stars or to the horizon system of coördinates.

5) The average apparent stellar magnitude of each meteor observed.

6) The duration of each meteor observed for a given length of path or the average angular velocity.

7) Any marked colors of meteors which were observed.

8) Notes with regard to the decrease of luminosity in the train of flight.

9) Any observed division of the meteor into two or more parts.

10) Any other unusual features observed.

Practical meteor observation, requiring as it does little or no expensive equipment, is undoubtedly the ideal field for the serious amateur astronomer. Because of the very nature of the problem, however, uniformity is often lacking in the methods of recording meteors or of planning such astronomical programs as "Project Perseids." In the future, it is certainly hoped that many more such projects will be organized.

Note. This article was communicated by Mr. Patrick Moore, the English lunar and planetary observer and author.

JUPITER, SOLAR INDUCED CHANGES

By: Elmer J. Reese

The writer has spent quite a few hours testing some apparent periodic variations in the color and intensity of Jupiter's Equatorial Zone, South Equatorial Belt, and North Equatorial Belt. He was trying to find a relation between the color and brightness of these regions on the one hand, and the position of the planet in its orbit and the sunspot cycle on the other. Observational data were available for 99 apparitions from 1836 to 1959.

To facilitate the investigation, numbers were substituted for certain words used by observers in describing the color and brightness of the various Jovian features. When the mean color and intensity values for those years when Jupiter was near perihelion (or a particular season or phase in the sunspot cycle) are compared with the mean values for those years when the planet was near aphelion (or an opposite season or phase), some rather impressive relations become apparent. The statistics, however, yield a correlation coefficient which is quite insignificant in most cases. The correlation coefficient, R, is a mathematical test for correlation. A coefficient of one indicates perfect correlation; zero indicates no correlation.

Some apparent relationships together with the computed coefficients follow:

EZ is whitest when planet is at perihelion, reddest at aphelion.	+0.36
EZ is brightest when planet is at perihelion, dullest at aphelion.	+0.16
EZ is whitest when sunspots are least.	+0.16
EZ is brightest when sunspots are least.	+0.07
NEB is of minimum redness at winter solstice for N. hemisphere.	+0.20
SEB is of minimum redness at winter solstice for S. hemisphere.	+0.15
NEB is reddest when sunspots are most numerous.	+0.25
Red Spot is darkest when SEB is lightest.	+0.65
Red Spot is darkest at winter solstice for S. hemisphere.	+0.20

Since the inclination of Jupiter's equator to the plane of its orbit is only 3°, we might expect seasonal effects to be very slight. It has been suggested, however, that the chemical and physical properties of the Jovian atmosphere are such that a small change in the amount of solar heat received by one hemisphere as compared to the other hemisphere might trigger an observable change in the appearance of the belts and zones. A far greater variation in the intensity of solar heat results from the eccentricity of the planet's orbit. At perihelion Jupiter receives about 22% more solar heat and light than it does at aphelion. Another source of change in the quantity and quality of solar radiation reaching Jupiter may be associated with the sunspot cycle.

It is quite possible that most of the observed changes in the color and intensity of Jupiter's belts and zones arise from internal forces and are entirely independent of external conditions. Success or failure in correlating Jovian changes with changes in solar heat may depend to a great extent upon the relative importance of the internal and external factors involved. The greater the influence of internal forces on the appearance of Jupiter, the poorer will be any correlation we might find with variations in solar heat. Thus the correlation coefficient may be too severe a test for determining the existence or non-existence of the relationships we are seeking.

In conclusion, we have seen that a mathematical analysis of the observational data accumulated from 1836 to 1959 does not provide us with a good correlation between Jovian changes and variations in solar heat. The solar influence is either non-existent or else of considerably less importance than the internal or inherent forces acting upon the atmosphere of Jupiter.

AN AMATEUR IN A PROFESSIONAL ECLIPSE EXPEDITION

By: Tim Wyngaard

In late September, 1959, over one hundred astronomers, both professional and amateur, converged on the barren island of Fuerteventura in the Canary Islands. Their purpose in making the trip, for some of them almost eight thousand miles, was to view the total solar eclipse of 2 October, 1959. I was privileged to make this trip and act as a part of one of the expeditions as a guest of the United States government.

This story actually begins in 1958. During the post-Sputnik examination of the American educational system, the National Academy of Sciences decided that they might be able to influence more students to enter science as a career if they helped a fortunate few in their ambitions to become scientists. In the spring of 1958, the NAS approached the Astronomical League and asked them to nominate a Junior Member of the League to travel with the American expedition to the Danger Islands for the eclipse of 12 October, 1958. The AL chose Dave Morrison, a fellow ALPO member. (See Str. A., Vol. 12, Nos. 10-12, pp. 148-151). In the early part of 1959, the NAS came to the AL with a similar proposal. The purpose was the same, but the destination was different. I was fortunate enough to be the choice of the NAS and the AL for the expedition to the Canary Islands.

This major IGC-59 project was composed of a group of eleven scientists from the High Altitude Observatory and the Sacramento Peak Observatory. The Air Force Cambridge Research Center was the official sponsor of this group. From September 8 to October 15 I travelled as a member of the expedition. Logistics was handled by the USAF, through their base in Wiesbaden, Germany. All transportation was through the facilities of the Military Air Transport Service (MATS).

The experiments of the HAO-Sac Peak group concerned the flash spectrum, visible only for short periods of time at the beginning and end of totality. Medium and high dispersion spectrograms of the light of the corona were planned. They used three cameras, one each for ultra-violet, visual, and infra-red light. Each camera was, in reality, two cameras so that there were six cameras in operation for this project. The purpose in having double cameras was to allow a continuous record of the spectrum to be obtained, one camera exposing film while the other transported the previous exposure. Each negative measured about six by twenty-two inches. During totality about one kilometer of film was used by these cameras!

The Physics Department of the University of Wisconsin also had a group in our camp. Their experiments concerned coronal polarization and temperatures. The polarization experiment used two Swedish Air Force cameras, each of six inches aperture and thirty-six inches focal length. One camera photographed the infra-red end of the spectrum, the other the ultra-violet end. For the next eclipse, the University of Wisconsin team plans to measure coronal rotation with the same equipment they used for the temperature studies. Serving in the U. W. group were two physicists from the University of Manchester, England.

Needless, to say, the arrival of a group such as this one made quite an impression on the quiet island life of Fuerteventura. Visitors constantly arrived at our camp, sometimes walking into the middle of the experimental tests. For this reason we found it necessary to have a police guard stationed at the entrance of the camp on eclipse day.

The nights were beautiful, especially to one used to a certain amount of city lights while observing. The seeing was not very good, but the transparency more than made up for this in pure splendor. While we were still more than twenty-five degrees north of the equator, the Milky Way was very impressive to one used to viewing it from a latitude of forty-three degrees. At times a distinct reflection off the ocean water from the brighter parts of the Milky Way was visible. Sunset over the ocean also supplied me with my first view of that curious phenomenon, the green flash.

The morning of eclipse day dawned partially cloudy. The men were not too despondent, however, as great clear patches continually drifted over from the direction of Africa. By the time of second contact, however, the sun was hidden, total obscuration occurring about four minutes before. A few seconds after second contact the sun broke through for about five seconds, and just before third contact the sun was visible again for a period of fifteen to twenty seconds. No words or film can truly describe the incomparable beauty of the scene. The corona was a pearly white and was in its typical near-maximum form. Gorgeous rose-red prominences reached high above the disk of the sun.

The clouds soon closed again, however, and the sun was invisible until about two minutes after totality came to a close. A similar experience happened to all the other groups on the island. Skies were clear enough in Las Palmas, a city about forty-five miles away, to see all of totality; but scattered light from high clouds made scientific observations useless.

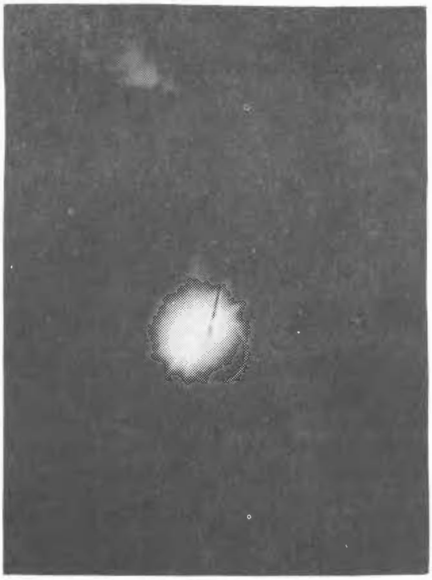

FIGURE 26. The "diamond ring" as observed from Las Palmas, Canary Islands during total solar eclipse on October 2, 1959. Photograph by F. Urquijo, Las Palmas.

FIGURE 27. University of Wisconsin building being erected for total solar eclipse on October 2, 1959. Figures 27 through 30 are photographs by Tim Wyngaard.

FIGURE 28. Dr. R. Grant Athay, High Altitude Observatory, using combination white light telescope and spectrograph to examine the sun. He was to watch the white light crescent almost until totality and then to switch over to the spectrum in the same field of view to watch for the flash spectrum.

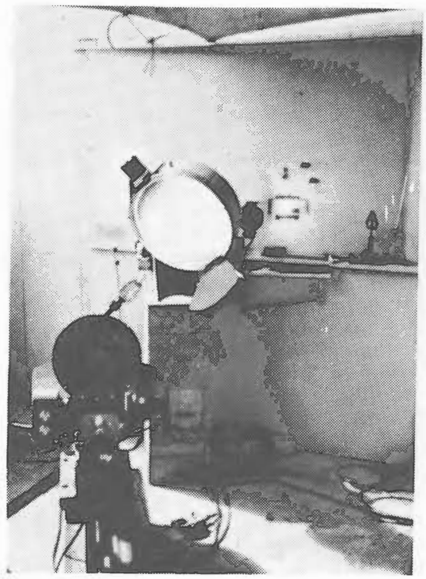

FIGURE 29 (above). Coelostats for the High Altitude Observatory-Sac Peak experiment. The bright spot to the right of the upper mirror is the image of the sun falling on the slit of the spectrograph housed behind the wall.

FIGURE 30 (left). Completed University of Wisconsin shed. Left to right: housing for coelostats and image--forming 12-inch lens, tube shielding optical path, and building for polarization cameras.

While no useful scientific results were obtained because of the clouds, the breaks were sufficient to prove that the equipment did work as planned. Plans are now being made for the future. The U. W. team will probably travel to the Italian Riviera for the eclipse of 1961, and the HAO-Sac Peak group may travel to the South Pacific for the eclipse of 1962. After two failures because of clouds, let's hope that they have a little better luck on these trips!

The NAS hopes to continue this project in the future. I, for one, hope that they do. They gave me, a seventeen year old amateur contemplating a career in science, a wonderful opportunity to view the field. I hope that others can have such an experience.

A GEOLOGICAL INTERPRETATION OF THE LUNAR SURFACE

By: S. Miyamoto
Kwasan Observatory, University of Kyoto, Japan

Abstract

The origin of the lunar maria is here ascribed to the differentiation of the light colored and light weight silicic mass from the dark and heavy basaltic mass, as in our earth. This hypothesis is compared with the current idea that the maria were formed by lava inundation following subsidence. Difficulties proposed up to the present are discussed, and an interpretation of the surface features is made based upon the differentiation hypothesis. The explosive nature of silicic masses and the fluidity of quiescent basaltic masses give rise to different aspects on the lunar continents and maria.

Introduction and Basic Hypothesis. A characteristic feature of the lunar surface is the crowd of ringed structures covering the brighter part of the lunar surface and the great expanses of dark plains. As is well known, hypotheses have been put forward relating to the origin of these surface features. The meteorite theory was propounded by F. Gruithuisen and was recently extended by R. B. Baldwin.[1] This theory ascribes the origin of the so-called lunar craters to the bombardment of meteorites. In particular, Baldwin considers maria as the largest craters, which were produced by the impact of gigantic meteorites. He showed that the kinetic energy of impact is sufficient for the melting and spreading of the meteorite, resulting in the formation of maria. One of the unfavorable points for the impact hypothesis is the fact that the distribution of the numerous craters is far from random.

The volcanic origin of the craters is supported by many authors. According to this theory, lunar craters and walled plains correspond to terrestrial volcanoes, in spite of the different environments, since the lunar craters were formed during the course of the solidification of the moon's crust. With this theory, the maria were produced by an immense outflow of lava, which flooded and destroyed the pre-existing craters, and later solidified, forming a nearly level surface by cooling.[2,3]

Although the two hypotheses mentioned above are mutually exclusive,[2] some authors invite meteoritic impact as a trigger for volcanic activities,[2] especially for some kind of "explosion craters." The volcanic theory seems most promising, but it is at present far from satisfactory with respect to the interpretation of the great variety of surface features.

In this paper, we try to give a geological interpretation of the surface features based on the idea that a differentiation of siliceous and basaltic substances took place in the lunar crustal zone, as on our earth, and that the lunar maria are basaltic matter corresponding to our ocean basins, and the bright regions to our continental masses. The idea is not new. In fact, R. Henseling[5] in 1927 put forward this hypothesis. However, the recent trend is to assume dark basaltic lava outflows over the underlying light colored crust for the formation of maria, as is suggested observationally by the presence of bright craterlets and isolated mountains in the maria. J. E. Spurr[3] published an important geological investigation, in which he assumed a differentiation of the silicic crust from the basic layer. He identified the former with the ancient crust, which he supposed to cover the entire surface. He considered, then, that the maria were produced as the result of collapse of giant domes of the original crust after the release of inflating gases. Subsidence of the crust and the flood of basic magma over it formed the dark expanse of the maria.

Our hypothesis identifies the differentiated silicic "blocks" as the continents. This concept leads to another and natural explanation of the origin of the maria and some aspects of the surface features, such as the crowding of craters and walled plains on the continental silicic masses and the scattered distribution of "ghost craters" and isolated "explosion craterlets" in the maria.

Origin of Maria and Continents. Near the surface of the earth, the bright colored and light weighted siliceous mass differentiates from, and floats above, the dark and heavy basic mass. The latter forms the ocean basin, and the former the continental mass blocks. Although the earth's crust is rigid in the ordinary sense, it behaves as a plastic in masses of continental dimensions and on a geological time scale. According to the principle of isostasy, the continental mass is thick beneath the high mountain ranges but, it is estimated, by not more than a few tens of kilometers. Under the basaltic layer, the andesitic mantle is believed to extend to great depth. Lava wells up through fracture systems from these layers. Earthquake records show that the andesite comes from the deepest layers, and the basalt rises from shallower layers.

Inspection of the lunar surface suggests that the differentiation of silicic and basaltic masses took place as on our earth. However, owing to the weakness of lunar gravitation and rapid cooling, the differentiation may not be so complete on the moon. Where the thickness of the continental silicic mass is not large, a bright silicic film may brush over the basic dark layer in some districts; or in others, silicic mass blocks may be dotted like an isolated island or chain of islands blown together to an intercellular corner by convection currents in the basaltic magma. Meanwhile, a weak point of the continental crust may be pushed apart by the underlying dark basic magma, which then exposes itself as a walled plain with a dark floor, or as a smaller mare with a circular boundary, such as Mare Crisium.

One of the most impressive features in the maria is the so-called "ghost craters" or "buried craters" and craters with partly destroyed walls. These objects strongly suggest the current idea that the maria were formed by subsidence followed by a great inundation of molten lava. However, close examination of the lunar surface shows immediately that there are great varieties among "ghost craters." Some of them have light colored and sharp walls, while others have dark and low walls. In terms of the differentiation hypothesis, large ghost craters with low and dark walls were formed in the fluidal basic crust, and brighter objects were mostly products of silicic islands. More detailed considerations will be found in due course.

With respect to the current theory, a difficulty may be pointed out. In and around Mare Nubium, there are abundant ruined rings and ghost craters, and they suggest strongly that these areas were once invaded by a lava flow. Palus Epidemiarum is separated on the west from Mare Nubium by the long rampart extending from Cichus northward through Mercator and Campanus to Hippalus. The only possible strait of lava flow is that from the southwestern border of Mare Humorum. But this strait is brighter in color than the Palus, and it seems difficult to suppose it was once the actual path of dark lava flow. On the other hand, no sign of a lava source is seen inside the Palus. The floor of this Palus is rather smooth, and no wrinkle ridges suggesting the direction of lava flow are seen. Capuanus, situated on the southern shore of this Palus, has a dark floor. Its darkness is comparable with that of the Palus. However, the wall of Capuanus is complete, except for craterlets on the north, so that it is difficult to consider that molten lava intruded there. Throughout the lunar surface, craters with dark floors are all located along the shore lines and none in the middle of the continents. These facts seem difficult to account for with the current theory.

By the way, Palus Epidemiarum provides us with an interesting topic. A long cleft runs from the north wall of Capuanus westwards. It disappears where it meets the mountain range connecting Cichus with Mercator but reappears in the Mare Nubium and reaches Hesiodus. The cleft might have originated when the basaltic basin was in a plastic state. However, the silicic mountain range, floating on the basin, remained unaffected. The behavior of this cleft seems to favor the differentiation hypothesis.

Our hypothesis is to suppose that the lunar maria are basaltic and correspond to our ocean basins. However, this does not imply that the maria were once covered with water. Rather they may have been oceans without water ever since the birth of the moon.

Walled Plains and Craters. Besides the smallness of surface gravity and the extreme tenuity of the atmosphere even at the earliest period, the lunar geology is fundamentally different from ours, as has been emphasized by J. E. Spurr, in that her surface features were formed during the course of the solidification of her crust. On our earth, such earliest features have long since been lost in the geological past by the ceaseless action of erosion and violent crustal movements. The terrestrial volcanic activity of today is the outflow of magma through the fissures of solid crust, and in this respect our volcanoes are by no means the exact counterpart of lunar craters.

Plato is a walled plain with a dark and smooth floor. It is a giant as a crater, but merely a dwarf among maria. In fact, its dimensions are much smaller than those of the circular maria, such as Mare Crisium and Mare Humorum. In view of our hypothesis, Plato should be grouped with the maria because of its dark basaltic floor. When the lunar surface was still in a semi-molten state, convection cells in the underlying basaltic layer in some districts might have broken off and drifted away from the overlying silicic crust and exposed themselves. Such an event would take place where the crust is not too thick, henceforth near the shore lines.

The circular form and lofty cliffs along the shore line of Mare Crisium may be accounted for by the same process, provided that the silicic layer was moderately thick in that district. On the other hand, Mare Humorum without scarps may be an example of a thin silicic crust.

Goclenius, Magelhaens, and many other objects on the northern border of Mare Foecunditatis are smaller than Plato; but they also show dark floors under a high sun. The continental crust is not thick in this district, and a basaltic layer might have exposed itself more frequently. Besides the circular formations mentioned above, we find dark but irregular patches in the same district. This area may be called "marshy."

Walled plains and many other lunar craters are by no means explosive. In fact, there would be no explosions while the crust is still in a fluidal condition. A violent explosion takes place only after the crust has solidified and enormous pressure has accumulated within it by some agency.

At the earliest stage of crustal solidification, local irregularity in the cooling process might have taken place. As is well known, the melting point of magma is greatly reduced by the water content. A spot with a high volatile constituent would have remained in a fluidal condition down to a comparatively later epoch and, after subsidence, would fossilize finally as vertical cavities or crater-pits. The importance of the role of volatile constituents for crater formation should be emphasized in view of the rich cosmical abundance of light elements. We find typical pits of this type in the extensive continents in the southwestern quarter of the moon. Crater-pits thus formed would naturally take a circular form, but they may often be affected by the mesh of cleft systems in the surrounding crust and thus might acquire a polygonal appearance. As polygonal craters are so common on the lunar surface, some authors choose to speak of "graben craters."

Terrestrial counterparts of lunar craters may thus be sought for in some kind of caldera with the character of graben rather than of volcanoes, namely, the caldera with very large conduits comparable in dimensions with the outer walls. On the moon, these collapse calderas with very large conduits seem common, and those like Wargentin with its elevated floor are exceptional.

Walled plains with light colored floors, such as Clavius, may belong to these collapse caldera, produced in the continental thick crust. Complex terraces seen on the inner walls of some craters may be the footprints of successive steps of floor depressions. It must be noted, however, that lunar craters are not necessarily equipped with central mounds or craterlets. These are of secondary importance. Even for those which have central volcanoes, such is not the generating power of the crater formation.

The dominant feature of the lunar landscape is the craters and not the mountain ranges, contrary to our earth. There seems to have been no real orogeny on the moon. We have mentioned the lofty mountain ranges surrounding Mare Crisium. Another example is the Apennines bordering Mare Imbrium.

The Taurus Mountains, west of Mare Serenitatis, exhibit a very impressive character quite different from the Apennines: a scene just like a slushy road. These mottlings of semi-molten craters may be due to the irregular cooling of the crust. The highland extending south from Mare Crisium shows a similar landscape. In this district, depressions are somewhat regularly arranged relative to the superposed chains of calderas. When a chain of calderas was isolated, it may be recognized as a valley, like that of Rheita.

Explosive Nature of Silicic Magma. It is well known that explosive activity is much more common in volcanoes that eject silicic lava than in basaltic volcanoes. The explosive power of magma depends upon how much gas it contains. As is well known, lunar continents are crowded with innumerable craters. The volatile constituents of silicic magma must have played an important role for their formation.

Basic magma contains a lesser amount of gases. It is heavier and softer so that conditions in the maria were not so favorable for crater formation. Some of the so-called "ghost craters" with dark colored low walls may be the counterpart of the continental craters. The oldest craters formed when the basin was still in a plastic state are of large dimensions, and the surrounding walls are low. An interesting example is the large "ghost crater" situated southwest of Arago at the center of Mare Tranquillitatis. Its fragmentary walls are almost indistinguishable from the neighboring wrinkle ridges. Later products, formed after the basin acquired hardness, have reduced dimensions, and at the same time the surrounding walls become more conspicuous. They may be compared with our terrestrial guyot.

Domes abounding in the maria suggest the evolution of craterlets in the maria: close examination reveals that most of the domes are equipped with a central pit. Giant domes near Arago in Mare Tranquillitatis have small pits, while for those in Mare Nubium pits are comparatively large and easily detectable. They are seldom associated with a fissure system. Domes arranged in a sequence of increasing pits' size connect with craterlets and suggest collapse caldera as the nature of the isolated craterlets distributed at random in the maria.

Let us now turn to the bright craterlets. When the mass block of high silicic content was located amid an ocean basin, that place would often be unstable, leading to crater formation. Bright craterlets observed in the maria may have formed in such a way. Another possibility is the violent outflow of andesitic deeper magma in a later stage after the solidification of the ocean basin.

FIGURE 31. Photograph of Clavius-Tycho-Pitatus region on moon. Taken by M. Matsui with a 12-inch refractor, Kwasan Observatory, University of Kyoto, Japan. Note Cichus fissure zone and Tycho septa system. See discussion in article by Dr. S. Miyamoto in this issue.

Of course, we do not reject entirely the current idea of the inundation of basaltic lava over the pre-existing craters in some districts. In fact, the anonymous crater due west of Delambre on the north-eastern border of Mare Tranquillitatis may be mentioned. The original brighter floor is well contrasted with the darker lava invading southward. However, one point must be mentioned against the lava flow hypothesis. A great lava flow may surely destroy many craterlets and, according to circumstances, bury them entirely without leaving any trace of their existence. But even if we take into account this effect, the present <u>maria</u> are covered too scantily with craters. Mare Nubium, for example, is covered with a comparatively thin lava layer in view of the current hypothesis because irregular variations in brightness and buried craters are seen clearly. However, the number of such craters is obviously few, in contrast with the great crowd of craters in the adjacent continents extending southwards.

Summarizing, lunar craters may be classified in principle in a two dimensional array. The first coördinate is the chemical composition of the crust, namely, the relative abundance of silicates. The second coördinate is the plasticity of the crust or the epoch in the cooling period. Of course, metamorphism cannot be included in this scheme.

<u>Ring Plains and Ray Systems</u>. After the advanced cooling of the lunar surface and solidification of the crust, the real volcanoes might have come into being. We see lava flows and ejectamenta around Copernicus, Aristillus, etc., which are the characteristics for the objects of this type, but are absent in other caldera type craters.

A full moon photograph shows that lunar continents are dotted with bright craters. Most of them are small; and giants such as Tycho, Copernicus, and Kepler are few in number. Under a high sun, they shine briliantly and are often accompanied with systerious ray systems. The continental corridor surrounded by Mare Imbrium, Oceanus Procellarum, and Sinus Roris is most spectacular. At full moon, this district is seen to be dotted with numerous "stars" and well contrasted with the surrounding darkness of the <u>maria</u>. According to D. Alter[4] they are called "explosion craters." They may be ascribed to the explosive overflow of silicic magma rich in gaseous constituents through fissures or weaknesses of the crust. Such explosions might have been the final activity of the dying moon.

Comparing Copernicus with Aristillus, the latter is darker and has no ray system, but both show ejectamenta around them. The brightness difference may be attributed to a difference of chemical composition of the magma. The Aristillus magma may have been more basic and hence less explosive. We know that there is no real orogeny in the lunar world, and hence the supply of heat maintaining volcanic activity must have declined rapidly. The lunar landscape is, in fact, the product of the cooling period. Probably the lunar crust is not thick enough that we can expect any appreciable amount of the radioactive elements in the lunar crust.

The spectacular ray systems radiating from the explosion craters are usually considered as the deposits of gases and cinders ejected from volcanoes. Against this hypothesis, D. Alter[4] recently drew attention to the fact that short rays are associated with bright crater-like formations, and craterlets are arranged in chains along long rays. He observed that the circular rays south of Stadius are thus chained by craterlets. The ray extending eastward from Copernicus also shows an association with craters. Indeed, a giant replica of short rays may be Hyginus and its great cleft. This system also is bright under a high sun. In spite of his important findings, it seems still dubious whether every ray system can be resolved into crater-chains. Observation reveals that they lunar surface is covered with a mesh of faults and fissures. A possible explanation of the correlation of the rays with topography was pointed out by Spurr: horizontally drifting ash may be trapped by a slight relief on the lunar surface.

The author is very grateful for the kind coöperation of Mr. M. Matsui, on our observatory staff, who secured many excellent photographs of the moon; and the present work entirely depends upon his materials.

References

1) R. B. Baldwin, The Face of the Moon, 1949.
2) H. P. Wilkins and P. Moore, The Moon, London, 1955.
3) J. E. Spurr, Geology Applied to Selenology, 1944.
4) D. Alter, P.A.S.P.; 67,237,1955; 67,246,1955; 68,38,1956; 68,437,1956; 69,158,1957; 69,245,1957; 69,533,1957; 70,489,1958.
5) R. Henseling, Der Mond und die Planeten, Stuttgart, 1927.

BOOK REVIEWS

Der Sternenhimmel 1960. Edited by Robert A. Naef. Published by H. R. Sauerlaender and Co., Aarau, Switzerland. 134 pages.

Reviewed by Ernst E. Both

For many years Der Sternenhimmel has been familiar to amateurs and professionals alike. This year it again appears in its usual make-up: explanation of use (14-21); general review of observable phenomena in 1960 (22-39), according to planets, asteroids, and periodic comets, with finding charts for the planets; oppositions of Mars 1948-1963 (Dr. M. Du Matheray's map of Mars retains the old nomenclature, see Strolling Astronomer, Vol. 12, Oct.-Dec., 1958, p. 147); discussion of "surface" and satellite phenomena of Jupiter and Saturn. A celestial calendar for each month follows, with monthly sky maps, detailed descriptions, diagrams, and special finding charts. As usual, important events are in bold type (37-103). The November 7, 1960, transit of Mercury is described with great care and in detail (91-94).

A smaller section of this observing handbook gives positional details for the sun, moon, large planets, and the asteroids Ceres, Pallas, Juno, and Vesta (104-111), followed by Solar System data (112), a list of Swiss observatories (113), a very excellent list of interesting stars, clusters, nebulae, etc., (114-122), a useful general map of the moon for beginners (123-124), directions for finding bright stars (125), some double star orbits (126), and explantions of astronomical terms (127-134).

As in previous years the book is profusely and carefully illustrated with photographs, charts, diagrams, and drawings. Perhaps Der Sternenhimmel is one of the best illustrated almanacs if not the best.

Both the beginning and the advanced student will find this handy reference work fascinating and very helpful. Although it is written in German, it can well be used by those who have only a very basic knowledge of the German language.

Standard Handbook for Telescope Making, by Neal E. Howard. Thomas Y. Crowell Company, New York, 1959. 326 pages. Price $5.95.

Reviewed by Leif J. Robinson

Surely all amateurs at some time have read in part, if not in the whole, the classic series Amateur Telescope Making. This set has been the foundation for the construction of literally thousands of amateur telescopes. However, upon the initial reading, very few persons, I suspect, found comprehension to be in excess of fity percent; also many of those persons who found less than fifty percent comprehension, and who were not fortunate enough to live close to a large astronomical society, never completed their first mirror. For this circumstance there are two reasons: (1) ATM was authored by many different persons; having as many different styles of writing, and consequently the volume was quite nonuniform and difficult to comprehend; (2) the work is somewhat dated, and while the principles are the same, the technique for the expedient execution of these principles has been modified with our increased technology. Today we have by Mr. Howard a delightful volume which attempts to remove many of the rigors of the ATM series in favor of a more liberal approach to the subject, leaving the more detailed and complex information for the advanced optical worker to find in other sources. Fortunately, the author did not succumb to the oft present opportunities to become overly liberal at the sacrifice of clearness, directness, and coherency.

The volume itself is presented in the popular text-book fashion with sub-sections embodied within the chapter headings. Such a form facilitates reading, for each point is clearly set off from the body of text. The text is presented on good quality paper with a substantial binding, making it practical for the volume to be subjugated to the rigors of the work-room without fear of its falling apart. Let us now look at the general format of this work.

Mr. Howard begins with the usual comments as to what a telescope is together with a short history of the birth of the various telescopic forms. The next eight chapters are concerned completely with the methods of making an eight-inch f/7 mirror. At least the author casts off the shop-worn standard six-inch f/8. This reviewer is unable to see why writers in the field of telescope making often find it necessary to relate the construction of telescopes in terms other than that of some standard example. In the two following chapters one finds the author presenting the next two most important parts of the optical train--the diagonal and the eyepiece.

Following the optical section the author begins on the subject of the mounting with three chapters being concerned with the telescope tube, the mounting proper, and the necessary adjustments. The fifteenth chapter deals with the construction of observatories, while the seventeenth is concerned with the construction of the lesser known types of telescopes. The reader will note that I have omitted mention of the sixteenth chapter--hoping that the author, in subsequent editions of this book, will do the same--for this reviewer is unable to see where a chapter on the methods of celestial photography is at all related to the subject of telescope making. It should not be implied that this chapter is not well handled in accord with the rest of the volume--it is only quite out of place, and might be handled in a sequel volume concerning the application and operation of the telescope in various fields of amateur astronomy.

Lastly, one finds the remaining pages of the book containing twenty appendices relating to various topics of interest to the amateur. Briefly, we shall look at some of the more interesting. Appendix II lists the sidereal time for 0^h (U.T.) for all dates in 1960. A footnote for the preceding appendix lists the corrections necessary to convert the given values to a mean table for any year. Certainly, this table would be of much greater convenience had the author listed the mean values instead of the specialized ones for 1960 alone. Appendix V contains a listing of many suppliers of telescopic materials and equipment and will be of much use to the amateur. The sixth appendix describes the method of silvering an eight-inch mirror. Such a section could be eliminated without loss as the process of aluminizing is widely practiced by many companies at very low cost. The eighteenth appendix lists a number of films and developers, but neglects any mention of the tremendously important spectroscopic films and plates.

Having reviewed the general format of this volume, this reviewer would like to examine the two principal sections in some detail--the mirror and the mounting. In his narrative of the process of grinding the curve of the mirror, Mr. Howard presents a clear picture of the ways and means to this end. Following the sections on grinding the author presents a rather complete description of the Foucault tester, its construction and its use. Logically just after the section on the Foucault tester are the sections dealing with the polishing and figuring of the mirror. It is worthwhile for the novice to note that the mathematics and theory behind many of these operations are kept to a minimum. The general topic of mountings is covered in the classic way with descriptions of the theory behind both the altazimuth and the equatorial, followed by the common designs of the equatorial and ending with a description of the construction of the German Equatorial. This reviewer was disappointed to find that Mr. Howard did not include mention of the more recent and very popular forms of the portable mounting, such as the Cave-Harris adaptation of the fork design (see Sky and Telescope, March, 1956). There have been other forms of modified construction in recent years, most of which are worthy of fuller consideration in the modern literature.

In conclusion, this reviewer would like to suggest Standard Handbook for Telescope Making to anyone who is starting the construction of a telescope for the first time. It offers much in the way of information for the novice but lacks appeal to the more advanced telescope builder.

OBSERVATIONS AND COMMENTS

Rümker. We have received the following note from Mr. Alika Herring: "For some reason which is difficult to understand, Rümker has received but little attention from lunar students in the past. The amount of descriptive material generally available is therefore small and comprises little more than the short description found in The Moon, by Wilkins and Moore. Neither are the various charts very informative; Wilkins belies his description by apparently showing a ruined ring, as does Goodacre, which aspect is most certainly incorrect, while the charts of Elger and Schmidt show only some indefinite ridges. The drawing on the front cover of this issue may therefore be of some slight interest to other observers who may wish to study this curious formation.

"My drawing was made in fairly good seeing, and during favorable conditions of libration, both in longitude and latitude. Due to these quite fortuitous circumstances I was able to record a number of details in the formation which are ordinarily difficult to see. These included the curious three sided squarish enclosure opening towards the northwest, several small craterlets in the area which are probably less than a mile across, and the numerous rounded dome-like hills in the main part of the formation which give it a decidely 'lumpy' appearance. In fact, Rümker seems to invite descriptions which are either humorous or picturesque; I have heard it described both as a 'confectioner's delight', and as resembling a 'raspberry' (!). Other more serious observers have variously described it as a 'cindery mass', a 'celestial slag heap', and a 'plateau.

"In my opinion these descriptions are more or less superficial and indefinite and indicate that the true nature of this formation has not been generally recognized. I believe that my drawing clearly reveals that Rümker is basically a laccolithic-type of uplift feature, in other words, a giant dome, which in turn is composed of numerous smaller domes."

We are indebted to Mr. Herring for this informative note on a little-known lunar feature. The fact that the true nature of Rümker as a giant dome should not have been recognized raises interesting questions about the possible existence of many other large domes of this kind. Their nature would be readily apparent only under very oblique solar lighting.

Occultation of BD-21°5359 by Saturn and its Rings on April 30-May 1, 1960. Readers may recall Mr. Cragg's article on this event on pp. 58-60 of the March-April, 1960, issue. At this writing (May 11) we know of no successful observations. Some observers had cloudy skies, and for others the seeing was too poor to allow the ninth magnitude star to be observed through the rings.

Interim Report on Mercury in 1958 and 1959. Mr. Geoffrey Gaherty, Jr., the new Mercury Recorder, has communicated the following report:

"As Mr. Owen C. Ranck is unable to continue as Mercury Recorder, Mr. Haas has asked me to take over the post. I will try to carry out my duties to the best of my ability; but I must have the coöperation of you, the observers. This coöperation should be in the form of frequent observations submitted promptly.

"In this brief report I will simply list the observers who have contributed, together with the number of drawings. These observations were made for the most part in the period from July, 1958, to December, 1959, although a few earlier observations which were received too late to go into Mr. Ranck's last report[1] are included.

Observer	Station	Telescope	Drawings
Clark Chapman	Buffalo, N. Y.	10" Refl.	4
Tom C. Constanten	Las Vegas, Nev.	3¼" Refr.	2
Dale P. Cruikshank	Williams Bay, Wisc.	40" Refr.	2
Stanley Emig	Leavenworth, Wash.	8" Refl.	1
Stuart Emig	Leavenworth, Wash.	8" & 10" Refls.	2
Walter H. Haas	Las Cruces, N. M.	12.5" Refl.	6
William K. Hartmann	Pittsburgh, Pa.	13" Refr.	1
Craig L. Johnson	Boulder, Colo.	4" Refl.	9
Jim Low	Montreal, Canada	4" Refl.	1
R. R. de Freitas Mourao	Rio de Janeiro, Brazil	8" Refr.	1
Werner Sandner	Grafing-Bahnhof bei München, Germany	116 mm. Refr.	1
S. Soho	Tucson, Ariz.	6" Refl.	1
Stephen E. Stoessel	Fairfield, Conn.	6" Refl.	3
Gary Wegner	Bothell, Wash.	4",6",8",& 10" Refls.	43
Phil Werren	Madison, Wisc.	4¼" Refl.	1
Tim Wyngaard	Madison, Wisc.	4¼" Refl.	1

"These drawings will be discussed in detail in a full report which is now in preparation. I would appreciate it if any unreported Mercury observations were sent to me as quickly as possible. Regarding future observations, I would like to request that more observers add intensity estimates to their drawings, as suggested recently by Mr. William K. Hartmann[2]. These take very little extra time and add greatly to the value of the observation. It is preferable to record such estimates on a separate rough sketch, rather than to mark up the original drawing. I look forward to receiving your observations of Mercury."

References

1. Ranck, Owen C., "Report of the A.L.P.O. Mercury Section," Str. A., Jan.-Apr., 1959, pp. 20-22.
2. Hartmann, William K., "Lunar and Planetary Observations. Part I: The Making of Drawings," Str. A., Jan.-Feb., 1960, pp. 7-9.

The Strolling Astronomer

SUBSCRIPTION RATES

Bimonthly Issue (in stock)	0.70
Trimonthly Issue (in stock)	1.00
6 Months - - - - - - - -	1.75
1 Year - - - - - - - -	3.00
2 Years - - - - - - - -	5.00

ADVERTISING RATES

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

Discount of 10% on 3-time insertion.

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