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Drawing of Lunar Crater Capuanus and Domes on its Floor by Richard J. Wessling on October 29, 1971, 0 hrs., 47 mins. to 2 hrs., 0 mins., Universal Time. 12-5-inch Newtonian reflector, 240X. Seeing 4, transparency 4. Colongitude 29.4 degrees. Lunar south at top, lunar east (IAU sense) at left. See Mr. Wessling's notes on this drawing on page 227 and a discussion of the Lunar Dome Survey on pages 212-215.

THE STROLLING ASTRONOMER
Box 3AZ
University Park, New Mexico
88003

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

ASSOCIATION OF LUNAR & PLANETARY OBSERVERS
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THE 1970 APPARITION OF JUPITER

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

A large number of observations were submitted for analysis during 1970--340 visual observations and 42 photographic observations. Of these, about 100 were actually used in the following report, 47 of which are being published as an appendix for purposes of illustration. Opposition was on April 21, 1970; and conjunction with the Sun occurred on November 9, 1970.

1. Listing of Visual Contributors during 1970

(1) James C. Bartlett, Jr.; Baltimore, Maryland; 3-inch refractor; 20 full discs and 26 verbal reports for a total of 46 observations. (2) Inez N. Beck; Wadsworth, Ohio; 6-inch reflector; 38 full discs. (3) Phillip W. Budine; Willingboro, New Jersey; 4-inch refractor and 10-inch refractor; 2 full discs and 2 strip sketches for a total of 4 observations. (4) Charles F. Capen; Flagstaff, Arizona; 12-inch refractor and 24-inch refractor; 4 strip sketches. (5) R. W. Crausby; Artesia, New Mexico; 2.4-inch refractor and 3-inch refractor; 8 full discs. (6) Brad Dischner; Riverside, California; 12.5-inch reflector; 6 full discs. (7) R. Doel; Willingboro, New Jersey; 8-inch reflector; 4 full discs. (8) Jean Dragesco (Prof.); Camerouns, Africa; 260-mm. O.G.; 29 full discs. (9) R. Gordon; Nazareth, Pennsylvania; 3.5-inch refractor; 3 full discs. (10) G. Happolot; Canton, Ohio; 6-inch reflector; 8 full discs. (11) Alan W. Heath (F.R.A.S.); Nottingham, United Kingdom; 12-inch reflector; 2 full discs and 18 verbal reports for a total of 20 observations. (12) Kevin L. Krisciunas; Naperville, Illinois; 6-inch reflector; 73 full discs. (13) Janet Lang; Vernon, Connecticut; 8-inch reflector; 4 full discs. (14) Chris Larkin; Binghamton, New York; 4-inch refractor; 2 full discs. (15) R. A. Lima; Jacksonville, Florida; 8-inch reflector; 2 full discs. (16) D. Louderback; South Bend, Washington; 8-inch reflector; 2 full discs. (17) M. McGrery; Philadelphia, Pennsylvania; 8-inch reflector; 1 full disc. (18) Patrick S. McIntosh; Boulder, Colorado; 6-inch reflector; 1 full disc and 2 strip sketches for a total of 3 observations. (19) Paul K. Mackal; Mequon, Wisconsin; 6-inch reflector; 5 full discs. (20) Ernst H. Mayer; Barberton, Ohio; 15.6-cm. reflector; 22 full discs. (21) José Olivarez; Orlando, Florida; 12.5-inch reflector; 1 strip sketch and one verbal report for a total of 2 observations. (22) T. Osawa; Hyogoken, Japan; 8-inch reflector; 12 full discs. (23) K. Pearson; Wheaton, Illinois; 6-inch reflector; 24 full discs. (24) Bob Rhoads; Flagstaff, Arizona; 12-refractor and 24-inch refractor; 1 full disc. (25) Charles L. Ricker; Marquette, Michigan; 6-inch reflector and 10-inch reflector; 4 full discs. (26) Terry Ross; Milwaukee, Wisconsin; 12.5-inch reflector; 9 full discs. (27) T. Sato; Hiroshima, Japan; 6-inch reflector; 66 full discs. (28) Horace A. Smith; Willimantic, Connecticut; 6-inch reflector; 6 full discs, 1 strip sketch, and 4 verbal reports for a total of 11 observations. (29) Joe Vitous; Berwyn, Illinois; 8-inch reflector; 9 full discs. (30) J. Wharton; Willingboro, New Jersey; 6-inch reflector; 3 full discs. (31) G. Wood; Galesburg, Illinois; 6-inch reflector; 1 full disc.

2. Listing of Photographic Contributors during 1970

(1) Charles F. Capen; Flagstaff, Arizona; 12-inch refractor and 24-inch refractor; 4 color slides and 20 black and white prints for a total of 24 observations. (2) Jean Dragesco (Prof.); Camerouns, Africa; 260-mm. O. G.; 4 black and white prints. (3) Elmer J. Reese; Las Cruces, New Mexico; 24-inch reflector; 2 black and white prints. (4) R. J. Wessling; Milford, Ohio; 12-inch reflector; 12 black and white prints.

3. Distribution of Observations over 1970

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.
4	2	6	27	32	24	8	5	1

This distribution refers only to those observations used in this report. Peak coverage was just after opposition in the months of April, May, and June.

4. The Qualitative Aspects of Jupiter in 1970

North Polar Region. It was rather featureless in January, February, and March with a stable intensity. On March 28, 1970, however, Larkin noticed a hazy patch of white over the preceding limb followed by a dash or hint of the North Polar Band on the 213° II meridian. First signs of the NNNTB were observed by Osawa at 219° II on April 14, 1970. [See Figure 8.] Furthermore, the NNNTB was seen imbedded in the NPR at 53° II on April

21, 1970, by Dragesco. In all other longitudes it was faint and formed a very thin border region along the southern edge of the NPR. [See Figure 13.]

On April 26, 1970, Horace Smith noticed a bluish cast in the NPR and NNTB, using a blue filter at 126° II. Soon after that, Bartlett too observed the NPR at 304° II as "bluish-gray". By late April Dragesco and Mayer noted a slight darkening of the NNNTB border at 238° II and 352° II respectively. However, by May this slight revival was reversed, according to Dragesco. However, the NNNTB remained strong in the longitudes of the Great Red Spot, according to Mayer and Dragesco. Budine and his observing team, consisting of Doel, Eppert, and Jones, reported that the NPR became more intense late in the apparition. Bartlett intimated that the NPR remained bluish-gray through May. By May 20, 1970 he found the polar cap neutral in blue light and darker in red light. The entire cap thus lost red at 133° II, 190° II, and 342° II. Heath called it "gray".

<u>North North Temperate Belt and Zone.</u> The NNTB was rather amorphous and showed distinct signs of activity in the early half of the apparition. This state was first noted by Dragesco on January 15, 1970 at 132°II. At 46°II Dragesco noted a strong belt, however, on January 29, 1970. [See Figure 1.] It was fainter and less active on a February 26 disc at 221°II, according to Dragesco. Dragesco also picked up dark spots on the belt, which were observed as well by Larkin on March 12. The NNTB was reported featureless during late March and early April by Beck. This was also true for Dragesco on April 10 and April 13 at about 300°II. The Recorder detected a strong belt in the RS longitude. There was always a white and clear NNTeZ separating the NNTB from the NPR or NNNTB. This zone was visible, like the NNTB, around the entire globe.

Throughout April Dragesco placed the NNTB farther south than most other observers, including the Recorder. Its activity appeared to wane early, though the intensity after opposition was quite constant. On a disc of April 23 the belt was indicated by Dragesco to be rather faint at 18°II, and in the normal northerly latitude. Some activity was still noticeable to Dragesco at 297°II on April 25. [See Figure 13.] There were occasional gaps in the NNTB, according to the Recorder, Horace Smith, and J. Vitous, through the months of May and June. However, this aspect was only so for those using smaller instruments; and the NNTB was still visible over its entire circumference, according to Dragesco and Mayer with slightly larger instruments. For example, see Figure 16. On May 1, however, Dragesco showed a residual portion of the NNTB very dark with its preceding and following ends very faint. [See Figure 19.] This fading continued through May. On May 8 NNTB activity was still visible to Dragesco, however, at 116°II, in the RS region, and at 319°II on May 12. Definite signs of irreversible fading were noticed on May 13 by Dragesco with a following end of an NNTB section located at 115°II.

<u>North Temperate Belt and Zone.</u> This belt remained faint to all of our A.L.P.O. observers in longitudes where it did not stray south towards the NEB. In any case, it was well photographed by C. Capen on March 30 and 31, April 30, May 3, 4 and May 23, 1970. [See Figures 3 and 18.] It was evidently darker in the early half of the apparition than in the later half. A brief resumé of its appearance follows.

On January 15 Dragesco noted the NTB in its regular latitude at 132°II, and again on January 29. [See Figure 1.] Here a preceding end was discovered at 46°II. A sign of fading was noticed on February 26 by Dragesco at 222°II with an even weaker NTB_s accompanying the NTB_n. This character was confirmed by Larkin on March 28 at 213°II. Whatever activity was then observed subsequently may be regarded as due to its fragmentation rather than to any real development of the belt. On April 10 Dragesco recorded a fairly consistent and strong NTB at 298°II. It was also strong at 130°II, according to Dragesco, also at 53°II on April 21 and at 218°II on April 22. [See Figure 11.] The NTB was quite weak by April 27, according to Dragesco and Mayer. The Recorder believes some haze must have temporarily lifted in the second half of April in the north hemisphere of Jupiter. Other features did not darken at all, however, during late April, though there was a cessation of white spot activity along the NTB in early April. Another possible explanation is a brightening of the NTeZ.

Through May and June Dragesco, Sato, and McIntosh indicated a steadily fading belt, which by June 29 appeared as a thin line at 8°II, according to P. W. Budine. [See Figure 41.] On July 1 this appearance was confirmed by Osawa at 332°II.

<u>The North Equatorial Belt Complex.</u> The most active region of Jupiter was, as usual, the NEB complex which was characterized by its double aspect throughout the apparition in most longitudes to all observers of the A.L.P.O. The NEB_s was the darker component and erupted all by itself in 1970 near opposition. First signs of this activity were observed by Dragesco on April 10 and April 13 at 280°I and 290°II. Normal activity was also recorded

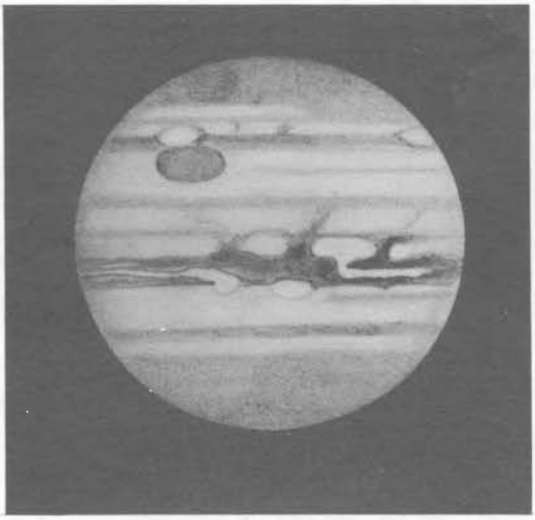

Figure 1. J. Dragesco; Jan. 29, 1970; 198°I, 46°II; 260mm O.G., 265x. Note SEBs and EZs festoons.

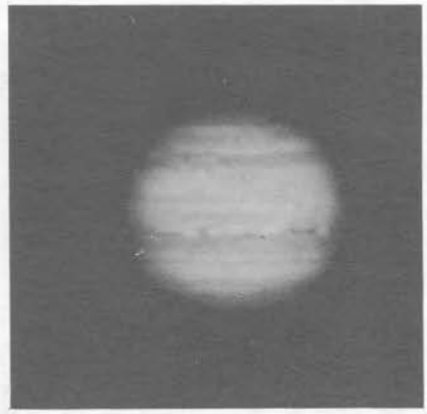

Figure 2. C. Capen; March 30, 1970; Red light photograph [Lowell Observatory.]. RSc on C.M., STB strong, and SSTB active.

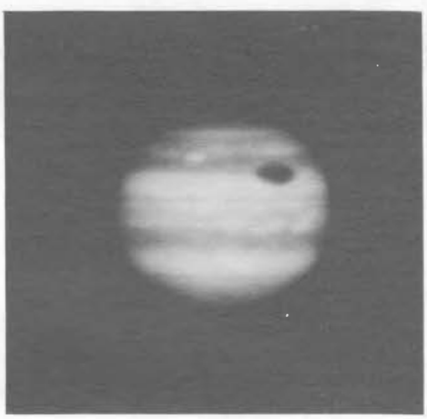

Figure 3. C. Capen; March 31, 1970; Blue light photograph [Lowell Observatory.]; note long enduring white oval FA in STB just f. C.M. p. RS.

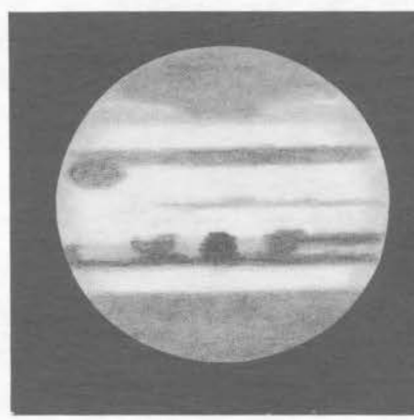

Figure 4. I. Beck; April 1, 1970, 4:55 UT; 6-inch reflector, 152x; 331°I, 64°II. Notice the interaction of the SSTB and the SPR.

in early months by Dragesco with many festoons and columns issuing from the NEB_s into the EZ_n. But such activity was secondary rather than primary in nature. A great deal of confusion and turbulence accompanied the major eruption of the NEB_s, however, in early April. This activity was most noticeable in the NEB Z on discs submitted by Dragesco, Osawa, and Sato. It involved connectors from the NEB_s to the NEB_n, blocks of dark haze, white ovals, and an occasional extra component to one of the belts. From time to time the NEB Z looked dusky and obscure and very much narrower than it had been in the earlier months, as if covered by a dark haze. The color of this haze appeared to be orange to Vitous and red to

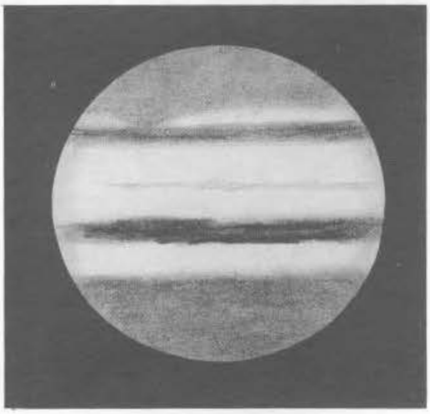

Figure 5. I. Beck; April 4, 1970, 4:45 UT; 6-inch reflector, 152x; 79°I, 150°II. Note interaction of STB & SPR.

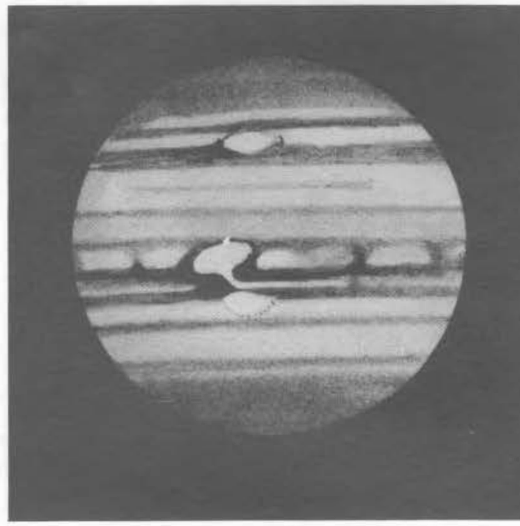

Figure 6. J. Dragesco; April 10, 1970; 279°I, 298°II; 260mm O.G., 265x. Note NNTB, NTB, the double NEB, dull EZs, and SEBs.

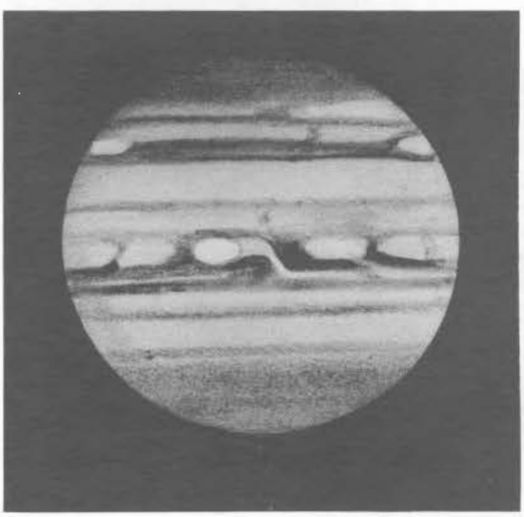

Figure 7. J. Dragesco; April 13, 1970; 280°I, 278°II; 260mm O.G., 265x. Note darkening in the NEBs.

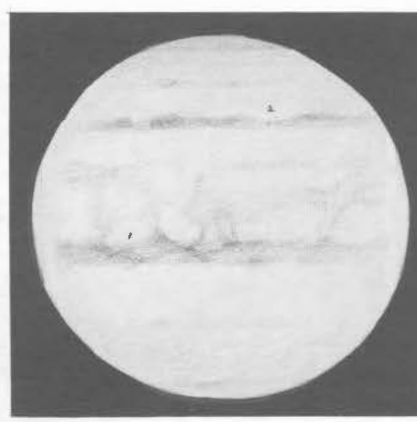

Figure 8. T. Osawa; April 14, 1970; 14:49 UT; 227°I, 219°II; 8-inch reflector, 286x. Notice the NNNTB and the agitated EZ.

Heath. However, photographs by C. Capen throughout the period resolved the two components without difficulty. The single aspect asserted itself in very confined regions, none-theless, on various presentations made by Osawa. [See Figures 23, 24, 29, and 30, all made in May.] On April 21 Dragesco showed brackish segments on the NEB$_S$ at 117°I, and those were confirmed by the Recorder and Vitous. [See Figures 10 and 12.]

On April 22 Dragesco noted more brackish areas at 290°I in the NEB$_S$. [See Figure 11.] On April 26 Vitous noted brackish areas at 278°I in the NEB$_S$. [See Figure 15.] By

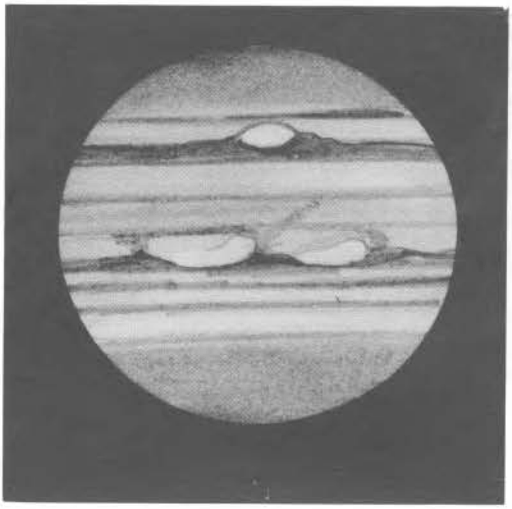

Figure 9. J. Dragesco; April 19, 1970; 176°I, 130°II; 260mm O.G., 265x. Note BC on C.M. and active EZ.

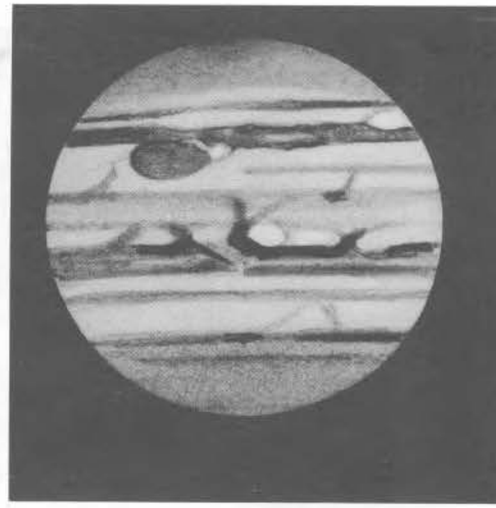

Figure 10. J. Dragesco; April 21, 1970; 117°I, 53°II; 260mm O.G., 265x. Note festoons in EZn, the NTrZ, and the SEBZ; brackish sections in the NEBs; and RS activity.

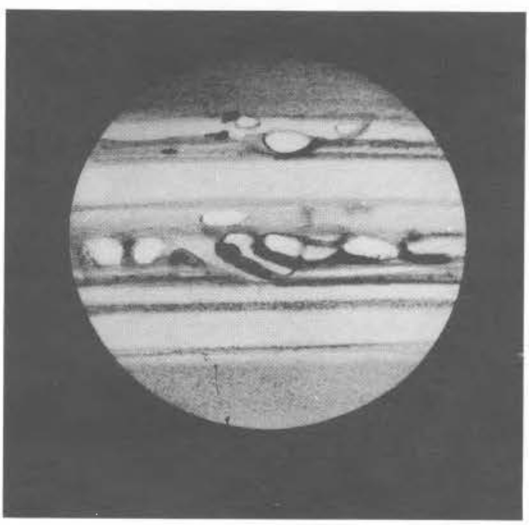

Figure 11. J. Dragesco; April 22, 1970; 290°I, 218°II; 260mm O.G., 265x. Note w. oval in EZs & NEBs.

Figure 12. J. Vitous; April 25, 1970; 3:47 UT; 122°I, 33°II; 8-inch reflector, 384x. Warm color in the NEB and EZ on original color drawing.

late April the NEB itself became reddish in hue, according to Vitous. This was also noticeable in the NEB_n and was confirmed by Heath. Equally dark areas were seen by Mr. Bob Hicks, a friend of the Recorder, from 76°I to 171°I on May 3, 1970. However, these were not confirmed by Mayer and Dragesco in the RS longitude (System I longitude about 200°). By May 11 Osawa showed little activity in the region at 147°I, and this was confirmed by Bob Hicks on May 17 from 125°I to 162°I. Areas in the vicinity of the RS remained quiet throughout the period as observed by Bartlett, Dragesco, and Osawa. Beck, McIntosh, and Osawa noticed some reduction in the active regions by late May, however. By June 1 the NEB_s was

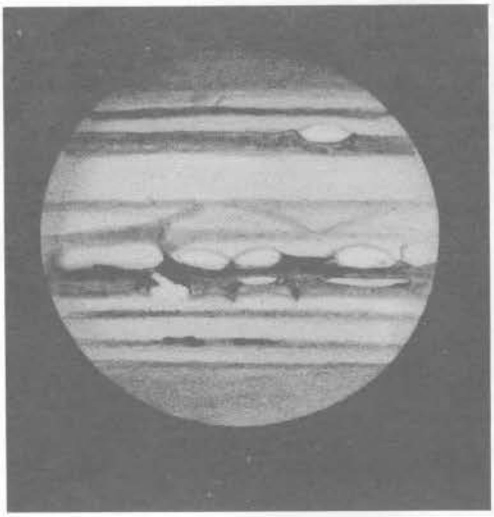

Figure 13. J. Dragesco; April 25, 1970; 32°I, 297°II; 260mm O.G., 265x. Note NNTB activity and festoons in EZs.

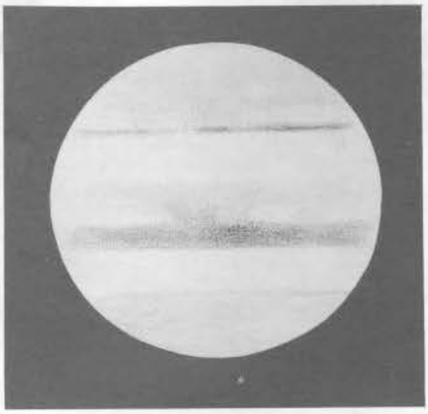

Figure 14. H. A. Smith; April 26, 1970; 2:12 UT; 222°I, 126°II; 6-inch reflector, 180x. Notice the interaction of the SPR and the STB.

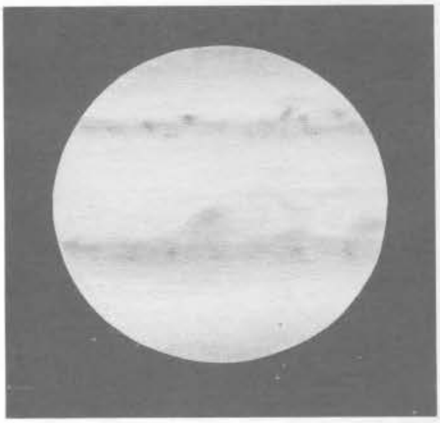

Figure 15. J. Vitous; April 26, 1970; 3:43 UT; 278°I, 181°II; 8-inch reflector, 384x. Notice the dark brown festoons issuing from the NEBs.

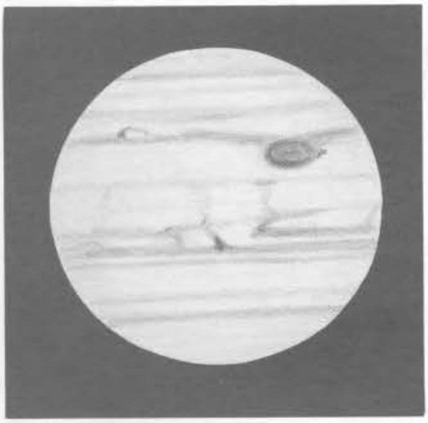

Figure 16. E. Mayer; April 27, 1970; 4:16 UT; 96°I, 351°II; 156mm reflector, 220x. Note the SSSSTB.

normal once again, and the eruption was over as recorded on a disc by Dragesco at 80°I. Some activity remained at 256°I on June 2, however, according to Dragesco, also at 326°I on June 5, 1970. See Figures 21, 23, 24, 25, 26, 27, 28, 29, 30, 32, 33, 34, 35, and 36. A considerable red hue was noted again by Vitous in July and some orange too. Bartlett's filter observations in the intervening period confirmed this impression. The eruption of the NEB_s was thus accompanied by a warming trend in the entire NEB complex. For the Recorder this discovery was indeed most gratifying and appeared to substantiate several of the theories he has promulgated concerning the coloration and short term changeability of

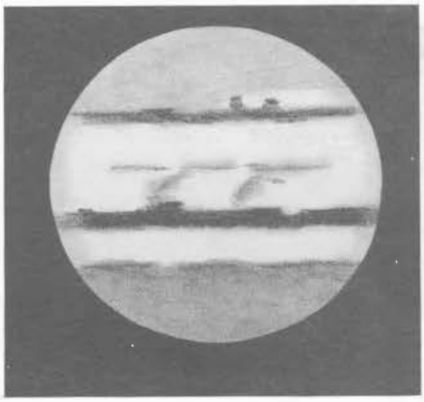

Figure 17. I. Beck; April 28, 1970; 4:10 UT; 250°I, 138°II; 6-inch reflector, 152X. Note interaction of STB and SPR.

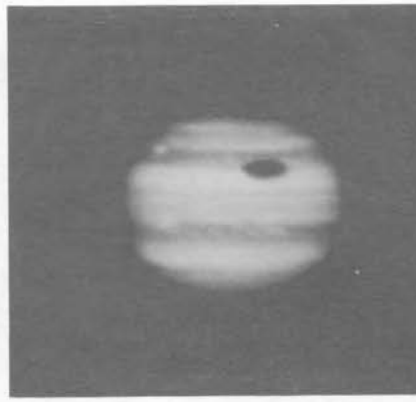

Figure 18. C. Capen; April 30, 1970; Blue light photograph [Lowell Observatory.]. Note strong and active SSTB.

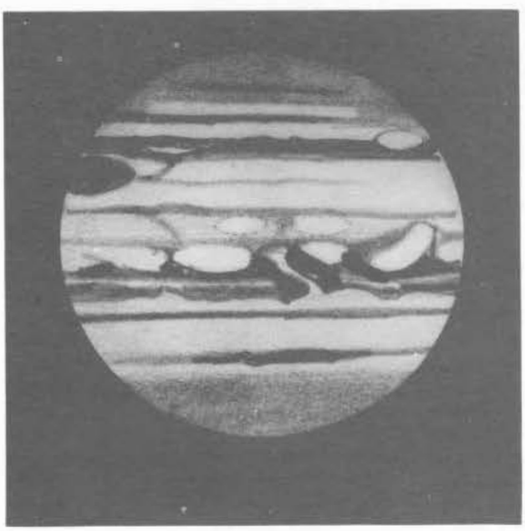

Figure 19. J. Dragesco; May 1, 1970, 0:10 UT; 218°I, 84°II; 260mm O.G., 265X. Note fading NNTB, a large festoon in the EZ, RS actiivity, and SSSTB.

Figure 20. J. Dragesco; May 2, 1970, 22:20 UT; 107°I, 318°II; 260mm O.G., 265X. Note weak NEB_s p. C.M., SEB_s, RS activity, FA, and double SSTB.

the activity and color indices of the NEB.

Concluding, we may say that the belt as a whole did not erupt in 1970 but only the NEB_s. It became active and then normalized. The double aspect remained throughout the active period. It was presented to all of our observers at a most auspicious moment, opposition, throughout the cycle of its inception, maximization, and minimization. I believe that had the NEB_n erupted too, the belt as a whole would have materialized the single

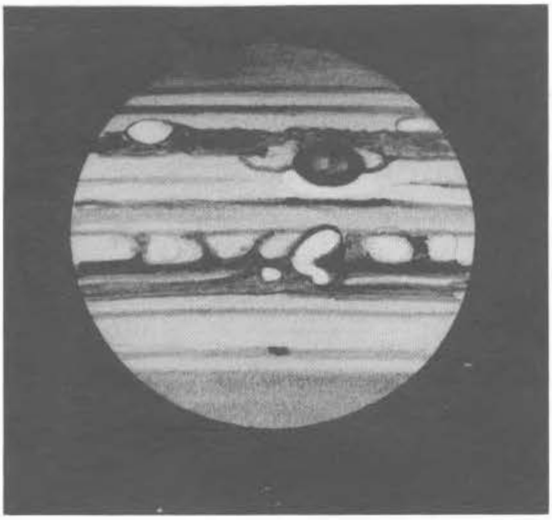

Figure 21. J. Dragesco; May 5, 1970; 21:10 UT; 178°I, 7°II; 260mm O.G., 265x. Note spot on NNTB, RSH and RS activity, and very active STB.

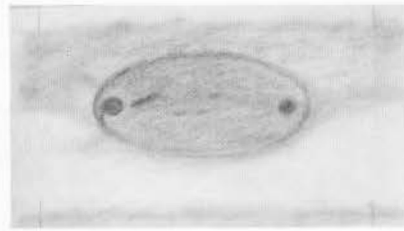

Figure 22. C. Capen; May 9, 1970; 12-inch refractor & 24-inch refractor, 900x. Notice terminal points in the RS.

Figure 23. T. Osawa; May 11, 1970; 14:05 UT; 147°I, 293°II; 8-inch reflector, 286x. Note column p. FA in STeZ.

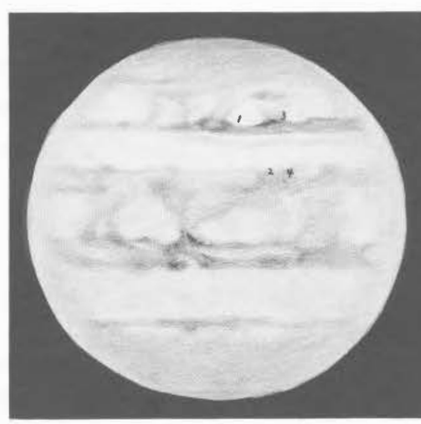

Figure 24. T. Osawa; May 17, 1970; 14:03 UT; 13°I, 113°II; 8-inch reflector, 286x. Note great agitation in the EZ along the EB and STeZ activity.

aspect. However, the NEB_n remained calm throughout the eruption cycle and throughout 1970. It appears evident from this discussion that solar causes cannot explain the series of events which took place on Jupiter.

<u>The Equatorial Band and the Equatorial Zone North.</u> This region of Jupiter was highly disturbed during the great NEB_s eruption. It did not itself contribute to the activity but simply was a result of the activity in the NEB_s, suggesting that much of the activity in the EZ_n is tertiary activity emanating from the NEB_s, just as much of the activity in

the EZ_s is determined by the NEB_s and NEB_n. A true EB was discernible in the first several months of the apparition but was obscured entirely at opposition and during the NEB_s eruption by a false EB issuing from dark NEB_s festoons. The material from these festoons formed a distinct belt in the EZ during the rest of the period till conjunction with the Sun in November of 1970.

First signs of fading of the true EB were noticed on March 6 at 51° I by E. Mayer and were confirmed by Larkin. However, in the region near 280° I J. Dragesco still depicted a strong true EB on April 10 when it was beginning to be obscured by the activity of the NEB_s eruption. A more agitated picture was supplied by Osawa on April 14, showing the formation of the false EB in the same longitude. [See Figure 8, 227° I.] As can be seen, numerous festoons extended to the SEB_n as well. On April 19 Dragesco noticed a hazy, dusky EZ_n and an agitated state at 176° I and on April 21 at 117° I as well. [See Figures 9 and 10.] A white oval in the EZ_n was noticed too on April 22 by Dragesco at 290° I. [See Figure 11.] Two more white ovals in the EZ_n were observed by Dragesco on April 27 at 348° I. [See Figure 19.] Finally, on May 1 Dragesco observed a large festoon subtending the whole EZ, issuing from the NEB_s, and reaching the SEB_n at 218° I (plus). The festoon was confirmed by the Recorder. We quote comments made by Bartlett about a festoon associated with the RS but applicable to this one:

> "On July 20, 1922, d'Azambuja et Meudon photographed in calcium light one of the largest such filaments ever recorded, and a rather thin structure resembling a Type A Jovian festoon. This remarkable object spanned two hemispheres of the sun, beginning at a point near one limb and extending almost to the opposite. On August 31, 1929, another spectroheliogram obtained at Meudon showed an immense filament which extended from the sun's south polar zone almost to the south equator. Of course we cannot suppose that Jovian festoons are in any way analogous to solar prominences, for the latter are eruptive masses of very hot hydrogen and other gases. ... But while we cannot properly compare Jovian festoons to solar filaments, nevertheless the latter do prove that truly immense linear filaments can exist in the atmospheres of very large bodies, cover distances of ... thousands of miles, and yet retain a coherent structure. Therefore, extraordinary length in a Jovian festoon does not necessarily preclude its objective existence."

That such "great festoons" existed was believed by this Recorder as early as the 1962 apparition. An occasional great festoon appears to have been observed by the B.A.A. in earlier apparitions of Jupiter. However, all such observations (until the one reported above) were made by one observer only, not two. One reason why it has taken so long to confirm the existence of these features is due to their short longevity, lasting anywhere from several days to several weeks but never lasting for several months. [See Figure 19.]

On April 30 and May 11 Bartlett recorded in his observer's notes an EB Disturbance which he described as -- "A faint, grayish, spindle-shaped marking ... on the EB, like a local swelling in the belt, with its p. end in longitude 136° I and its f. end in longitude 162° I ...". On the same date Osawa showed a region in the EZ which was very active from 147° I to about 160° I suspended between two brownish gray festoons. This observation was only 10 hours after that of Bartlett and does not confirm the appellation applied above in the Recorder's view. Another disc made by Osawa on May 17 at 13° I showed an even more agitated region, presumably, in the Recorder's opinion, produced by turbulence in the EZ_n. In addition, these regions were not at all conspicuous to Dragesco and Bob Hicks. [See Figures 23, 24, and 25.] That these were faint objects and not Disturbances in the sense in which the term was used in 1968-69 is perhaps arbitrary, as was found to be the case with the discovery of minor SEB Disturbances and minor STrZ Disturbances. At least in 1968-69 the EB eruption could not be explained in terms of that of the NEB, for it exceeded the intensity of the NEB complex. However, in 1970 the NEB_s eruption exceeded in intensity the darkening of the EB. It is still probable that some sort of Disturbance took place which may even account for the coloration of the equatorial region of Jupiter; but this opinion appears to be an alternative hypothesis to the one the Recorder wishes to posit, namely that tertiary activity in the EZ was produced by the eruption of the NEB_s and by turbulence in the EZ_n.

By May 22, 1970, Osawa recorded the region again and showed EZ_n turbulence at 66° I, another region first noted by Bartlett in early May and again on May 20 from 70°-94° I. [See Figures 29 and 30.] Osawa also put the following end of this activity at 94° I, Figure 30 on May 27, 1970. A third region of turbulence was seen by Bartlett on May 31 from 294° I to 325° I, in the EZ_n like the others. Considerable activity was also seen on June 5 by Dragesco at 326° I, which appears to indicate the cause to be an NEB_s festoon. [See Figure 33.] Some slight turbulence was also seen by Bartlett and Osawa from 218° I to

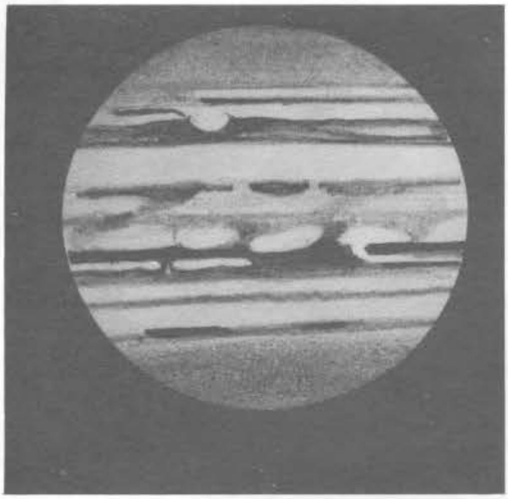

Figure 25. J. Dragesco; May 18, 1970; 20:00 UT; 29° I, 120° II; 260 mm. O.G., 265X. Notice broken SEB_n and strange line associated with BC in the STeZ.

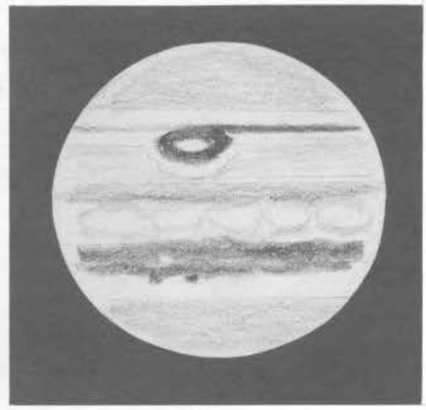

Figure 26. J. C. Bartlett, Jr.; May 19, 1970; 3:51 UT; 316° I, 44° II; 3-inch refractor, 300X. Note dark red RS ring.

Figure 27. K. Krisciunas; May 19, 1970; 2:16 UT; 6-inch reflector, 183X. Note weak NEB_s p. C.M. 258° I, 347° II.

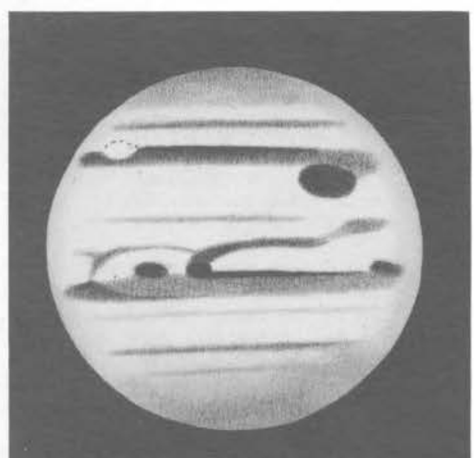

Figure 28. T. Sato; May 21, 1970; 13:50 UT; 277° I, 347° II; 15 cm. reflector, 192X. Cf. Fig. 27.

242° I from May 22 through May 30, 1970. Clearly, the region was drifting and was not fixed, as would be required in order for it to be a Disturbance. However, the region from 70° I to 94° I appeared to be more stationary, along with the NEB_s eruption which persisted the longest in the region near 117° I. The real evidence appears to be, however, that when the NEB_s eruption died down, even this region of activity in the EZ died down as well. This state of affairs was realized by June 8, 1970. See Figure 37.

The South Equatorial Belt, North and South. The SEB_n was very faint in January and February of 1970, according to Dragesco. The SEB_s was not visible early in the apparition.

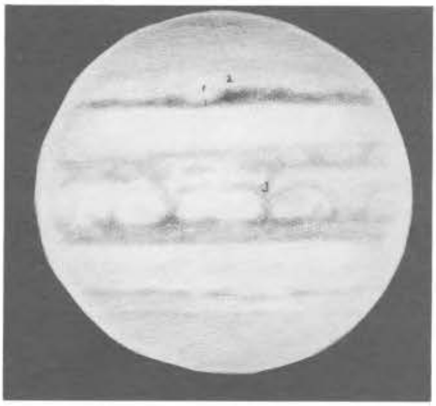

Figure 29. T. Osawa; May 22, 1970; 13:20 UT; 57° I, 119° II; 8-inch reflector, 222X. Note NEB_s festoons and dull STeZ.

Figure 30. T. Osawa; May 27, 1970; 12:34 UT; 98° I, 123° II; 8-inch reflector, 222X. Note a very large EZ oval on C.M.

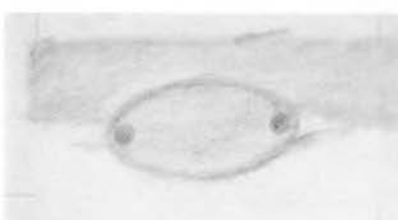

Figure 31. C. Capen; May 28, 1970; 12-inch & 24-inch refractors, 900X. Notice a bar between the p. and f. ends of the RS.

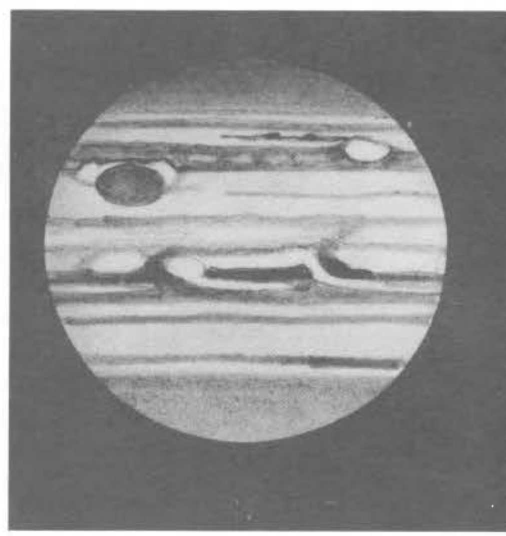

Figure 32. J. Dragesco; June 1, 1970; 80° I, 64° II; 260 mm. O.G., 265X. Note RS activity and plume preceding STeZ oval BC.

For Heath the belt remained a difficult feature and was weak in intensity throughout the entire 1970 apparition.

On March 12 Larkin noticed some activity along the SEB_n at 312° II. This activity was confirmed by C. Capen on March 30, including the observation of the RSH (Red Spot Hollow) and an SEB_s preceding the RS. [See Figure 2.] Activity of this kind was also seen at 213° II by Larkin on March 28. There has been some discussion of an eruption of the SEB in 1970 in the J.B.A.A. In the Recorder's opinion this information is wholly spuri-

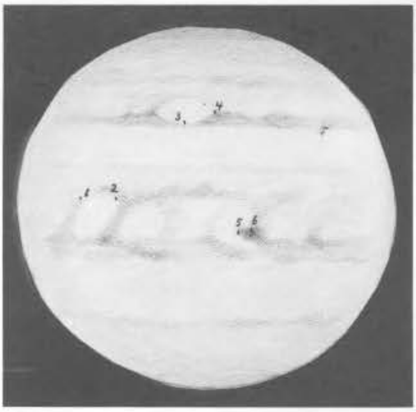

Figure 33. T. Osawa; June 6, 1970; 12:52 UT; 249° I, 196° II; 8-inch reflector, 286X. Note dim n. hemisphere, festoons from the weak NEB_s, and DE on STB.

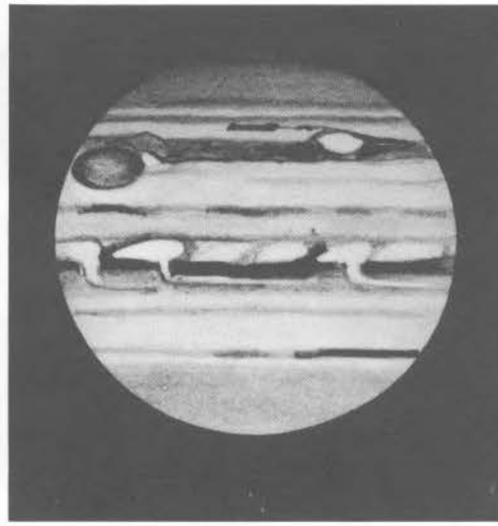

Figure 34. J. Dragesco; June 6, 1970; 134° I, 80° II; 260 mm. O.G., 265X. Note dark NEB_s.

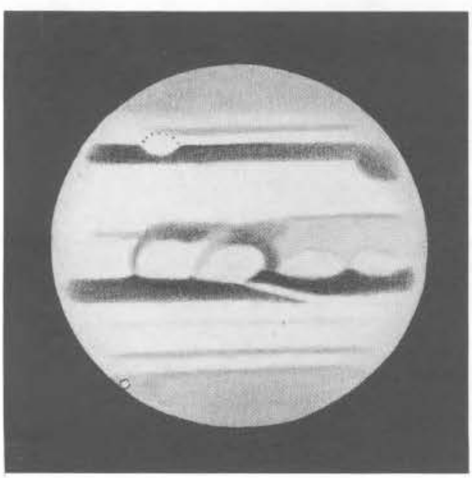

Figure 35. T. Sato; June 7, 1970; 12:15 UT; 24° I, 324° II; 15 cm. reflector, 192X. NNTB still visible, EZ_n & NEB_s still prominent p. RS from FA. Satellite III on disc in NPR at p. limb.

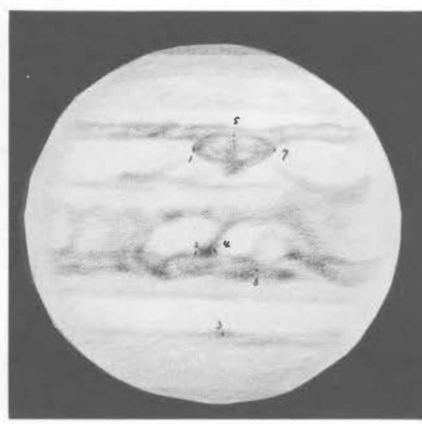

Figure 36. T. Osawa; June 7, 1970; 13:39 UT; 75° I, 15° II; 8-inch reflector, 222X. Note prominence of NEB and EZ activity near RS and RS activity.

ous and is of no consequence, for no such activity was perceived to take place by any observers of the A.L.P.O. except in the region of the RSH. Quoting from a letter the Recorder received in late June from Elmer Reese: "As yet there is no sign of a new SEB disturbance on Jupiter." (June 21, 1970.) A typical observation is that of April 10 by Dragesco, recording no activity at all in the SEB Z at 298° II. The SEB_n remained faint

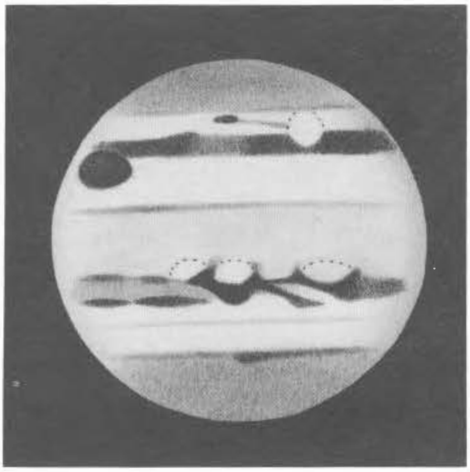

Figure 37. T. Sato; June 8, 1970; 11:10 UT; 143° I, 75° II; 15 cm. reflector, 192X. Note weak EZ f. RS and plume p. oval BC.

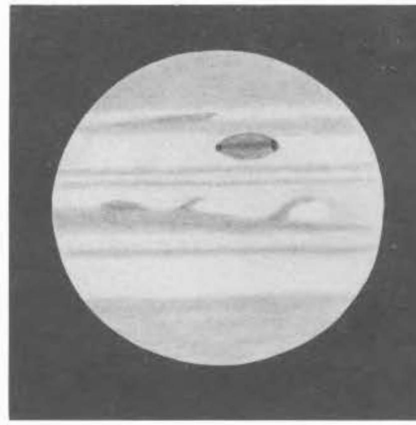

Figure 38. B. Rhoads; June 21, 1970; 5:15 UT; 176° I, 14° II; 12-inch & 24-inch refractors, 400X. Note bar in RS.

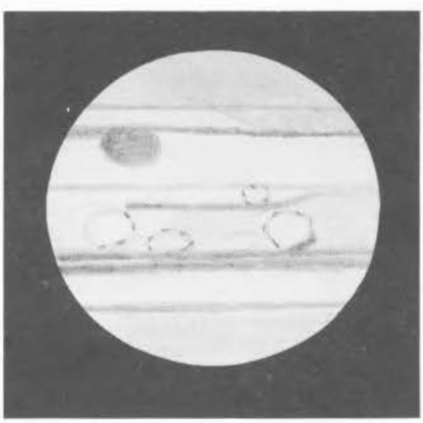

Figure 39. K. Krisciunas; June 22, 1970; 2:17 UT; 228° I, 58° II; 6-inch reflector, 250X. Note shading in STeZ.

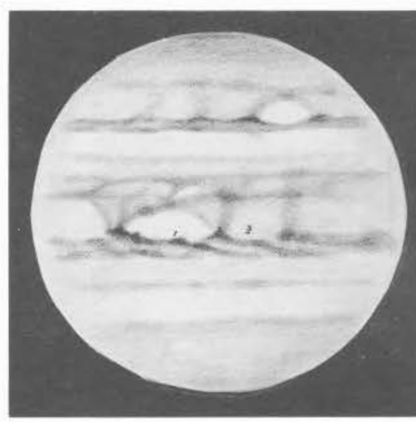

Figure 40. T. Osawa; June 28, 1970; 12:50 UT; 120° I, 260° II; 8-inch reflector, 286X. Note NTB, webbed region of EZ_s between EB and SEB_n, and STeZ activity.

too during April, according to Dragesco and Osawa. Two SEB Z festoons were noticed by Dragesco on April 21 at 53° II. [See Figure 10.] Also on April 27 a preceding end of the SEB_s was noted by Dragesco at 238° I. No other activity was seen, however. Bartlett, Dragesco, and Osawa did record numerous interactions of the RS with the SEB_s and SEB_n festoons, however. This and this alone is the best evidence of some sort of SEB Z activity, but it did not reach the proportions we normally associate with any kind of Disturbance in the region, even if it is a "minor one".

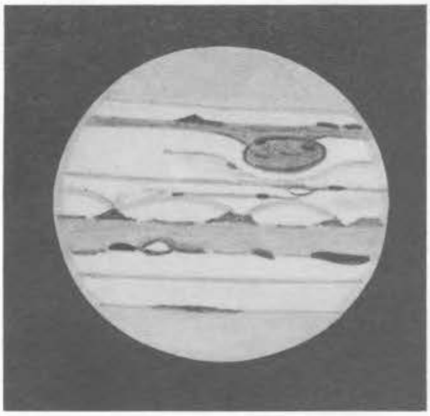

Figure 41. P. W. Budine; June 29, 1970; 1:45 UT; 232° I, 8° II; 4-inch refractor, 167X. Note EZ activity and RS interior.

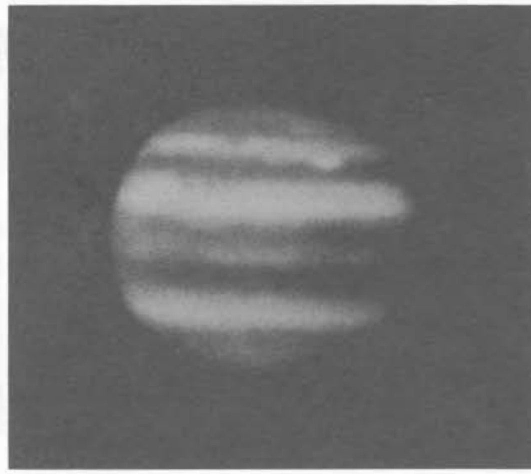

Figure 42. New Mexico State University Observatory blue light photograph; Aug. 7, 1970; 2:29 UT; 291° I, 129° II; 24-inch reflector. Prec. end STrZ Disturbance at 90°4 II.

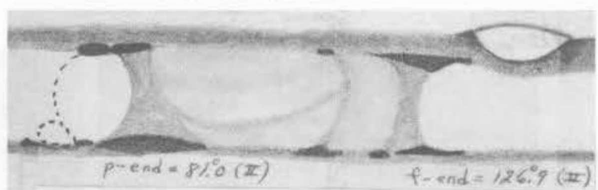

Figure 44. P. W. Budine; Sept. 2, 1970; 23:45 UT; 10-inch refractor, 250X. Beginning section of the STrZ Disturbance. p.e. 82° and first f.e. 127° II.

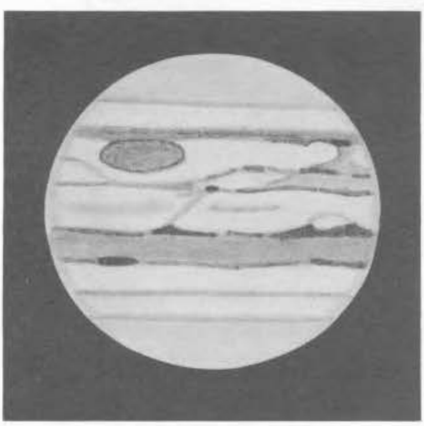

Figure 43. P. W. Budine; August 26, 1970; 0:55 UT; 350° I, 44° II; 4-inch refractor, 167X. p.e. STRZ disturbance at 84° II.

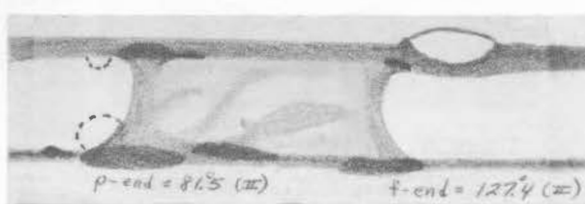

Figure 45. P. W. Budine; Sept. 5, 1970; 0:25 UT; 4-inch refractor, 214X. Beginning section of the STrZ Disturbance. p.e. 81° and first f.e. 127° II.

South Tropical Zone, Red Spot, and South Tropical Zone Disturbance. On May 2 Dragesco noticed the STrZBd, which was seen in 1967-68 and 1968-69 and was discovered in 1967-68 by Osawa. [See Figure 20.] A considerable amount of activity was seen involving the RS and various processes of dark material throughout May by Dragesco and Bartlett. [See Figures 19, 20, 21, and 32.] On May 5 Dragesco observed a similar band to the STrZBd connected to the f. end of the RS, which on May 1 had appeared also merged with the SEB_S. These bands, were again seen on May 7, May 17, and June 1 by Dragesco and were confirmed by

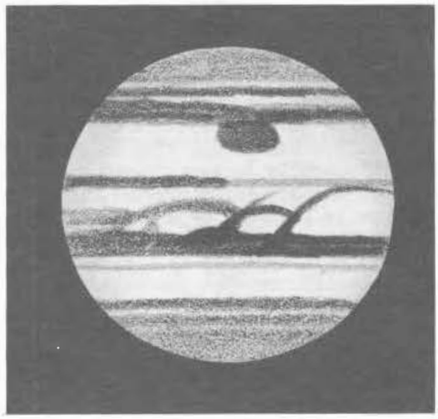

Figure 46. Paul Mackal; April 5, 1970; 6:50 UT; 313°I, 16°II; 6-inch reflector, 212x. "Confirmation" drawing of a large EZ festoon f. RS. [Assuming a stationary drift over 30 days of ±5°(I).]

May 3,1970(U.T.)

Seeing-7
Transparency-2.5

Telescope:
6" Newtonian,f/8.5
120x-240x

System I

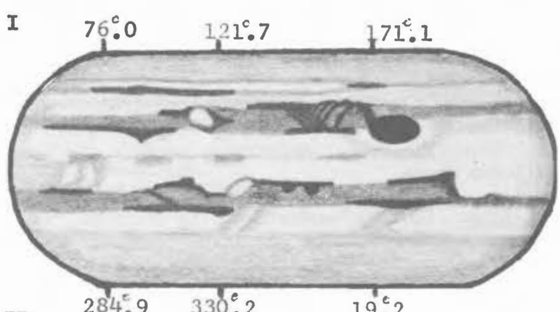

Figure 47.

System II

7h20m 8h35m 9h56m -Time(U.T.)

Place of observation- 1209 Daniels Avenue, Los Angeles
Mailing address- Apt. A-303, 11740 Wilshire Blvd., Los Angeles
California 90025
Observer-Bob Hicks

Bartlett on June 3. Suggestions of the bands were also indicated by Capen, P. S. McIntosh, and E. Mayer. [See Figures 22 and 31.] On May 9 Bartlett called the RS "intensely dark and dark red color". On May 17 Heath called the RS a "strong rosey pink colour.. .a little less intense than the STB". Capen described the color as orange and red. Mayer found it with an orange cast late in the apparition. On May 19 Bartlett stated that the RS was "intensely dark red with a lighter, pinkish interior oval". This description was repeated on June 3. A line across the RS was noted by Capen on May 28 and by Rhoads on June 21, 1970. This line may have been responsible for the Spot's change in color and for its change in shape as well. For Bartlett the RS was a half oval, and this aspect can be seen on some of the drawings and photographs submitted by the A.L.P.O. On June 6 a stronger SEB_s following the RS was noted by Dragesco, and RS activity was radically altered. Connections of the RS to the SEB_n were noted by Osawa on June 7 at 13.6° II and 32° II. Quoting Heath's summary remarks: the RS was "very conspicuous. It seems to be involved with the STB and shows a strong pink colour, but I do not feel it was so colourful as at the last apparition. However, the colour is very strong indeed."

The STrZ was usually the brightest zone on the planet in 1970, according to Horace Smith and Alan Heath. In fact, it was the brightest it has been in a very long time, at least in the memory of the Recorder who began observing in 1962. To everyone's surprise an eruption took place in the STrZ which is in every sense a revival of the classical STrZ Disturbance observed from 1900 to 1939-40. (However, it is the opinion of the Recorder that the present Disturbance is produced by a fresh batch of sources.) A blue light photograph supplied by Elmer Reese showed its preceding end at 90°.4 II on August 7, 1970. [See Figure 42.] At this time it appeared as a rather vague sort of feature; and one might easily have come to the conclusion that the festoons involved would disappear and cease to be visible, having something to do with the STrZ complex of 1966-67 or with the STB itself. However, these features did not fade, and many more of them appeared so that several f. ends appeared over the entire region. At New Mexico State University Observatory several observations were made of the Disturbance in 1970 and were published in Icarus, 14:343-354. Quoting Elmer Reese:

> "Towards the end of the apparition a dusky area appeared in the South Tropical Zone about 70° following the RS. The feature resembled in some respects the South Tropical Disturbance of 1901-39 and the South Tropical Streaks of 1941, 1946, and 1955. Although the new disturbance did not become a conspicuous object until 14 August 1970 (...), a faint dusky wisp marking its preceding end had been under observation since 19 July when it was at longitude (II) 98°. Even earlier, a forerunner of the disturbance may have been a small dark projection on the north edge of the South Temperate Belt which was first recorded on 25 June at longitude (II) 143°. ... The intensity of the disturbance was greatest near the preceding end and fell off in several steps in the direction of increasing longitude, giving the impression of several following ends. Thus on 29 August the overall length of the disturbance extended between longitudes 80° and 180°; however, there were other "following ends" of darker sections at longitudes 110°, 133°, and 156°. ... The preceding end of the disturbance steadily advanced upon the Red Spot during the interval of observation (...). When last observed on 24 September, the preceding end was at longitude (II) 70.3° and moving at the rate of -0.41 degrees per day which corresponds to a rotation period of $9^h55^m23^s.8$ [pp. 356-358].

On June 25, 1971, the Recorder received a communication from Elmer Reese that the STrZ Disturbance was dragging the RS along in decreasing longitude, System II, after their conjunction on December 24, 1970. This result appears to confirm the thesis that indeed a revival of the region had taken place.

The South Temperate Belt and Zone. The long enduring white ovals BC, DE, and FA were quite conspicuous once again and continued to be permanent features of the STB. The center of BC moved from 132° to 89° II during the period of May 22 to August 7, 1970. The center of DE moved from 215° to 197° II from May 6 to May 28, 1970. The center of FA moved from 330° to 276° II from April 15 to July 8, 1970. These data were supplied by P. W. Budine.

The STB became the darkest belt on the planet in 1970, rivalling the NEB though not quite so dark as the NEB_s during its resurgence. After opposition, the STB reasserted itself and became the darker feature. On February 26 Dragesco saw a double STB with a faint zone separating the two components. By March 6 Mayer saw a wide STB preceding the RS, which was confirmed by Beck and Hicks at 313° II on March 24, 1970, and May 3, 1970 respectively. A great deal of activity and turbulence took place in the STez, very similar in nature to that observed by the A.L.P.O. and the Recorder in 1962. These hazes included distinct columns and festoons, and connections extended in longitude between the STB and the SPR and the SSTB and the SPR at various longitudes. [See Figures 1, 4, 5, 7, 11, 12, 13, 14, 15, 17, 19, 23, 24, 25, 29, 30, and 33.]

On June 1 Dragesco noted a plume or belt in the STeZ associated with the p. end of BC. [See Figures 32 and 34.] The feature was confirmed by Sato on June 8 at 75° II. [See Figure 37.]

The South South Temperate Belt and the South Polar Region. The SSTB was fairly obvious throughout the apparition in most longitudes and was very active, like the STB in appearance but somewhat fainter. Sometimes it was independent of the SPR; at other times it was obscured by the haze, and often it was a border to the SPR. The SSSTB was also noted as a border to the SPR on several occasions. A prominent connection of the SPR and the STB was observed first by Beck at 130° II and was confirmed on April 26 by H. A. Smith. Much activity appeared to be evident in this region afterwards and was recorded in detail by Osawa. A SPB was noted on April 27 by Mayer at 351° II. [See Figure 16.] This may or may not be an actual SSSSTB. Such a belt was confirmed by Dragesco on May 1 at 84° II and on May 5 at 7° II. On May 8 Dragesco noted an active region in the SSTB at 96° II and on May 12 found a double SSTB at 319° II. On May 21 Osawa saw a double SPB or SSSSTB at 35° II. On June 22 a double SSTB was once again seen by Dragesco.

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By: J. Russell Smith

(Published from June, 1968 to October, 1969)

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LUNAR NOTES

By: John E. Westfall and Harry D. Jamieson, A.L.P.O. Lunar Recorders

Additions to the A.L.P.O. Lunar Photograph Library: Amateur and Apollo-14 Photographs

(John E. Westfall)

Notice--Increase in Mail Charges

The A.L.P.O. Lunar Photograph Library was started in 1964. Since then, increases in postal rates have made its operation more and more expensive. This library is a non-profit service, but should not involve continual losses. Accordingly, the following charges are now in effect:

1. Requests for the Lunar Photograph Library Catalog must be accompanied by 56 cents in stamps.

2. Requests for the loan of photographs must also be accompanied by 56 cents in stamps. (This charge approximates the average cost of mailing a photograph loan order.)

Amateur Photographs

Many A.L.P.O. members take lunar photographs, as evidenced at convention exhibits; but only a handful are ever forwarded to the Lunar Photograph Library. The writer suggests that the A.L.P.O. lunar photographer make an extra 8x10-inch enlargement of each better-quality negative and submit it to the library. Coverage of the following lunar areas is particularly desirable:

1. High-sun views of dark-haloed and bright craters.

2. Low-sun views of lunar domes.

3. Views of banded craters and Selected Areas at all lightings.

4. Views of the "Luna Incognita" region at favorable librations. See Str. A., Vol. 23, Nos. 7-8, pp. 118-122 and 134-136.

Seven photographs recently received from A.L.P.O. member Richard J. Wessling illustrate the capability of amateur lunar photography. Mr. Wessling's photographs, one of

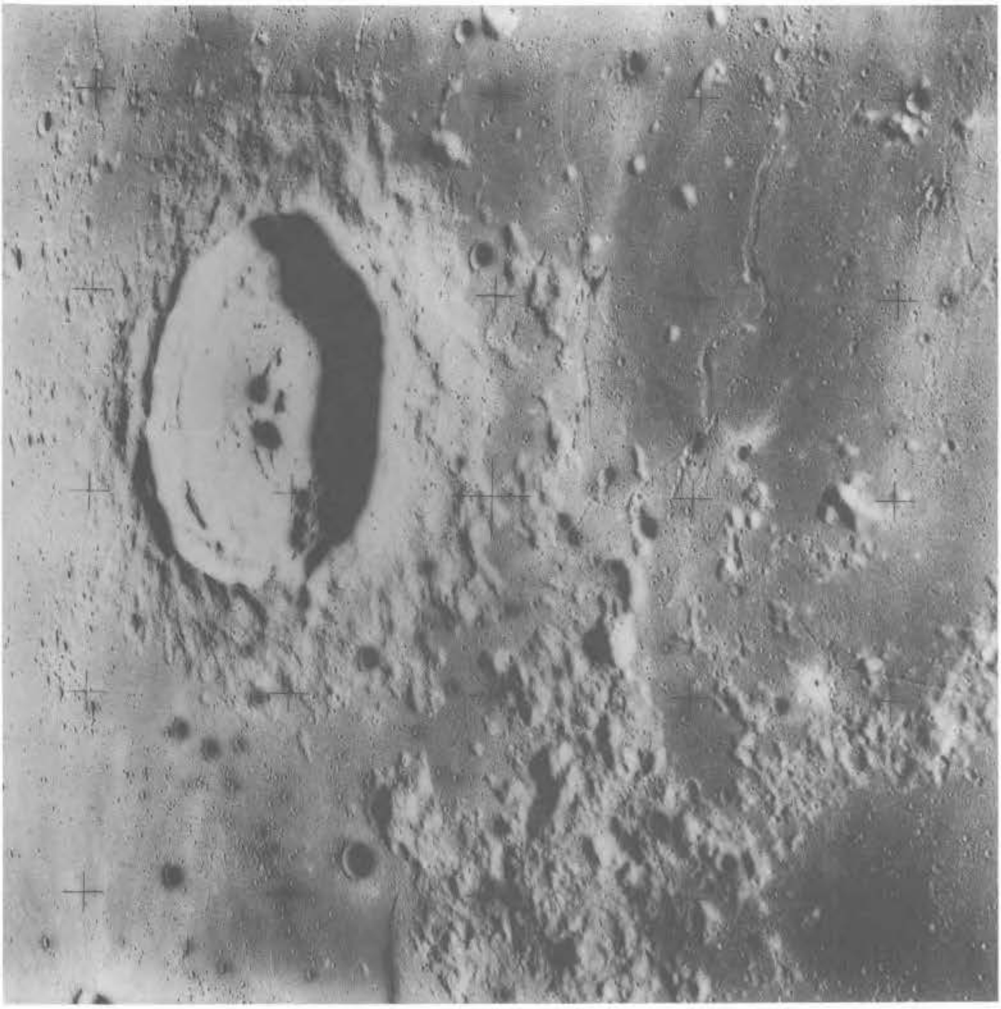

Figure 48. An oblique view of the crater Lansberg (to left), on the lunar equator in Oceanus Procellarum. Lansberg is 40 kms. in diameter and 2600 meters deep. East (right) of Lansberg are scattered uplands material and two sinuous rill systems. (Photograph AS14-70-9824). North at top.

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which (RW-2) was reproduced on the front cover of Vol. 23, Nos. 9-10 of this Journal, were all taken with a 12½-inch Newtonian reflector. Data on these photographs (all 8x10-inch enlargements) follow:

Code Number	Area Covered	Date and Time (U.T.)	Colongitude	Scale (Approx.)
RW-1	First Quarter Moon	1969, Jan. 26, 01:50	003°2	16.7 M*
RW-2	Copernicus-Eratosthenes (Overlaps RW-3)	1969, Jul. 24, 02:05	026.9	3.4 M
RW-3	Cassini-Archimedes-Timocharis (Overlaps RW-2, RW-4)	1969, Jul. 24, 02:12	026.9	2.8 M
RW-4	Plato-Alps (Overlaps RW-3)	1969, Jul. 24, 02:15	027.0	2.8 M
RW-5	Deslandres-Tycho-Clavius (Overlaps RW-6)	1969, Jul. 24, 02:17	027.0	3.2 M
RW-6	Maginus-Clavius-Moretus (Overlaps RW-5)	1969, Jul. 24, 02:30	027.1	2.8 M
RW-7	Aristarchus-Marius Kepler w/Pleiades #172 Occultation	1969, Dec. 21, 02:00	055.1	5.2 M

*I.e., 1/16,700, 000, etc.

Apollo-14 Photographs

The 29 photographs listed below were taken from low lunar orbit during the Apollo-14 Mission in February, 1971. Two of these photographs are reproduced here (AS14-70-9824 and -73-10095). The lenses used were 80-mm. (Photos 70-), 250-mm. (73-), and 500-mm. (69-). The Apollo-14 landing was at 3°67 S/17°47 W. Below, pertinent data are listed in the same manner as in the previous report on Apollo-11, -12, and -13 photographs. (See Str. A., Vol 23, Nos. 3-4, pg. 64.) Directions are given in the I.A.U. system, where west is the hemisphere of Oceanus Procellarum.

Code Number AS14-	Format	Solar Altitude	Description
69-9622	L-OBL 30°	21°	Euclides KA-Lansberg η. (3°5 S/25°W).c.170T (1/170,000).
69-9624	L-OBL 30°	21°	SW. of Lansberg η. (3° S/26°5 W). c.160T.
69-9625	L-OBL 30°	21°	N. of Lansberg L. (3° S/27° W). c.150T.
69-9627	L-OBL 30°	21°	NW. of Lansberg L. (3° S/28° W). c.130T.
69-9629	L-OBL 30°	21°	S. of Lansberg ω. (3° S/28° W). c.110T.
69-9631	L-OBL 20°	21°	Lansberg B. (3° S/28° W). c.90T.
70-9771	VERT.	70°	Maedler. (10° S/29° E). 340T.
70-9793	VERT.	48°	Hipparchus-Hind-Halley. (7° S/7° E). 360T.
70-9795	VERT.	45°	Halley-Hipparchus X. (7° S/5° E). 360T.
70-9797	VERT.	45°	Hipparchus J, T, U, K-Mueller. (6°5 S/3° E). 360T.
70-9799	VERT.	45°	Gyldén. (6° S/1° E). 360T.
70-9801	VERT.	40°	Gyldén-Herschel. (6° S/1° W). 360T.

Code Number	Format	Solar Altitude	Description
AS14-			
70-9803	VERT.	40°	Herschel-Herschel C, D, H. (5°5 S/3° W). 360T.
70-9805	VERT.	35°	Herschel D-Lalande N. (5° S/5° W). 360T.
70-9807	VERT.	34°	Lalande C, R. (5° S/7° W). 360T.
70-9809	VERT.	32°	Lalande. (4°5 S/8°5 W). 360T.
70-9811	VERT.	31°	Lalande ω-Turner M. (4°5 S/10°5 W). 360T.
70-9813	VERT.	28°	Turner M, L, K, H, τ. (4° S/12° W). 360T.
70-9815	VERT.	25°	Fra Mauro δ, ζ, Z, H. (3° S/15° W). 360T.
70-9816	VERT.	25°	Fra Mauro η, H, G, K. (3° S/16° W). 360T.

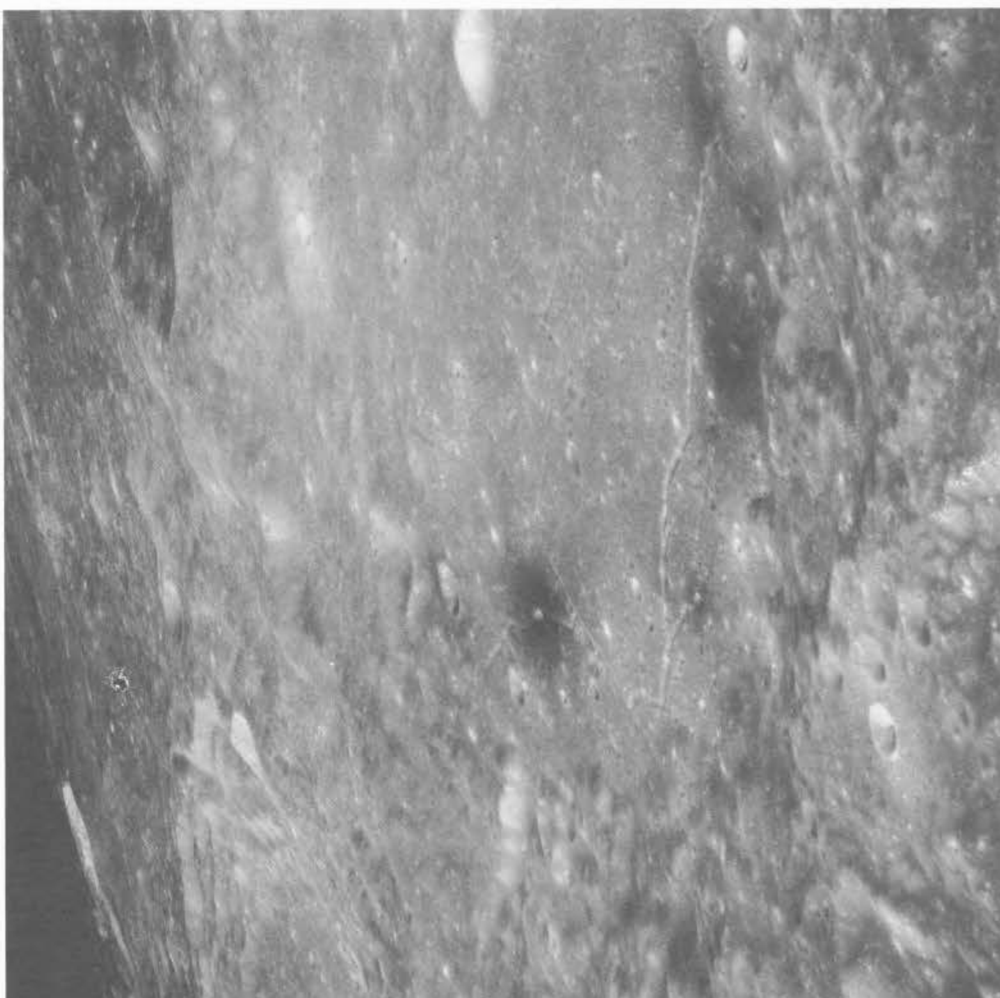

Figure 49. Looking southwest across the southern interior of the crater Alphonsus, showing several unusual dark-haloed craters on its floor. In the upper left is Alpetragius, with a conical central peak. In the lower left is part of Arzachel and, beyond it, Thebit. The horizon is in Mare Nubium, near the Straight Wall. (Photograph AS14-73-10095). North at left.

Code Number	Format	Solar Altitude	Description
AS14-			
70-9818	L-OBL 15°	23°	Fra Mauro T, J. (2°5 S/18°5 W). 460T.
70-9821	L-OBL 15°	18°	Gambart R-Lansberg σ, β, P. (2° S/22° W). 460T.
70-9824	L-OBL 40°	15°	Lansberg-Lansberg N, η, β. (0°5 S/26° W). 460T.
70-9827	L-OBL 30°	10°	Lansberg C, G, Y, A-Kunowsky D. (0°5 S/29° W). 460T.
73-10040	L-OBL 40°	70°	Beaumont L. (14°5 S/30° E). c.170T.
73-10041	L-OBL 40°	70°	Beaumont L. (14° S/29°5 E). c.170T.
73-10093	L-OBL 50°	38°	Alphonsus--Central Portion. (12° S/2° W).
73-10095	H-OBL 60°	37°	Alphonsus--SE. Portion. (15° S/3° W).
73-10097	L-OBL 50°	36°	Alphonsus--NW. Portion. (13° S/4° W).

Apollo-14: Strip Coverage

Most of the photographs listed above may be joined at their edges, giving strip coverage (usually elongated in an E-W direction). Such strip coverage is listed below, with component photographs in order of coverage, so that each photograph overlaps the one or two photographs listed adjacently. Where the tilt is low and scales are comparable, the areas of overlap may be viewed stereoscopically.

Strip No.	Component Photographs (All AS14-)
I	69-9622/9624/9625/9627/9629/9631.
II	70-9793/9795/9797/9799/9801/9803/9805/9807/9809/9811/9813/9815/9816.
III	70-9818/9821/9824/9827.
IV	73-10040/10041.
V	73-10095/10093/10097.

The Lunar Dome Survey: A Progress Report

(Harry D. Jamieson)

The ALPO's Lunar Dome Survey will be nine years old this summer, making it easily the longest running program ever sponsored by the Lunar Section. Over the years, many past and current observers have helped the program to raise the known number of domes to three times the 1963 level. The most outstanding of these are listed below.

Inez N. Beck	Marvin W. Huddleston	Kenneth Schneller
Winifred S. Cameron	Randy Lambert	Douglas Smith
Clark R. Chapman	José Olivarez	Donald W. Watts
Kenneth J. Delano	Chet Patton	John E. Westfall
Todd Hansen	Charles L. Ricker	Richard J. Wessling

Of course, no mere alphabetical listing can serve to point out the very special services that many of the above have rendered to the program. This writer owes a great deal to José Olivarez, who shared equally with him in the founding of the program and who served as the program's Assistant Recorder for a number of years afterward. A special debt is owed to the Reverend Delano, who served as the program's Assistant Recorder in later years and who directed the program in my absence for nearly half of its lifetime. Among those others who have also made outstanding contributions to the program, first mention must go to John E. Westfall, whose dome classification system[1] is the standard used by the ALPO, and whose recent studies of the distribution and characteristics of domes[2] must be considered to be the most complete and accurate one ever published. In addition, the energies and talents shown by Charles L. Ricker, Randy Lambert, Donald W. Watts, Marvin W. Huddleston, and Kenneth Schneller (whose catalog was the most complete available in 1963)[3] in the making of observations and reports have been of very special help to the program.

This brief progress report is the first in what it is hoped will become a regular series to be published in the "Lunar Notes" portion of each Strolling Astronomer. They will deal largely with lists of newly discovered and confirmed domes, as well as offering an occasional selection of some of the better drawings submitted to the program. It is hoped that observers will thus gain a better idea of what is going on in the program and perhaps will be tempted to participate.

The total number of domes presently (March 18, 1972) in the LDS files (confirmed and unconfirmed) is 491. Of these, about one-half may be considered to be fairly well confirmed (strong photographic and/or visual evidence). Included in the above total are a number of newly discovered domes which are listed below by their xi and eta orthographic coördinates.

Position	Feature	Diameter (kms.)	Observer	Remarks
+822-309	Vendelinus	8	KJD	Circular and flat
+811-315	Vendelinus		KJD	Ill-defined
+807-310	Vendelinus	17	KJD	Circular and flat
+769+223	Lick	4 (HDJ)	MWH	Sharp summit
+754-047	Messier	5 (HDJ)	MWH	Nature uncertain
+736-085	Messier	10 (HDJ)	HDJ	Low and oval
+680-210	Magelhaens	18x12 (CP)	KJD	Summit crater
+667-079	Lubbock	9 (CP)	MWH	High and round
+652+379	Macrobius	6	JSK	Circular and flat
+617+068	Cauchy	16	KJD	Very uncertain
+600+055	Cauchy	8	KJD	Ill-defined
+584+107	Cauchy	10 (HDJ)	MWH	Ill-defined
+274+299	Menelaus	Small	MWH	Cut by cleft
+240+371	S. Gallus	Small	MWH	Round
+239+361	S. Gallus	Small	MWH	Round
+069+065	Triesnecker	Small	MWH	Irregular in shape
-082+389	Wallace	Fairly large	KJD	Flat
-148-265	Lassell		KJD	
-212-484	Pitatus		KJD	Cleft winds around dome

The observers listed above are, in aphabetical order:

KJD Kenneth J. Delano	HDJ Harry D. Jamieson	CP Chet Patton
MWH Marvin W. Huddleston	JSK John S. Korintus	

All positional and other information are by the observer listed unless otherwise noted. Observers interested in searching for the above newly reported domes are cordially invited to contact the writer. It is important that the domes listed in our ultimate catalog be as well confirmed as possible, for it is hoped that professional lunar researchers will find some use for it. The catalog - our primary goal - will list the diameter, height, Westfall Classification, position, and contributing observers for each of a hoped-for total of 500 well confirmed domes. Figure 50 shows a sample lunar area where further work of this kind can be undertaken.

Some months ago this writer discussed a dome reported by Inez N. Beck near the crater Kirch.[4] Observers were asked to attempt to recover the object; and several people responded with drawings, written reports, and photographs. By far the best of these latter were taken by Richard J. Wessling, who used a 12½" f/10.8 reflector of his own construction. The photographs clearly show a very dome-like object in the exact location depicted on the Beck drawing (see Figure 51), and the object was also seen and reported as a dome by Huddleston and Patton working visually with a 6" reflector and 5" refractor

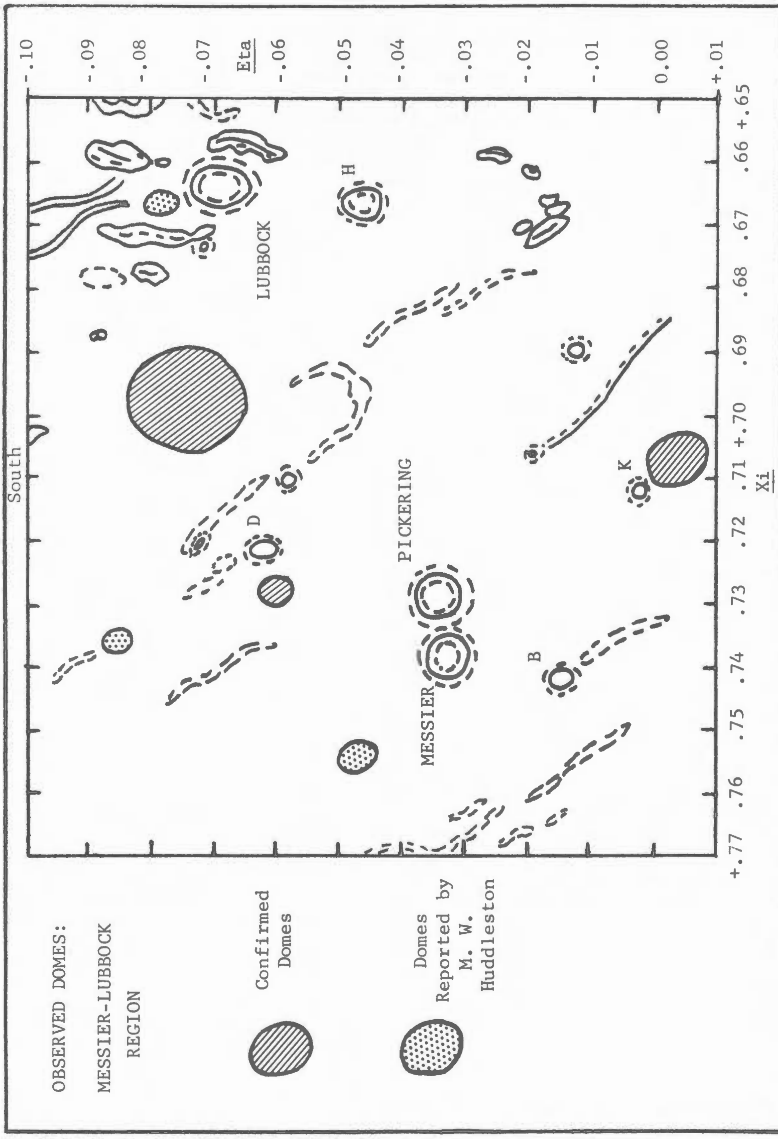

Figure 50. Chart of Domes in the Messier-Lubbock Region, showing Confirmed Domes in the ALPO Lunar Dome Survey list and new domes reported by Marvin W. Huddleston. See also accompanying text by Lunar Recorder Harry D. Jamieson.

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respectively. However, a report by Winifred S. Cameron based on a search of Orbiter photographs has revealed the true nature of the object. The feature is a crater about one-half the size of Kirch with walls too low and narrow to be visible from Earth, but with interior hills and ridges which could easily be taken for a dome by observers using ground-based instruments.

It goes without saying that this writer would like to see more such efforts in the future. While it is, of course, true that ground-based instruments cannot hope to match Orbiter photography in the resolution of small details, the reasonably well equipped amateur still has the advantage of choice of lighting and area coverage. A better attitude

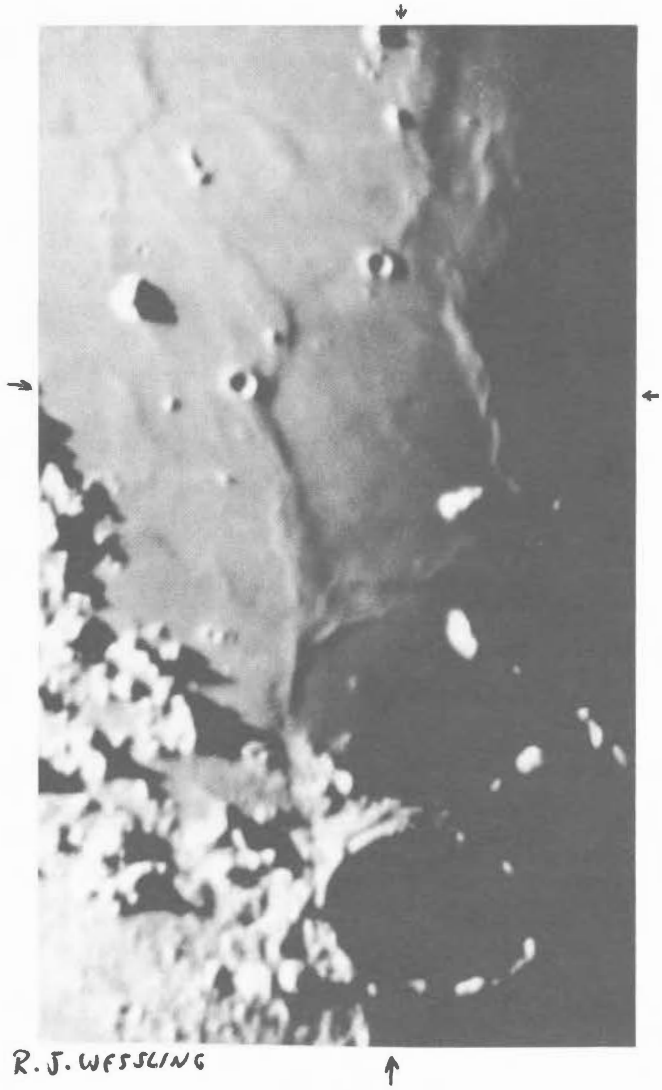

Figure 51. Enlargement of photograph of Plato-Pico-Piton Region by Richard J. Wessling with a 12.5-inch reflector. Taken on September 28, 1971 at 0^h30^m, U.T. Colongitude 11°2. The arrows point to a dome-like feature reported by Mrs. Inez N. Beck. See text by Lunar Recorder Harry D. Jamieson.

to take, of course, is the realization of the fact that space-craft and ground-based astronomy are fully compatible with each other and should be used together to advance our research goals. The study of domes and their distribution can be a very important part of the overall study of the Moon and its origins, for these features are almost certainly igneous in origin and thus offer good clues to the Moon's early internal condition. Advanced observers with moderate to large aperture instruements are warmly invited to join with us in this important and interesting work.

References

1. Westfall, John E., "A Generic Classification of Lunar Domes", Str. A., 18, 1-2, pgs. 15-20.

2. Westfall, John E., "Statistical Analysis of Lunar Dome Characteristics" and "Statistical Analysis of Lunar Dome Distribution", Str. A., 23, 5-6, pgs. 90-98.

3. Schneller, Kenneth, "Catalog of Lunar Domes", Journal of the Planetary and Lunar Spectroscopical Society, Vol. 2, No. 1, Oct., 1961. (159 domes.)

4. Jamieson, Harry D., "Strange Object on the Mare Imbrium", Str. A., 23, 3-4, pgs. 62-63.

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THE 1970-71 APPARITION OF SATURN

By: Dr. Julius L. Benton, Jr., A.L.P.O. Saturn Recorder

General Introduction

The Report that appears here covers the observing period from June 20, 1970 to April 25, 1971, during which the value of B (the axial tilt to the Earth) varied between -21°8 and -23°2. Opposition occurred on November 11, 1970, when Saturn was at -0.1 apparent visual magnitude in eastern Aries. The planet exhibited a polar diameter of 18" and an equatorial diameter of 20", while the major axis of the ring system extended to 46",

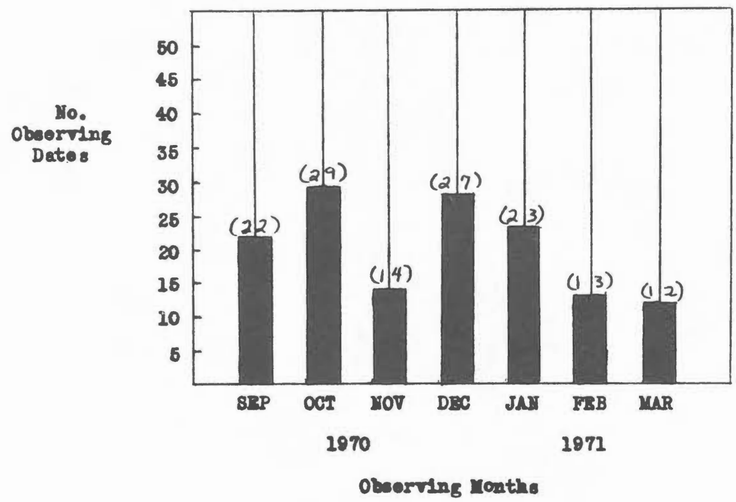

Figure 52. Histogram to show time distribution of ALPO observations of Saturn during its 1970-71 apparition. See also text of Saturn Report by Dr. Julius L. Benton.

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all on opposition date. The southern portions of the globe and rings were easily accessible to observers during this apparition.

Observations were received from the following six individuals:

Observer	Location	Instrument	No. Observing Dates
James C. Bartlett, Jr.	Baltimore, Md.	$4\frac{1}{4}$" Refl.	39
Julius L. Benton, Jr.	Savannah, Ga.	6" Refr.	6
Michael Covington	Valdosta, Ga.	6" Refl.	5
Kenneth J. Delano	Taunton, Mass.	$12\frac{1}{2}$" Refl.	61
Walter H. Haas	Las Cruces, N. M.	$12\frac{1}{2}$" Refl.	9
Alan W. Heath	Nottingham, England	12" Refl.	20

In all, there was a total of 140 observations submitted to the ALPO Saturn Section for analysis, and Figure 52 will show the relative distribution of contributed observations throughout the apparition. Here one "observation" is all the records secured by one person on one date. No observations were received for the months of June, July, and August, indicating that there was the usual serious neglect of the earlier parts of an apparition. The bulk of the observational material was obtained during September, October, December, and January, as Figure 52 clearly indicates. Note also that there was a curious decline in the number of observations during November, the month in which Saturn reached opposition. The last observation submitted was during the month of March, 1971; and Saturn was in conjunction with the Sun in May.

The Recorder would like to express his sincere thanks to those individuals mentioned in this Report for their faithful and valuable contributions.

The reader will find it helpful to examine the illustrations which accompany this article in connection with the text below.

The Globe

Southern Portions of the Disc. With B varying between -21° and -23°, it is quite obvious that there should have been a much better observational coverage of the southern hemisphere of Saturn during 1970-71 than in recent years. Only a very limited amount of activity was reported in the southern regions of the planet, and Bartlett made a very meaningful series of observations during the months of September and October, 1970, recording color and intensity variations mainly in the SPR (South Polar Region). Due to the limited amount of available information, it would be a little presumptuous for us to conclude that there had been a reduction in activity since the 1969-70 apparition.

South Polar Region (SPR). Heath reported the SPR as a diffuse, grey region, showing little or no differentiation, an impression confirmed by several other observers. Bartlett, however, detected a very small white "cap" in the extreme southern portion of the SPR on September 21, 1970; and he noted that this "cap" projected noticeably (presumably because of irradiation) beyond the south limb of the planet on October 14th. On October 16th Bartlett observed that this bright area had spread out into a much larger region with no detectable projection over the limb, and by October 17th the region had expanded into a whitish "band" across the south limb of Saturn. This "band" apparently lasted only about a day or two because on the next night, October 18th, the feature was reduced back into a small white "cap" in the otherwise dark SPR. No other observers confirmed the presence of this feature during September and October. Bartlett also recorded a very interesting series of color and intensity variations in the SPR. On September 5th and 8th he noted that the SPR was generally brownish, while during the period from September 12th through 20th the region was much darker and grey in color. On the 21st of September Bartlett recorded a faint greenish hue, but on September 22nd and 24th the SPR was noticeably grey. On the 25th he observed the faint brown tinge again, changing to neutral grey on September 26th and remaining so until October 7th. The SPR was brownish-grey on October 14th and 18th and olive-brown on the 19th of October. Haas was able to detect the elusive SPB (South Polar Band) encircling the SPR during most of the 1970-71 apparition, and he recorded its color as faint grey.

South Temperate Zone (STeZ). Early in the apparition Heath indicated that this zone was indistinct apart from the general polar shading, seen only as a definite zone after Dec. 21, 1970. Delano detected the STeZ on numerous occasions in 1970-71, reporting that the STeZ was slightly darker than the EZ (Equatorial Zone). Bartlett noted that the STeZ was a pale yellow color in late September, changing to a brownish-yellow hue in October. Benton also reported a similar color variation of the STeZ during the same period.

South Temperate Belt (STeB). Haas saw the STeB only with considerable difficulty during January, 1971, noting that the belt displayed a faint grey color. Bartlett was able to see the STeB often during the apparition, recording some very interesting intensity and color variations throughout the months of September and October. He noted that the STeB was very faint, with a greyish color in the early part of September; but by the middle of the month the belt had undergone a progressive darkening trend. The STeB was reported by Bartlett to be a definite chocolate-brown color on September 23rd, but on the 26th he noted a sudden brightening of the belt. By October 1st, however, the darkening trend had resumed and continued until late October, when Bartlett terminated his observing program. On October 15th Bartlett detected a moderately large and diffuse dark spot at the south edge of the STeB, but no other observers submitted corroborating evidence. In comparison to the SEB (South Equatorial Belt), the STeB showed a similar coloration and intensity during September, but by the month's end and throughout October the STeB was definitely the darker belt.

South Tropical Zone (STrZ). Bartlett was the only individual to submit observations of the STrZ during 1970-71. Throughout most of September the zone displayed a brownish-yellow color, but by the end of the month the STrZ had become pale yellow. In October the STrZ had gradually changed back to the brownish-yellow hue and remained so until October 19th, the date of the last observation made by Bartlett. There is considerable similarity between intensity and color flucuations in the STeZ and the STrZ during 1970-71, an indication of some generalized variations in the southern hemisphere of the planet.

South Equatorial Belt (SEB). Most of the individuals who contributed observations tended to agree that the SEB was not so conspicuous during 1970-71 as in previous years. Heath reported that the SEB was double on many occasions during the apparition, separated into the SEB_n and SEB_s components. Heath pointed out that the SEB became less distinct in early December but maintained a definite brownish color throughout the apparition. Bartlett noted the SEB as a faint, greyish band in early September, usually equal in intensity and color to the STeB. By the middle of the same month, however, the SEB had become fainter than the STeB, which had subsequently darkened. The STeB remained the darker of the two belts for the remainder of September and October. Bartlett maintained that the SEB turned a chocolate-brown color in late September, but it became grey again by the middle of October. Delano reported the SEB as having a reddish-brown color in October, November, and December, noting also that the SEB had become much fainter than in 1969-70.

Haas noted the double nature of the SEB off and on during the apparition, the SEB_n being consistently darker than the SEB_s. The two components were noted to be separated by a definite brighter zone, the SEB Z; and Haas recorded a brownish-grey color for each of the SEB components.

Equatorial Zone (EZ). The EZ was reported to be the brightest region on the entire globe of Saturn during 1970-71 by virtually every observer submitting reports. Delano indicated that the EZ was not nearly so bright during 1970-71 as in previous years, and he recorded its color as yellowish during January. Bartlett noted that the EZ exhibited slight but apparently objective variations in color and intensity throughout September and October. Bartlett indicated that the EZ was the brightest zone on the disc of the planet in the first couple of weeks of September, but by mid-September the EZ was no brighter than either the STeZ or STrZ. Up until September 17th the color of the EZ was reported by Bartlett to be pure white, but on that date the zone appeared brownish-yellow. The EZ changed back to a pure white color later in the same month and remained so until October 16th, when it was noted to be pale yellow. Another color change occurred on October 18th, when the EZ was brownish-yellow; and on October 19th the pale yellow hue was again apparent. Haas noticed also that the EZ was not so bright as it had been in previous years, but he did point out that it still remained as the brightest zone on the planet. Haas recorded its color as yellowish-white consistently throughout the apparition. With respect to the EB (Equatorial Band), only Heath, Bartlett, and Haas reported having seen this feature during the apparition, all agreeing that its color was grey.

Shadow of the Globe on the Rings. All observers tended to agree that the shadow of the ball on the rings was a distinct black throughout the apparition.

TABLE I

VISUAL INTENSITY ESTIMATES OF SATURNIAN BELTS AND ZONES FOR

THE 1970-71 APPARITION

Feature	Number of Estimates	Average Intensity
Zones:		
EZ	7	6.4
SEB Z	6	4.6
STeZ	2	4.1
Belts:		
SPC	4	5.3
STB	2	4.1
SPR	2	4.0
EB	2	3.8
SEB_s	7	3.5
SPB	5	3.3
SEB_n	6	2.8
Rings:		
B (outer third - standard)	7	8.0
A (inner edge)	3	7.0
B (inner portion)	7	6.6
A (outside A5)	4	6.3
A (inside A5)	5	5.7
B2	2	3.8
A5 (Encke's)	2	3.7
C (Crape band)	7	2.1
C (off ball)	7	1.4
B10 (Cassini's)	7	0.7
Shadow Ball on Rings	7	0.0

As noted in the above table, the standard for the ALPO system of intensity estimates is the outer third of Ring B, which is held constant at a numerical value of 8.0.

Latitudes of Saturn's Belts and Zones. Haas was the only individual to submit visual latitude data for Saturn during 1970-71. He employed the method he developed several years ago, now the standard technique of the Section, and it involves estimating visually at the telescope the fraction of the polar semidiameter of the planet's disc subtended on the CM by the belt whose latitude is desired. The method is very simple and yields a surprisingly reliable mass of data in a short period of time, which can subsequently be reduced mathematically to planetocentric, planetographic, and eccentric (mean) latitudes. Presented below are latitudes determined for a number of Saturn's belts. The Recorder must point out here, however, that to assume too much from such a limited amount of data would be quite dangerous. We need many more participants in this aspect of observing, and interested individuals can find a set of instructions for pursuing the technique in the Saturn Handbook.

TABLE II

MEAN LATITUDES OF SATURNIAN BELTS, RING PROJECTIONS, AND ZONES

DURING THE 1970-71 APPARITION

Feature	Saturnicentric	Saturnigraphic	Eccentric (Mean)
N edge Ring A	+39°5	+45°9	+42°7
S edge Ring B	+14.1	+17.6	+15.8
S edge Crape Band	+ 9.1	+11.4	+10.2
Center EB	- 6.0	- 7.5	- 6.7
N edge SEB_n	-20.5	-25.1	-22.6
S edge SEB_n	-22.6	-27.6	-25.1
N edge SEB_s	-25.9	-31.4	-28.6
S edge SEB_s	-29.1	-34.9	-32.0
Center STB	-51.6	-57.6	-54.6
N edge SPB	-68.5	-72.6	-70.6
S edge SPB	-78.0	-80.4	-79.3

[There is a good discussion of the meaning of planetocentric latitude, planetographic latitude, and eccentric latitude in B. M. Peek's The Planet Jupiter, pp. 269-271. - Editor]

The Rings

Ring B. Numerical intensity estimates of various features on the globe of Saturn and its rings were made relative to the previously adopted intensity standard of 8.0 for the outer third of Ring B. Nearly everyone who contributed observations agreed that Ring B was consistently white and undoubtedly the brightest feature of the ring system. None of the various zones on the globe of Saturn reached an intensity equal to the outer third of Ring B, but the inner portion of B was often reported to be nearly equal to the EZ and to the outer region of Ring A. Under conditions of good seeing, Benton and Haas were able to detect several intensity minima in Ring B, but only B2 was noted with any confidence. (The name means that this minimum lay two-tenths of the way from the inner edge of Ring B to its outer edge.)

Ring A. Haas observed that Ring A was slightly brighter to the outside of Encke's Division (A5) than toward the inside, an impression confirmed by the majority of observers. Heath noted that Ring A was quite dark, having an intensity similar to that of the SEB; but no other observer indicated having detected such a relationship. For the most part, the record shows that there was a close resemblance in intensity among the EZ, the inner part of Ring B, and Ring A just outside of A5. Most individuals noted a white to bluish-white color for Ring A, but Bartlett observed a bluish-grey tint of the ring during September and October. Nearly all of the reports received by the Section indicated that Encke's (A5) and Cassini's (B10 or A0) Divisions were seen near the ansae on most occasions during the apparition. Cassini's Division was reported to be black throughout 1970-71, but Encke's was more greyish in appearance.

Ring C. Most participants in the observing program noted Ring C visibly projected against the ball of Saturn in the region of the EZ. Nearly everyone agreed that it was a distinct brownish-grey to reddish-brown color during 1970-71. Haas, Bartlett, and Heath were the only individuals who reported seeing Ring C as a dark inner border to Ring B, all noting its color as a dark grey.

White Spot on the Rings. Haas and Heath simultaneously reported a faint white spot adjoining the shadow of the globe on the rings during 1970-71. This was presumably another Terby White Spot, often said to be caused by a contrast effect.

Bicolored Aspect of the Rings. On September 7th Bartlett noted that the west arm of the ring system was brighter in a red filter than the east arm, and in a blue filter the east arm appeared brighter. Heath observed the effect only once, on December 8th when the west arm appeared brighter than the east arm in blue light. No other observers reported that there was any difference between the east and west arms in either the blue or the red filters normally employed.

The Satellites of Saturn

Visual estimates of the magnitudes of the brighter satellites of Saturn were made by Delano from October 2, 1970 to March 28, 1971. In making his estimates, Delano assumed that the magnitude of Titan was stable at 8.4, the standard used by the Saturn Section in general. The other satellites were compared with Titan's brightness. It was also necessary to assume that Rhea was fairly stable at visual magnitude 9.8; but it was noted that Rhea appeared to vary by 0.7 magnitudes during the apparition, from 9.6 to 10.3. Tethys and Dione showed variations of 0.2 and 0.4 magnitudes respectively. Iapetus, however, was observed to vary between magnitude 8.6 and magnitude 10.5, being about 1.9 magnitudes brighter at western than at eastern elongation. One may summarize the results of magnitude estimates made by Delano during 1970-71 as follows:

Satellite	Number of Observations	Observed Magnitudes	Variation	Average Magnitude
Tethys	45	10.3 - 10.5	0.2	10.48
Dione	51	10.4 - 10.8	0.4	10.43
Rhea	61	9.6 - 10.3	0.7	9.84
Titan	61	8.4	0.0	8.40
Iapetus	55	8.6 - 10.5	1.9	9.74

As was noted in the 1968-69 and the 1969-70 apparitions of Saturn, the average magnitude of Iapetus was approximately that of Rhea. The greatest observed brightness was magnitude 8.6, the same as in the immediately preceding apparition (1969-70). However, for 1970-71 Iapetus remained a full magnitude brighter at minimum than during 1969-70 (10.5 in 1970-71 as opposed to 11.5 in 1969-70).

When the magnitudes of Iapetus were plotted on graph paper according to days elapsed since eastern elongations, it was noted that there were three rather abrupt changes in magnitude evidenced in the course of the satellite's orbit. Iapetus was at magnitude 9.1 on the 49th day after eastern elongation on October 8th but declined by 1.1 magnitudes to 10.2 by the 58th day, a duration of only 9 days for this noticeable fading to occur. Again on the 49th day after eastern elongation on December 26th, 1970, another sharp decline of 1.1 magnitudes in a nine-day period was observed as Iapetus dropped from magnitude 8.9 on the 49th day to magnitude 10.0 on January 4th, the 58th day. A rapid nine-day increase in brightness was also observed at the time of one of the two inferior conjunctions. Thus on the 15th day after eastern elongation on November 22nd Iapetus was at magnitude 9.9, but by the 24th day (on December 1st) it had brightened to magnitude 9.0.

General Conclusions

From the observational data presented in this Report, one might be led to conclude that there had been a substantial decrease in activity in the atmosphere of Saturn during 1970-71. In view of the very limited amount of information on the planet over the last few years, the writer feels somewhat reluctant to draw too many conclusions at this point. Saturn has been so poorly observed since 1966 that it is extremely difficult for us to derive any meaningful deductions as to the actual situation. At best, all that one can strive for is a more thorough and scientific survey of the planet in the years to come by ALPO observers.

This Report marks the end of a laborious effort to alleviate a massive backlog of observations since the present Recorder was appointed early in 1971. From this point on the Saturn Section will operate in its reorganized form, and it is hoped that observers will find something interesting to pursue in the realm of Saturn studies. Already the Section has begun to show great promise, and it is the fervent hope of this Recorder that the Saturn Section will never again face a period of inactivity similar to the one it has apparently grown out of. Of course, this will be up to the membership of the ALPO and to

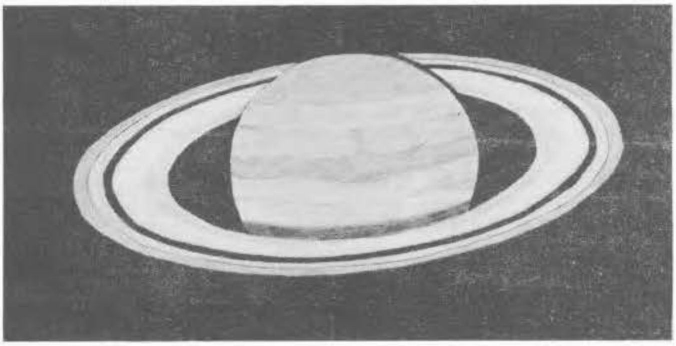

Figure 53. Drawing of Saturn by Ron Doel on November 24, 1970 at 3 hrs., 10 mins., U.T. 8-inch reflector, 224X. Seeing 9 (very good), transparency 5.5 (limiting magnitude). Contributed by Willingboro Astronomical Society. Note wide SEB, very narrow EB, STB, and very faint SSTB at edge of dusky SPR. Ring A more dusky outside of Encke's (A5). Divisions B3 and B7 faintly visible. Simply inverted view with south at top. Observation hampered by strong winds. The STeZ was brighter than the STrZ, and the latter was crossed by a dusky column and a diagonal festoon. EZ slightly dimmer north of EB.

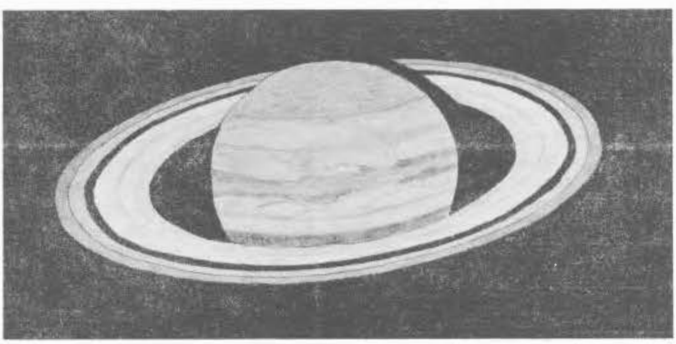

Figure 54. Drawing of Saturn by Ron Doel on February 1, 1971 at 2 hrs., 27 mins., Universal Time. 8-inch reflector, 224X. Seeing 7 (good), transparency 6 (limiting magnitude). Contributed by Willingboro Astronomical Society. SPR much darker than before. Note fine detail in doubled SEB and along its edges. Large shadow of ball on rings. STB darker than before. Crape Band prominent above projected rings. SEB apparently shifted northward compared to previous views. Another simply inverted view with south at the top.

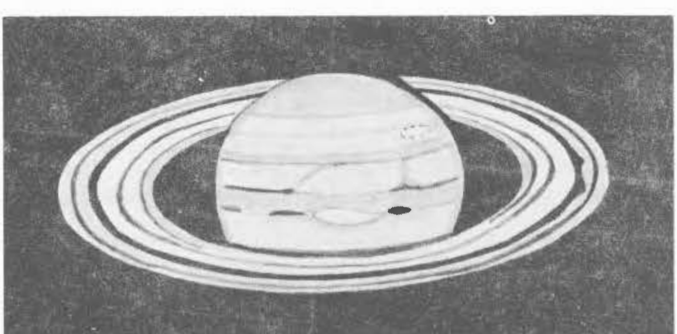

Figure 55. Drawing of Saturn by Phillip W. Budine on December 8, 1970 at 3 hrs., 25 mins., Universal Time. 4-inch Clark refractor, 250X. Seeing 9, transparency 6. Large white oval in EZ, festoons in STrZ, and small very bright spot in STeZ near following limb. STB double. Divisions B3, B5, and A5 (Encke's) noted in rings. Ring B brighter than EZ.

the Recorder himself, who must direct his team of observers into the proper lines of research.

The Saturn Section strongly urges interested individuals to write for details as to how they may set up their own observing programs. The Recorder pledges his support and leadership to those observers seeking a worthwhile endeavor in amateur astronomy.

EDUCATIONAL AND OBSERVATIONAL AIDS OFFERED BY THE ALPO

By: Harry D. Jamieson

Perhaps the most common type of mail received by the ALPO is the inquiry letter. Generally, these ask for information about the ALPO's purposes, methods, and goals, as well as its requirements for membership and the availability of educational and other materials. It is the purpose of this short article to list these last in the hope that ALPO members will thus have a clearer idea of just what the Association has to offer. In order of their appearance on the back inside cover of this issue, the various observing Sections and special service programs offer the following free or low-cost items to ALPO members:

The Mercury Section - no complete information available at time of writing, though it is known that Recorder Hodgson supplies observing-forms for Mercury.

The Venus Section offers its very excellent 11-page pamphlet "Observing Venus", by Recorder Dale Cruikshank, as well as the Section's handy observing forms, free to ALPO members. A shorter version of the pamphlet is planned for a future issue of the Str. A.

The Mars Section has recently offered a considerable amount of observing aids for those wishing to undertake serious work on the planet. The basic Mars Observing Kit, consisting of a standard reply form, central meridian tables, an article on filter techniques, an introductory article about the planet entitled "Mars - A Dynamic World", the 1954 ALPO map of the planet, several other working maps of Mars as available, various current reprints and ephemeris graphs, and standard ALPO Mars observing forms, is available for the low cost of $2.00, which covers the cost of materials and postage. Extra observing forms may be obtained for 50¢ per packet of 20 forms. Current Mars maps will be ready in the foreseeable future, while a current list of Mars observers and their addresses should be ready by October, 1972. These last may be obtained free of charge if the writer includes a self-addressed stamped envelope with his inquiry to Recorder C. F. Capen.

The Jupiter Section also offers ALPO members a complete assortment of observing aids. Central meridian transit forms are free, and Recorder Paul Mackal also has a supply of free ALPO membership application forms. At low cost are also the Section's disc drawing forms, costing $1.00 for a packet of 20, as well as helpful strip sketch and photographic forms in the near future for the same low price. Educational materials include Elmer Reese's 1964 Jupiter Handbook for 50¢ and Recorder Paul Mackal's "An Advanced Observer's Handbook for Amateur Jupiter Observers" in 1970 ($1.50) and 1972 ($3.00) editions.

The Saturn Section is still in the process of reorganization following the appointment of Recorder Julius Benton; but most of the old materials still remain available, and a number of new aids are projected. Free to ALPO members are a set of Introductory Observing Instructions and a set of observing blanks. Low-cost items include the "Saturn Section Handbook and Observing Guide" for $3.00, the complete set of observing forms for $1.00, and a proposed Saturn Section Monthly Newsletter for $5.00 a year. Other materials planned for the future include reprints of published values for B (ring tilt), a more detailed version of the Saturn Handbook for advanced observers in hard-cover edition, and an Annual Report for the Saturn Section free to subscribers to the Newsletter (1 copy priced at $1.00 for non-subscribers). The old Saturn Section Kit, as such, has been discontinued.

The Remote Planets Section does not offer any standardized observing aids to members because of the very nature of the work open to amateur observers of Uranus, Neptune, and Pluto. These planets are very difficult to work with, and little in the way of drawing is done. Recorder Young stands ready to help interested observers through correspondence, though; and ALPO members with moderate to large telescopes are encouraged to write to him.

The Comets Section naturally has available a full assortment of materials, including free copies of reprints from the published article "Comet Observing" by Recorder Milon, and observing forms priced at 50 for $2.00. An announcement service for new discoveries and recent observations is also easily obtained by writing to Mr. Milon and including a supply of self-addressed stamped envelopes with your letter of enquiry.

The Lunar Section is not structured like the others, and each Recorder is in charge of his own observing programs. Most, however, offer some sort of aids for observers, and these may be listed in the same manner as for the individual Planetary Sections above. In alphabetical order, the various Lunar Recorders offer the following materials to observers:

Kenneth J. Delano, who has charge of our Dark-Haloed Craters Program, has available free lists of confirmed and unconfirmed dark-haloed craters, and a 2-page instruction pamphlet outlining the goals of the program. A third page of additional instructions is projected.

Harry D. Jamieson, who directs the Lunar Dome Survey and the Messier-Pickering Program, offers observers free dome lists and occasional outline charts of dome clusters. Observers who include self-addressed, stamped envelopes usually receive much faster attention. Observations for the Messier-Pickering Program are normally tabular in form and do not require a special form.

John E. Westfall handles our lunar eclipse programs and our Lunar Photograph Library in addition to his new Luna Incognita Program (studies of the Moon's South Polar Region). Available from him are Lunar Eclipse Observing Forms (free), a Lunar Photograph Library Catalog (56 cents in stamps), and forms for the Incognita Program. The Lunar Observer's Manual, edited by Charles L. Ricker, is now out of print. A new Manual is projected by the Lunar Section and will contain more advanced and up to date material.

Christopher Vaucher, who directs our Selected Areas Program, has the special program observing forms available for 4¢ apiece.

The Lunar and Planetary Training Program, under the direction of Richard J. Wessling, offers a large amount of free educational materials to ALPO members wishing to enroll in the Training Program. Among these are included typed copies of materials needed to observe and initial information on how to approach the first observations, old-style Selected Areas Program observing forms, and other information on telescope making and lunar and planetary photography. All of this information plus a great deal more will eventually be gathered into a Novice Observer's Handbook, which should cost about $1.00. It is scheduled for completion in early 1973.

Finally, the Director will supply a 2-page descriptive circular about the ALPO free of charge, and the Librarian can furnish a fairly current list of books in the ALPO Library.

It is hoped that this article has shed some light on the vast amount of material available from the ALPO at little or no cost to members. The Recorders are always happy to help observers do the kind of work that is a credit to the term "amateur", and it can be seen that the ALPO has never before offered so much in the way of varied and useful observing aids.

BOOK REVIEWS

Handbook of Elemental Abundances in Meteorites, edited by Brian Mason (1971). Gordon and Breach, Science Publishers, Inc., 44 Park Ave. South, New York, New York 10016, 555 pages, $35.00 ($28.00 prepaid).

Reviewed by William K. Hartmann

Readers in the planetary sciences may be familiar with the excellent books produced by Brian Mason in recent years. These include a lucid introduction to geochemistry and an introductory survey of meteorites, as well as a recently co-authored introduction to the chemistry of the lunar rocks. While these earlier books of Mason were ideal materials for an amateur astronomer who wanted to explore the technical and theoretical problems of planetary geology, the present book is hardly intended for the layman. This could be surmised from the exorbitant price alone, which usually indicates that the publisher has made a small printing and hopes to make sales to institutions but not to the larger audience of general readers.

This is not to say that the Handbook of Elemental Abundances in Meteorites is not exceedingly useful for certain specialists. The contents of the book are simple to describe. Each of the 65 chapters following the introduction is devoted to a description of a single element or group of related elements. For example, the book begins with a discussion of hydrogen abundances in meteorites by I. R. Kaplan. The remaining chapters are by specialists in the geochemistry of the elements considered; and the authors include a number of well-known meteoriticists, such as Carleton Moore, Gordon Goles, George Wetherill, and several others. The authors have surveyed the literature and have produced a compendium of very detailed data representing our present knowledge of the chemistry of meteorites. Pages 549-555 are devoted to an index of individual meteorites mentioned in the text, a feature which will be very useful to scholars studying certain falls or finds.

While I would not recommend this book to beginners or to lay readers (7 pages, 2 diagrams and 2 tables on the ruthenium content of meteorites is hardly bedtime reading!), some readers of this Journal who may be considering careers in planetary science may want to familiarize themselves with the kind of data collected in this volume. As an outgrowth of the work by Harold Urey, Edward F. Anders, John Wood, and others, there is a rapidly expanding area of fundamental research on Solar System history approached by means of chemical relations in the meteorites. This approach is fruitful because the meteorites are samples of very primitive material, some of which has been scarcely altered since the formation of rocky planetesimals in the early Solar System. Students and researchers who want to attack the problems of Solar System cosmogony through the routes of physical chemistry, geochemistry, or petrology of meteorites and lunar samples will find this book to be an invaluable source of data.

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La Vision dans les Instruments Astronomiques et l'Observation Physique des Surfaces Planétaires, by Jean Dragesco. Published by La Société Astronomique de France. Price 4F.

Reviewed by Eugene W. Cross, Jr.

Vision in Astronomical Instruments and the Physical Observation of Planetary Surfaces is a twenty-nine page booklet by Jean Dragesco. While those readers without a working knowledge of French might pass this booklet by, I admonish them not to. Anyone modestly knowledgeable about telescopes and astronomy will benefit from the text, especially with the aid of the excellent illustrations.

Jean Dragesco is a seasoned observer whose views have earned the right to be respected as authoritative. Examples of the high standard of his observational work are not unknown to readers of this Journal, for he is a frequent contributor to the Jupiter Section.

Vision is written for the visual observer of planets who wants to know what his observational limitations are, which of those limitations he can control, which limitations are beyond his control, and what his expectations should be and who wants suggestions for programs of observation. There is little that cannot be applied to planetary photography.

Major topic titles include "The Human Eye", "The Telescopic Image", "Atmospheric Effects", "The Optimum Aperture for Planetary Observation", "The Ideal Planetary Observatory", "Other Practical Suggestions", and "The Observation of the Moon and Planets". In "The Human Eye", the perception of contrasts and the luminosity-contrast relationship are discussed, as well as visual acuity and the contrast-resolution relationship; the importance of the eyepiece's exit pupil size (preferably 0.5 mms. to 0.7 mms. in diameter) and its dependence on magnification per unit of aperture are considered. "The Telescopic Image" contains the subtopics of diffraction, resolving power, magnification, and quality of optics. For viewing extended objects such as the Moon and planets, there is no real limit at which quality can be compromised; empirical results are noted which confirm this. Of great interest is a discussion of the geographical distribution of observation sites having good seeing. In "Atmospheric Effects", Mr. Dragesco recommends establishing an observatory for planetary studies in Equatorial Africa, not only because the planets would pass near the zenith, but because the high relative humidity is conducive to stable images. The most effective aperture for planetary observations is said to be in the range of 20 cms. (8 inches) to 60 cms. (24 inches), with the exact value depending on the existing seeing conditions. A guide is furnished for observing the Moon and bright planets.

Vision is a brief, well presented, authoritative, well referenced, and inexpensive handbook-reference work. It is unhesitatingly recommended in all respects. It may be obtained by sending one U.S. dollar to the following address: Société Astronomique de France
28, rue Saint-Dominique
Paris-VIIe, France

Inquiries regarding the S.A.F. and its journal, l'Astronomie, will be welcomed at the aforementioned address.

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What Star Is That? by Peter Lancaster Brown, published by Viking Press, Inc., New York, 1971; 224 pp., 48 illustrations in text; table of planetary positions, 1971-1980; 21 pp. of charts; table of naked-eye variables; index; 15 color slides (35 mm. in 2x2 in. cardboard mounts) as aids for identifying constellations and a few popular nebulae and clusters. Price, complete with slides, $12.95.

Reviewed by Chas. F. Johnson, Jr.

This book, which has been published simultaneously in England and the United States, is the work of an experienced British amateur astronomer. It is well planned and interestingly written as a beginner's guide to the constellations, major planets, and the more easily observed nebulae, star clusters, and variables.

The first chapter, devoted to the early history of the constellations and the attempts to represent them suitably on globes or other maps, appears more detailed and lengthy than is needed for beginners trying to learn about the sky. Most of the book (over 140 of the 224 pages) is, however, concentrated on basic information about prominent individual stars, leading constellations, and various specific objects in our Solar System and Milky Way Galaxy.

Principal meteor showers and comets are described at some length, but the minor planets (even the "Big Four") are barely mentioned. Other serious omissions are the Sun (the nearest and, to us, the most vital of all the stars) and the Moon, certainly the two most striking objects of all, which are mentioned only in terms of their relative stellar magnitudes. The book, which is particularly intended for beginners and non-specializing amateurs, appears out-of-balance in these respects and in regard to Chapter 1, as already noted.

The extra feature of the slides, carried in a pocket at the back of the book, must add substantially to the production costs of the work, although it will be of limited value to most users. A higher quality of illustration in the text itself, using glossy sheets at least for printing of photos, would have been a better investment. Improved detail and much more attractive views would thereby have been possible for objects such as the Milky Way, Jupiter, and many others that are normally quite appealing to beginners.

Lastly, the price is regrettable. Few young people of elementary and high school ages will either wish, or be able, to spend such an amount on any hobby-book, especially one that is useful chiefly at the introductory stage. As for members of the A.L.P.O., the volume will obviously have little practical value.

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Celestial Handbook, by Robert Burnham, Jr. Celestial Handbook Publications, Box 614, Flagstaff, Arizona. Sections 1 and 2, 1966; Section 3, 1967; Section 4, 1969. The first 4 Sections (930 pages) are available now at $3.25 per Section. The other 4 Sections will follow.

Reviewed by J. Russell Smith

This most complete and most up-to-date handbook available today has a loose-leaf format so that revisions and additions can be made easily. Mr. Burnham, of comet fame, has been on the staff of the Lowell Observatory for many years and has had the resources of the library of this great observatory, its instruments, and its plate collection to aid him in preparation of this guidebook for the observer, student, research worker, amateur, or professional astronomer.

In the Introduction, the author indicates that the Celestial Handbook is intended to be a standard catalogue and detailed handbook of thousands of objects suitable to observers with 2" to 12" telescopes. In the opinion of the reviewer, this is what it is! The author also states that the Handbook contains most of the objects in the Skalnate Pleso Atlas of the Heavens.

Chapters 2 and 3 of Section 1 (about 75 pages) are in reality a good short course in some of the fundamentals of stellar astronomy. One will find this part of Section 1 quite helpful for review as well as for reference.

Each Section contains many excellent photos as well as separate listings for each constellation (contained in that Section) for double and multiple stars, variable stars, and deep-sky objects--nebulae, star clusters, and galaxies. For many selected objects, Mr. Burnham has included finder charts, light curves, orbit diagrams, and tables. These are followed in each Section by pages of descriptive notes on each constellation treated in the Section. The purchaser of these Sections of the Celestial Handbook will need a three-ring binder.

In short, here is a monumental work which will be first in its class for many, many years.

Postscript by Editor. Reviewer Smith directs attention to a "Progress Report" from Mr. Robert Burnham, Jr. in January, 1972. The price of each Section is $3.25 postpaid in the United States, or $3.50 in other countries. All four Sections complete with ring binder can be bought for $14.95 postpaid in the United States, and one dollar more in foreign countries. Binders are available separately at $3.95 each or $7.50 for a set of two. Customers in other countries should add $1.00 to each order.

Mr. Burnham is continuing to work on this monumental project on a one-man, spare-time basis. Increasing production costs have been a severe problem. Mr. Burnham merits our understanding and patience in his continuing work on a remarkable Celestial Handbook.

ANNOUNCEMENTS

Changes in Jupiter Recorders. Mr. Phillip W. Budine has been appointed to replace Dr. Julius Benton. The change has been caused by a large increase in Dr. Benton's professional duties in his employment and by Mr. Budine's recently finding greater opportunities for personal astronomical work. We thank Dr. Benton for his work while he was on the Jupiter Section staff and welcome back Mr. Budine to our staff, where he has capably served before.

Mr. Budine, Mr. Paul Mackal, the Jupiter Recorder, and the Editor have discussed how the work of the Section may best be divided. Central meridian transits and other quantitative data will be handled by Mr. Budine. Qualitative data will be handled by Mr. Mackal (a recent Section Report by him starts on pg. 189 of this issue). All Jupiter observational data and all correspondence about the work of the Section should be addressed to Mr. Mackal. The pertinent material will be forwarded to Assistant Recorder Budine. It is planned to stress the determination of latitudes on Jupiter in the near future. In due time, all data on Jupiter will be properly filed by the Recorders.

Mr. Budine's address is 91 Townsend St., Walton, New York 13856. All interested ALPO members are warmly invited to support the Jupiter Section with their interest, their ideas, and especially their observations. Current plans include a Section Newsletter.

ALPO Saturn Section Monthly Newsletter. Recorder Benton has sent us this advance information: "Beginning in January, 1973 there will appear a new publication for observers of the planet Saturn. The 'ALPO Saturn Section Monthly Newsletter' shall contain detailed information on all aspects of Saturn observing, special announcements, progress reports throughout a particular apparition, ephemerides, etc. The 'Newsletter' will become available for mailing early in December, and all subscriptions for it should be received no later than December 1, 1972. The subscription rates will be: "Before December 1, 1972 one year for $4.00 and two years for $7.00.

"After December 1, 1972 one year for $5.00 and two years for $9.00.

"It shall be the aim of the Section to prepare the publication and mailing so that all subscribers will receive their issue before the beginning of the month covered by the current number. All those who subscribe to the 'Newsletter' will receive free each year a copy of the Saturn CM Ephemeris and the Annual Report of the Saturn Section.

"All subscriptions should be paid by check or money order to Dr. Julius L. Benton, Jr., ALPO Saturn Section, P.O. Box 5132, Savannah, Georgia 31403."

The Planetarian. This name is that of a new quarterly astronomical education journal, the official organ of the new International Society of Planetarium Educators. The emphasis is on the teaching of astronomy, including recent advances in techniques and equipment. Contributors to the Inaugural Issue, June, 1972, include Isaac Asimov, V. D. Chamberlain, G. L. Verschuur, Mark Chartrand, and Dick Norton. The normal single subscription price for one year is $5.25; discounts are offered for bulk orders. Further information may be obtained from Dr. Frank C. Jettner, Executive Editor, Dept. of Astronomy and

Space Science, State University of New York at Albany, 1400 Washington Ave., Albany, New York 12222.

In Memoriam. We announce with sorrow the death of Dr. Kurd von Bülow, of Rostock, East Germany (Deutsche Demokratische Republik). He had belonged to the ALPO since 1962. We know little about our late colleague, but he was several times very helpful in arranging for the exchange of scientific articles and reprints.

Addition to ALPO Library. Mrs. Haas, the Librarian, calls attention to an attractive recent addition to the Library. It is The Astronomical Observatories in Japan: A Photographic Album, donated by Mr. Takeshi Sato of Hiroshima, Japan. The text is in Japanese, but Mr. Sato has kindly supplied English titles for the several hundred photographs. The photographs were taken by Mr. Akira Fujii, and the album was published by Seibundo-Shinkosha Publishing Co., Tokyo. The price is ¥680.

Sustaining Members and Sponsors. The persons in these special kinds of membership as of September 7, 1972 are listed below. Sponsors pay $25 per year; Sustaining Members, $10 per year. The balance above the normal rate is employed to assist the ALPO in suitable ways. We thank all these colleagues for their generous and meaningful assistance.

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New Zip Code in Our Address. The postal zip code of New Mexico State University has recently been changed, and the address of the ALPO and it journal is now Box 3AZ, University Park, New Mexico 88003.

OBSERVATIONS AND COMMENTS

Capuanus and Three Domes. The front cover drawing for this issue was contributed by Lunar Recorder Harry D. Jamieson. The observer, Mr. Richard J. Wessling, has here furnished a drawing of unusual artistic merit, one which may well serve as a model for recruits to the Lunar Dome Survey. Mr. Wessling says in his observing notes: "Capuanus displayed two well defined domes, and a third was questionable. There was also an elongated mound on the crater floor, which showed well. Seeing was quite fast but sharp when at its best. Some surface wind hampered the observation too. The rille north of Capuanus was very interesting, and only part of it was drawn. A very small crater was visible south of the third dome in Capuanus." The domes described have been confirmed well by other observers.

Domes in Mare Spumans. Figure 56 shows two newly discovered domes in Mare Spumans, located on the Moon's east limb (IAU directions) at its equator. Observation is hence chiefly possible at sunset lighting soon after Full Moon. Confirmation of these domes by other observers is very much desired. The observer, Lunar Recorder Westfall, reported Mare Spumans Alpha to be low and circular, with a flat summit and ridges on its north side. The major axis of Alpha was determined to be 27 kms. on the basis of comparisons with Apollonius S and Dubiago P. Mare Spumans Beta was described as low and irregular, with a flat summit. It was steep on its northeast side and exhibited a craterlet on the southwest. The major axis of Beta was determined to be 34.5 kms. Rectangular coördinates were determined from LAC 62 as: Alpha, xi = + .915, eta = + .025; for Beta, xi = + .904, eta = + .023.

Partial Lunar Eclipse of July 26, 1972. The middle of the eclipse was at $7^{h}16^{m}$, U.T., and 55 per cent of the Moon's diameter was then eclipsed. The only observational report which we have comes from Michael Fornarucci of Garfield, New Jersey. He estimated the eclipse luminosity to be 1.5 on the Danjon Scale. He observed with a 6-inch reflector at

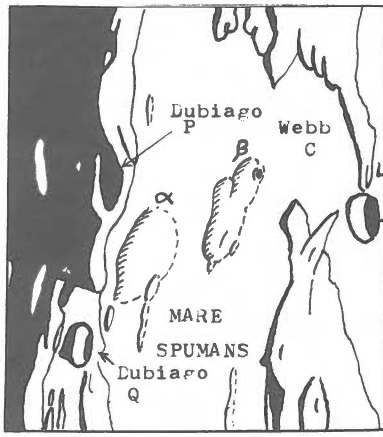

Figure 56. Drawing of Mare Spumans and two "new" domes by John E. Westfall. November 26, 1969. 4^h29^m - 4^h52^m, U.T. 10-inch Cassegrain reflector, 320X. Seeing 3, transparency 5. Colongitude 112°3. Lunar south at top, lunar east (IAU sense) to left.

****

30X, with fair seeing and good transparency, from 6^h0^m to 8^h12^m, U.T. He noted: "The umbra was gray throughout the eclipse in the 6-inch reflector but did show some reddish color to the naked eye at all stages except near maximum eclipse. Detail was difficult in the 6-inch; but some detail was present, especially near the Moon's limb. A reddish-yellow rim was seen at times.

"A darkening of the southern limb of the Moon was noticeable a few minutes before First Contact [at 5^h55^m, U.T.]. The umbra was gray in the telescope as the eclipse began, and a yellow-orange color at the edge was visible through the telescope at 6^h4^m, U.T. A dark reddish coloration was first noticeable to the naked eye at 6^h20^m, but not in the telescope. Near maximum eclipse the Moon appeared similar to its First Quarter except that the umbra was slightly brighter than the dark side of the Moon and showed a reddish cast (weakest at maximum eclipse). The colored umbra edge vanished a few minutes after mid-eclipse but was again visible at 7^h39^m, U.T., at which time the deep red color also returned to the umbra. At 7^h58^m the umbra edge lost its color again [Moon left umbra at 8^h37^m], and I lost the Moon from view 14 minutes later."

Report on Total Solar Eclipse of July 10, 1972. Mr. Richard E. Mc Clowry of Freeport, Pennsylvania has communicated the results of a six-member Allegheny-Kiski Astronomy Association expedition to Cap Chat, Quebec. Clouds covered the Sun seven minutes before totality, and rain fell by evening. The darkness of totality was much less pronounced than with the March 7, 1970 eclipse; the observers could easily distinguish the horizon in all directions and the church in the town a mile away. A beautiful pinkish-blue light gleamed on the horizon above the Chic-Chocs Mountains to the south. There was no indication at all of shadow band phenomena. Temperature measures were made both in direct sunlight and in shade. The eclipse itself caused a temperature drop of 10° F.

The Strolling Astronomer

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Persons requiring prompt acknowledgement of correspondence or contributed observations from staff members are requested to furnish stamped, self-addressed envelopes.

STAFF

EDITOR

Walter H. Haas
Box 3AZ
University Park, New Mexico 88003

SECRETARY

Atty. David P. Barcroft
Box 3AZ
University Park, New Mexico 88003

LIBRARIAN

Mrs. Walter H. Haas
2225 Thomas Drive
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BOOK REVIEW EDITOR

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Dennis Milon
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Cambridge, Massachusetts 02139

LUNAR RECORDERS

John E. Westfall
Dept. of Geography
San Francisco State College
1600 Holloway Avenue
San Francisco, California 94132

Winifred S. Cameron
NASA, Goddard Space Flight Center
Code 641
Greenbelt, Maryland 20771

Kenneth J. Delano
22 Ingell Street
Taunton, Massachusetts 02780

Harry D. Jamieson
4030 S.E. Gladstone, Apt. 15
Portland, Oregon 97202

Christopher Vaucher
6130 S.E. Reed College Place
Portland, Oregon 97202

LUNAR AND PLANETARY TRAINING PROGRAM

Richard J. Wessling
946 Deblin Drive
Milford, Ohio 45150