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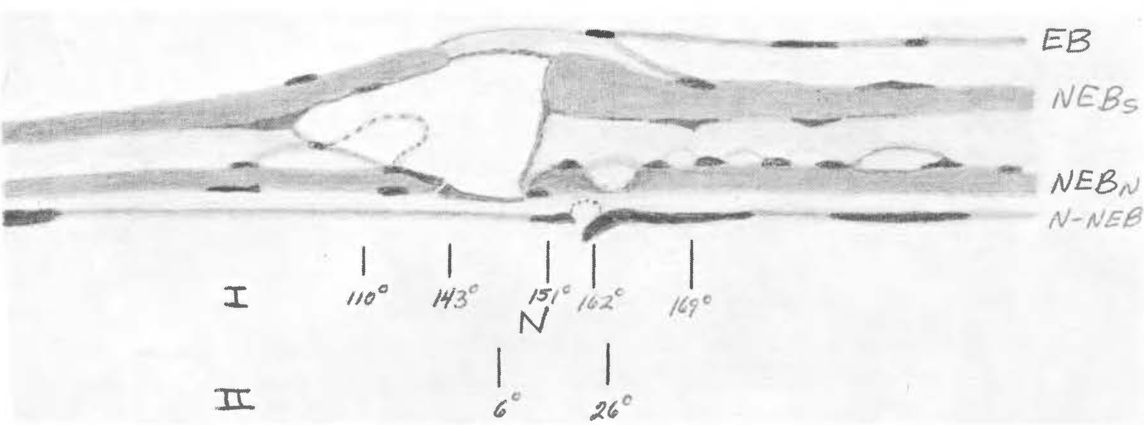

A "sectional sketch" of the North Equatorial Belt of Jupiter and its environs by Phillip W. Budine on April 7, 1968 from 3hrs., 35 mins. to 4 hrs., O mins., Universal Time. 10-inch reflector. 250X, seeing 8 (very good), transparency 5. The numbers at the bottom show the longitudes of features of which central meridian transits were observed. These CM transits are tabulated in Table 4 on page 98. Mr. Budine discusses several kinds of strip sketches of Jupiter in an article "A Procedure for Drawing and Notating Strip Sketches of Jupiter" on pages 97-101.

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ALPO
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IN THIS ISSUE

THE 1968-69 APPARITION OF JUPITER

By: Paul K. Mackal, A.L.P.O. Jupiter Recorder

Preface

This apparition of the Giant Planet was covered by 23 observers from October 24, 1968 to opposition on March 21, 1969 and from opposition to August 13, 1969. The angular diameter was 44".2 on the date of opposition.

List of Visual Contributions

(1) J. D. Aylward; Anderson, Ind.; 6-inch reflector; 1 full disc drawing.
(2) J. C. Bartlett, Jr.; Baltimore, Md.; 3-inch refractor; 50 verbal reports.
(3) I. Beck; Wadsworth, Ohio; 6-inch reflector; 43 full disc drawings.
(4) M. Blandford; Dayton, Ohio; 6-inch reflector; 8 full discs.
(5) R. Crausby; Las Cruces, N. M.; 2.4-inch refractor; 9 full discs.
(6) E. W. Cross, Jr.; Las Cruces, N. M.; 12-inch and 24-inch reflectors; 2 strip sketches and 10 verbal reports.
(7) K. Delano; Taunton, Mass.; 12 ½-inch reflector; an intensity and color report.
(8) C. Eppert; Philadelphia, Pa.; 6-inch reflector; 5 full discs.
(9) J. Farrell; Binghamton, N. Y.; 12 ½-inch reflector; 1 full disc drawing and 1 verbal report.
(10) R. Fite (& T. Preslar); Landis, N. C.; 8-inch reflector; 78 full discs.
(11) R. Gordon; Lyndhurst, N. J.; 3 ½-inch refractor; 1 full disc.
(12) A. W. Heath; Nottingham, U.K.; 12-inch reflector; 4 full disc drawings and an intensity and color report.
(13) K. Krisciunas; Naperville, Ill.; 6-inch reflector; 92 full discs.
(14) P. K. Mackal; Mequon, Wisc.; 6-inch reflector; 6 full discs.
(15) E. Mayer; Barberton, Ohio; 15.6-cm. reflector; 36 full discs.
(16) B. Moser; Connellsville, Pa.; 8-inch reflector; 27 full discs.
(17) T. Preslar (& R. Fite); Landis, N. C.; 8-inch reflector.
(18) M. Senour; Cleveland, Ohio; 10 ½-inch refractor; 8 full discs.
(19) J. R. Smith; Waco, Texas; 8-inch reflector; 1 verbal report.
(20) W. A. Smith; A.P.O. address; 6-inch reflector; 9 full discs and an intensity report.
(21) J. Starbird; Topeka, Kans.; 6-inch reflector; 2 full discs.
(22) J. Vitous; Riverside, Ill.; 8-inch reflector; 8 full discs drawn from photographs.
(23) J. Williams; Stamford, Conn.; 10- and 12-inch reflectors; 3 full discs.

List of Photographic Contributions

(1) E. Mayer; Barberton, Ohio; 15.6-cm. reflector; 1 black and white photograph.

All in all, there were approximately 400 observations of Jupiter during this period (exclusive of central meridian transit observations). Most of these were wholly visual in nature. Continuity was rather good with many multiple observations in April of 1969.

Qualitative Aspects of Jupiter

This Report is concerned with the qualitative aspects of Jupiter in 1969, including changes in belt and zone structure, belt and zone activity (of a certain magnitude), intensities, and colors (of a certain magnitude). Essentially I have broken down my analysis chronologically into four periods of time--(1) October of 1968 up to and including February of 1969, (2) March of 1969 to April of 1969, (3) April of 1969 to May of 1969, and (4) May of 1969 up to and including August of 1969. No particular significance is attached to the span of these time periods other than the convenience of the analysis and the ease of presentation of results from the analysis.

North Polar Region

This region was featureless from October to mid-December and slightly less intense than the SPR. On December 24, 1968, Mackal recorded a NNNTB at 230° II ± 30° bordering the NPR. The rest of the region was entirely featureless. This aspect was recorded on several other occasions by Fite and Preslar, but its intensity appeared variable in various longitudes.

In the second period the NPR remained featureless and constant in intensity over latitude and longitude. On March 1, 1969, E. Mayer noted a tail-end of the NNNTB at 21°

II. On March 4, 1969, Farrell recorded a double NNNTB under conditions of perfect seeing. In general this belt was a very thin border to the NPR reduced considerably in width in comparison to the first period in the RS region through the first half of March. By March 16, 1969, Mayer again showed the NNNTB but only a section of it, the end at about 20° II. A very faint NNNTB bordering the NPR was recorded by Mayer and others throughout March.

In the third period the NPR presented itself constant and inactive with the NNNTB barely visible in the longitude of the RS region on April 4, 1969, according to Mayer. The NNNTB fading trend was thus proceeding at a steady pace, and by April 7 it was gone on everyone's drawings preceding and following the RS some ± 100° II. However, Mackal and Mayer on April 8, 1969, noted an exceptionally strong NNNTB at 230° II ± 30°. This part had been the darkest portion in the first period as well. Another drawing on the same date by Mackal showed the NNNTB entirely gone preceding the Red Spot. On April 17 Mayer noted the NNNTB at 146° II ± 30°. It is curious to note that at those longitudes in which the NNNTB was exceptionally faint or even absent, the NPR was wider; and where the NNNTB was strong, the NPR was very narrow. This relation is fairly common in occurrence. In the RS region the NNNTB was back by late April on Mayer's drawings in moments of exceptionally good seeing.

In the last period the NNNTB was shown to be declining even at its favored location. On May 4, 1969, Mayer indicated a dark section at 172° II for 20° or so. Throughout May the NNNTB appeared to become invisible.

North North Temperate Zone and North North Temperate Belt

A faint thin NNTeZ and a dark wide NNTB were noted by Mackal on November 2, 1968, at 325° II. The width of the belt was not consistent, and at 200° II Mackal noted on December 24 that it tapered off into a thin line in the preceding direction. The other end of the faint section was roughly in the longitudes following the Red Spot through period one. The NNTeZ was somewhat wider in various places around the disc.

The belt was considerably faded at the beginning of period two. On March 3, 1969, Mayer noted a faint NNTB at 258° II, considerably darker in the following direction. A distinct tail-end was noted by Mayer on March 3 at 7° II with the belt proceeding in the following direction on the disc. The belt extended beyond the RS region by some 30° II on a March 4 disc drawing by Farrell. The NNTeZ appeared to widen somewhat throughout period two so that often one was surprised to see the NNTB close to the latitude of the NTB with the NTB very faint and placed far south too. For those who could not see the NTB, the NNTB might have easily been confused with it. (Of course, the NNTB of 1969 might be entirely different from the NNTB of 1962.) The NNTB was visible from the 4th through the 14th of March in the RS region. By mid-March it was gone from all the discs submitted. However, it was still faintly visible on drawings by Mayer--on March 20 at 274° II and again on March 31 at 170° II under exceptional seeing conditions.

During April (period three) the NNTB was considerably reduced in prominence at 282° II on a drawing by Mayer. Heath showed it gone at 149° II on April 3, 1969. However, in a drawing on the 4th it is visible again in the RS region! Mackal saw the NNTB at 270° II on April 6. It was fairly conspicuous and suggested a very slight revival in early April. On April 7 Mayer noted it again in the RS region. The NNTeZ was narrow again in these two regions. Mackal traced it out to 106° + 30° in II on the same date. On April 8 Mackal recorded a thin faint NNTB in the vicinity of 230° II with a reduced belt at 312° ± 30°. The NNTB tended to darken a bit more through mid-April at all longitudes. On April 21 Gordon recorded a thick belt in the RS region. This thickening proceeded elsewhere too, according to Mayer. However, on April 26 Mayer recorded another reversal! At about 19° II the preceding part of the belt faded out for some distance (30° or so).

In period four, on a May 1, 1969, drawing the NNTB was very dark at 81° II ± 30° and on May 4 at 355° II ± 30°. The fortunes of the belt in late May and early June were not ascertained by our Jupiter Section, unfortunately.

North Temperate Zone and North Temperate Belt

For Alan Heath this belt was gone throughout periods 2, 3, and 4 and was noticed once on November 24, 1968. It was noted again on April 13, 1969, by Kenneth Delano, who stated: "the NTB has displayed the most remarkable brightening..." None of the other observers could discern it in period one, perhaps because of smaller aperture telescopes and fairly average seeing in the U.S.A. It was not quite gone but nearly so and had been fading in 1968 prior to conjunction with the Sun. (This behavior was confirmed by the Recorder and Elmer Reese on New Mexico State University Observatory prints of Jupiter.) It

Sample ALPO drawings of Jupiter during its 1968-69 apparition

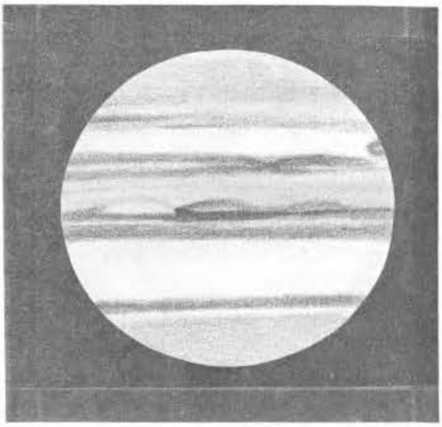

Figure 1. Paul Mackal; Nov. 2, 1968, 10:55-11:03 UT; CM I - 260°-264°, CM II - 321°-326°; Seeing 5, Transparency 5; 6-inch Reflector, 141x. Note the dark NEBs and the SEB.

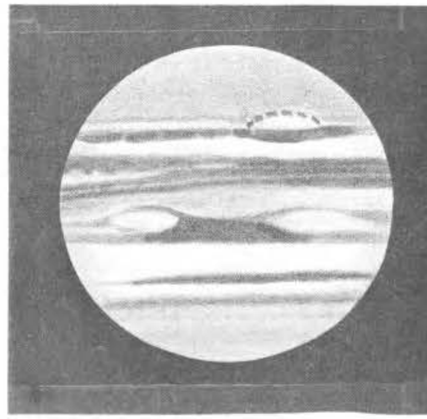

Figure 2. Paul Mackal; Dec. 24, 1968, 11:25 UT; CM I - 205°, CM II - 230°; Seeing 7, Transparency 5; 6-inch Reflector, 141x. Note the dark NEB and the EB-SEB complex.

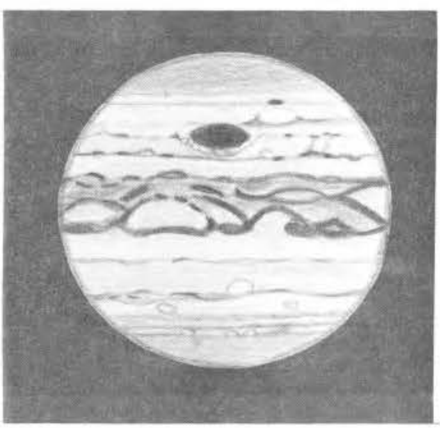

Figure 3. Joanne Farrell; March 4, 1969, 3:14 UT; CM I - 164°, CM II - 18°; Seeing 10, Transparency 5; 12 1/2-inch Reflector, 300x. Note NTB, EB, SEBs, RS, FA, STB, and SSTB.

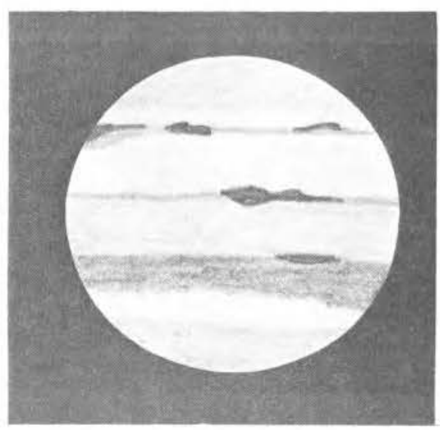

Figure 4. Bob Hicks; March 17, 1969, 2:20 UT; CM I - 26°, CM II - 140°; Seeing 6, Transparency 2; 6-inch Reflector, 200-320x. Note dark section on SEBn.

was not surprising, then, to see it disappear in 1969. At present no periodicity appears to apply to NTB fading, suggesting that many sub-surface sources produce different NTB belts over intervals of time at different latitudes or in the same latitude.

In period two Jupiter was nearing opposition and Farrell noted a thin NTB with a dusky NTeZ at 18° II. She called it quite faint. Its southern displacement was noticeable. (Jean Dragesco showed it located in its usual latitude throughout 1967-68.)

In period three no sign of the NTB was recorded, although Mayer suspected it on April 4, 1969, at 40° II; but it was not seen subsequent to Delano's observation in mid-April. Finally, during period four no NTB showed up on any discs. The NTeZ was somewhat brighter from April on and was called by Heath "off-white."

North Tropical Zone and North Tropical Zone Band

The NTrZ was bright in period one, according to Heath and Mackal, rivalled only by the STrZ. This state of affairs persisted through period two, but by mid-March Mayer had reidentified the famous NTrZBd first observed by Reese and Mackal in 1964. (A thin NTB_s dislocated southward was noted by Hargreaves of the B.A.A. on March 2, 1943, Memoirs B.A.A., Vol. 35, Part 4.) Reese has subsequently called it an NTB_s. But its lack of history makes this assessment rather dubious, and so I still refer to it as the "North Tropical Zone Band", a term which was coined in 1964. Dr. Slipher's photos of Jupiter in 1928 show a very dark NTB_s located north of the position of the NTrZBd latitude. The 1962 NTrZBd was located farther south than the 1969 NTrZBd so that classification is a matter of taste. Rotation periods should help to clear this matter up in the future. Two periods found in 1964 indicated that it rotated similarly to "NTrC-A." (See JALPO, p. 94, Vol. 18, Nos. 5-6 and JALPO, p. 147, Vol. 18, Nos. 7-8.) The preceding end of the NTrZBd was noted by Mayer on March 31, 1969, at 170° II. Bartlett recorded a bright and white NTrZ in late March. (On the band, also see JALPO, Vol. 19, Nos. 7-8, p. 115.)

In period three Mayer caught the following end of the NTrZBd at about 282° II. Heath noted the NTrZ as "off-white" in April, and its intensity appeared to fluctuate somewhat in different longitudes. Bartlett noted that the NTrZ was somewhat brighter than the STrZ, but not quite so bright as the EZ_n within white ovals on the NEB_s. In general the EZ was out-ranked by the Tropical Zones, according to Bartlett. Intensity estimates show the zone constant over time in 1969. On April 8, 1969, Mackal noted the NTrZBd at 227° II ± 30°, this band being the faintest feature on the planet. On the same night Mayer noted the preceding end at about the original position of March 31. The NTrZBd was not seen subsequently by the Jupiter Section, but this result may be due to the increasing distance of Jupiter from earth as the band was on a very low level of resolvability in small reflectors. On April 9 Bartlett noted that the NTrZ was brighter than the STrZ and especially so in a yellow K2 Wratten Filter. (For the most part in 1968-69 the STrZ was the brightest zone.) On many occasions the NTrZ was the brightest zone in April.

It remained the brightest zone in early May and especially from May 16 to May 30. However, the STrZ was brighter in yellow light at 64° II. On June 1, 1969, Bartlett recorded: "The NTrZ was only slightly brighter than the STrZ and definitely appears to be losing intensity", having also lost its yellow tinge. The NTrZ and STrZ were recorded equal in intensity by Bartlett in mid-June at 247° II. Delano indicates that the STrZ lost intensity from 1968 to 1969 and that the NTrZ gained about the same amount of intensity from 1968 to 1969.

North Equatorial Belt

Heath recorded much activity in the NEB and on the NEB_s in the EZ_n. Large bright white ovals characterized the activity along the NEB_s. It was very much like the activity of 1966-67 and 1967-68. Active regions noticed by Heath were--(1) 108°-117° in I, (2) 135° I, (3) 221° I, and (4) 313°-336° I. The NEB was double in most longitudes over the four periods of the apparition. Heath remarked: "The belt has often shown a dark southern or northern edge, giving the appearance of being double." Such was certainly true in April and during period four in certain longitudes. However, the NEB remained double with a light NEB Z in some longitudes throughout period four. It was brown and was not too warm in color. It was the darkest belt of the apparition and remained fairly constant in intensity, according to Heath. Delano indicated that the NEB_n became a bit darker compared to 1968; and the NEB_s, although very dark and darker than the NEB_n, became slightly lighter as compared to 1968.

On November 2, 1968, Mackal showed the NEB_s on the 0° latitude line. However, it was more normally placed to the north by December 24, 1968, according to Mackal. A lack of a double aspect was noted by Mackal on this same date with a double NEB preceding and following it (see Figure 2). The NEB_s was generally darker than the NEB_n in period one.

By March the NEB Z became obscured in certain longitudes, and the NEB_n exhibited activity in the form of rods and connections to the NEB_s, especially in the RS region. There were also dips, slopes, dents, and faded stretches.

By April another connection was noted between the NEB_n and the NEB_s in the RS region by Mayer. Does this aspect account for Delano's observations? The NEB_s was very dark at 328° I on April 6, 1969, according to Mackal. Slanty connectors of dark material were recorded on April 7 by Mayer. White spots and festoons along the NEB_n were spotted in the RS region as well. A double NEB_n (the following end at about 152° in I) was noted by Mackal and by I. Beck at 266° I. On April 8 Mackal noted a very dark NEB_n, rivalling the

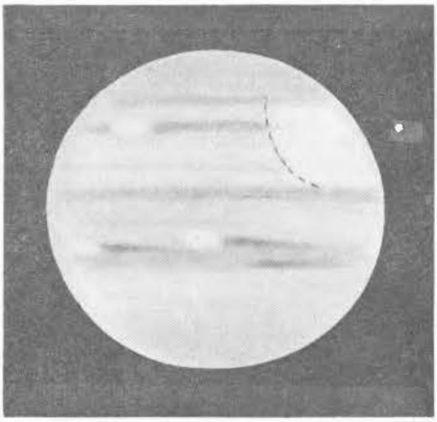

Figure 5. Alan Heath; April 3, 1969, 21:25 UT; CM I - 171°, CM II - 149°; Seeing fair; 12-inch Reflector, 190x. Note faint region over SEBZ-STeZ. Sat. I to right of disc.

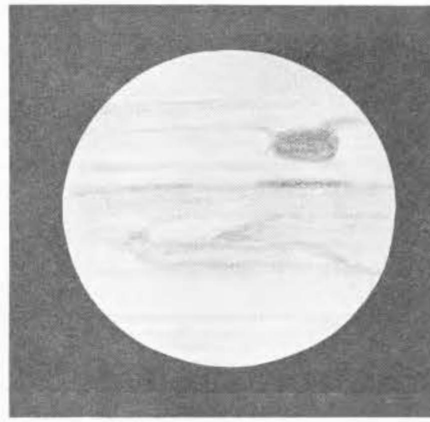

Figure 6. Ernst Mayer; April 4, 1969, 3:25 UT; CM I - 30°, CM II - 6°; Seeing 4-8, Transparency 3; 15.6-cm. Reflector, 220x. Note EZ and RS.

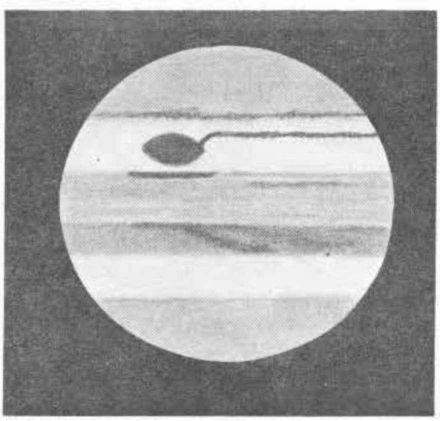

Figure 7. Inez Beck; April 4, 1969, 4:10 UT; CM I - 57°, CM II - 34°, Seeing 7, Transparency 4; 6-inch Reflector, 152x. Note STB f.RS.

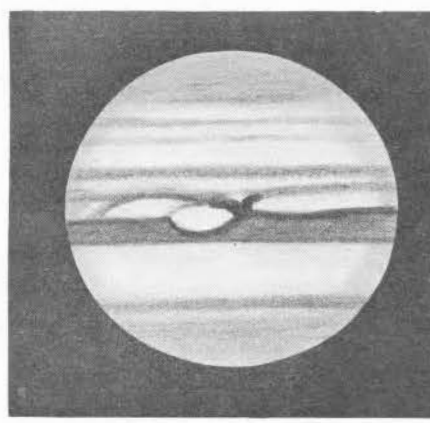

Figure 8. Paul Mackal; April 6, 1969, 2:55 UT; CM I - 328°, CM II - 289°; Seeing 4, Transparency 5; 6-inch Reflector, 141x. Note dark NEBs, bright NTeZ-NTrZ, EB, faint SEBs, and faint STB.

NEB_s, at 302° I with its following end at about 27° I. The NEB_s was also broken in places, with a preceding end noted at about 240° I by Mayer on April 12. A curious large white oval in the NEB_n was noted at 293° I (preceding end) on the same date by Mayer. By late April the amount of interaction between the NEB_n and NEB_s was very excessive in the RS region. In mid-April the NEB lost a reddish tinge, according to Bartlett, in several places.

In period four the NEB Z became very dark in many longitudes, as was evident in late April as well (310° I $\pm$ 30°). The NEB Z was light at 64° I $\pm$ 30°, according to Mayer. A light NEB Z was evident on May 5 at 256° I, with the preceding end of an NEB_s. Vitous noted the following end of a double NEB at 272° I on June 4. The NEB Z was definitely darker than the EZ throughout 1969.

Equatorial Zone, north; Equatorial Band; and Equatorial Zone, south

Heath noted that this zone varied in intensity over the apparition. In November the EZ was rather dull and appeared shaded all over, according to Heath and Mackal. A noticeable EB was observed, and it varied in intensity with longitude. Mackal noted that the EB was located centrally in the EZ on November 2, 1969. On December 24 Mackal noted a very dark belt contiguous to the SEB_n and slightly slanted to the north on the preceding side at 205° I. No sign of the normal EB was recorded here, and the EZ as a whole looked wide and dusky. This belt was a very southerly EB as intense as the SEB_n or else a second component of the SEB_n. A weak centrally located EB was noted by Beck on February 6, 1969, at 99° I in addition to the presumed EB_s. A light EZ_n was noted to the north of the EB_c. On February 19 Mayer recorded the EB_c and the EB_s at 5° I ± 30°. Mayer noted an orangish cast to the EZ_n and EZ_s at this time and also again at 305° I ± 30° on February 28. During March the EB_c was rather faint and inactive. The EZ was yellow in mid-March, according to Beck.

In period three, on April 1, 1969, Mayer depicted an EB_c issuing from NEB_s festoons at 283° I. Heath showed an EB_c on April 3 and described the EZ as "fawn" at 171° I. Prior to this date Bartlett had called the EZ "dull white." On April 7 he did not note the fawn or orange colors recorded by Heath and Mayer. Mayer again noted the EB issuing from an NEB_s festoon. An EB_c connection with the SEB_n was also noted by Mayer on April 4 at 64° I. On April 6 Mackal noted a terrific EB_c issuing from festoons off the NEB_s at 328° and rivalling in intensity the SEB_n. The EZ appeared yellow to him, and the EB red. This observation accounts for the impression of Heath and Mayer of an orangish cast in the EZ. The red EB was confirmed by Delano, who said: "The EB was broader, though not as dark as it was in 1968. Up until the May 1st observation, the EB occupied the entire southern half of the EZ, giving the EZ_s a salmon pink color. The EZ_n was white throughout the apparition." On some days the EB had a central core which was very dark, however, and more so than it had been in 1968. A drawing of Mayer's on April 7 at 65° I confirmed his observation of a connection of the EB with the SEB_n in period one and noted by Beck as well at 83° I on the same date. Beck thought that the EZ was yellow. At 152° I on the same date Mackal recorded an EB_c which he called orange. He described the EZ as chrome. On April 8 he recorded the EB Disturbance at 302° I, which Bartlett later defined on April 10 as "a thicker and darker portion of the EB...at 258° I, ...running eastward to the limb." This was an EB_c with a sheath of dusky material to the south and north of a darker central component, making the EZ_n and EZ_s very faint and thin indeed. Its following end was placed at 305° I by Mackal, and a more normal EB_c proceeded in the direction of increasing longitude. A very bright oval in the EZ_n was noted following this EB Disturbance. The EB_c was weak at 27° I on a Mackal drawing of the same date. A smaller upheaval of some sort was noted from 39° to 80° I by Bartlett on April 27. On April 24 Bartlett confirmed an apparent stable point of eruption for the EB Disturbance at 258° I.

In period four Vitous called the EZ tawny. The EB_c was back to normal, and no sign of the Disturbance was discovered although the EB_c still issued from NEB_s festoons. The EZ_s remained dull except north of the EB in the NEB_s white ovals, which were noted throughout the apparition. They often had a slight yellow cast. The EZ appeared neutral in red, green, and blue light throughout June, according to Bartlett. Heath noted the fawn hue again on June 1, still at 184° I. On June 13 Bartlett noted a bright EZ in a K2 Wratten Filter at 204° I. On June 17 the tawny section was noted again, 263° I, curiously at the point of eruption of the EB Disturbance.

South Equatorial Belt and South Equatorial Belt Zone

The SEB in the first period was about the same in color and intensity as the NEB_n at most longitudes. During the course of the apparition, however, it faded considerably. Bartlett called this trend a "radical decline." On November 2, 1968, Mackal noted a single point of origin of the SEB_n and the SEB_s at about 260° I and 325° II with the normal classical appearance preceding and following the point of origin. This point was considerably darker than the rest of the SEB! The SEB appeared to be relatively stable and active. On December 24, 1968, Mackal recorded an SEB_s inclining towards the south preceding the 230° II mark and the SEB_n inclining itself north. In this way it appeared to be returning to its faint structure and position on Jupiter, which is heralding the quiet SEB stage. The SEB was very faint. A light SEB Z formed through January of 1969 around the entire planet. By the end of period one Mayer showed the SEB Z bright and white at 305° I ± 30° (188° II).

By the beginning of March the SEB_s became so faint that at moments of only average seeing it was not visible in a 6-inch reflector, and this faintness persisted throughout period two. The SEB_n appeared to be fading out too as early as March 17 (see Figure 4). Gaps appeared in the SEB_n and the SEB_s. These gaps became most obvious in period three.

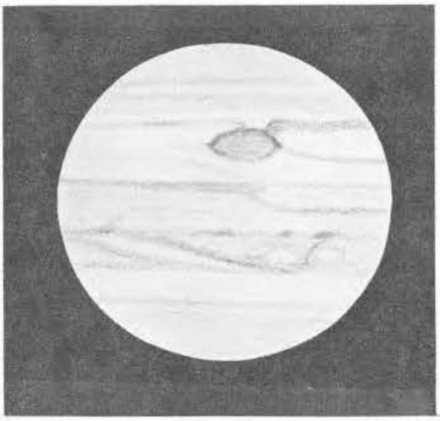

Figure 9. Ernst Mayer; April 7, 1969, 1:15 UT; CM I - 65°, CM II - 19°; Seeing 10, Transparency 4; 15.6-cm. Reflector, 220x. Note NEBZ detail and STrZ belt p.RS.

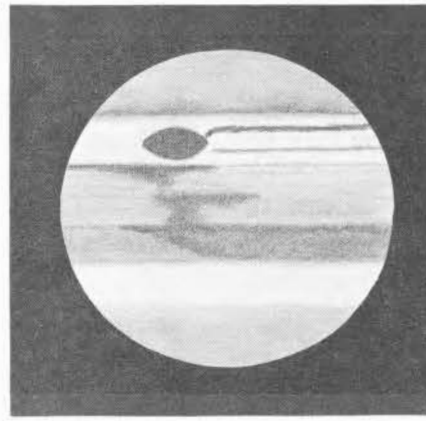

Figure 10. Inez Beck; April 7, 1969, 1:45 UT; CM I - 83°, CM II - 37°; Seeing 9, Transparency 5; 6-inch Reflector, 152x. Note EB activity.

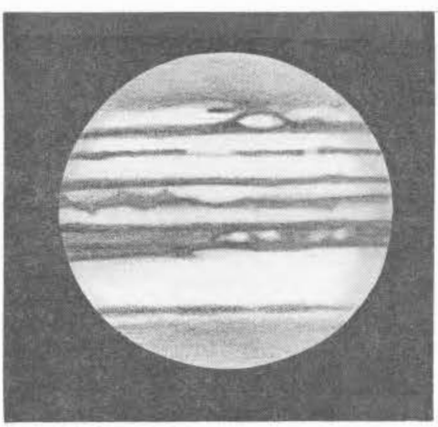

Figure 11. Paul Mackal; April 7, 1969, 3:38 UT; CM I - 152°, CM II - 106°; Seeing 5, Transparency 3; 6-inch Reflector, 141x. Note dash-like feature p.BC.

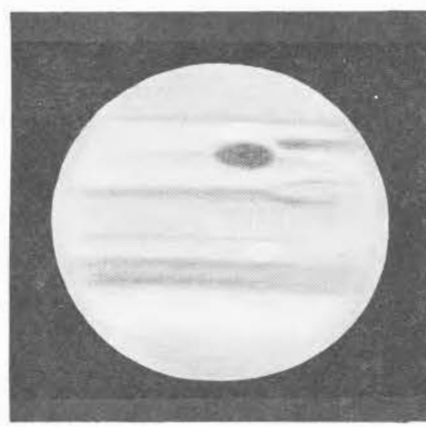

Figure 12. Alan Heath; April 7, 1969, 21:00 UT; CM I - 67°, CM II - 15°; Seeing fair; 12-inch Reflector, 190-318x. Note FA in conjunction with the RS.

Heath noted a fainter, almost white and blank region from 150° + 30° II from the SEB Z to the STeZ, and Heath called the SEB_s "fragmentary." On April 6, 1969, Mackal noted a rather southerly SEB_s at 289° II ± 30°. At 106° II ± 30° Mackal noted a very fragmented SEB_s which was of a "reddish cast", a color not noted previously by observers. Curiously, the SEB_s was now connected to the following end of the Red Spot! Prior to this time it was disconnected. On April 26 Mayer noted the SEB_s preceding the Red Spot connected to the preceding end of the Red Spot and the SEB_n. The SEB_s was rather dark following the Red Spot.

The fourth period was very much like period three. On May 5 the SEB_s was disconnec-

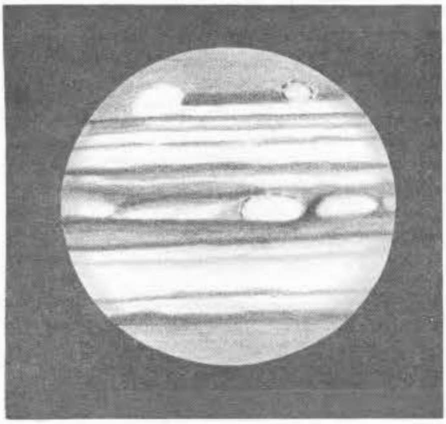

Figure 13. Paul Mackal; April 8, 1969, 3:25 UT; CM I - 302°, CM II - 248°; Seeing 5, Transparency 3; 6-inch Reflector, 141-212x. Note EB disturbance, NTrZ band, STBs, STBn, DE, and SSTB white oval.

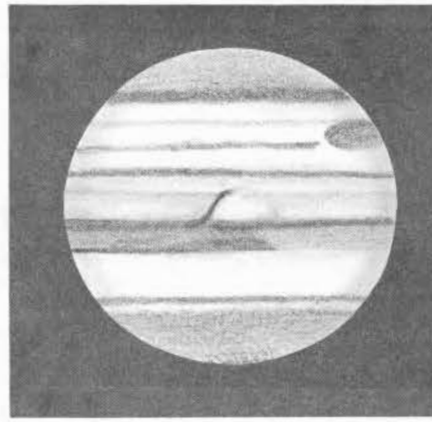

Figure 14. Paul Mackal; April 8, 1969, 5:45 UT; CM I - 27°, CM II - 333°; Seeing 6, Transparency 3; 6-inch Reflector, 141x. Note very dark SSTB.

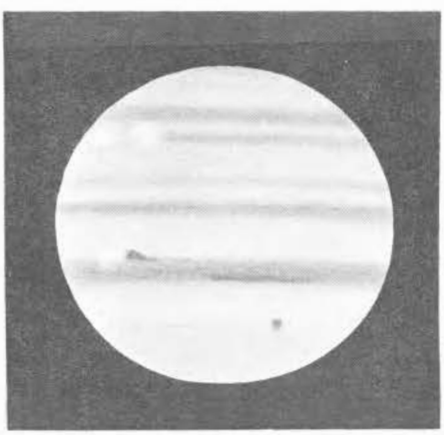

Figure 15. Alan Heath; April 17, 1969, 22:15 UT; CM I - 253°, CM II - 124°; Seeing fair; 12-inch Reflector, 190x. Sat. III on disc.

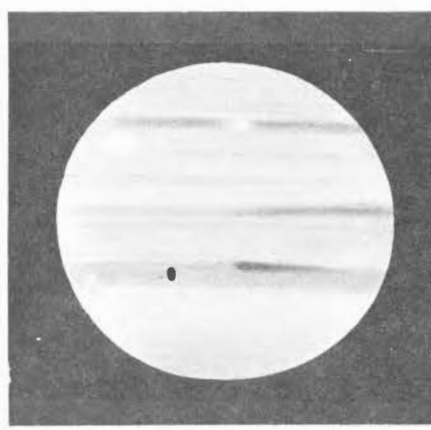

Figure 16. Alan Heath; April 18, 1969, 21:46 UT; CM I - 33°, CM II - 257°; Seeing fair; 12-inch Reflector, 190x. Note DE and SSTB white oval near CM. Sat. I and shadow on disc.

ted from the preceding end of the RS, according to Mayer. On May 14 Vitous observed the SEB Z orangish white at 217° II ± 30°, also on May 15 at 351° II ± 30° and on May 16 at 149° II. The SEB_s was again connected to the preceding end of the RS, according to Mayer, on May 17 at 28° II. No SEB_s was noted at 165° II by Mayer on May 28. The SEB_s was noted by Mayer on June 11 at 213° II.

South Tropical Zone

Through period one it was very bright and whitish. In March it was similarly described by Farrell and remained so throughout period two. Heath called it "off-white." In

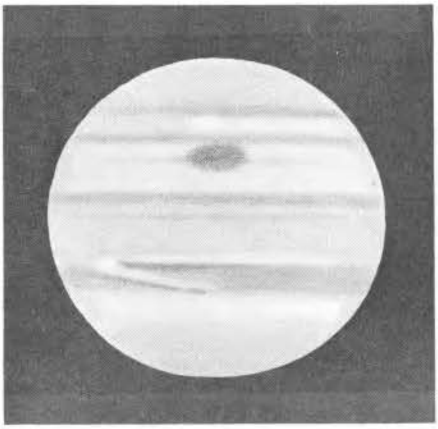

Figure 17. Alan Heath; April 19, 1969, 21:10 UT; CM I - 169°, CM II - 25°; Seeing very good; 12-inch Reflector, 190-318x. FA stuck over RS!

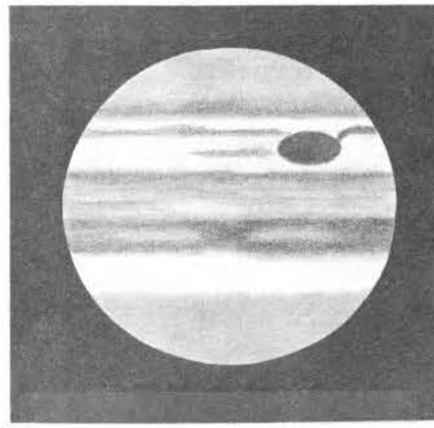

Figure 18. Inez Beck; April 21, 1969, 2:15 UT; CM I - 153°, CM II - 360°; Seeing 7, Transparency 5; 6-inch Reflector, 152x. Note revived STB p.RS and EZ activity.

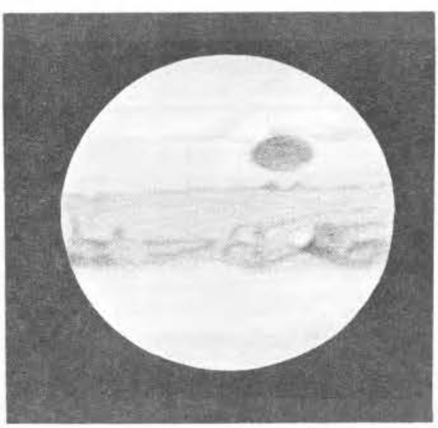

Figure 19. Joseph Vitous; April 26, 1969, 1:37 UT; CM I - 199°, CM II - 8°; Seeing 6-7, Transparency 5; 8-inch Reflector, 360x. Note NEB detail and FA near RS.

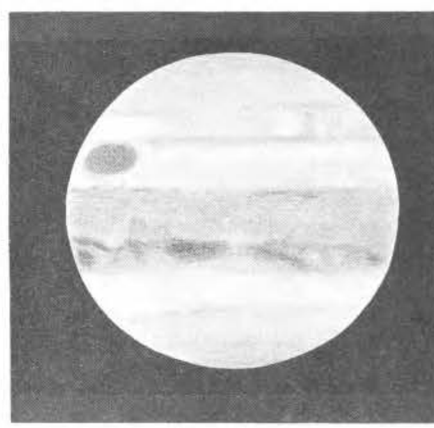

Figure 20. Joseph Vitous; April 26, 1969, 3:04 UT; CM I - 252°, CM II - 61°; Seeing 5-6, Transparency 5; 8-inch Reflector, 360x. Note EZ activity.

period three veiled portions were noted by Heath at 150° II ± 30° and preceding the RS in early April of 1969. Heath and Mayer noted an STrZBd connected to the preceding end of the RS on the 7th of April. The zone was very complicated in intensity and had minor variations, according to Heath in mid-April. In period four the STrZ was bluish to Vitous.

Red Spot

The Spot was exceptionally saturated in red-orange color but was only about as intense as it had been some time in the early sixties, according to Heath. The RS has been visible since 1960 when it revived from its faded aspect of 1959. (See JALPO, p. 37, Vol.

19, Nos. 3-4.) A seven year run from 1931 to 1937 was the closest thing to this record in the 20th century, according to B. M. Peek's table on p. 240 of The Planet Jupiter. Even there it was clear that the RS had been faint during one conjunction. I suspect that this record was duplicated in the 19th century because the Spot was very much more conspicuous then.

I wrote a letter to Dick Hodgson about the appearance of the Spot, and he confirmed Heath's impressions of it in a return letter. This result was confirmed by the Recorder and other members of the Jupiter Section. It appears that the Spot was deceptively intense because of the weak belts and bright zones in its region. Delano noted the decline in RS intensity from the 1966-67 and 1967-68 values too.

The RS had rather sharp edges and thus appeared to be a "pink fish." It was uniformly red throughout and was not in its ringed aspect. STeZ Oval DE was in conjunction with the Spot during conjunction with the Sun in 1968. Oval BC was moving away from the RS in 1968 and towards it by the end of 1969. Oval FA was almost in conjunction with the RS on March 4, 1969. (See Figure 3.) Comparing Figures 12 and 17 by Heath indicates that FA was stuck over the RS for a prolonged period! On April 26 Vitous showed the white oval still close to the RS.

South Temperate Belt and South Temperate Zone

The STB was usually as conspicuous as the NEB but was sometimes very faint or very dark on the globe. It was dark brown all year. According to Delano, the STB was not only fainter than in 1968 but was fainter than in 1966-67; and the STeZ was somewhat duskier but not quite so dusky as in 1966-67. A faint STB not so conspicuous as the NNTB was noted by Mackal on November 2, 1968, with the following end of the STB_s located at about 320° ± 30° II. A dusky STeZ was present. On December 24, 1968, Mackal noted a very dark STB with its preceding end at 230° II immediately north of Oval DE, which was somewhat longer and less intense than normal. (The oval was to brighten somewhat in April.) Preceding and following DE the STB was fragmented and faint. By February Oval BC extended south a considerable distance and intruded on the SSTB, as recorded by Beck on two dates. On February 19, 1969, Mayer showed the STB faded completely preceding the RS for some 60° II. This aspect was confirmed on February 22 by Beck. The following end of the STB was located at about 200° II on February 28, according to Mayer. This condition prevailed throughout March as well. The STB darkened in the 250° II region by mid-March. The STB following the RS also darkened and appeared connected to the RS, due to imminent conjunction with Oval FA. On March 19, 1969, Oval BC looked flattened out again, while Oval DE upon coming into BC's old position began to deflect the SSTB again about its southern edge on a drawing by Beck. The latitude of the STB appeared quite stable, however. At 268° II the STB was very faint on March 20. The oval had the appearance of being wrong-side up for the rest of period two. A faint STB was noted preceding the RS by Mayer.

The STB was back to prominence on April 1, 1969. Aside from seeing fluctuations and drifting of the belt, it is safe to say that a belt on the limit of resolvability in a small telescope will, if it varies in intensity even slightly, appear to flick on and off from time to time, when in larger telescopes it appears merely to fade a bit and darken a bit. A patch of lightness was noted by Heath at 149° II on April 3. Preceding the RS the STB was much darker. The color of the STB was not recorded by Beck or Mayer. Mackal noted the STB equal to the faint SEB_s on April 6, 289° ± 30° II. On April 7 Mackal noted a dark STB preceding Oval BC at 106° II. The STB_s arched over BC, and preceding BC in the STeZ there appeared a rather dark dash-like feature similar to Feature X observed by Moore in 1966-67. Oval BC appeared very normal. The STeZ was bright preceding BC and dusky following BC. On April 8 Mackal noted a rather large abnormal DE riding on the STB. The preceding end of the SSTB was at the following end of DE! This aspect confirms the impressions of Beck. Preceding the RS the STB was faint, according to Mackal on the same date. The STB was single in most locations. Heath's impression of DE was similar to Mackal's and Beck's except that he did not locate the STB_n. On April 19 he found the STB dark preceding the RS. In June STB normalcy was returning.

South South Temperate Belt and South Polar Region

This belt was often not noticed where the SPR extended far north. In any case the size of the SPR was similar to that of the NPR. The SPR was featureless in period one. A dark following end of the SSTB was noted by Beck preceding BC on February 10, 1969. A fainter section followed BC. Mayer noted another dark preceding end at 317° II on February 19. A feature over FA in the SSTB was located by Farrell on March 4 in period two. This feature over FA was not noted on disc drawings in 1966-67, but in the Rotation Periods Report we find some dark spots in the SSTB which might have gotten stuck over FA

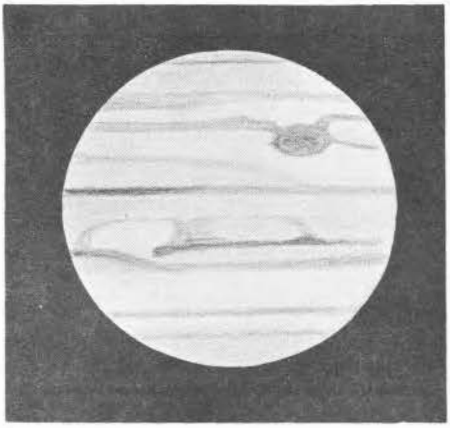

Figure 21. Ernst Mayer; May 5, 1969, 3:40 UT; CM I - 256°, CM II - 355°; Seeing 8, Transparency 5; 15.6-cm.Reflector, 220x. Note p.e.NEBs and SSSTB. FA close to RS (?)

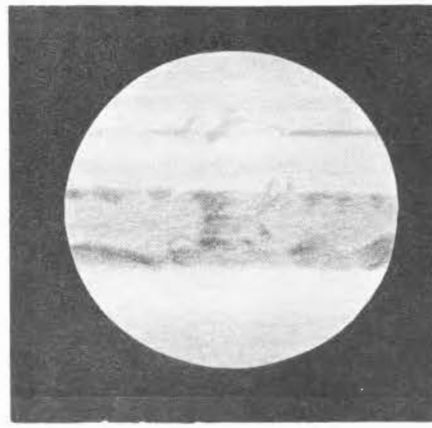

Figure 22. Joseph Vitous; May 14, 1969, 2:16 UT; CM I - 185°, CM II - 217°; Seeing 4, Transparency 4-5; 8-inch Reflector, 360x. Note EB activity on CM and STB.

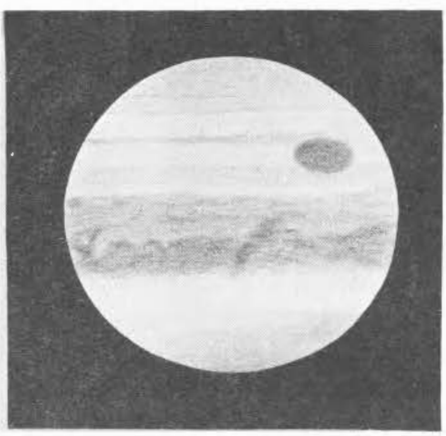

Figure 23. Joseph Vitous; May 15, 1969, 1:49 UT; CM I - 326°, CM II - 351°; Seeing 5-6, Transparency 5; 8-inch Reflector, 412x. Note EZ detail.

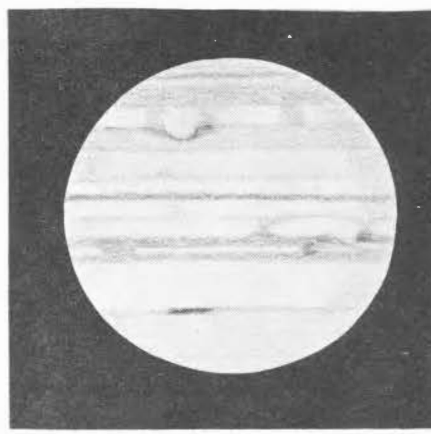

Figure 24. Ernst Mayer; June 11, 1969, 2:15 UT; CM I - 283°, CM II - 101°; Seeing 6-9, Transparency 4; 15.6-cm.Reflector, 220x.

when near the RS. In general the SSTB was rather faint with a few dark sections. From March 20 on there was a noticeable darkening, however. Mackal called the SSTB very dark on April 6.

A curious white oval was located over the SSTB in early April, according to Heath and Mackal, following DE some 30° in II. Mayer noted a very faint SSSTB in the SPR on April 25 and April 26. Mayer noted this belt again in May in the RS region. A faint SS-TeZ was noted by Vitous at about 200° II.

Satellites

Heath noted a dark transit of Jupiter III on April 17, 1969, similar to one seen in 1964 by Paul Mackal. Heath noted that this appearance was recorded seven times from 1903 to 1932. Delano sent in a very complete satellite report, which appeared to conform well with professional observations of intensity fluctuations due to orbital, solar, and rotational phase.

ADDITIONS TO THE A.L.P.O. LUNAR PHOTOGRAPH LIBRARY:

AMATEUR, JPL, ORBITER-IV AND -V, AND APOLLO-8 PHOTOGRAPHS

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

The A.L.P.O. Lunar Photograph Library

The A.L.P.O. Lunar Photograph Library was founded in 1964 and has grown to a collection of about 600 photographs, mostly in the form of 8 x 10-inch enlargements. Photographs have been generously supplied from A.L.P.O. members themselves, the Table Mountain Observatory of the Jet Propulsion Laboratory, and N.A.S.A. (the latter include 22 Mariner-IV photographs of Mars).

Interested A.L.P.O. members may obtain a listing of the holdings of the Lunar Photograph Library (through 1967) by sending 35 cents (for postage) to the writer, requesting the Lunar Photograph Catalog 1967. Members may borrow photographs for six weeks (renewable for another six weeks), again at a mailing cost of 35 cents (stamps are acceptable).

Request for Amateur Photographs

Although our Lunar Photograph Library now comprises a large collection of lunar photographs, coverage of some areas is still very weak, which is a handicap to their use in the Lunar Section's programs. Good quality amateur photographs can help remedy this deficiency, and advanced amateurs are urged to send the library any extra lunar enlargements they have (preferably in 8 x 10 format), and to continue or to initiate their own lunar photography programs in order to supply the library with new photographs. In particular, photographs are needed in the following categories:

i. The following "selected areas"--Alphonsus, Plato, Messier-Pickering, Eratosthenes, Kepler, Aristarchus, Atlas, Pierce-Pierce A, Theophilus, Eudoxus, Plinius, Aristillus, Conon-Bradley Region, Linné, Manilius, and Pico.

--Furthermore, almost all lunar photographs (including the Orbiter series) show areas under intermediate lightings (solar altitudes of 10° - 30°). Photographs are needed for other illuminations, particularly--

ii. High-sun photographs; photographs showing "steep places" and tonal variations in features with solar altitudes above 30°. High-contrast film is recommended for this purpose (e.g., Panatomic-X, High Contrast Copy).

iii. Low-sun photographs; photographs exposed for solar altitudes under 10°, showing such features as domes, ridges, crater rings, and terminator deformations. (Plus-X and Tri-X films are suitable for this work.)

Amateur Photographs

This list contains six amateur photographs recently added to the Lunar Photograph Library, which have been kindly supplied by the following members:

Lyle T. Johnson (LTJ): LTJ-1, 10-in. Rl. (5 x 8 in.)
LTJ-2, 10-in. Rl. (8 x 10 in.)
LTJ-3, 16-in. Rl. (8 x 10 in.)
LTJ-4, 16-in. Rl. (5 x 8 in.)

Patrick S. McIntosh (PSM): PSM-11, 12-in. Coelostat (4 x 5 in.)
PSM-12, 6-in. Rl. (4 x 5 in.)

Code Number	Area Covered	Date & Time (U.T.)	Colongitude	Approx. Scale**
LTJ-1	Aristarchus	01 Mar 1953 06:15	095°.7	6.0M
LTJ-2	O. Procellarum	25 Jul 1954 08:21	208.9	5.3M
LTJ-3	M. Imbrium	07 Nov 1957 06:53	090.3	8.4M

Code Number	Area Covered	Date & Time (U.T.)	Colongitude	Approx. Scale**
LTJ-4	Aristarchus	23 Dec 1958 02:27	057°3	4.3M
PSM-11	Aristarchus	06 Jul 1963 06:19	080.1	2.7M
PSM-12	Aristarchus	14 Jan 1965 02:40	047.0	3.9M

**In terms of an orthographic projection. "6.0M" indicates a scale of 1/6,000,000.

JPL Photograph

One new photograph (8 x 10 in.) has been received from the Jet Propulsion Laboratory, taken with the 16-in. reflector of Table Mountain Observatory.

Code Number	Area Covered	Date & Time (U.T.)	Colongitude	Approx. Scale
2175c	Pitatus-Birt	22 Feb 1964, 06:44	021°6	1.6M

Orbiter-IV and -V Photographs

The following 14 photographs are photocopies by the writer of selected areas from Orbiter-IV and -V photographs. They are useful for mapping because the areas are shown in near-vertical views. OIV-H-060, -077, -097, and -098a are 4 x 5 in. enlargements; the remainder are 8 x 10 in. In the descriptions: S is the scale, C is the colongitude, and SA is the solar altitude. The latitudes and longitudes are for the center of each enlargement. On longitudes east and west are in the I.A.U. sense.

Code Number	Date & Time (U.T.)	Description
Orbiter-IV-H-060	14 May 1967, 17:03	Messier-Messier A (01°9 S/47°3 E). S = 1/465,000. C = 335°4. SA = 23°.
H-077	16 May 1967, 05:05	Mädler (10°8 S/29°7 E). S = 1/465,000. C = 353°7. SA = 23°.
H-097	17 May 1967, 17:43	Agrippa (04°2 N/10°5 E). S = 1/650,000. C = 012°4. SA = 23°.
H-098a	17 May 1967, 18:16	Linné (27°7 N/11°8 E). S = 1/240,000. C = 012°6. SA = 22°.
H-098b	17 May 1967, 18:16	Valentine Dome (30°6 N/09°9 E) (2 copies). S = 1/290,000. C = 012°6. SA = 19°.
H-108	18 May 1967, 17:17	Alphonsus (13°5 S/02°7 W). S = 1/720,000. C = 024°4. SA = 21°.
H-127	20 May 1967, 06:26	Plato (51°6 N/09°3 W). S = 1/595,000. C = 043°2. SA = 21°.
H-133a	20 May 1967, 17:56	Milichius π Dome (10°0N/30°4 W). S = 1/270,000. C = 049°1. SA = 18°.
H-133b	20 May 1967, 17:56	Hortensius ω Dome (07°3 N/27°8 W). S = 1/320,000. C = 049°1. SA = 21°.
H-138a	21 May 1967, 05:57	Kepler (08°1 N/37°9 W). S = 1/195,000. C = 055°2. SA = 17°.
H-138b	21 May 1967, 05:57	Encke (04°5 N/36°6 W). S = 1/195,000. C = 055°2. SA = 19°.
H-150	22 May 1967, 06:00	Aristarchus-Herodotus Region (23°9 N/48°0 W). S = 1/710,000. C = 067°4. SA = 18°.
H-163	23 May 1967, 06:34	Rümker (40°7 N/58°5 W). S = 1/430,000. C = 079°8. SA = 16°
Orbiter-V-M-135	15 Aug 1967, 10:55	Eratosthenes (14°4 N/11°1 W). S = 1/240,000. C = 028°6. SA = 17°.

Apollo-8 Photographs

The following 20 photographs are a selection of 8 x 10 in. enlargements from photographs taken during Apollo-8's lunar orbits in December, 1968. Format is indicated as follows: VERT = vertical or near-vertical, L-OBL = low oblique (tilted--limb does not appear), and H-OBL = high oblique (tilted--limb appears). In the case of the oblique views, the scale given is the approximate unforeshortened scale at the center of the portion of the moon shown on the photograph. The following photographs overlap each other (these overlaps, if at equal scales, may be viewed stereoscopically):

Figure 25. The crater Wilhelm Humboldt, 190 kms. in diameter, is in the upper right corner of this view from Apollo-8. Note the intricate rille system and three dark patches on the floor of Humboldt. Below this crater and to the right appears Mare Australe, largely composed of lunabase-flooded craters. North at right; the sun is to the bottom at an altitude of 40°. Photograph AS8-12-2210 in the A.L.P.O. Lunar Photograph Library.

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AS8-13-2224, -2227.
-13-2341, -17-2810.
-17-2805 to -2824 form a strip of 7 photographs.
-18-2850, -2859.
-18-2859, -2850, -2860.
-18-2864, -2865, -2881.

Code Number	Format	Description
AS8- 12-2210	L-OBL	W. Humboldt-M. Australe (36°S/85°E). S = 3.4M. SA = 40°.

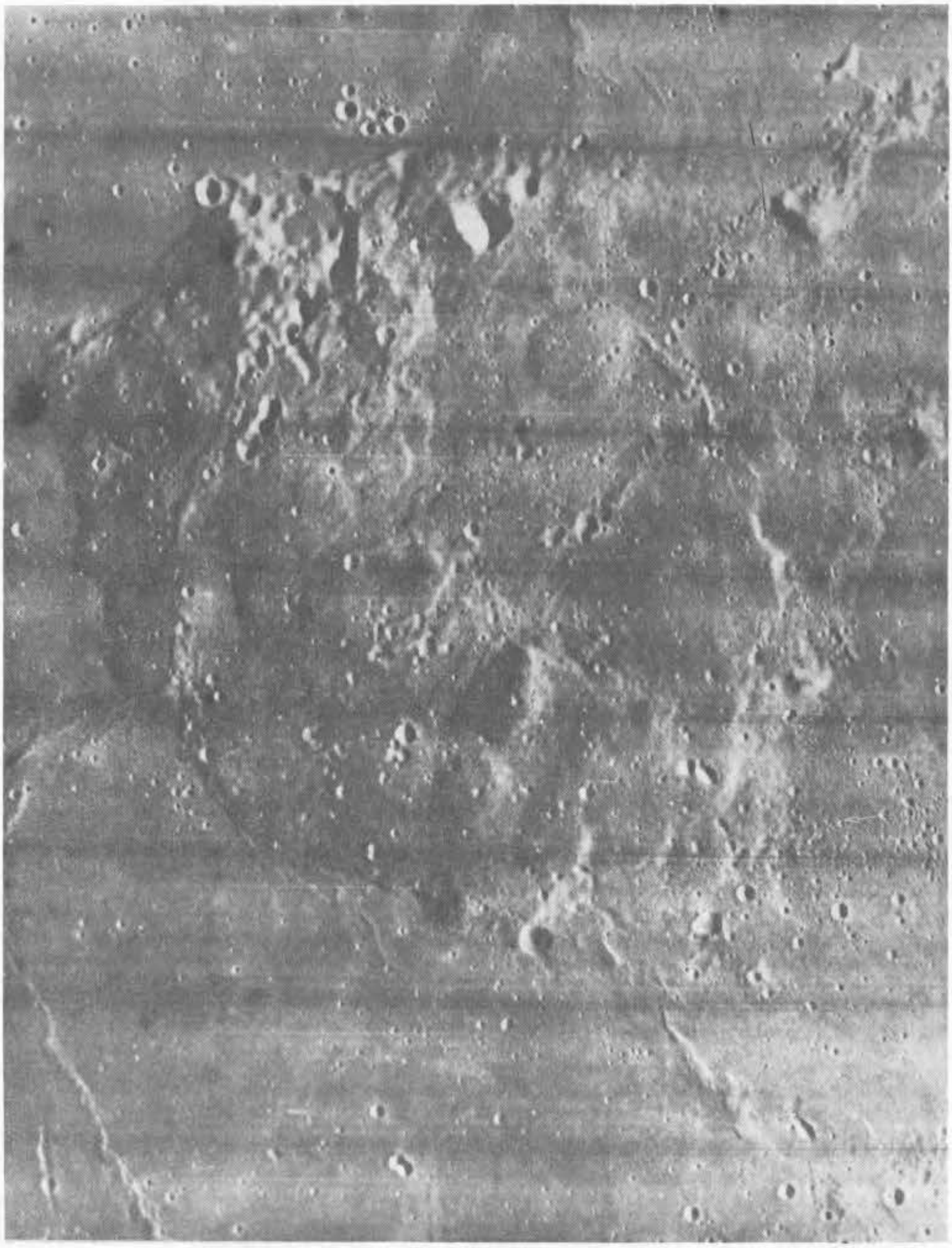

Figure 26. The unusual feature Rümker, in northern Oceanus Procellarum, fills most of this Orbiter-IV photograph. Rümker appears to be a complex collection of domes that have merged, and its surface contains many small ridges, hills, and craterlets; the diameter of the entire feature is about 50 kms., with a maximum altitude of only 400 meters. Taken on May 23, 1967, 06:34 U.T., with a colongitude of 079°.8 and a solar altitude of 16°. This is A.L.P.O. Lunar Photograph Library photograph OIV-H-163. North at top. Old-time A.L.P.O. members may want to compare this photograph with Alika Herring's drawing and description on March 11, 1960 at colongitude 69°.0, Str. A., Vol. 14, Nos. 5-6, front cover and pp. 95-96, 1960.

Code Number	Format	Description
AS8-		
13-2224	L-OBL	Goclenius (11°.3 S/45° E). S = 1/580,000. SA = 13°.
13-2227	L-OBL	Gutenberg D (11° S/42°.5 E). S = 1/550,000. SA = 10°.
13-2341	H-OBL	Messier-Messier A (02° S/47° E). S = 1.2M. SA = 17°.
16-2613	L-OBL	Langrenus (06°.5 S/61° E). S = 1.1M. SA = 32°.
17-2805	H-OBL	M. Fecunditatis-Taruntius K (01° N/51° E). S = 1.3M. SA = 29°.
17-2810	H-OBL	M. Fecunditatis: Messier-Taruntius (01° N/48° E). S = 1.2M. SA = 23°.
17-2812	H-OBL	M. Fecunditatis-Secchi (02° N/44° E). S = 1.0M. SA = 21°.
17-2815	H-OBL	M. Tranquillitatis-Taruntius F (04° N/41° E). S = 1.5M. SA = 17°.
17-2818	H-OBL	M. Tranquillitatis: Taruntius F-Maskelyne F (04° N/38° E). S = 1.5M. SA = 15°.
17-2820	H-OBL	M. Tranquillitatis-Maskelyne F (04° N/ 35° E). S = 1.4M. SA = 10°.
17-2824	H-OBL	M. Tranquillitatis: Maskelyne-Maskelyne M. (05° N/29° E). S = 1.4M. SA = 05°.5 (terminator visible).
18-2845	VERT	M. Smythii (06° S/85° E). S = 2.7M. SA = 57°.
18-2850	H-OBL	M. Nectaris (10° S/35° E). S = 3.6M. SA = -- (terminator visible).
18-2859	H-OBL	M. Tranquillitatis (05° N/40° E). S = 4.5M. SA = -- (terminator visible).
18-2860	H-OBL	Palus Somnii-Posidonius (20° N/ 45° E). S = 4.8M. SA = -- (terminator visible).
18-2864	L-OBL	M. Crisium - M. Undarum (13° N/65° E). S = 4.7M. SA = 33°.
18-2865	H-OBL	M. Crisium-Endymion (24° N/ 67° E). S = 4.7M. SA = 30°.
18-2881	VERT	M. Fecunditatis-Langrenus (03° S/56° E). S = 4.4M. SA = 28°.
18-2885	H-OBL	M. Marginis--Joliot-Curie (22° N/94° E). S = 3.5M. SA = --.

LUNAR NOTES

By: John E. Westfall, Charles L. Ricker, H. W. Kelsey,
Kenneth J. Delano, and Harry D. Jamieson, A.L.P.O. Lunar Recorders

I. Introduction (John E. Westfall)

This column is the first of what is planned to be a regular feature in each issue of The Strolling Astronomer. The purpose of "Lunar Notes" is to keep A.L.P.O. members up-to-date with the activities of their Lunar Section. Lengthier reports on A.L.P.O. Lunar Section projects will continue to be printed as separate articles outside this column as, of course, will any independently written articles dealing with the moon.

It has become clear to the Lunar Recorders that observer participation in the current lunar projects is declining. It is hoped that the publication of "Lunar Notes" will remind A.L.P.O. members that these projects are continuing and will encourage greater response from them. In addition, two new programs are described in Part IV of this column, which will give observers a wider variety of projects to participate in.

The Lunar Recorders welcome correspondence concerning Lunar Section projects, lunar studies in general, and the topics discussed in "Lunar Notes" in particular. Readers are reminded that copies of the Lunar Section's Lunar Observer's Manual are still available from the Lunar Recorders.

II. Selected Areas Program (Charles L. Ricker and H. W. Kelsey)

A. Activities of the Selected Areas Program:

1. Observing activity has been very low throughout the recent winter with a few notable exceptions! Inez Beck, Harry Jamieson, Ronald Fournier, William Richrath, and Christopher Vaucher have all consistently sent observations throughout the winter months.

2. Although it is not part of an official ALPO program, several observers are individually participating in the Lunar Transient Phenomena patrol sponsored by the Smithsonian Institution, Center for Short-Lived Phenomena during the Apollo missions. A number of confirmed LTP events have resulted from this program, including one which was ob-

served independently by the Astronauts. What is seriously needed now is objective evidence of LTP, and participants in the program have been requested to use photographic and spectrographic methods whenever possible.

3. The Recorders are presently engaged in a comprehensive analysis of the Alphonsus observations on file. Two observers, Carl Dillon and Christopher Vaucher, have made independent reports on their Alphonsus observations, and these will be very helpful to the Recorders. It is anticipated that this coming report will be the most extensive of its kind yet, and a number of months will probably be required for its completion.

B. Future Plans:

1. The Selected Areas Program has now added vertical-profile studies of the selected areas, and all observers are asked to be particularly careful in drawing in shadows, and also to record the time when the shadows are added to the drawings.

2. Four new selected areas have been chosen for study IN ADDITION to the present ones. The selection was based upon either unusual sightings in the past, or unique selenomorphology. The new areas are: Atlas, Ross D, Colombo, and Piccolomini (including the Altai Scarp).
New observing forms are being prepared and will probably be ready for distribution to interested members by the time this article appears. Notice that two of the areas lie in quadrant IV which has been badly under-observed in the past, and that they all are in the eastern (IAU) lunar hemisphere so that observers will have the opportunity to observe early in the lunation, and hopefully will be more readily able to cover all colongitudes from lunar sunrise to sunset at the formations.

III. Lunar Dome Survey (Kenneth J. Delano)

The A.L.P.O. Lunar Dome Program's present catalog contains 149 confirmed domes. Observational reports submitted by participants in the Lunar Dome Survey as well as detailed lunar photographs and charts present over 200 additional domes for consideration, many of which are probably true domes but are not yet included in the catalog for lack of observers to confirm their existence by telescopic observation.

Perhaps by asking everyone to concentrate his attention on one particular region of the moon over a definite period of time, we can obtain more lunar dome confirmations. The most promising area is the Marius Hills region, where Lunar Orbiter photographs have revealed what appear to be several domes. Furthermore, John Westfall, in examining U. S. Geological Survey charts, found 10 domes (in addition to the catalog dome -773 +155) in the hummocky region west of Marius and north of Reiner, i.e., from longitude 50° to 60° W and between latitudes 8° and 16° N. Searchers for domes in the Marius Hills should be most careful to distinguish domes from the steeper hills and from ridges or any part of ridges. (The A.L.P.O. Lunar Observer's Manual will acquaint new members with lunar dome observing.)

The sun's elevation will be low in the Marius Hills region, thus making any domes more apparent, on the following eight nights: May 31/June 1, June 15/16, June 30/July 1, July 15/16, July 29/30, August 13/14, August 27/28, and August 28/29, 1970. Results of this appeal for the observation of domes in the Marius Hills region will be given in this column in the fall.

Observers are also asked to give more attention to the limb areas of the moon, where few domes have thus far been recorded. Make your search along the terminator when the moon is a thin crescent and just before and after Full Moon, mindful that any dome will appear to be very much elongated due to the great foreshortening of all features in the limb regions.

IV. Two New Programs For The ALPO Lunar Section (Harry D. Jamieson)

As has been discussed elsewhere,[1] there has been a general feeling that the Lunar Section for some time has not been operating at its fullest potential. Participation in the presently existing programs has declined markedly, with the result that the Recorders now feel that some changes are necessary if the Section is to continue to serve the Association and its members in the best possible way. One of these changes will be the addition of two new programs, the purpose here being both to broaden the scope of our investigations, and to offer the membership more variety in their studies. These new programs were chosen with some care, as it was desired that they either complement or interlock with other existing programs, as well as be interesting and useful. Of those considered, the following two were finally chosen:

A. The Bright and Banded Craters Program

With this program, we hope to gather more information on the statistics of such craters (which may be related) as regards to distribution, size, the absence or presence of bright halos, and the number and placement of dark (or bright) bands, if any. We wish to determine, primarily, if there is a positive correlation between bright and banded craters, why some craters brighten as the sun rises higher above them while others do not, and whether such craters show a statistical preference for maria or for the uplands. A complete and detailed catalog will also be a goal.

B. The Vertical Profiles Program

The purpose of this program is two-fold. Its primary function will be to determine the heights and depths of previously ignored features, including faults, sinuous rilles, clefts, ridges, dark-haloed craters, and some mountains of particular interest. It is also planned that this program will provide a service to any of the other Recorders needing information on the vertical dimensions of features under study by their programs. The program's secondary function will be to continue and to complete the steep places program started some time ago by Ricker but later discontinued for lack of interest. This writer now has the complete files for this program; and should interest resume, it could be completed in short order and with some very interesting results.

As discussed above, one of our two main reasons for initiating these two new programs was the hope that, if we did so, the membership would take advantage of the increased variety thus offered and participate more fully in the activities of their Lunar Section. No research program - regardless of how well planned and directed - can be successful without the support and participation of an adequate number of competent observers (and requirements for the two new programs are not great). Interested observers who would like to participate in either of the two programs above are cordially invited to contact the writer, whose address may be found on the inside back cover of this issue, for more details.

Reference

1. Clark R. Chapman, Kenneth J. Delano, H. W. Kelsey, Harry D. Jamieson, Charles L. Ricker, and John E. Westfall, Str. A., 22, Nos. 3-4, pgs. 64-65.

THE SUN-GRAZING COMETS*

By: Darrell Conger

Members of the ALPO Comets Section have become familiar with the phrase "Orbit by Marsden." "Marsden" is Dr. Brian G. Marsden, of the Smithsonian Astrophysical Observatory, who for several years has computed comet orbits. He is the author of several papers concerning comets and comet orbits. The following article summarizes a paper by Marsden of much interest to amateur comet observers. Entitled "The Sun-grazing Comet Group", it was published in The Astronomical Journal, Volume 72, No. 9, November, 1967.

The paper begins with a short history of past work on the sun-grazers. The Great Comet of 1680 was the first comet recognized by astronomers to have passed within 200,000 kilometers of the sun, and Halley considered it to be a return of a comet seen in February of 1106. This was later proven to be false. (However, the 1106 comet turns up again later in the paper.) Clausen and Hoek discussed the concept of groups of comets, but Kirkwood in 1880 was apparently the first to suggest that the sun-grazers formed such a group. An extensive study of the group was made by Kreutz in 1888, 1891, and 1901 (hence the name, "Kreutz Group," often applied to the sun-grazers). Kreutz presumed that the group originated when some primordial comet split up at a perihelion passage. (This idea came after the Comet of 1882 had been observed to split into several fragments.)

Since Kreutz made his study, three further members of the group have appeared: 1945 VII (du Toit), 1963 V (Pereyra), and 1965 VIII (Ikeya-Seki). They are included in the following table giving the orbital elements of the generally acknowledged members of the Kreutz Group:

***Paper communicated by Mr. Dennis Milon, ALPO Comets Recorder.**

Table 1

Comet	T (UT)	ω	Ω	i	q (a.u)	e	P (yr)	L	B
1668	Feb. 28.08	109°.81	2°.52	144°.38	0.066604	1.0	....	248°.61	+33°.23
1843 I	Feb. 27.91	82.64	2.83	144.35	0.005527	0.999914	512	281.86	+35.31
1880 I	Jan. 28.12	86.25	7.08	144.66	0.005494	1.0	....	281.68	+35.25
1882 II	Sep. 17.72	69.59	346.96	142.00	0.007751	0.999907	761	282.24	+35.24
1887 I	Jan. 11.63	58.35	325.50	128.47	0.009665	1.0	....	280.24	+41.79
1945 VII	Dec. 28.01	50.93	321.69	137.02	0.006305	1.0	....	289.73	+31.96
1963 V	Aug. 23.92	85.82	6.77	144.52	0.005162	0.999952	[illegible]	281.90	+35.37
1965 VIII	Oct. 21.18	69.03	346.25	141.85	0.007761	0.999918	929	282.24	+35.21

In the above table, T is Time of perihelion passage, ω is argument of perihelion, Ω is longitude of ascending node, i is inclination to ecliptic, q is perihelion distance, e is eccentricity (with 1.0 indicating a parabolic orbit), P is period of revolution, L is longitude of perihelion, and B is latitude of perihelion.

Upon examining Table 1 and including several other comets not included in the original Kreutz Groups, namely Comets 1689, 1695, 1702a, and the 1882 eclipse comet, Marsden remarks that "It can scarcely be doubted that the comets are fragments of one original comet. The fragmentation may of course have taken place randomly over several revolution periods." He then derives the following specific points from examining the table:

(1) The times of the appearances of the comets are distributed in a highly non-uniform manner. There appear to be three distinct clusters of comets--one in the seventeenth century, a second in the nineteenth century, and a third in progress at present.

(2) The positions of the perihelion points of the five well-defined orbits are all contained in a very localized region: L = 282°.0 ± 0°.3, B = +35°.3 ± 0°.1.

(3) The values of ω, Ω, i, and q differ quite markedly and appear to be correlated with the position of Jupiter at the time of perihelion passage.

(4) The elements ω, Ω, i, and q for the individual nuclei of the comets observed to split are almost precisely the same. The derived revolution periods for adjacent nuclei differ by a century or more.

Some of these points were later found to have no dynamical foundation, but they can serve to deduce a working hypothesis for the origin of the group: assuming that the fragments of the primordial comet had identical values of ω, Ω, i, and q, if the breakup were like those observed in Comets 1882 II and 1965 VIII, the components would have periods differing by a century or so (point 1). The differences among the orbits of the returning comets would be explained by planetary perturbations, particularly by Jupiter (point 3). The breakup probably took place at the previous perihelion passage of the comets, during the twelfth century; or the clustering would not have been so pronounced.

However, this neat picture is proven untenable in the next section of Marsden's paper, in which he considers the actual effects of planetary perturbations on the comet group. It is pointed out that due to the relatively high inclinations of the comets' orbits, direct attractions by the planets are small. Indeed, it is impossible for a member of the group to approach within about 3 A.U. of Jupiter, for example. Taking only the indirect attractions of the planets for possible perturbations, Marsden computed the effect of Jupiter on the comets, and later computed the complete attractions of all the planets from Jupiter to Pluto. His conclusion was that the computed perturbations were much smaller than the observed differences in the orbits of the members of the group. He remarks: "The line of apsides is scarcely affected by the perturbations, and this is consistent with point (2). Although there are significant perturbations in the line of nodes they are considerably smaller than the differences among the orbits of the various members of the Kreutz group. Point (3) must thus be completely discarded." Therefore, the entire Kreutz Group did <u>not</u> originate at the last perihelion passage of a primordial comet in the twelfth century.

Next, Marsden considers some of the individual comets of the group, in particular, the last three members to appear, and the suspected earlier members of the group. For 1965 VIII, (Ikeya-Seki, of fond memory to ALPO observers), he computes new orbits using 3 different methods: Newtonian, relativistic, and the Brans-Dicke method (in which the sun is considered to be an oblate spheroid). He concludes that all 3 methods fit the observations equally well, and it is impossible to choose between them.

Returning to Table 1, Marsden notes that point (1) assumes that there are 3 clusters of comets sorted according to time of appearance. However, if the longitudes of the ascending nodes (Ω) of the group members are examined closely it will be noted that they fall within a range of about 40°; and within this range there appear to be two subgroups in which the lines of nodes are separated by about 20°. These subgroups are given in Table 2.

Table 2

Members of the two subgroups (identified by dates of perihelion passage)

Subgroup I	Subgroup II
1668 Mar. 1?	1689 Dec. 2??
1695 Oct. 23?	1702 Feb. 15??
1843 Feb. 27	1882 Sept. 17
1880 Jan. 28	1945 Dec. 27
1882 May 17?	1965 Oct. 21
1887 Jan. 11??	
1963 Aug. 23	

Presumably, the members of these subgroups are more closely related to each other than to members of the other subgroup. Therefore, point (1) is largely invalidated.

Discussing subgroup II first, Marsden considered the similarities in the orbits of Comets 1965 VIII and 1882 II. He concludes that it is virtually proven that these comets were previously seen as the Comet of 1106 and that they are the principal fragments of this comet. The other members of subgroup II may have originated at this perihelion passage or at the next previous passage, in the fourth century, A.D.

A previous appearance for subgroup I is not as easily proven; but noting similarities in the orbits of Comets 1963 V and 1843 I, Marsden suggests that this previous appearance was seen as the Comet of 1075, or even as the Comet of 1106. Another possibility is that the members of this subgroup split up at the next previous passage.

To explain the differences in the orbits of the two subgroups, Marsden supposes that following the breakup of the primordial comet at least 5, and probably 10 to 20 revolutions ago, only two of the fragments consistently survived. By the cumulative action (over several revolutions) of the planets, the lines of nodes and perihelion distances differed more and more until, two revolutions ago at the most, the two fragments could become the parents of the two subgroups. Thus we see that of the original specific points derived from the table of orbital elements (Table 1), only points (2) and (4) have been borne out. Point (3) has been dismissed as fortuitous, and point (1) is probably so.

The final theory is not too different from the original working theory except that the breakup of the primordial comet occurred far earlier than the twelfth century, A.D., planetary perturbations did not have the influence originally assumed, and the clustering by time of appearance appears to have no foundation. A further point must be considered: only substantial fragments of a break-up appear to survive for a long time. Marsden speculates that only the two pricipal nuclei of Comet 1882 II, and possibly of 1843 I, will ever appear again.

Recognizing the desirability of observing as many of the sun-grazers as possible, Marsden includes a perennial search ephemeris for members of the group within 50 days of perihelion at any time of the year.* It should be noted that a member of this group at perihelion between mid-May and mid-August will undoubtedly be missed unless it is bright enough to be seen in daylight, or is seen during a total solar eclipse, because it will approach and leave the sun from behind.

In the final section of his paper, Marsden discusses the idea that <u>all</u> comets with perihelion distances less than 0.5 A.U. might be related to the sun-grazers. This has also been suggested by others. The idea is given only as a suggestion, and no proof is offered either pro or con. His final comments concern the Comet of 1680, which was mentioned at the beginning of this article as being the first recognized sun-grazer. In the year -371, the Greek historian Ephorus claimed to have seen a comet split in two. His report has generally been disregarded because he might have manufactured it to support the ancient theory that comets were formed when two stars passed close together--and thus that they ceased to exist when the stars separated again. Marsden speculates that if Ephorus really saw a split-up he might have witnessed the split-off of the Comet of 1680 from the Kreutz Group.

The picture all this leaves in my mind is of a <u>really</u> "Great" Comet which appeared, perhaps several times, to our ancestors some thousands of years ago. About, say, ten revolutions ago, this protocomet split into two comets which, one or two revolutions ago, split

*This search ephemeris is reproduced on pages 93-95.

into the two subgroups we have been observing since the seventeenth century. At least two members of the subgroups, 1882 II and 1965 VIII, have been observed to split further. At any rate, the splitting process appears to be accelerating. Is it possible that we are witnessing the final "death throes" of the original comet? Or will more sun-grazers, perhaps even more "subgroups", continue to appear in the coming centuries?

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A search ephemeris for the sun-grazing group, compiled by Brian G. Marsden and reprinted here from The Astronomical Journal, November, 1967. This is a perennial ephemeris for members of the group within 50 days of perihelion passage at any time. The column heads indicate 50 days before (-50) and 50 days after (+50) perihelion. At each entry are given the right ascension (in hours and minutes, equinox 1950), the declination in degrees, and the geocentric distance in astronomical units.

This table should be used in conjunction with the magnitude list by John Bortle which accompanies this article. The magnitude list table begins on page 95.

t--T (days)	-50	-40	-30	-20	-10	+10	+20	+30	+40	+50	
r (a.u.)	1.49	1.28	1.06	0.80	0.50	0.50	0.80	1.06	1.28	1.49	
	5 10	4 31	2.38	21 58	19 48	17 39	15 24	10 24	8 39	8 04	
Jan. 1	-52.2	-60.9	-71.4	-69.6	-48.4	-46.8	-69.4	-70.0	-57.9	-48.7	Jan. 1
	0.93	0.79	0.67	0.62	0.68	0.64	0.56	0.61	0.73	0.88	
	4 16	3 27	1 52	23 16	21 04	19 14	19 26	6 39	6 52	6 54	
11	-47.2	-53.0	-58.6	-57.2	-43.4	-47.1	-76.6	-77.1	-59.9	-49.3	11
	0.98	0.84	0.72	0.67	0.72	0.61	0.52	0.57	0.70	0.85	
	3 43	2 58	1 46	0 00	22 05	20 46	23 12	3 39	5 15	5 49	
21	-40.6	-44.1	-47.0	-46.0	-37.3	-43.8	-66.1	-65.8	-54.1	-45.4	21
	1.06	0.92	0.81	0.74	0.76	0.61	0.52	0.58	0.71	0.86	
	3 27	2 48	1 52	0 32	22 53	22 06	0 31	3 01	4 23	5 04	
31	-33.9	-36.0	-37.4	-36.6	-31.0	-37.6	-51.1	-50.3	-44.3	-38.7	31
	1.49	1.02	0.90	0.82	0.82	0.62	0.56	0.63	0.76	0.92	
	3 22	2 49	2 03	0 59	23 36	23 10	1 15	2 58	4 01	4 39	
Feb. 10	-28.0	-29.0	-29.6	-28.8	-25.0	-30.1	-37.9	-37.5	-34.3	-31.4	Feb. 10
	1.28	1.14	1.01	0.92	0.89	0.66	0.63	0.72	0.86	1.01	
	3 23	2 55	2 16	1 23	0 11	0 03	1 48	3 05	3 55	4 28	
20	-22.7	-23.2	-23.2	-22.3	-19.4	-22.6	-27.3	-27.4	-26.1	-24.5	20
	1.40	1.26	1.13	1.02	0.95	0.71	0.72	0.83	0.97	1.12	
	3 29	3 04	2 31	1 47	0 43	0 47	2 16	3 17	3 58	4 26	
Mar. 2	-18.3	-18.2	-17.9	-16.9	-14.4	-15.8	-19.1	-19.7	-19.4	-18.8	Mar. 2
	1.53	1.38	1.24	1.11	1.02	0.78	0.82	0.94	1.09	1.25	
	3 37	3 16	2 48	2 10	1 14	1 26	2 42	3 32	4 06	4 29	
12	-14.5	-14.1	-13.5	-12.3	-10.0	- 9.9	-12.6	-13.6	-14.0	-14.1	12
	1.65	1.50	1.35	1.21	1.09	0.85	0.93	1.07	1.22	1.38	
	3.47	3 29	3 05	2 32	1 43	2 01	3 06	3 48	4 16	4 36	
22	-11.2	-10.6	- 9.8	- 8.4	- 6.0	- 4.8	- 7.4	- 8.9	- 9.7	-10.2	22
	1.77	1.61	1.46	1.30	1.15	0.92	1.04	1.19	1.35	1.52	
	3 59	3 43	3 23	2 54	2 11	2 34	3 30	4 05	4 29	4 46	
Apr. 1	- 8.4	- 7.6	- 6.6	- 5.0	- 2.4	- 0.5	- 3.3	- 5.1	- 6.2	- 7.0	Apr. 1
	1.88	1.72	1.55	1.38	1.21	0.99	1.14	1.31	1.48	1.65	
	4 13	3 59	3 41	3 16	2 38	3 06	3 54	4 23	4 43	4 58	
11	- 6.0	- 5.1	- 3.9	- 2.2	+ 0.7	+ 3.0	- 2.0	- 2.0	- 3.3	- 4.3	11
	1.99	1.82	1.64	1.46	1.27	1.07	1.24	1.42	1.60	1.78	
	4 27	4 15	3 59	3 38	3 06	3 36	4 17	4 42	4 58	5 11	
21	- 4.1	- 3.0	- 1.7	+ 0.3	+ 3.3	+ 6.0	+ 2.7	+ 0.5	- 1.1	- 2.2	21
	2.08	1.91	1.72	1.53	1.31	1.14	1.33	1.53	1.71	1.89	
	4 41	4 31	4 18	4 00	3 33	4 06	4 40	5 00	5 14	5 24	
May 1	- 2.4	- 1.3	+ 0.2	+ 2.3	+ 5.6	+ 8.4	+ 4.8	+ 2.4	+ 0.8	- 0.5	May 1
	2.16	1.98	1.79	1.58	1.36	1.20	1.42	1.62	1.82	2.00	

t--T (days) r (a.u.)	-50 1.49	-40 1.28	-30 1.06	-20 0.80	-10 0.50	+10 0.50	+20 0.80	+30 1.06	+40 1.28	+50 1.49	
May 11	4.57 - 1.1 2.23	4 48 + 0.1 2.05	...	...	...	4 35 +10.3 1.26	5 03 + 6.4 1.50	5 20 + 3.9 1.71	5 31 + 2.2 1.91	5 39 + 0.9 2.10	May 11
21	...	...	...	...	...	5 04 +11.6 1.32	5 26 + 7.6 1.56	5 39 + 5.1 1.79	5 48 + 3.3 1.99	5 54 + 1.9 2.18	21
31	...	...	...	...	...	5 32 +12.5 1.36	5 49 + 8.4 1.62	5 59 + 5.8 1.85	6 05 + 4.0 2.06	6 10 + 2.6 2.26	31
Aug. 9	7 21 - 1.7 2.23	7 27 - 0.6 2.04	...	...	...	...	...	...	...	...	Aug. 9
19	7 36 - 3.2 2.16	7 43 - 2.1 1.97	7 53 - 0.7 1.76	8 08 + 1.3 1.54	8 33 + 4.6 1.29	...	...	...	...	...	19
29	7 51 - 4.9 2.08	8 00 - 4.0 1.89	8 12 - 2.8 1.69	8 30 - 0.9 1.48	9 00 + 2.1 1.24	...	...	...	8 40 - 1.7 2.06	8 31 - 2.6 2.25	29
Sept. 8	8 04 - 7.0 1.99	8 15 - 6.3 1.80	8 30 - 5.2 1.61	8 52 - 3.6 1.40	9 28 - 0.9 1.19	9 58 + 1.0 1.37	9 29 - 1.2 1.60	9 10 - 2.6 1.80	8 56 - 3.6 2.00	8 45 - 4.4 2.18	Sept. 8
18	8 17 - 9.5 1.88	8 30 - 8.9 1.70	8 48 - 8.1 1.52	9 14 - 6.7 1.32	9 57 - 4.4 1.13	10 23 - 1.8 1.32	9 49 - 3.7 1.54	9 27 - 5.0 1.73	9 11 - 5.8 1.92	8 59 - 6.4 2.09	18
28	8 29 -12.3 1.77	8 44 -12.0 1.59	9 05 -11.4 1.42	9 36 -10.4 1.23	10 26 - 8.3 1.06	10 49 - 5.0 1.27	10 10 - 6.6 1.46	9 45 - 7.6 1.64	9 26 - 8.3 1.82	9 12 - 8.7 1.99	28
Oct. 8	8 39 -15.6 1.65	8 57 -15.6 1.48	9 22 -15.4 1.31	9 59 -14.7 1.14	10 57 -12.9 0.99	11 16 - 8.5 1.21	10 31 - 9.8 1.38	10 02 -10.6 1.55	9 40 -11.0 1.72	9 24 -11.3 1.88	Oct. 8
18	8 47 -19.5 1.53	9 08 -19.9 1.36	9 38 -20.1 1.20	10 22 -19.9 1.04	11 30 -17.9 0.93	11 43 -12.2 1.14	10 52 -13.5 1.29	10 18 -14.0 1.45	9 53 -14.2 1.60	9 34 -14.3 1.76	18
28	8 52 -24.0 1.40	9 17 -24.9 1.24	9 52 -25.8 1.08	10 46 -25.9 0.95	12 06 -23.6 0.86	12 13 -16.3 1.08	11 14 -17.5 1.19	10 34 -17.9 1.33	10 05 -17.8 1.48	9 43 -17.6 1.63	28
Nov. 7	8 52 -29.2 1.28	9 21 -30.9 1.12	10 05 -32.6 0.97	11 12 -33.3 0.85	12 48 -29.9 0.80	12 44 -20.8 1.00	11 36 -22.2 1.09	10 49 -22.3 1.22	10 15 -21.9 1.36	9 49 -21.4 1.50	Nov. 7
17	8 46 -35.3 1.49	9 20 -38.1 1.01	10 14 -41.0 0.87	11 42 -42.1 0.76	13 38 -36.5 0.74	13 19 -25.6 0.93	11 59 -27.7 0.98	11 02 -27.6 1.09	10 22 -26.7 1.22	9 52 -25.7 1.37	17
27	8 28 -41.8 1.05	9 07 -46.5 0.90	10.17 -51.3 0.77	12 19 -52.7 0.69	14 39 -42.9 0.70	13 58 -30.7 0.85	12 25 -34.2 0.88	11 14 -34.0 0.97	10 24 -32.4 1.09	9 50 -30.6 1.23	27
Dec. 7	7 54 -48.1 0.98	8 31 -55.3 0.83	10 01 -63.8 0.70	13 19 -64.9 0.63	15 55 -48.2 0.67	14 46 -36.0 0.78	12 54 -42.0 0.77	11 22 -41.8 0.85	10 20 -39.1 0.97	9 39 -36.0 1.11	Dec. 7
17	6 57 -52.7 0.93	7 15 -62.3 0.78	8 30 -76.1 0.66	15 51 -76.4 0.60	17 27 -51.0 0.66	15 44 -41.2 0.72	13 31 -51.6 0.68	11 22 -51.6 0.74	10 01 -46.7 0.86	9 16 -41.8 1.00	17

t--T (days)	-50	-40	-30	-20	-10	+10	+20	+30	+40	+50	
r (a.u.)	1.49	1.28	1.06	0.80	0.50	0.50	0.80	1.06	1.28	1.49	
	5 45	5 22	3 52	20 38	19 04	16 57	14 31	10 59	9 17	8 34	
Dec. 27	-53.5	-63.3	-77.0	-75.1	-50.1	-45.4	-63.2	-63.6	-54.6	-47.0	Dec. 27
	0.92	0.78	0.66	0.60	0.67	0.66	0.59	0.65	0.76	0.91	

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For use with Marsden's comet search ephemeris, John Bortle of Mount Vernon, New York, has compiled a magnitude list for a typical sun-grazing comet having an absolute magnitude of 7.0. (The absolute magnitude of a comet is its brightness if placed one astronomical unit from both the sun and the earth.) The last sun-grazer, Ikeya-Seki 1965f, had an absolute magnitude of 6.2, according to ALPO observations (The Strolling Astronomer, Vol. 20, Nos. 9-10, p. 165).

Bortle's list can be used to determine what instrumental aid should be used in a comet search. As an example, observing on September 18th, first plot the positions on Norton's or the Skalnate Pleso for the ingoing branch, starting, say, with -30 days if you are using binoculars. On this branch you will be looking for an 8th to 4th magnitude comet.

The magnitudes in Mr. Bortle's table are based on the formula $m = 7.0 + 10 \log r + 5 \log \Delta$, where r is the distance from the sun in astronomical units and Δ is the distance from the earth.

t-T	-50^d	-40^d	-30^d	-20^d	-10^d	$+10^d$	$+20^d$	$+30^d$	$+40^d$	$+50^d$
Jan. 21	-	-	-	-	3.4	-	-	-	-	-
31	9.1	8.2	7.1	5.5	3.5	3.1	-	-	-	8.5
Feb. 10	9.2	8.4	7.3	5.8	3.7	3.1	5.0	6.6	7.8	8.7
20	9.4	8.6	7.6	6.0	3.9	3.3	5.3	7.0	8.0	9.0
Mar. 2	9.6	8.8	7.8	6.2	4.0	3.5	5.5	7.2	8.3	9.2
12	9.8	9.0	8.0	6.4	4.2	3.7	5.9	7.5	8.5	9.4
22	9.9	9.1	8.1	6.6	4.3	3.8	6.1	7.7	8.8	9.6
Apr. 1	10.1	9.3	8.3	6.7	4.4	4.0	6.3	7.9	9.0	9.8
11	10.2	9.4	8.4	6.8	4.5	4.2	6.5	8.1	9.1	10.0
21	10.3	9.5	8.5	6.9	4.6	4.3	6.6	8.2	9.2	10.1
May 1	10.4	9.6	8.6	7.0	4.7	4.4	6.8	8.4	9.4	10.2
11	10.4	9.7	-	-	-	4.5	6.9	8.5	9.5	10.3
21	-	-	-	-	-	4.6	7.0	8.6	9.6	10.4
31	-	-	-	-	-	4.7	7.1	8.6	9.7	10.5
Aug. 9	10.4	9.7	-	-	-	-	-	-	-	-
19	10.4	9.6	8.5	6.9	4.6	-	-	-	-	-
29	10.3	9.5	8.4	6.8	4.5	-	-	-	9.7	10.5
Sep. 8	10.2	9.4	8.3	6.7	4.4	4.7	7.1	8.6	9.6	10.4
18	10.1	9.3	8.2	6.6	4.3	4.6	6.9	8.5	9.5	10.3
28	9.9	9.1	8.1	6.4	4.1	4.5	6.8	8.4	9.4	10.2
Oct. 8	9.8	9.0	7.9	6.3	4.0	4.4	6.7	8.3	9.2	10.1
18	9.6	8.8	7.7	6.1	3.9	4.2	6.6	8.1	9.1	10.0
28	9.4	8.6	7.5	5.9	3.7	4.2	6.4	7.9	9.0	9.8
Nov. 7	9.2	8.4	7.2	5.7	3.5	4.0	6.2	7.7	8.8	9.6
17	9.1	8.2	7.0	5.4	3.4	3.8	6.0	7.5	8.5	9.4
27	8.8	-	-	5.2	3.2	3.7	5.7	7.2	8.3	9.2
Dec. 7	-	-	-	-	-	-	-	-	-	9.0

BOOK REVIEWS

Map Review: The USAF-NASA LMP Series

Reviewed by John E. Westfall, A.L.P.O. Lunar Recorder

Although parts of the moon's farside were photographed eleven years ago, this writer knows of only three publicly-available flat maps (as opposed to globes) that cover the entire moon. The first was the Soviet Map of the Entire Moon, published in 1967, on nine sheets on the Mercator Projection between 60° N and 60° S, and on the Stereographic Projection between 50° and 90° N-S. The Mercator scale was 1/5,000,000 at 30° N-S and the Stereographic scale was 1/10,000,000. Although this was the first map of all the moon, farside data were confined to the Soviet lunar probes so that many areas were left blank or were shown only vaguely.

In 1969, the National Geographic Society published The Earth's Moon, which had the advantages of employing Orbiter photographs and of being published on a single sheet on a single projection, the Lambert Azimuthal Equal-Area. This projection is very useful for statistical studies since all lunar areas are shown in their correct relative sizes. Unfortunately, the map's fairly small scale (1/11,620,000) reduced its usefulness for detailed studies.

Because of the limitations of the two all-moon maps above, the recent publication of the LMP series by NASA is a welcome development. The three LMP maps were compiled by the U.S. Air Force, Aeronautical Chart and Information Center, for NASA, based on photography from Orbiters I - V. The LMP series is available for $1.50 ($0.50 per map) from the Superintendent of Documents, U.S. Government Printing Office.

The Lunar Earthside Chart (LMP-1) covers the moon between longitudes 100° W and 100° E and between latitudes 50° N and 50° S. The Lunar Farside Chart (LMP-2) covers the same latitude range as LMP-1 between longitudes 80° E and 80° W. Both LMP-1 and LMP-2 are on the Mercator Projection, with a scale of 1/5,000,000 at 34° N-S. There is some confusion about the equatorial scale, which (assuming the moon is spherical) should be 1/6,013,090; however, it is stated as 1/5,857,864 on LMP-1 and as 1/6,035,533 on LMP-2. The third map, Lunar Polar Chart (LMP-3), shows the moon poleward of 45° latitude on two Stereographic Projections whose scales are 1/5,000,000 at the poles. The three maps have a common scale at latitude 45° N-S.

For limb and farside areas, the detail and accuracy of the LMP series are probably the best now available, superior, for example, to the earlier USAF Lunar Farside Chart (LFC-1), 2nd Ed., 1967). For most of the earthside, the estimated positional accuracy is 5 kms. (1 mm. at scale); most of the limb areas have 10 kms. accuracy, and the farside positional accuracy is 10 or 15 kms. (By contrast, many farside positions on LFC-1 appear to be inaccurate by 60-90 kms.) The technique of relief depiction and lunabase/lunarite distinction are also superior on the LMP series when compared with the earlier LFC-1.

The writer's only major criticism of the LMP series is its projection. The choice of the Mercator Projection makes it impossible to show the polar regions on the same map as the rest of the moon (in contrast with the National Geographic Society's The Earth's Moon). Even on the portion of the moon shown on this projection, the scale varies as much as 56 percent. The useful property of the Mercator Projection, as applied to lunar mapping, is its conformality (i.e., ability to show small areas in their correct shapes); but several other projections are conformal as well, yet can show the entire sphere. The Stereographic Projection (often used to show the Earth in two hemispheres) has, besides conformality, the advantage that circles of any diameter on the moon appear circular on the map.

A less important criticism is that of the maps' reliance on Orbiter photography as their only source. Thus, most low-lying features, even the largest domes, are not shown. Also, the area near the moon's south pole is only vaguely shown, being labeled "Unsatisfactory Photography," although both amateur and professional astronomers have mapped this area independantly of Orbiter photographs.

The above criticisms are relatively minor; even the unfortunate choice of projection is largely an inconvenience only. The LMP series is actually the first usable and reliable map coverage of the entire moon and is recommended to all lunar students.

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The World of Mars, by V. Axel Firsoff, M. A., F.R.A.S.; Oliver and Boyd Ltd., Edinburgh; c.1969, 128 pages. Price 7/6.

The World of Mars is an inexpensive paperback which, by omitting methodological technicalities, contains within its 128 pages a surprising amount of observational data along with interpretations and theories to account for what has been observed. The book has been quite correctly described on its back cover as having been written "so that it is easy for the layman to follow and yet retains interest for the specialist".

The first two chapters of the well known English astronomer's book give basic information concerning the origin of the planets, the orbit of Mars, and the internal constitution of the Earth and Mars. The reader should not be misled at this point into considering Firsoff's book as simply another popular introduction to the Red Planet. The observer of Mars will find his interest quickened by the 3rd and 4th chapters, entitled "At the Eyepiece" and "What are the Canals?" Seasonal and temporary variations of the Martian surface are discussed, and an emphasis is placed on the use of filters in observing Mars.

On Plate VII the drawings of Mars made by Alan W. Heath using a 12-inch reflector demonstrate what the amateur astronomer can achieve by employing red, green, and blue filters.

The chapter on the canals of Mars leaves the matter of their nature and extent an unsettled question. Among the 50 well chosen photographs and drawings which appear on the 17 plates illustrating the book, numerous canals are evident in the drawings by C. F. Capen, S. Ebisawa, and T. Saheki. Also, Plate XI presents three Lowell Observatory photographs which show a few of the major Martian canals. The author notes that Mariner IV's photographs only vaguely suggest the presence of some rectilinear canal-like features. Because The World of Mars had gone to press while Mariner VI and VII were on their way to Mars, none of those two spacecrafts' results are contained in the book.

An entire chapter is devoted to Mariner IV; and here Firsoff questions the validity of the Mariner occultation experiment, which has indicated an atmospheric surface pressure on Mars only 1/100th to 1/20th that of Earth. A Martian barometric pressure of about 1/11th of our sea level pressure, as had been previously determined by Earth-based polarization measurements, would be more in keeping with the general theme of Firsoff's book, i.e., that Mars has been and still is the scene of massive volcanic activity, which accounts for the craters of Mars and the rising mushroom-shape clouds reported by E. M. Antoniadi in 1910 and 1911 and by Japanese observers in 1950 and 1952 as well as flares seen in 1937, 1951, 1954, and 1958. In attempting to add support to the theory that the surface of Mars has been largely shaped by vulcanism, Firsoff is too positive in asserting that Mariner IV's frame 11 shows "an unmistakable volcano" on the rim of the 75-mile crater and that on the north wall "flows of lava descend in tiers to its floor, from which a round dome bulges up." Participants in the A.L.P.O. Lunar Dome Program know how necessary it is to observe under differing solar illuminations anything which appears to be a dome on any one photograph before positively identifying it as a dome.

The author concludes his book with three informative chapters in which he discusses the climate of Mars, the probability that the maria are vegetated areas, and the mysterious little moons of Mars.

A 19-item bibliography of books and magazines, half of which are British publications, is given, and also a handy index.

The World of Mars is just the kind of book that any A.L.P.O. member will enjoy reading. The successful Mariner VI and VII missions have made Firsoff's book only slightly out of date. Most of the questions raised in the book are still unanswered.

A PROCEDURE FOR DRAWING AND NOTATING STRIP SKETCHES OF JUPITER*

By: Phillip W. Budine, A.L.P.O. Assistant Jupiter Recorder

Visual observations submitted to the ALPO Jupiter Section are usually in the form of disc drawings which portray the complete appearance of Jupiter at a given time. Disc drawings are of value to the Jupiter Section. Many observers, however, spend all of their time making disc drawings and neglecting other kinds of observation which may be of even more value than discs. (E.g., transits, intensities, or color observations.) On many occasions when checking the drawing files for confirmation of transit features, I note that an observer has contributed as many as 75 to 100 discs during a given apparition. There may even be 2 or 3 discs for the very same evening. Couldn't an observer better use his observing time after having made one full disc drawing by allocating the remainder of his time for other kinds of observation?

E.g., making strip sketches is just as important as making full disc drawings. While a full disc represents the appearance of the planet for a given time period and illustrates the various latitudes and intensities of Jovian markings, it does not enable the observer to note detailed changes in a belt or zone in proper scale for interpretation; nor does it provide a means whereby the observer can extend the disc drawing (given the standard disc blank) made over a period of a few hours of observation.

What are the special advantages of strip sketches? Firstly, they usually can be quickly executed at the telescope. Secondly, they can represent small detail in a zone or a belt much more clearly than on a full disc drawing. Thirdly, they represent more accurately the relative positions and relationships between Jovian features in adjoining

*Communicated by Paul K. Mackal, A.L.P.O. Jupiter Recorder.

(text continued on page 98)

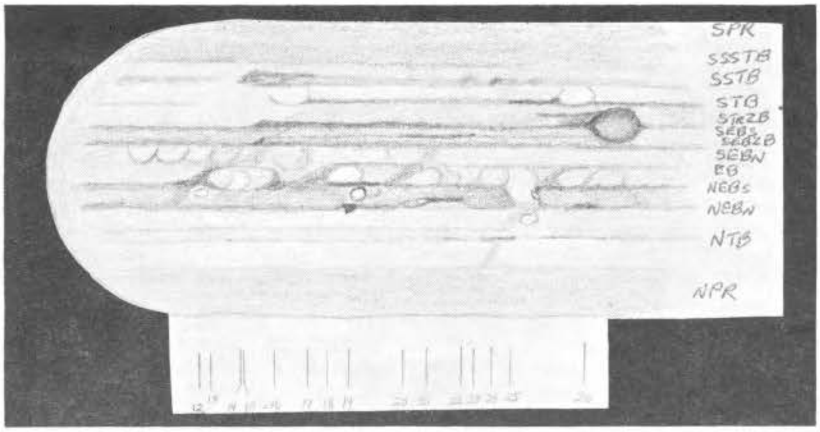

Figure 27. A sample of an "extended disc drawing" of Jupiter. Made by Patrick S. McIntosh, $3^h\ 10^m$ to $7^h\ 20^m$, U.T., March 6, 1968. 6-inch reflector, 160X to 210X, seeing excellent. The numbers at the bottom reference positions of marks of which central meridian transits were observed, as recorded in Table 1 below. The techniques of recording central meridian transits and Jovian nomenclature are explained in "Procedures for Recording CM Transits on Jupiter and Their Reduction," Str. A., Vol. 22, Nos. 3-4, pp. 37-38.

Table 1.

Number	UT Time	Object	Location	CM-I	CM-II
12	3:10	Dc	NEBs	119°	--
13	3:21	Wp	NEBs	126°	--
14	3:35	Dp (belt)	SSTB	--	237°
15	3:37	Wc	NEBs	136°	--
16	3:55	Wf	NEBs	146°	--
17	4:20	Dp (belt)	STB	--	264°
18	4:36	Wp	NEBs	172°	--
19	4:50	Dc	NEBn	--	282°
20	5:23	Dc (festoon)	NEBs	200°	--
21	5:50	Dp (belt)	NEBn	--	318°
22	6:21	Df (belt)	NEBn	--	337°
23	6:28	Df (belt)	SEBc	--	341°
24	6:40	Dc (festoon)	SSTB	--	349°
25	6:48	Df (belt)	NEBc	--	354°
26	7:20	RSp	STrZ	--	13°

Table 4. (for front cover sketch)

Number	UT Time	Object	Location	CM-I	CM-II
937	2:32	Dc (Dk. Proj.)	S-NEB	110°	--
938	3:26	Wc (v. Brt. Oval)	EZn	143°	--
939	3:35	Wc (Brt. Gap)	NEBc	--	6°
940	3:40	Dp (v. Dk. Proj.)	S-NEB	151°	--
941	3:58	Dc (v. Dk. Proj.)	S-NEB	162°	--
942	4:08	Dc (v. Dk. Proj.)	N-NEB	--	26°
943	4:10	Dc (Proj.)	S-NEB	169°	--

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latitudes. Fourthly, they may cover a narrow band of latitude which allows one to concentrate on a region which is rapidly changing as the planet rotates. And fifthly, they are of great value to illustrate the sequence of activity on Jupiter, e.g., the development of a SEB or STrZ Disturbance or changes in the region of the RS.

What are the basic aims of visual observation which apply to strip sketches? 1. --

(text continued on page 100)

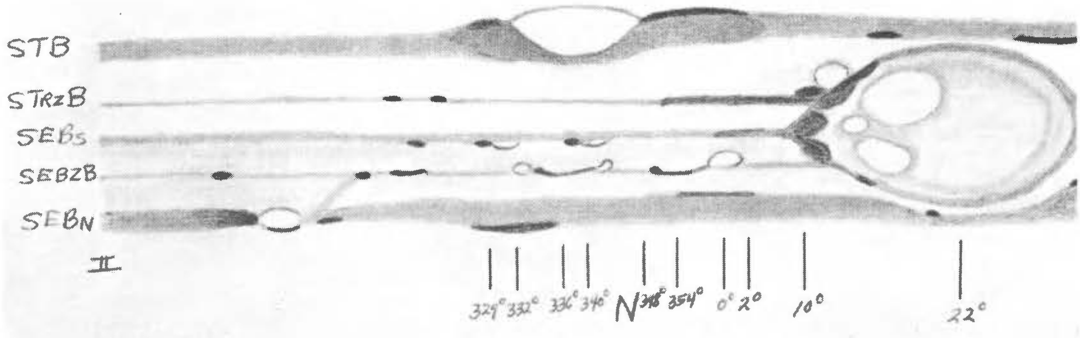

Figure 29. A sample "sectional sketch" of Jupiter, here chosen to extend in latitude from the South Equatorial Belt North to the South Temperate Belt. Made by Phillip W. Budine from $2^h\ 40^m$ to $3^h\ 10^m$, U.T., April 7, 1968. The numbers at the bottom are longitudes in System II of features of which central meridian transits were observed (see Table 3). 10-inch reflector, 200X, 250X, 334X. Seeing 8 to 9 (excellent), transparency 5.

Table 3.

Number	UT Time	Object	Location	CM-I	CM-II
938	2:33	Dc (Dk. Proj.)	STBs	--	329°
939	2:38	Wp (oval) BC	STeZn	--	332°
940	2:44	Dc (v. Dk. Elong.)	SEBZB	--	336°
941	2:52	Wc (Oval) BC	STeZn	--	340°
942	3:05	Wf (Oval) BC	STeZn	--	348°
943	3:14	Dc (v. Dk. Elong.)	SEBZB	--	354°
944	3:25	Wc (v. Brt. s.)	SEBZBs	--	0°
945	3:27	Dc (v. Dk. Sect.)	STrZB	--	2°
946	3:41	RSp	STrZ	--	10°
947	4:01	RSc	STrZ	--	22°

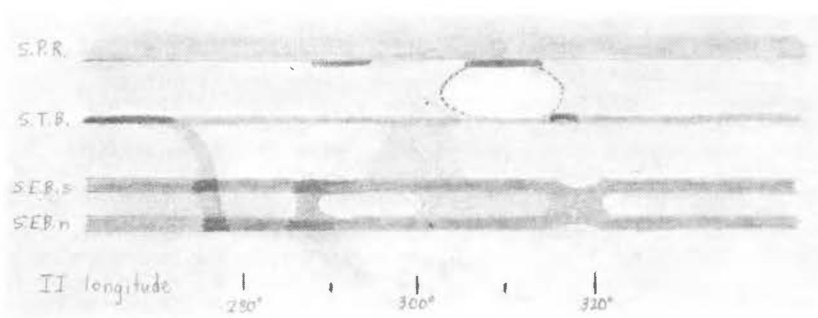

Figure 28. A sample "sectional sketch" of Jupiter from the South Equatorial Belt North to the northern part of the South Polar Region shading. Made by Eric Thiede on December 19, 1967, 15.6-inch reflector. The numbers at the bottom are longitudes in System II. Table 2 tabulates observed central meridian transits.

Table 2.

Number	UT Time	Object	Location	CM-I	CM-II
12	10:08	Df (Section)	STB	--	264°
13	10:45	Dc (Shading)	SEBZ	--	287°
14	10:52	Dc (Projection)	SSTB	--	291°

(Table 2 continues on pg. 100)

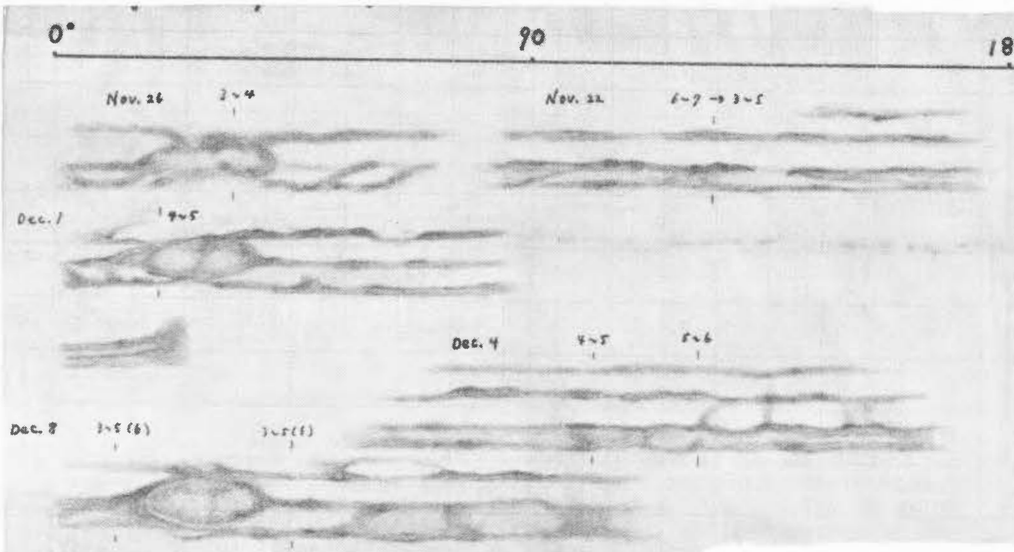

Figure 30. A series of strip sketches of Jupiter from the South Equatorial Belt North to the South South Temperate Belt. Made by T. Osawa, 8-inch reflector, November 22 to December 8, 1967. Longitude in System II. Red Spot near longitude 30°.

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Table 2. (Cont.)

Number	UT Time	Object	Location	CM-I	CM-II
15	10:59	Wc (Oval)	SEBZ	--	295°
16	11:08	Wf (Oval)	SEBZ	--	301°
17	11:10	Wp (Oval)	STeZ	--	302°
18	11:22	Wc (Oval)	STeZ	--	309°
19	11:30	Dp (Shading)	SEBZ	--	314°
20	11:34	Wf (Oval)	STeZ	--	316°
21	11:35	Dc (Shading)	SEBZ	--	317°
22	11:37	Df (Projection)	STB	--	318°
23	11:42	Df (Shading)	SEBZ	--	321°

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to place on record changes of form, intensity, and position of atmospheric features; 2. --to make the record as continuous as possible and thus complete in order that it may furnish reliable information regarding any such changes as may be systematic or periodic; and 3. --to provide data which may inspire, and against which may be checked, physical theories that will ultimately give us a better understanding of the laws that govern the distribution and circulation of the gases that comprise the atmosphere of Jupiter.

Now how does one go about making such a strip sketch in the first place? A procedure is followed comparable to that used in the making of full disc drawings. However, style and artistic values are not very important in the making of strip sketches since these are not so pleasing to the eye as discs. Here the important factor is securing position and structural detail. I shall proceed to discuss some typical examples of strip sketches made by several regular observers in the ALPO Jupiter Section. I shall comment on the technique used by these observers.

Figure 27 should probably be called an "extended disc drawing", but I prefer to call it a type of strip sketch. This is because it is extended in longitude. The scale of this extended strip sketch is similar to that of a disc drawing. It is recommended that this scale be enlarged so that finer details are not too small and crowded in on each other. None-the-less Figure 27 has the advantage of allowing the Recorder to compare the detail and activity in many different latitudes on Jupiter.

In Figure 28 one can see at the bottom of the sketch a longitude scale indicating a number for each 20° of longitude and marked for each 10° interval. The System II longitude is indicated, and by interpolating horizontally one can measure the longitudes of specific Jovian features.

Figure 29 and the front cover sketch are two of my own strip sketches which I often call "sectional sketches." They indicate that it is important to make your drawing as large as possible because if one makes the observation on too small a scale the finer detail will not show proper relationship to the larger detail. One primary purpose of such sketches is to indicate short-lived changes and structural transformation on consecutive dates of observation. It is wise with large apertures not to make the sketches too small. The orientation of the sketch and the longitude system associated with it should be indicated on each sketch. One should try to note the longitudes of each pertinent marking as it moves across the central meridian and to notate the sketch accordingly. In the front cover sketch we see that markings have been timed in both Jovian systems of longitude. In this case both systems of longitude should appear on the top or bottom scale of the strip sketch.

Figure 30 consists of a "series" of strip sketches. The longitude scale for System II is indicated at the top of the series of sketches. One great advantage of sketching on graph paper is that the features may be plotted very accurately as regards position. A series of this kind enables the serious student of Jovian structural transformation to make interesting conclusions about the kinds of changes actually occurring. Plates IX and X in B. M. Peek's The Planet Jupiter are excellent examples of the value of a good series of strip sketches in studying activity in a particular portion of Jupiter.

Summary: 1. --Strip sketches prove most valuable in their ability to illustrate features which the observer has timed as they cross the Jovian central meridian. 2. --Strip sketches prove most useful for picturing changes in a narrow band of latitude. 3. --Strip sketches are the best method for tracing the history of the development of a very active region in the planet's atmosphere.

THE MARCH 7, 1970 TOTAL SOLAR ECLIPSE IN MEXICO

By: Trudy E. Bell, John Laborde, and William B. Lindley

On the 27th of February, the eclipse expedition led by Leonard Farrar of Rialto, California departed from San Diego in two pickup trucks with camper shells. Expedition members were Farrar's wife Carol, Jerry Fifer of Riverside, John Laborde of San Diego, Trudy E. Bell of Santa Cruz, and (met in Mexico City the next week as prearranged) William B. Lindley of San Diego.

The expedition split just outside of Oaxaca, the Farrars and Jerry Fifer heading for Miahuatlán, and the rest of us making for a site seven miles west of El Camerón (78 miles southeast of Oaxaca on the Pan American Highway) along a very bad dirt road leading to San Carlos Yautapec. Our situation was atop a mountain some 500 feet above the site chosen by an expedition led by Tim Hogle of San Luis Obispo. We arrived on the early evening of Thursday, 5 March, 1970.

The day of the 6th was spent in preparing equipment for the eclipse. The 7th dawned clear and bright. Conditions were utterly superb--the brilliant blue sky was completely cloudless save for a few uninterfering cirrus or smoke wisps hugging the tops of southern mountains; there was practically no breeze.

Photography

John Laborde writes in a letter:

> The object of the experiment was two-fold--to photograph the eclipse in color, and to try to detect faint comets in close proximity to the sun.
> The color photography was accomplished by the use of two telescopes: 1. A six-inch, f/4 reflector using a $1\frac{1}{4}$-inch Kellner eyepiece coupled to a Nikon camera using a 50-mm. Nikon lens. This combination gave a field of 2 by $1\frac{1}{2}$ degrees. 2. An Aero-Ektar f/2.5, 305 mm. focal length lens with a 4 x 5 inch cut film holder at the focal plane. This gave a field of approximately 18 x 14 degrees.
> Approximately ten minutes before totality both telescopes were trained on the sun and were clock-driven to follow. Aperture stops down to one inch

were put over each instrument during the time before totality to prevent the lenses and eyepieces from overheating, and were removed during the time of totality.

I manned the six-inch, f/4 and was able to acquire 36 pictures ranging from 1/500 second to one second exposure. The film used was Ektachrome X, ASA 64.

As I was waiting to take the first picture of Baily's beads I noticed that I could see the faint corona extending about one-half to three-quarters of a solar diameter as much as twenty seconds before totality began. The corona appeared first on the side opposite the receding crescent sun. During totality the corona extended to one and one-half solar diameters with two jets (one north and one west, separated about 90 degrees) extending to as much as three solar diameters. Two reddish-orange prominences could be seen readily, as well as what appeared to be a thin ring of fire around the black moon. The innermost part of the corona was a faint baby blue, and the majority of the outer corona was a silvery white color.

About 15 seconds into totality, a slight gust of wind came up from the west (probably due to the temperature drop). The air stabilized again about one minute into totality. The pictures were difficult to take during this breezy period. Thirty-seven pictures later totality ended with a pinpoint of light on the west limb of the moon and grew so bright that I could no longer view it through the 'scope after fifteen seconds.

Bill Lindley manned the Ektar lens. He took three color 4 x 5 plates on Ektachrome X. The exposures were one, two, and five seconds. The intention was to bring out the outermost part of the corona. One additional photograph was made to pick up any faint comets in the vicinity of the sun. The plate was developed within twenty minutes after totality with the thought that if a comet was found, the position could be radioed to the East Coast so that there would have been plenty of time for confirmation. However, the results were negative; no comets were recorded on the film.

Shadow-Bands

The apparatus Trudy Bell used for observing shadow-bands was the standard, prescribed by Edgar Paulton in his papers. It consisted of a square framework 65 inches on a side covered by a white sheet as a screen on which was inscribed a five-foot-diameter circle graduated in ten-degree increments along the circumference. Through the center of the circle projected a 15-inch gnomon rigidly attached to the framework, to be oriented just before totality so that it cast no shadow onto the sheet; hence, for all practical purposes the screen would be perpendicular to the sun's rays. The observations of shadow-bands described here are by Trudy Bell unless the reverse is stated.

First contact occurred before 10:20 A.M. C.S.T. (16:20 U.T.); by 11:00 A.M. the landscape was noticeably dimmed. Bill read the background with his camera light-meter. Before the eclipse, the landscape registered an EVS of 13 (each number is a stop, representing a factor-of-two loss in brightness); by 11:07 A.M. the landscape had dropped to an EVS of less than 12. It was noticeably cooler; a slight wind had sprung up from the east-southeast; the white sheet of the shadow-band experiment was no longer so glaring.

11:13 A.M.--EVS of 11 for the background.

11:22 A.M.--EVS of 10.

11:23 A.M.--EVS of 9, or 1/16 normal daytime brilliance. As the time of totality grew closer, terrestrial shadows changed character. They were distinct for objects near the ground, such as tree branches, but were fuzzy and indistinct (although not double or multiple) and eventually non-existent for taller objects. The landscape looked like that of an overcast day, only not so washed out.

11:27 A.M.--very cool; one could almost <u>watch</u> the lanscape dim (EVS of 8), and nearly look at the sun. The darkness was similar to that just before a storm.

11:28:49*--EVS of 7, or 1/64 daytime brilliance--the shadow-band screen looked almost grey, and <u>faint</u> shadows appeared to be crossing it, although of this I am exceedingly uncertain.

11:28:57--dimming grew faster.

11:29:00--shadow-bands! They were diffuse filaments of about one centimeter width

*All times are within five seconds in accuracy and are obtained from a tape recording made during, and reduced after, the eclipse.

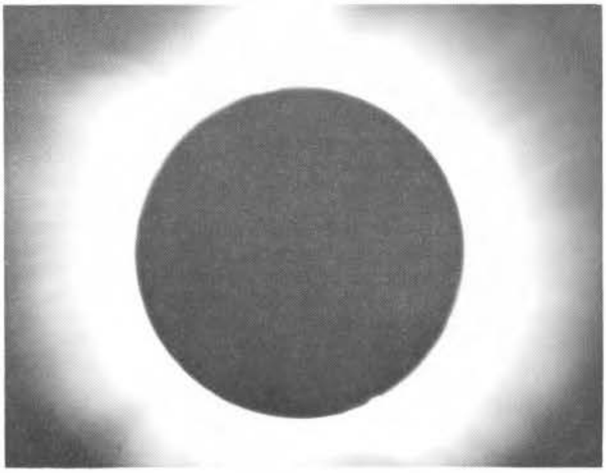

Figure 31. Photograph of total solar eclipse on March 7, 1970. Taken by Robert A. Yajko at Virginia Beach, Virginia with a 4-inch refractor and a 35-mm. Yashica Camera. Plus-X film. Exposure $\frac{1}{4}$ second. Outer corona shown well. South on top.

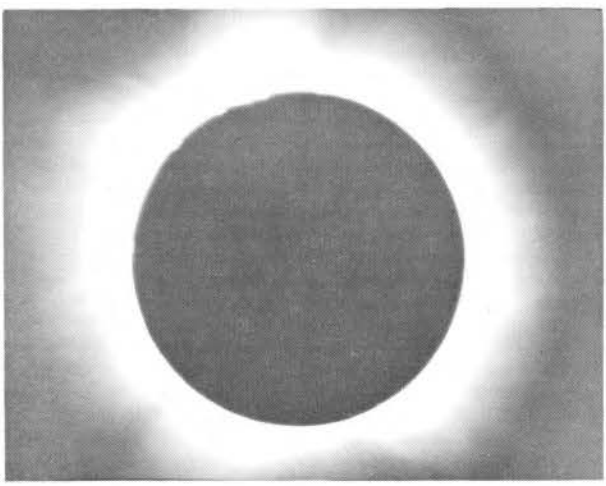

Figure 32. Photograph of total solar eclipse on March 7, 1970, taken by Robert A. Yajko at Virginia Beach, Virginia. Same telescope, camera, film, and orientation as Figure 31. Exposure chosen to show fine structure in corona and Baily's beads, five of which are clearly visible.

and separated by eight to ten times that distance, moving from 9 o'clock to 3 o'clock across the screen (roughly south to north) very quickly, much like a strobe effect. Their speed and number were impossible to measure; I can only estimate that there were some fifteen to twenty on the screen at once. The first impression was actually not one of motion, but of fluttering; and they were best seen with averted vision. As time passed, the filagree pattern became more definite. It was very much like viewing the shadows cast on the bottom of a pool by ripples in the water on a sunlit day. There appeared to be several different speeds at once--some bands took about three seconds to cross the screen; others crossed it faster than the eye could. The bands themselves were oriented perpendicular to their direction of travel. They could easily be seen as unmistakable long wavy lines undulating across the ground...long stripes moving south to north at the speed of a good trot! As the time of totality grew closer, the bands on the screen became fewer in number, widened to about two inches, were separated by eight or nine inches, and travelled more slowly, although in the same direction. Here Bill Lindley (who was Trudy Bell's assistant in the experiment) reports differently that he observed the interval between bands in the early stages before totality to be large--two feet or more. As the left-right motion became discernible, the separation narrowed but was still hard to determine. It will be very interesting for us to compare our observations with those made by others.

Totality

Totality collapsed suddenly, within the space of a few seconds, like a cloak falling.

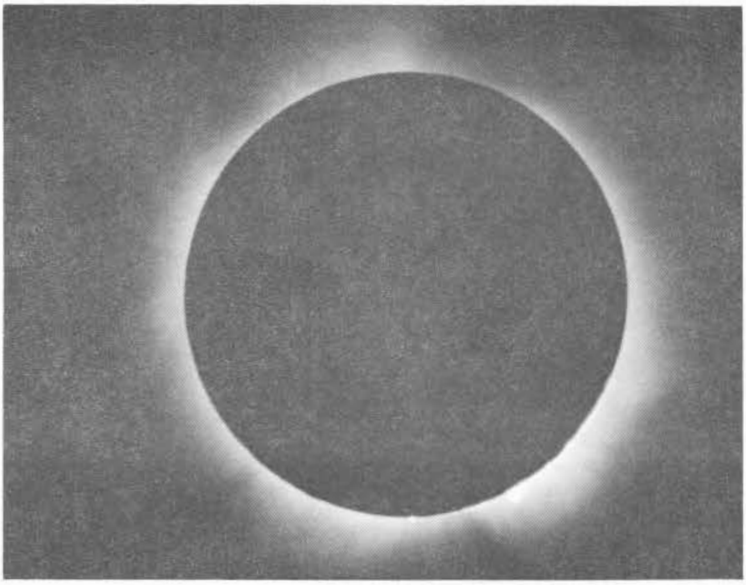

Figure 33. Photograph of total solar eclipse on March 7, 1970 taken by Robert A. Yajko at Virginia Beach, Virginia. Same telescope and conditions as Figures 31 and 32. South again at top. An exposure of 1/100 second here reveals the inner corona and several prominences along the limb.

Above, two-thirds of the way to the zenith, the moon presented a black disk surrounded by a silver corona uniformly stretched out for half a degree all around. Its edges were feather-like soft and fuzzy, except for three sharp spikes one to one and a half degrees long extending to the east, north, and west. The backdrop of the sky was a dusky blue similar to that ten minutes after sunset, and no other celestial objects could be seen except for Venus due east (left) of the sun by ten degrees and Mercury southwest by about twelve degrees. The horizon, a mountainous landscape, was completely bright, as if it were seconds before a sunrise but instead for 360 degrees around.

Contrasting to the above, Trudy Bell's unaided visual observations, Bill Lindley later wrote his impressions of totality:

> In the last few seconds before totality my attempts at watching shadow-bands faded away; and my attention was riveted on my shadow, which was rapidly fading. I saw it grow fainter and fainter, and then suddenly it was gone. (I found afterwards that I had missed a fine display of Baily's beads.) I turned around, took off my dark glasses, and looked at the sun. Sure enough, there was the corona. Also visible, and quite bright, were Venus on the left and Mercury on the right (not quite in line). I looked briefly for stars but saw none. I went directly to my preassigned task of exposing four plates on John Laborde's telescope...I watched the sun a bit during the 30-second exposure. This was poorly timed since I did not count; and it was too dark to see my watch, although not too dark to see the landscape or the things I was working with. The plate exposure task done, I used my first few seconds of free time to look for Fomalhaut, Achernar, and the summer triangle, especially Vega. Assuming that Venus was magnitude-3 and Mercury -1, zero and even first magnitude stars should in principle have been easily visible since Mercury and Venus were quite bright. However, I failed to see any stars at all. I believe that this is not because I was insufficiently dark-adapted (my chief worry) but rather because there was too much light in the sky. It was a deep velvet blue, a very lovely color, but far from being black. It was about like a half hour after sunset at my latitude (33 degrees north). I then used my own camera to take two 35-mm. Kodachrome II slides (no magnification) of the sun...The sun came out of totality just as (or right after) I took the picture. Three minutes is all too short.
>
> It should be noted that I went to Mexico to see the eclipse, not to observe it, that my primary purpose was to have the experience.

After Totality

These final impressions are again those of Trudy Bell.

Totality ended 3 minutes and 26 seconds after its beginning with the marvelous diamond ring effect: on the southwest side of the sun, a brilliant silver point rapidly grew to a blazing ball, while the rest of the moon was still faintly outlined in silver. Within seconds the spectacle became so blinding that I had to glance away. Bill Lindley noticed that the southwest landscape looked brighter than the northeast as the shadow of the moon passed us.

Shadow-bands were once again racing across my projection screen with the same orientation as before, but going in the opposite direction. Again they were too fast to time; they started out wide and slow and fairly dark, quickly grew diffuse and faster and after 1 minute, 35 seconds melted away altogether as the sun's crescent grew larger and brighter. Just before disappearing, the bands changed orientation on the screen to 2 o'clock to 8 o'clock from the general 3 o'clock to 9 o'clock motion.

Almost needless to say, all of us were in a general euphoria after witnessing our first total solar eclipse--a magnificent event that is not only scientifically valuable, but breathtakingly awesome as well.

ANNOUNCEMENTS

Sponsors and Sustaining Members. There follows a listing of our Sustaining Members (who pay $10 per year) and Sponsors (who pay $25 per year) as of May 16, 1970. We are greatly indebted to these colleagues for their generous and valuable financial support of the A.L.P.O. Many of them are also among our major contributors as observers, authors of papers, and speakers at A.L.P.O. Conventions. Their assistance and loyalty have been most important to the A.L.P.O.

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Change in Address of Venus Recorder. The name and address of the A.L.P.O. Venus Recorder are now:

Dr. Dale P. Cruikshank
Institute for Astronomy
University of Hawaii
2840 Kolowalu St.
Honolulu, Hawaii 96822

As the address implies, Dr. Cruikshank has joined the staff of the Institute for Astronomy at the University of Hawaii. He will be employed in planetary research using an 88-inch telescope now almost completed. We wish him every success in his new position.

Instructional Material for Venus Observers. Dr. Dale Cruikshank, the A.L.P.O. Venus Recorder, has available for distribution upon request a multi-page description of visual studies of Venus with instructions for observers. Interested readers are cordially urged to obtain and to study (and apply!) this material. The present time is very opportune since Venus is favorably placed in the evening sky, reaching greatest elongation east on September 1, 1970 and inferior conjunction on November 10.

Change in Address of Mars Recorder. The name and new address of the A.L.P.O. Mars Recorder are:

Charles F. Capen
223 W. Silver Spruce
Flagstaff, Arizona 86001

Mr. Capen has recently joined the Lowell Observatory IAU Planetary Research Center. He and Assistant Mars Recorder Tom Cave are working up ALPO 1969 observational data on Mars, and the first of several planned reports should be ready soon. Any observers who have not yet submitted their observations should do so at once. We wish our Mars Recorder every success in his new job and thank him for his splendid coöperation in many ALPO projects during his years with the Jet Propulsion Laboratory's Table Mountain Observatory.

Astronomical League National Convention. In a letter dated May 7, 1970 Mr. Alfred V. Bowen, 85 Meigs St., Rochester, New York 14607 reminds us of the 24th National Convention of the Astronomical League on July 9, 10, and 11, 1970. The site will be the Nazareth College Campus at Pittsford, New York. Special arrangements have been made for astronomical exhibits. Any ALPO members who would like to attend are urged to participate in this meeting. Astronomical displays demonstrating the interests and activities of the ALPO are particularly desired.

WAA-ALPO Convention at Sacramento. Readers are reminded of this joint meeting on August 20, 21, and 22, 1970 at the Mansion Inn in Sacramento, California, located at 16th and H Sts. near the State Capitol. All ALPO members who can are heartily urged to attend and to participate with papers, exhibits, and the like. General information about the Convention may be obtained by writing to: Sacramento Valley Astronomical Society
6218 28th Ave.
Sacramento, California 95820

Inquiries about commercial and individual or group display space requirements should be sent to the same address. All ALPO papers should be mailed to the Editor. The deadline for inclusion in the Proceedings is July 20, and papers are much needed as of the present time (May 22).

It will be very helpful for the hard-working committee members of the host Sacramento Valley Astronomical Society if those who can will register in advance. It is hard to plan these meetings without knowledge of attendance. The needed information can be obtained from the Society address given above.

A special feature of this WAA-ALPO Convention will be tours to the Yo-Lo Telescope at Colfax, California. This instrument was designed by the optics expert and artificial satellite specialist, Art Leonard, who has given papers about its features at several past Conventions. The Yo-Lo will be ready for looking, though perhaps not for photography, at Convention time.

OBSERVATIONS AND COMMENTS

Transit of Mercury on May 9, 1970. Several ALPO members have reported viewing and photographing this event. If there are enough reports and they are of good enough quality, we shall hope for a future article about the transit from Dick Hodgson, our Mercury Recorder. Figure 34 is a photograph by Mr. Richard Wessling at Milford, Ohio. Mr. Wessling points out in a letter written on May 17 that the photograph is of mediocre quality (in his opinion) because of an incorrect exposure time, caused in turn by his lack of experience in photographing the sun. Even so, we thank Mr. Wessling for his interest and his contribution and hope that his results will encourage others to try their luck when Mercury again transits the sun in November, 1973.

Comet Honda 1968c. Readers will find a number of drawings and photographs of this comet on pages 106, 107, and 108. These are part of a set of illustrative material supplied by Mr. Dennis Milon, our Comets Recorder. It is his intention soon to give us a report on ALPO studies of Comet Honda. Meantime, the pictures should tell their own story and ought to be especially interesting to all who observed this comet.

Figure 34. Photograph of solar transit of Mercury on May 9, 1970 by Richard J. Wessling. Taken at third contact, Mercury just inside limb of sun. Tri-X film, solar filter, 5-inch aperture at f/23, 1/100 sec. exposure. (12½-inch telescope).

Figure 35. Photograh of Comet Honda 1968c on Sept. 2.34, 1968, U.T. by Steve Larson, Tucson, Arizona. He attached a 12-inch f/2.5 camera to the 61-inch Catalina reflector for guiding.

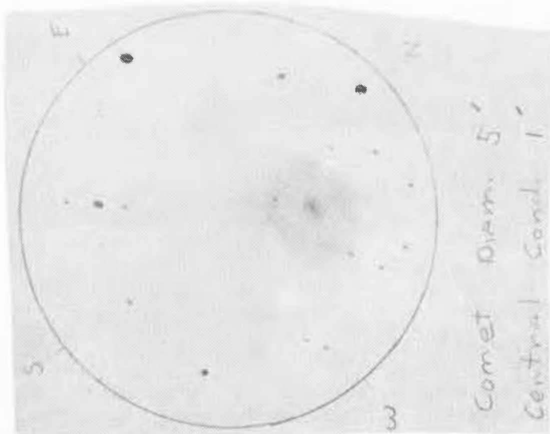

Figure 36. Sketch of Comet Honda 1968c by John H. Wulf of Dallas, Texas with a 10-inch reflector on July 27, 1968. Negative shading.

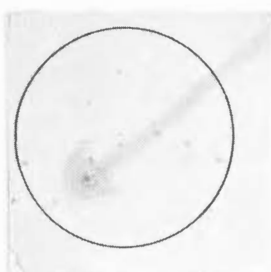

Figure 37. Drawing of Comet Honda 1968c by Logan Rimes at Houston, Texas on July 29, 1968 at 9^h30^m, U.T. with a $12\frac{1}{2}$-inch refl. The coma contained a star-like nucleus. Mr. Rimes estimated the total magnitude at $7\frac{1}{2}$ and saw a tail $1\frac{1}{2}$ degrees long.

Figure 38. Photograph of Comet Honda 1968c by Charles Scovil and John Bortle on July 30, 1968 at about 8^h, U.T. with a 22-inch telescope. North at top. Tail 25' long. Mr. Bortle noted that the comet could be faintly seen with the naked eye as a 6.0- magnitude glow west of 74 Draconis.

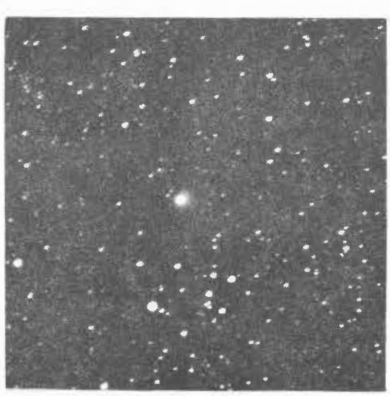

Figure 39. Photograph of Comet Honda 1968c by Greg Redfern of Garden Grove, Calif. on Sept. 1, 1968. 135-mm. lens; 10-minute exposure beginning at 7^h51^m, U.T.

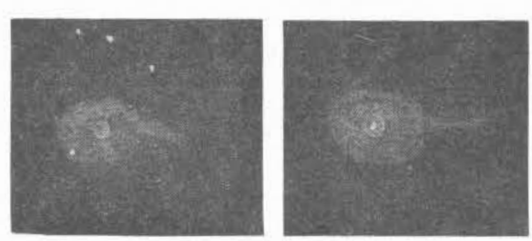

Figure 40. Drawings of Comet Honda 1968c by Jimmy Leslie Mitchell with a 6-inch reflector. Part of a series drawn at Cairo, Ga. Left drawing on August 6, 1968, 9^h, U.T.; right drawing on August 17, 1968, 9^h, U.T. Note stellar nucleus on later date, not present on earlier date. Mitchell timed the drift of the comet through his eyepiece field and on Aug. 6 obtained a diameter of 5.8 minutes of arc for the coma and 1.3 minutes of arc for the central condensation.

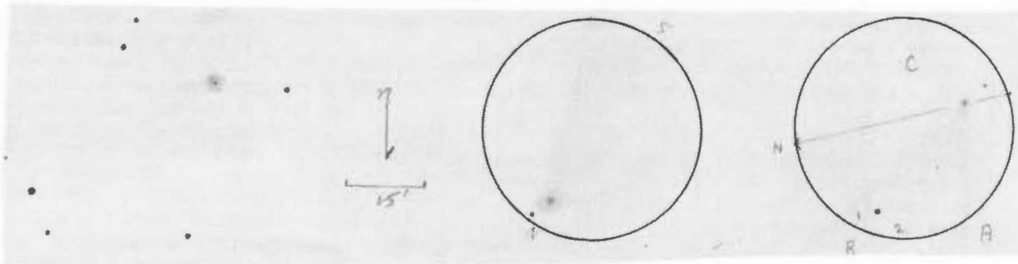

Figure 41. Drawings of tails of Comet Honda 1968c. Left: John Bortle, Aug. 4.33, 1968, U.T., 6-inch reflector. Double tail, position angles 285° and 300°. Center: Tom Middlebrook, Nacogdoches, Tex., 8-inch telescope, Aug. 29.14, 1968, U.T. Three tails at position angles of 125°, 165° (1/3 degree long), and 200° (1½ degrees long). Nucleus stellar. Right drawing: Tom Middlebrook, Sept. 12.12, 1968, other data as on center drawing. Four tails at position angles 30° (1¼° long), 45° (3/4° long), 80° (3/4°), and 290° (½°).

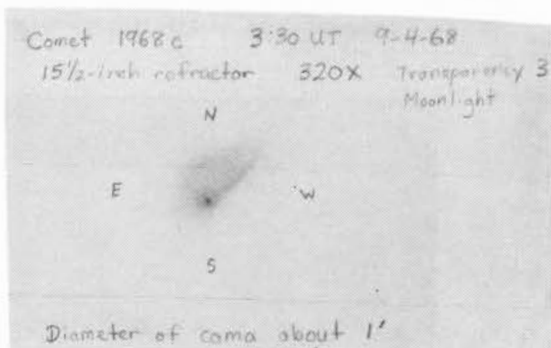

Figure 42. Drawing of Comet Honda 1968c by Eric Thiede on September 4, 1968 with a 15½-inch refractor at 320X at Madison, Wisc. Negative shading.

We conclude with a few remarks about Figure 35 on pg. 106. Mr. Larson measured a tail 3° long on his original photograph, panchromatic 4X film. Mr. Milon calls attention to the thinness of the tail and to the diffuse area right (east) of the coma.

The Strolling Astronomer

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