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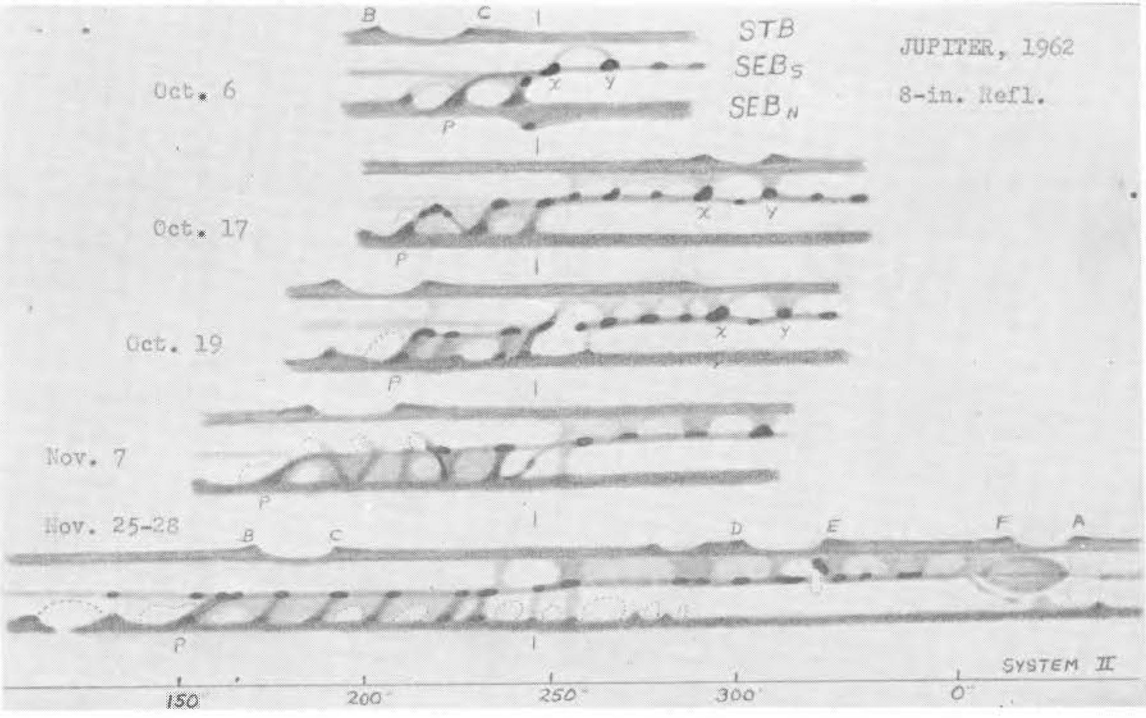

The early development of the 1962 major S.E.B. Disturbance on Jupiter. Drawings by Elmer J. Reese with an 8-inch reflector at Uniontown, Pennsylvania. The initial outbreak occurred at longitude 245°(II) on or very near September 24, 1962. See also Mr. Reese's article on pp. 260 - 263 of this issue A scale of longitudes (II) is given at the bottom.

THE STROLLING ASTRONOMER

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ASSOCIATION OF LUNAR & PLANETARY OBSERVERS
ALPO

IN THIS ISSUE

PLANETARY OCCULTATIONS AND APPULSES IN 1963

By: Gordon E. Taylor

1. The following occultations of stars by Mars have been predicted:

Date	Star	Area of Visibility	Station	Disappearance U. T.	Disappearance P	Reappearance U. T.	Reappearance P
(1963) Feb. 17	B.D.+ 22°2029 ($7^m.3$)	Asia	Tashkent	14^h44^m	301°	14^h59^m	84°
			Tokyo	14 30	298	14 46	88
			Hyderabad	14 44	253	14 58	133
May 31	B.D.+ 13°2208 ($8^m.5$)	W. Asia	Tashkent	18 37	70	18 41	336
		N.E. Africa	Helwan	18 36	106	18 41	300

2. The following occultation by Jupiter has been predicted:

Jan. 18	B.D.- 8° 5989 ($8^m.8$)	E. Asia	Tokyo	Sun		09 02	280
		New Zealand	Wellington	Sun		09 03	272

3. Venus may pass in front of the radio source MSH 21-115 on March $22^d.8$, 1963.

4. Mars may pass in front of the radio source MSH 12-020 on August $19^d.9$, 1963.

5. The following appulses may be of interest to observers:

Planet	Date	U.T. Time of Conjunction	Star	Mag.	Geocentric Separation*	Horizontal Parallax
Venus	(1963) July 7	19^h 42^m	1 Gem	4.3	+ 19"	5"
Mars	Feb.17	14 41	B.D.+ 22°2029	7.3	+ 2	13
	May 31	18 36	B.D.+ 13°2208	8.5	+ 3	6
	June 10	03 56	B.D.+ 11°2222	8.0	+ 20	6
	Aug.10	21 09	B.D.- 2°3540	8.0	- 5	4
	Aug.17	00 52	B.D.- 4°3360	8.8	- 8	4
	Oct.13	05 26	B.D.- 18°4017	8.5	- 14	4
	Nov.16	13 11	C.D.- 23°13039	8.4	- 14	4
Jupiter	Jan.18	08 25	B.D.- 8°5989	8.8	- 9	2
Pluto**	Feb.15.9		Paris + 20°1297	9.6	+ 1	0.3

Note by Editor. We are again indebted to Dr. Taylor of the Nautical Almanac Office of the Royal Greenwich Observatory at Herstmonceux Castle for his continuing courtesy in supplying these predictions. We urge A.L.P.O. members to repay his helpfulness by observing all of these phenomena that they can. The three optical occultations in 1963 will not be observable from the continental United States.

* The geocentric separation given here is in the sense declination planet - declination star.

** If an actual occultation by Pluto appears likely, predictions will be issued a few weeks beforehand.

FOURTH REPORT ON MARS: MARS IN 1962-1963 (GENERAL COMMENTS)

By: Ernst E. Both, Mars Recorder

The impending 1962-63 apparition of Mars is even more unfavorable than that of 1960-1961, but because of this fact we should again make every effort to observe it as completely as possible. It will be recalled[1] that the work of our Mars Section during the last apparition covered primarily late winter and early spring conditions in the northern hemisphere of Mars, while during the present approach we have an opportunity to study the entire seasonal development during northern spring (southern autumn), obtaining thus a valuable extension of our earlier observations. Spring in the northern hemisphere began on October 18, 1962 (heliocentric longitude 84°), while summer will start on May 5, 1963 (heliocentric longitude 174°). The latitude of the center of the disc will increase from 10°.9 N. at the beginning of October to a maximum of 18°.5 N. around December 14, decreasing then to 12°.4 N. on March 10, 1963, then to increase once again. Thus the northern hemisphere will be much better displayed to the terrestrial observer than during the 1960-61 apparition.

The circumstances of the 1962-1963 apparition of Mars are:
Closest approach: February 3, 1963.
Opposition: February 4, 1963.
Position at opposition: Right Ascension $9^h 16^m 10^s$; Decl. + 20°38'37".
Apparent angular diameter at opposition: 13".96.
Stellar magnitude at opposition: - 1.0
Latitude of center of disc at opposition: + 14°.65
Distance from Earth at opposition: 61.3 million miles.

Compared with the 1960 opposition the diameter will be smaller by 1".4, and useful observations may be carried out until April 1963 (apparent diameter should not be less than 8" unless large instruments are used). It is intended to continue with the observational program outlined earlier[2], although the following lines of observational work should be especially pursued:

1. Comparative drawings of the appearance of the northern polar cap in white light, with deep blue filters (Wratten 47B), and in red light (Wratten 25). Observations of this kind should enable us to separate any surface deposits from atmospheric haze phenomena.

2. Estimates of the size of the polar cap may be carried out either in terms of the radius of the planet or by means of the angle which the cap subtends at the center of the disc.

3. Cloud or haze phenomena should be carefully followed and should be reported by special mail. A blue clearing can sometimes be detected by comparing the image in yellow/red light (Wratten 15, 21, or 25) and blue light (Wratten 38A, 47B, or 48A). Blue clearing is indicated if the surface details are well-visible with the blue filters.

4. Central meridian transit timings of well-defined surface features. The observer must indicate clearly what map was used in identifying the features observed.

5. Drawings ought to be made for specific, stated purposes (see reference 2). Until our observing forms are available, observers are urged to use a uniform disc size of 5 cms. diameter (2 inches), to facilitate reductions. Since original drawings can only be returned when all reductions are completed, it is suggested that members submit copies which may be kept as part of our permanent records. All observations should be accompanied by the following data: name of observer; time in U.T.; telescope employed; magnification used; seeing and transparency estimated according to the system generally used by the A.L.P.O. [The seeing is on a scale of 0 (worst) to 10 (perfect). The transparency is the stellar magnitude of the faintest star visible to the naked eye at the position of Mars, correcting when necessary for twilight and moonlight.]

References

1. Both, Ernst E. "First Report on Mars, 1960-1961," The Strolling Astronomer, Vol. 15, Nos. 1-2, January-February 1961, pp. 26-33.
2. Both, Ernst E. "The A.L.P.O. Mars Program for 1960-1961," ibid. Vol.14, Nos. 7-8, July-August 1960, pp. 99-102.

A PRELIMINARY REPORT ON THE OCCULTATION OF BD-19°5925

BY SATURN ON JULY 23, 1962

By: Joel W. Goodman, Saturn Recorder

The occultation of the eighth magnitude star BD-19°5925 by Saturn on July 23, 1962 was the most extensively observed event of its kind in history. The observations contributed require reduction to a standard position in order to correct for parallax, a laborious and involved process which will require considerable time. Consequently, the results derived from the raw data will not be published in the immediate future. The present communication is devoted wholly to discussion of the kinds of information derivable from visual observations of stellar occultations by Saturn's rings, some of the conclusions gleaned from previous occultations, and a few general remarks pertaining to the most recent such event.

Initially, a list of contributors to the ALPO Saturn Section for the 1962 occultation follows:

Observer	Location	Instrument	
Brasch, K.	Rosemere, Quebec, Canada	8"	Rl.
Cahill, W. J.,Jr.	Teaneck, New Jersey	12.5"	Rl.
Cave, T.R.	Long Beach, Calif.	12.5"	Rl.
Chapman, C.	Tucson, Arizona	16"	Rl.
		12"	Rl.
Cragg, T. A.	Mt. Wilson, Calif.	16"	Rl.
Cruikshank, D.P.	Tucson, Arizona	12"	Rl.
Gaherty, G., Jr.	Montreal, Quebec, Canada	8"	Rl.
Goodman, J.W.	Mt. Hamilton, Calif.	12"	Rr.
Haas, W. H.	Long Beach, Calif.	12.5"	Rl.
Hartmann, W. K.	Tucson, Arizona	16"	Rl.
Isbell, C. W.	Austin, Texas	9.5"	Rr.
Johnson, C.L.	Boulder, Colorado	10.5"	Rr.
Maag, R.	California, Missouri	12.5"	Rl.
Milon, D.	Houston, Texas	8"	Rl.
Mourao, R. R. de F.	Rio de Janeiro, Brazil	18"	Rr.
Robinson, L. J.	Mt. Hamilton, Calif.	36"	Rr.
Smith, J. R.	Eagle Pass, Texas	16"	Rl.
Solberg, G.	Las Cruces, New Mexico	6"	Rl.
Wray, R. J.	Austin, Texas	9.5"	Rr.

Rl. = reflector, Rr. = refractor.

A particular expression of appreciation is hereby extended to the staff of Lick Observatory for generously making available the 36-inch and 12-inch refractors to ALPO observers. Not only does the use of such instruments make the observations more meaningful, but the hospitality and cooperation shown us made the event doubly memorable.

The primary purpose of this undertaking was to map as extensively as possible the optical densities of the rings, or, in other words, to determine the positions of intensity minima. The optical density of Ring B may be greater than heretofore suspected since Robinson found that BD-19° 5925 remained invisible in the 36-inch refractor throughout its passage behind this ring. Atmospheric conditions at Lick were disappointing on the night in question, but a number of intensity minima were detected in Ring A, and it was felt that analogous diminutions in the optical thickness of B should have been perceived. Reports of the occultation of a seventh magnitude star in 1920 by observers in South Africa using a 6-inch refractor supported the concept of a translucent Ring B.[1,2] Several extenuating circumstances may account for the discrepancy between these two observations, the most significant of which is that the ring system was within a few months of the edgewise phase during the 1920 occultation. A photometric tracing of the rings by Dollfus revealed four intensity minima in Ring B.[3] The possibilities that these minima either were not strong enough to permit delineation of an eighth magnitude star by a 36-inch telescope or that the minima are transient and were weak or absent at the time of the 1962 occultation must be considered. On the other hand, Cragg remarked two brightenings of BD-19°5925 behind Ring B, one at the inner edge which he felt corresponded to "division" B0 and the other close to the outer edge of the ring. These observations were unsubstantiated and consequently must be regarded as suggestive at best.

Fluctuations in the star's brightness while behind Ring A were recorded by several observers. No fewer than seven such variations were seen by Robinson, five by Cragg, three by Goodman and Milon, and one by Chapman. The star remained visible while behind Ring A to Robinson except for a few brief intervals. Cragg found BD-19°5925 visible only intermittently while Goodman lost it for a period of 4.5 minutes during its approximate 12-minute passage. Two British amateurs observing the occultation of a seventh magnitude star by Ring A in 1917 found it uninterruptedly visible in telescopes of five and nine inches aperture.[4] The magnitude difference between the brightnesses of the stars involved in these two occultations is a sizable factor and could well account for the discontinuity in the visibility of the fainter star even in larger instruments. In any event, the most interesting aspect of the occultation promises to be the degree of correspondence between the intensity variations reported by different observers. In the opinion of the Recorder, agreement to within ± 10 seconds of time will be necessary to establish correspondence since this span is equivalent to about 3 percent of the breadth of Ring A.

A distinct possibility that Cassini's Division is not a perfect void is raised by reported dimmings of BD-19°5925 while in this gap by Cragg and Robinson. There are several disturbing aspects to these reports. One stems from a very large discrepancy in the observed time interval during which the star remained in Cassini's. Robinson's value was $1^m 25^s$ while Cragg's was a remarkably discordant $2^m 57^s$. Goodman, at Robinson's observing station, timed the interval at $1^m 31^s$, in reasonable agreement with the latter's estimate. Another disturbing factor arises from an interruption in Cragg's observing while the star was behind Cassini's. The dimming apparently occurred while he was away from the telescope; on his return he found the star fainter by an estimated one magnitude. This observation is certainly more subjective than if he had actually seen the star to diminish in brightness and should be evaluated with this reservation firmly in mind. Robinson considered the star well below full brightness throughout its passage across the gap and even completely lost it briefly (about two seconds). Goodman found it continuously visible but considered its brightness difficult to evaluate. In addition to its extreme proximity to a very bright object, the star's diffraction disc was larger than the breadth of Cassini's Division as seen in a 12-inch telescope. Thus, the star was never seen "free" in the gap. Descriptions of the occultation of a seventh magnitude star in 1917, referred to above, gave no indication of the existence of obscuring material in Cassini's Division.[4]

Lastly, it was considered possible, though perhaps improbable, that evidence pertinent to the Ring D controversy might evolve from observations of BD-19°5925 following last contact with Ring A. Impressions of apparent brightening as the star receded from the glare of Saturn seem unavoidable and serve to becloud the issue, rendering interpretation of magnitude estimates hazardous. Be that as it may, Cave and Chapman reported sudden brightenings of the star some minutes after last contact with Ring A. These were more than balanced, by number if not by significance, by the negative impressions of other observers. However, a superficial analysis of the two reports indicated suggests that there may be more than coincidental agreement between them. More can be ascertained following reduction of the data. At that time a fuller report will be published.

References

1. J.B.A.A., Vol. 30, pg. 230 (1920).
2. ibid, Vol. 31, pg. 37 (1920).
3. Dollfus, A., in Planets and Satellites, Kuiper and Middlehurst, Univ. of Chicago Press, 1961.
4. J.B.A.A., Vol. 27, pgs. 7 and 212 (1917).

LUNAR CRATER TERRACING - A PRELIMINARY REPORT

By: Francis J. Manasek

(Paper read at the Ninth A.L.P.O. Convention at Long Beach, California, August 24-26, 1961.)

A characteristic of many lunar craters which has been much neglected in most of the recent lunar literature is the interesting series of terraces which appear on their inner and outer walls. The terraces are frequently concentric and appear to follow the contour of the crater walls rather closely. Complete systems of terracing which extend around the entire wall are most frequently found in newer craters, and here a high degree of concentricity is exhibited. Crater Herschel is but one example of this type. Older craters, especially those which have suffered extensive morphological changes subsequent to their initial formation, exhibit a generally lower degree of terrace concentricity and continuity. This condition is present in craters of the general Stoefler and Maurolycus type.

Terraced craters may be divided into two general types:

1. Those with terracing on the inside slope only.
2. Those with terracing on both the inside and outside slopes.

Conspicuous by their absence are craters with terracing only on their outside slopes. This is not to say that they may not exist; however, a preliminary survey of the lunar surface has failed to reveal any. On the other hand, terracing on the inner slopes is often found in craters which have no outer wall terraces. This condition is especially common among the cauldera, which have either no raised walls or only very low ones, and also among many of the newer craters of the 15 or 20 mile diameter class found scattered about on the surface of the maria. The latter all have walls which are rather low on an absolute scale. The wall height is significant since there appears to be a direct relationship between absolute wall height and presence of terraces on the outer slopes.

Craters of about 10 miles diameter and smaller, which are present in great numbers on the maria, usually do not have the polygonal outlines which the larger terraced craters frequently exhibit. If an assumption is made, namely that the polygonal (usually hexagonal in the case of smaller structures) crater represents the transformation of an essentially round or oval crater by the post-formative, semi-quiescent volcanic activity which also produced terracing, the absence or reduction in number of individual terraces in many of the smaller, round craters is to be expected, since they are now regarded as small and round because of an early cessation of activity. The entire series of crater shapes ranging from smooth-walled, small round pits to larger hexagonal terraced forms can best be seen among the great selection of craters present on the surface of Mare Imbrium, and it will be noticed that only the smaller craters there are circular in outline. Somewhat larger craters are oval, and when the diameter approaches the vicinity of 8 or 10 miles, the polygonal crater makes its appearance, as do the terraces. The absence of terraces from the slopes of the smaller craters may be only apparent; the terraces may be of such size as to make detection with the instruments used in this study difficult or impossible.

The terracing mechanism is obviously closely tied in with that of crater formation and cannot be neglected in any proposed complete mechanism of lunar crater formation and evolution. In some of the craters the internal terraces are probably composed of frozen lava and breccia which was left clinging to the internal slopes when the level of the still molten floor fell because of a lessening of hydrostatic pressure. Either a subsequent series of shifts in the hydrostatic equilibrium, both upward and downward; or just a continuous, gradual, lowering of the floor level could create the concentric terraces. This mechanism can be applied to both the collapse cauldera with no raised walls or with only gently sloping walls and also to the craters with raised walls. In the case of the latter, this mechanism applies only to formation of the inner terraces. Spurr[1] outlines a mechanism whereby the settling of his proposed gas-supported, dome-shaped floor created a series of step-faults visible as terraces. There are several flaws in this theory, and its applicability appears rather limited.

Outer slope terrace formation appears to be an integral part of the very formation of the wall itself. If a plutonic origin for the basic crater, which manifested itself initially by an epimagmatic upheaval with subsequent collapse is assumed, a low rampart surrounding the center of activity and composed of breccia, rubble from the landscape, and congealed lava appears to be a plausible structure. Subsequent overflowings of the raised lava lake would gradually build up the wall in veneer-like layers, and the cumulative effect would be to produce the outer terraces.

The mechanisms just described are admittedly rather brief and sketchy, and an attempt will be made to develop them further in a later paper. However, most interesting of all is the fact that these various stages of epimagmatic upheaval, overflowing, wall development, and inner slope terracing have all been observed[2] in volcanic structures on the earth and represent no mere speculation in the description of the sequence of events. The similarity between the morphology of lunar and terrestrial structures of this type is even more pronounced when other characteristics are also considered, such as the previously mentioned polygonal outlines of terraced lunar craters. Terrestrial structures of this type usually have this outline also. Other similarities, for example concentric craters, which were not discussed in this paper only serve to reinforce the idea that perhaps the moon's most numerous features - her craters - may be more like terrestrial features than we now suppose.

References

1. Spurr, J.E., <u>Lunar Catastrophic History</u>, Concord, Rumford Press, 1948.
2. Jaggar, T.A., <u>Origin and Development of Craters</u>, Baltimore, Waverly Press, 1947.

THE FORMS OF LUNAR CRATERS

By: Patrick Moore

(Paper read at the Ninth A.L.P.O. Convention at Long Beach, California, August 24-26, 1961.)

In discussing the origin of the lunar craters, I am entering a controversial domain. Arguments between the meteoritic theory supporters on the one hand, and the adherents of a volcanic (or, better, "igneous") theory on the other have continued for many years. In point of fact, both processes must have been operative. Undoubtedly there are impact craters on the Moon, just as there are on the Earth; and there are also volcanic formations which look remarkably like terrestrial vulcanoids. Here, however, I want to confine myself to the larger craters, for which I personally believe the basic cause to be found in the Moon itself rather than in meteoritic impact.

Let us consider the cases in which one crater breaks into another. Thebit is an excellent example; its wall is broken by A, while A itself adjoins a still smaller formation. Suppose, for a moment, that both Thebit and A are meteoritic in nature. Thebit is clearly the older (there can be no gainsaying this), and so A must have been formed by a second meteorite's landing on the wall. In this case, surely, there would have been a major "moonquake" which would have shaken down the existing wall for some distance upon either side of the impact point. Yet this is not observed - and it never is observed in lunar formations. The wall of Thebit remains standing right up to the point of junction with the intruding wall of A.

There are almost innumerable similar cases. With twin craters, such as the Sirsalis-Bertaud or Steinheil-Watt pairs, there is a dividing wall; if the twins had been formed by simultaneous meteorite impacts, it is hard to see how such a wall could have survived - it would be more logical to assume that the result would be one larger, perhaps less regular formation. Look at the very deep Tralles, as it intrudes into Cleomedes. And consider the ray-crater Tycho, which, on the impact theory, must be one of the youngest formations in its own particular area of the Moon. Tycho is over 50 miles in diameter, and is relatively deep. Had it been formed by impact at a late stage, the shaking in the lunar crust would have been considerable, to put it mildly. I very much dount whether patently older formations such as Street and Sasserides could have survived in recognizable form; yet Street, for instance, is still more or less regular in shape.

If we are going to assume that such impact craters can be produced without causing widespread devastation in existing formations, we must also assume a very unlikely nature of the Moon's crust - and this seems unreasonable. Of course, the same objections can be raised against any volcanic theory of the "explosive" type, and to me it seems to indicate that the Moon's main craters were not formed by a cataclysmic process at all.

When I put forward an "uplift and subsidence" theory, in 1953, I also mentioned this point about the lack of observed devastation produced by relatively young craters. Unfortunately, no full mathematical investigation of the conditions has yet been carried out. I hope this will be done shortly. Meanwhile, it seems - to me at least - that here we have another objection to the idea that the chief craters of the Moon are due to meteoritic impacts.

Many of you may well disagree with me; I am more than ready to be proved wrong - but in any case there can be no harm in arguing about a problem which is of special interest both to astronomers of 1961 and to the astronauts of tomorrow.

PHOTOGRAPHING JUPITER IN COLOR

By: Philip R. Glaser, Jupiter Recorder

During 1962 Jupiter presented such striking and vivid colors to the telescopic observer that it was quite inevitable that serious attempts would be made by amateurs to record the colors photographically. At the date this is being written (1962, November) it appears that perhaps a dozen workers in at least three countries, the U.S.A., Great Britain, and Italy, have been experimenting simultaneously (and for the most part independently) to establish successful techniques for producing photographs of Jupiter in natural colors with telescopes of 8 inches of aperture and larger. It is hoped that the several results obtained can be compared with each other and evaluated by our most experienced visual observers. In the meantime, perhaps the following account of the writer's own methods and results will be of interest and will encourage others to strive for better results.

The telescopes used. Two telescopes of the Newtonian form were employed in this work: an 8-inch, f7 and a 12½-inch f9 reflector. Both instruments possess excellent optics, and both have accurate electric drives. The 8-inch instrument was always easily accessible while the 12½-inch required a trip of some 30 miles to the Observatory of the Milwaukee Astronomical Society; for this reason most of the initial test exposures were made with the smaller instrument. The happy coincidence that the 12½-inch has almost exactly twice the focal length as well as approximately twice the light gathering power of the 8-inch was a great convenience since the same exposure times and techniques could be used with both. This made it possible to take the fullest advantage of the larger instrument's greater photographic capabilities on nights of particularly fine "seeing", and on several occasions a rather long series of consistently fine pictures was obtained.

The camera used. Several years ago the writer obtained an ancient "127 film size" Exakta camera on the second-hand market which he has found particularly easy to adapt for use with a telescope. It is of the single lens reflex type, and the ground glass focusing screen was easily removed and replaced with a 1/8 inch thick aluminum plate into which a positive eyepiece was fitted. A single spider web was installed flush with the bottom of the plate and across the lower end of the eyepiece tube. Since the aluminum plate was accurately fitted to occupy exactly the original position of the ground glass, the web is permanently fixed in the reflex focal plane of the camera; and before using it in the telescope the eyepiece must be focused by locking it in that position which gives a sharp view of the web, after which focusing for the exposure can be accomplished with the telescope's rack and pinion. It proved impossible to obtain a well corrected commercial eyepiece of sufficiently long focal length for use in this assembly, but a special one was easily constructed by machining a suitable cell for mounting a pair of two-element lenses taken from an old "stereo viewer". These give good quality images and allow for magnifications of either 2X or 4X depending on whether one or both lenses are used. The 4X magnification is used with the 8-inch telescope and the 2X with the 12½-inch since with it the two-lens combination yields so large an image that accurate visual focusing cannot be done with certainty. Of course, the camera's threaded lens assembly was removed and replaced with a 1.25-inch outer diameter adapter tube which holds various projection eyepieces and lenses and which allows the camera to be inserted into the eyepiece holder of the telescope.

The film used. All of the writer's Jupiter color photographs were made on Eastman E-127 Improved Ektachrome Daylight film. Its speed is indicated by the manufacturer as "ASA 64". Acceptable color rendition and unexpectedly good resolution of planetary detail were obtained in the positive transparencies yielded by this film when exposure times near 3 seconds were used. The image sizes used were (for Jupiter's equatorial diameter near the 1962 opposition) 3/16-inch for pictures made with the 8-inch and 3/8-inch for those with the 12½-inch telescope. The amplifying lenses used to project these image sizes onto the film were a 16mm. Brandon eyepiece and a Goodwin Barlow Lens. Their positions in the camera-telescope adapter tube were determined simply by making test exposures, and the light loss due to scattering through this rather considerable amount of glass was minimized by carefully lining the inside of the adapter tube with black "flocked" paper (which allows for easy changes in lens positions) and by stopping down the Barlow Lens to near the minimum clear aperture required.

The exposure technique used. The actual procedure used in making the color exposures was no different than would be employed in making Jupiter photographs on ordinary black and white film. Only one exposure per frame was made so that nothing but the centers of the lenses in the projection system were in use when the focusing image was in the center of the field. The "seeing" was carefully monitored to insure that exposures would only be made under the best possible conditions. The camera's focal-plane shutter was not used because it invariably introduced image

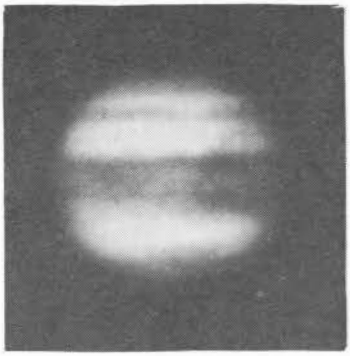

FIGURE 1. Copy of Ektachrome color transparency of Jupiter. Original photograph by Philip R. Glaser with Milwaukee Astronomical Society Observatory 12.5-inch reflector. Film Improved Ektachrome, exposure 3 seconds at f 107. October 4, 1962, 2^h46^m, U.T. C.M.$_1$ = 119°, C.M.$_2$ = 209°. Note SEB Z festoon marking prec. end of early aspect of 1962 SEB Disturbance, bright spots both prec. and fol. the festoon, STeZ oval "BC" approaching the C.M., detail in the EZ, and the dark section of the NNTB. Readers will realize that some of the more difficult detail present on Mr. Glaser's prints, this one and Figure 2, has been lost in publication.

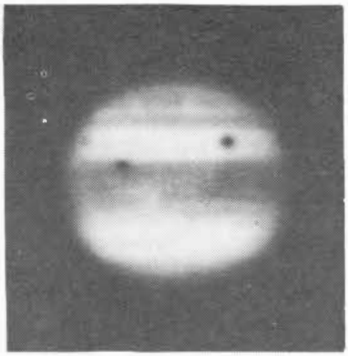

FIGURE 2. Copy of Ektachrome color transparency of Jupiter. Original photograph by Philip R. Glaser with Milwaukee Astronomical Society Observatory 12.5-inch reflector. Film Improved Ektachrome, exposure 3 seconds at f 107. September 21, 1962, $4^h 24^m$, U.T., C.M.$_1$ = 285°. C.M.$_2$ = 114°. Note bright ovals in STeZ, J. III and its shadow on SEB$_s$, J.I bright near the prec. limb, shadow I on SEB$_n$, partial doubling of NEB, and EZ bright areas.

movement and, hence, blurred pictures. Instead, a generously large panel of corrugated cardboard was held in front of the telescope tube (but not in contact with it) while the camera shutter (set on "time") was opened with the cable release. The card was then pivoted smoothly down and up while counting the exposure, "one-thousand-and-one", etc.. Crude as this method may seem, it is quite capable of consistently good results provided that careful notes are kept of the exact count used for each exposure.

Processing the transparencies. While Ektachrome film can be processed in the home-darkroom, the writer found this plan too time-consuming to undertake when combined with a busy observing schedule. Instead, the help of a commercial processing firm which specializes in high quality color work was solicited. The processed color transparencies were returned uncut and unmounted so that no confusion could arise over correct identification of test exposures or about the exact time when each was made. The separate transparencies were then carefully trimmed and inserted into 35mm. glass protected slide-mounts.

Viewing the transparencies. It was found that the usual minature slide projector did not afford the best viewing of the Jupiter color transparencies. Correct color rendition (as compared with visual estimates at the telescope) seemed to be adversely affected by the color of the light produced by the projection lamp in the writer's own apparatus. Also, even the minimum convenient enlargement available with the projector proved too great to retain the finest details present in the transparency. Accordingly, other means of viewing were used which varied somewhat with the individual pictures being examined. Probably the most often used of these methods was to fasten a sheet of high quality drawing paper to the reflector of a draughtsman's fluorescent lamp and to view the transparency through the center of a large reading-glass as the slide was illuminated by the light being reflected from the paper. With the Ektachrome transparencies, best color rendition was obtained when Westinghouse "cool white" (bluish) fluorescent tubes were used in the lamp. Care must be taken that the slide and magnifying lens are held parallel to each other; but if this is done, then every detail present in the transparency can be examined under optimum magnification.

Interesting viewing results were also noted when a large table-viewer was used. This viewer had a fixed magnification of about 4X and a variable light intensity. This latter feature is of course most useful in examining slightly underexposed or overexposed transparencies, but in addition it was found that on photographs correctly exposed for Jovian surface detail the weak images of those of the four bright satellites which chanced to be in the dark sky area of the slide could also be made clearly visible by increasing the brightness of the viewing light. The table viewer also proved useful in compensating for the effects of atmospheric dispersion when these were present on photographs made when Jupiter was at a low altitude. Such correction can be secured by moving the head until one is looking through only that portion of the large viewing lens which shows the planet's disc free of limb-coloration, thus employing the same principle often used in visual observing when Jupiter's image is brought toward the edge of the field of a Ramsden eyepiece.

A third method of viewing is to insert two slides in a handviewer designed for use with stereoscopic photographs. Since this method optically superimposes the two images, the graininess of the Ektachrome film is quite noticeably diminished at the rather high magnification afforded. Also, true "3-D" effects can be seen if suitable objects (particularly bright Jovian satellites) are present on exposures made from 5 to 20 minutes apart. On these, satellites which have just emerged from eclipse or occultation will often be truly seen as far behind the planet, while those just entering or leaving transit appear as true globes seen well in front of Jupiter itself.

Making black and white prints. Black and white copies of the color transparencies can easily be made by straightforward home-processing techniques. The examples submitted with this article, Figures 1 and 2, were produced by placing the color-slide in a printing enlarger and projecting the image onto Eastman High Contrast Copy Film (formerly Microfile). Best results were obtained when the projection lens was used at its smallest opening and the scale was adjusted to 1X. In this way copy negatives can be made which record every detail of the original color transparency and possess such high contrast that they can be printed on #1 Kodabromide paper.

The value of Jupiter color photographs. It may be questioned whether or not making color photographs of Jupiter with small aperture telescopes is worth the effort and expense. Certainly it is several times more expensive than ordinary black and white photography. However, at the present time no reliable record exists of the color changes on Jupiter, and it would seem desirable to gather such a record photographically, if at all possible. It is this writer's belief that a useful record of this sort can without doubt be obtained by amateurs possessing telescopes of 12½-inches of aperture and larger provided that they will develop a careful procedure and use the same film over a period of several successive Jupiter apparitions. Some difficulties in making photographs which are strictly comparable from one apparition to another may, perhaps, be minimized if the individual worker will plan his program for peak efficiency when Jupiter is near opposition, thus taking advantage of the largest apparent size of the planet as well as its longest period of constant brightness.

Note to the Editor

If a sufficiently good series of color photographs of Jupiter could be obtained, it is certainly desirable that those of highest quality be published in color. Such a project, however, is probably quite beyond the financial resources of the A.L.P.O. as a single organization. On the other hand, perhaps several groups of amateur observers such as the B.A.A., the O.A.A., and the A.L.P.O. could jointly finance a specially printed insert-page of Jupiter color photographs each year to be included in their separate publications. The writer will be happy to institute inquiries in this regard if those other amateurs who have made color photographs of Jupiter feel that the idea has merit and wish to loan him their best transparencies for this purpose. Your comments are invited.

Comments by Editor. We hope very much that those of our readers with the necessary experience and equipment will pursue the color photography of Jupiter here described so well. It has been a matter of regret that A.L.P.O. Jupiter apparition reports say almost nothing about colors on the Giant Planet. The reason in part, of course, is the extremely subjective nature of visual observations of planetary colors - photography in color may here supply much more acceptable data.

We are extremely sympathetic to Mr. Glaser's suggestion that an effort be made to finance the future publication of an insert-page of the best Jupiter color photographs each year. We might properly begin by trying to determine how much such a page would cost.

At the A.L.P.O. Convention at Montreal Mr. Glaser showed a number of his 1962 Jovian photographs in natural colors. These were greatly admired by all who saw them. One of our most advanced members in fact considers the colors shown on our author's prints the truest renditions of Jovian colors of all those color photographs which he has seen.

THE ORIGIN AND DEVELOPMENT OF THE DOLLFUS WHITE SPOT ON SATURN

By: Jan Sitler

I. Introduction

Prior to the emergence of the Dollfus White Spot the North Polar Zone of Saturn was a small, inconspicuous, band-like zone serving only to differentiate between the North North Temperate Belt and the North Polar Region on the occasions when they were separated. However, in late April 1960, a large white spot was found in the NPZ by A. Dollfus; and it was confirmed on the 2nd of May. From this time until late May, this spot (DWS) was degenerating into the NPZ and disappearing as a distinct feature, though the NPZ was brightening and expanding as a result.[1,2] The spot was last observed on May 26th, 1960 after which time no central meridian transits could be obtained.

The NPZ maintained its new aspect throughout the rest of the 1960 apparition and into the early part of the 1961 apparition; but in the later period it appeared to be decreasing in width and brightness.[3] Between late August and early September in 1960 many white ovals were observed in the zone, one with a duration of approximately forty-five days (a half-month longer than the DWS).[4]

II. Evaluation

In their meteorological theory of Jupiter J. Eyer and J. Sitler draw an analogy between Jupiter's Red Spot and the Dollfus White Spot with reference to their respective origins.[5] It is stated that the RS is a large condensation of coloring compounds sustained in a reasonably stable condition by a sub-surface energy source. (The theory, being only concerned with happenings in Jupiter's upper atmosphere, does not attempt to describe the conditional properties of such a source.) Because Saturn is a Jovian planet it is assumed to exhibit similar phenomena. Therefore, establishing a parallel between the RS and the DWS, it is supposed that the spot is like a typical zonal white oval (that is to say, an ammonia crystal cloud in an unstable condensed state due to rotation); but it too has an internal energy source (below the opaque cloud layer). This sub-surface vortex degenerated steadily throughout the period in which the spot was visible and transformed the NPZ. Though the duration of the spot would seem to indicate no sub-surface origin, the facts that the spot-material redistributed itself throughout the NPZ and that it kept its prominence as a major zone for many months after that dispose us to accept the above as a reliable explanation; an ammonia crystal cloud could not remain stable in either of these forms due to mere external causes for any great length of time.

The outbreak of white ovals in the NPZ between late July and early September is easily explained in terms of the formation of this characteristic feature. The redistributed material of the DWS in the NPZ would result in a proclivity for such ovals to form until the material at last degenerated into the usual methane-ammonia suspension of the zones, resulting in a return of the NPZ to its former, inextensive condition. The long-duration white oval (forty-five days) observed between July 23rd and September 6th, 1960, gave every indication of being a discrete feature, unlike the DWS, and characteristic of this group of objects.

Late in the 1959 apparition P. Budine observed several bright ovals in the NPZ.[6] Approximately one month before its discovery, J. H. Botham observed a white oval in the corresponding position of the DWS.[7] This might indicate a slow gathering of ammonia-crystal clouds rather than the spontaneous generation of a large-scale spot.

III. Conclusion

On the whole, the Dollfus White Spot is interpreted as being a typical "white oval" feature with the difference that the formation process was on an unusually large scale and that it was initiated by a sub-surface energy source. Its evolution was comparatively gradual: starting with the sporadic appearance of ovals, the emergence of the DWS, the distribution of the DWS into the NPZ, the secondary white ovals in the invigorated NPZ, and the slow return of the NPZ to its former aspect as a narrow zone.

Regardless of the previous analysis, the astronomical significance of the DWS-evolution has not been fully appreciated by contemporary researchers. On a relatively inactive portion of a relatively inactive planet has occurred an atmospheric metamorphosis on a "grandiose" scale. It is hoped that in the future the nature and importance of homologous phenomena will be evidenced.

References

1. Cragg, T.A.; "The Dollfus White Spot: A Preliminary Report"; Str. A.; Volume 14; Numbers 7-8; page 121.

2. Cragg, T.A.; "Recently Observed Rotation Rates On Saturn"; Str. A.; Volume 14; Numbers 11-12; page 162.

3. Goodman, J.W..; "Saturn In 1961"; Str. A.; Volume 16; Numbers 3-4; pages 69-78.

4. Cragg, T.A.; "Rotation Periods Of Spots On Saturn Near Latitude 60° North In 1960"; Str. A.; Volume 15; Numbers 5-6; pages 96-98.

5. Eyer, J. and Sitler, J.; "The Darkening Phenomenon Of the Jovian Equatorial Zone, A Description and Possible Explanation"; page 52 (not in print).

References (Continued)

6. Cragg, T.A.; "Saturn In 1959"; Str. A.; Volume 15; Numbers 3-4; pages 60-62.

7. Cragg, T.A.; "Saturn In 1960"; Str. A.; Volume 15; Numbers 7-8; pages 124-132.

THE TELESCOPIC APPEARANCE OF VENUS

By: Henry Brinton, F.R.A.S. and Patrick Moore, F.R.A.S.

During some recent observations of Venus, made by the present writers, an effect was observed which, whether or not it is associated with the planet itself, seems difficult to explain. The Schröter Effect, or difference between theoretical and observed dichotomy, is well known; and it was in studying this phenomenon that the new effect came to our notice.

The effect referred to was first observed just after theoretical dichotomy in 1962, and has been noticed once or twice since; but was not apparent in the weeks immediately preceding dichotomy. It takes the form of a telescopic image of the planet which appears to be part of a less than half-illuminated sphere. That is to say, the line joining the cusps is less than a diameter. The observations were mainly by Brinton with his 12-inch refl. and by Moore with his 8.5-inch reflector and also jointly with Brinton's 12-inch. The result was checked by using totally untrained observers, who were not even told what they were looking at. They were merely asked to look through the eyepiece and to draw what they saw. Their drawings not only confirmed the effect but also established what we had suspected: that the effect was much clearer with a low magnification than with a larger one.

A search through existing photographs showed the effect to a marked degree in many cases. Since, however, some photographs of the Moon and of Mercury also showed the same effect, though to a lesser degree, we arranged for some photographs to be taken of an artificial planet. C. Crosthwaite, who did this work for us, has shown that the effect is easily produced by underexposure. Photographic evidence, therefore, will be useless. The only satisfactory way to study the effect will be with micrometrical measurements. British weather and the present southern declination of Venus made these very difficult to get between the time when the effect was first observed and the 1962 inferior conjunction and will continue to hamper the work. It is, therefore, asked that Venus observers who feel inclined to help should make as many measurements as possible and communicate with Brinton (Old Mill House, SELSEY, Sussex, England).

This is necessarily only a preliminary note, and the problem is likely to remain obscure until much fresh evidence is available; but, whether the effect is due to seeing conditions or is associated with Venus itself, it presents some interesting features.

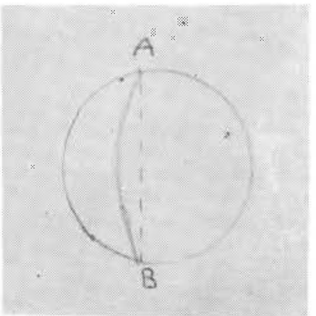

FIGURE 3. Rough sketch to illustrate Venus phase effect discussed by authors Moore and Brinton in their article. Geometry alone would make the line joining the cusps, A and B, equal to a diameter at all phases. In the observations here described this line was found to be less than a diameter.

Note by Editor. Perhaps the most conservative explanation of the Brinton-Moore Venus phase effect would be that the cusps of the crescentic planet are merely not seen at their true geometric locations. Poor seeing, bright sky-background, poor transparency, low magnification, small apertures, etc. would all increase the difficulty of recording the thin, dim tips of the crescent. Photographs would suffer from these handicaps too. If this interpretation is valid, then the Brinton-Moore effect should become less pronounced as observing conditions improve.

In any event this effect should receive some study, perhaps as part of a systematic general effort to compare the observed and geometric phases of Venus over all phases and not just near dichotomy.

STANDARD LUNAR CRATER OUTLINES

By: Patrick S. McIntosh

In keeping with the trend of this technological age amateur astronomy is in the throes of evolving into a more specialized pasttime. The serious amateur must now come to a full and realistic evaluation of his limitations and his special abilities. Recent issues of The Strolling Astronomer have correctly underlined the direction that amateur lunar research must now take. In general, random sketching of scattered features is of little value. Professional lunar cartography and the space program are making it increasingly difficult for the amateur to contribute to the detailed picture of the moon. Three areas of lunar research which now appear open for work by competent and well-equipped amateurs are: refining of photographic charts by taking fullest advantage of visual acuity and superior seeing conditions, determination of vertical dimensions of features through careful measurements of shadow lengths, and patrol of features suspected of variations. It goes without saying that these observations must be of extraordinary accuracy, as compared to the usual amateur lunar observations. Large telescopes, photographic equipment, and filar micrometers are great boons in this research; but far too few amateurs are fortunate enough to have the use of such instruments. Therefore a simple aid in obtaining the desired accuracy is here proposed -- standard lunar crater outlines.

Other sections of the ALPO are already finding that standard observing forms are helpful in increasing the efficient use of telescope time, in increasing the accuracy of relative positions of planetary features, and in making it easier to compare observations. It has occurred to others[1] that the use of lunar photographs as a base for visual observations would be of great value, but the scale of even the greatly enlarged photographs in the Photographic Lunar Atlas is too small for visual work. The shortcoming is easily remedied by making enlarged outline charts of craters, such as Standard Crater Outline No. 1, here published as Figure 4. This was constructed by placing a transparent overlay ruled into 1/10th inch squares over the print in the Photographic Lunar Atlas and sketching the details square by square onto 1/4 inch-square graph paper. This process allows almost no loss of detail or accuracy and enlarges the photograph in the ratio of 2:5. The resulting scale of the original outline chart was 1:470,000 with 1 mm. to 0".3 or 0.47 kms. This generous scale and the care in reproducing every photographic detail gives a multitude of easily identified and accurately placed reference points for use in positioning the more delicate detail seen with the telescope. This outline is somewhat more complete and accurate than the one appearing in a previous article,[2] except that here only the well defined craterlets on Plato's floor are included.

The use of such standard crater outlines is not without some difficulties; but, if these are recognized and allowed for, very good accuracy in the placing of fine detail can be achieved. The most serious problem is the complex changes in apparent shape of a crater that occur during libration. The appearance of Plato in this outline chart is that of

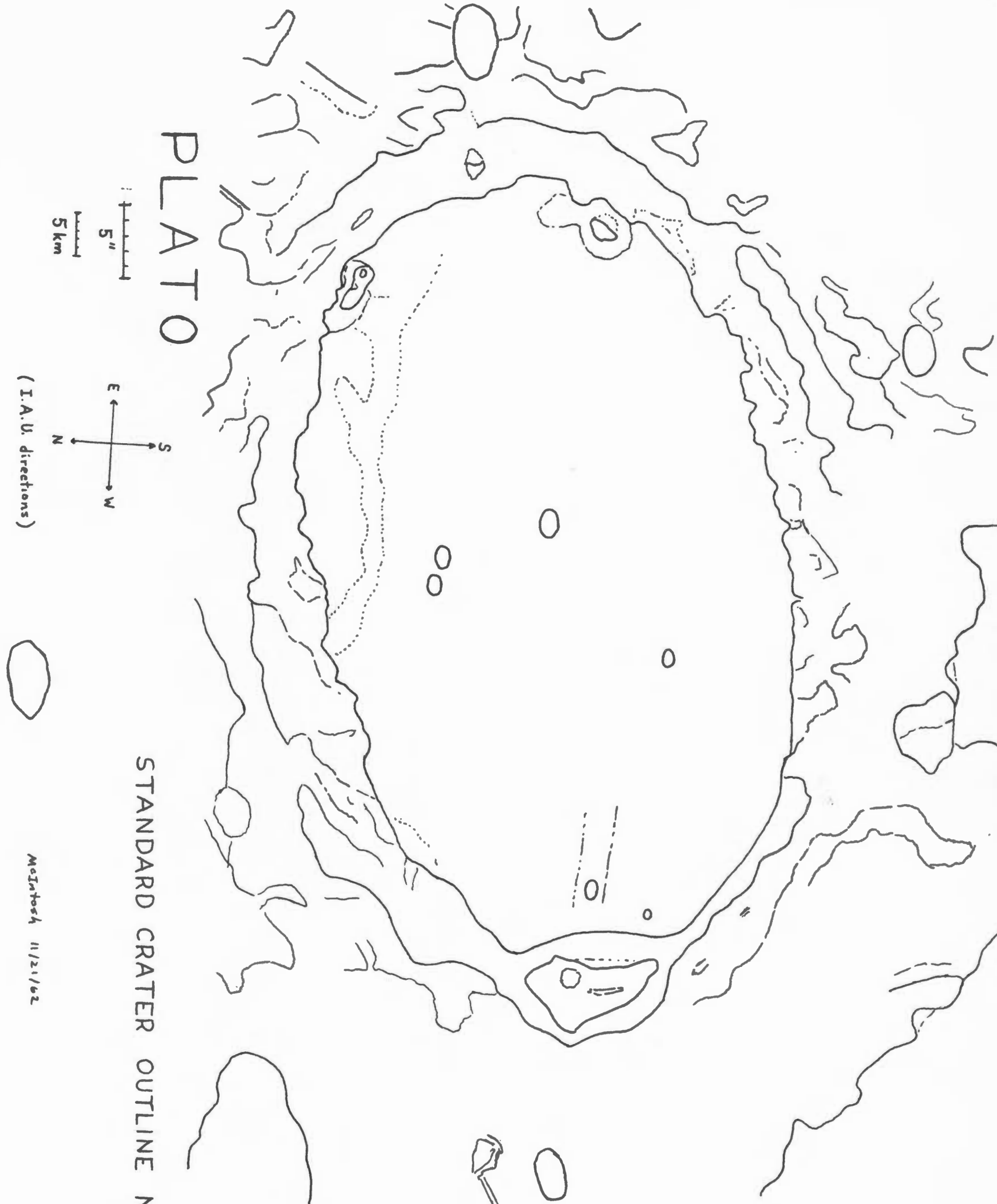

FIGURE 4. Standard Crater Outline No. 1, Plato and its environs. Constructed by Patrick S. McIntosh from Plates D-1a and D-1e in the Kuiper Photographic Lunar Atlas. See also discussion in article "Standard Lunar Crater Outlines". Lunar directions on Figure 4 and in this article are the new I. A. U. directions.

approximately mean libration, so its usefulness is maximized. It has been my experience with Plato that no matter what the libration, triangulation of the fine detail with prominent rim detail will always give the same position. However, regions near the limb will require two or more outlines for adequate coverage. As an example of triangulation, an imaginary line passing from the craterlet in the southwest part of the floor through the central craterlet intersects the rim at the west end of a prominent mound nestled close to the rim. Another line through this craterlet passes through the craterlet in the streak near the west wall and intersects the south rim at a prominent indentation. All other floor detail can be located in a similar manner. Of course, the craterlets mentioned in the example were positioned from the photograph and may be used for reference in placing more delicate detail. The outlines of depressions, ridges, and craters adjacent to Plato are also included as additional, easily identified features for use as reference points.

An almost equally important difficulty is how to create a crater outline that can be used at all solar lightings. Most of Outline No. 1 was made from Plate Dl-a (lunar sunset), but the west rim (in shadow on D 1-a) had to be filled in with the aid of Plate D 1-e. The appearance of the base of the rim adjacent to the crater floor is well presented, but only the top ridge of the rim could be outlined in addition. As ALPO observers use this and subsequent outlines, it is hoped that improved ways of representing craters in outline form will be developed.

All interested ALPO observers should take tracings of this outline to the telescope to add fine details to the crater floor, altering the outline into a more accurate form when seeing permits, and always positioning detail with the greatest care by triangulation with the many outcrops, indentations, mounds, and craterlets appearing on the outline. A great amount of detail in the form of complex light patches, delicate bright spots and pits have been mapped in Plato in the past. The most recent and reliable charts [3,2] will serve as a check on the effectiveness of this outline in increasing the positional accuracy of visual mapping of Plato. It is important that visual estimates of shadow lengths be attempted with the use of this outline. If the response of ALPO observers is favorable, outlines of other popular and problematic lunar features will be constructed. Observations made with the use of this outline should be sent to me for evaluation. It would be of interest to know what points on the outline are used for reference in locating each added detail. My address is Sacramento Peak Observatory, Sunspot, New Mexico.
[Mr. McIntosh will carry on this study and others in his new post as an A.L.P.O. Lunar Recorder. - Editor]

Footnotes

[1] The Strolling Astronomer, 16, May-June, 1962, page 144.

[2] Patrick S. McIntosh, "In Defense of Visual Observations of Plato", The Strolling Astronomer, 16, September-October, 1962, page 205.

[3] Alika K. Herring, "A Re-Examination of the Plato Problem", The Strolling Astronomer, 16, July-August, 1962, page 158.

BODE'S LAW APPLIED TO THE SATELLITES OF JUPITER, SATURN AND URANUS

By: H. M. Hurlburt

The distances of the planets of our Solar System from the Sun were observed to fit a regular pattern by the German astronomer, Bode, in the eighteenth century. This pattern, Bode's Law, can be stated as:

$$R = a + 2^{n-1}d \quad \text{for} \quad n \geq 1, \; R = a \text{ for } n = 0,$$

where R is the distance of the nth planet from the Sun and a and d are constants. For example, the index number of the planet Mercury is zero, and the distance is a or 0.4 astronomical units; while the Earth is number two in the sequence, and its distance from the Sun is 0.4 + 2d. By definition the Earth is one astronomical unit from the Sun so that d = 0.3 a.u!s. In spite of very good agreement of the planets' distances with the mathematical formula above there is no direct, clear-cut physical explanation for it.

Fairly recently, however, accretion theories which rather successfully account for the origin of our Solar System have begun to take shape, and out of these has come Bode's Law as a consequence rather than a merely empirical statement unsupported by reason. The Von Weizsäcker Mechanism of 1943 and the Protoplanet Hypothesis of Kuiper both require the ratio of a planet's distance from the Sun to the distance of the planet just inside it to be about two; and this ratio, of course, is Bode's Law.

A feature of both Von Weizsäcker's Mechanism and Kuiper's hypothesis is that the process for the planets' formation can easily be extended to account for the formation of satellites about a planet. In this case Bode's Law should account for the distances of satellites from a planet. It is therefore interesting to attempt to fit the observed distances of a planet's satellites to a sequence like the formula above to test this alleged applicability to satellites of a relation observed for planets a couple of hundred years ago.

The Table contains the results. Only the satellite systems of Jupiter, Saturn, and Uranus were examined because only these planets have a sufficient number of satellites for fitting the possible law. As a matter of fact, only the five inner satellites of Jupiter were included in the fitting since the other Jovian satellites lie in two distinct groups as far as their distances from their planet are concerned. The distances of the two groups have, moreover, a ratio of two as in Bode's Law but seem to be unrelated to the distances of the five inner satellites from Jupiter.

In each of the satellite systems examined the agreement of satellite distances with the "Bode's Law" which best fits the system is good over most of the distances to a pleasing degree. Each system, however, perhaps fortunately, contains distances which deviate somewhat extremely from the pattern. It will be noticed, moreover, that the extreme deviations occur where the satellite size, that is, mass, is of a different order from that of the satellites which fit the pattern well. For example, the innermost Jovian satellite has a mass which is almost negligible compared to the masses of the next four satellites. The most extreme deviation in the Uranus system is for the next-to-last satellite, whose mass is much larger than average; while the extreme deviation in the Saturnian system comes at about the middle of the sequence, where the satellite mass is again extreme compared to the masses of its neighbors.

The Saturnian system has another interesting feature. If it is assumed that there is a gap in the Bode's Law sequence between the two outermost known satellites one obtains a very good fit for Bode's Law there -- otherwise, no. One can therefore infer the possible existence of an undiscovered satellite at that distance -- about 4,100,000 miles out -- with a period of a little less than seven months.

A Fit of the Distances of Satellites from Jupiter, Saturn and Uranus to the Sequence a, a + d, a + 2d, . . . , $a + 2^{n-1}d$. ($n \geq 1$.)

The Five Inner Satellites of Jupiter. a = 127. d = 132.8.

i	R_i	R_i obs/10^3 miles	R_i comp/10^3 miles	Dev'n.	% Dev'n.	Diameter Miles
0	a	113	127	+ 14	11.0	150?
1	a + d	262	260	- 2	0.8	2000

Table (cont.)

i	R_i	R_i obs/10^3 miles	R_i comp/10^3 miles	Dev'n.		% Dev'n.	Diameter Miles
2	a + 2d	417	393		-24	6.1	1800
3	a + 4d	666	658		- 8	1.2	3100
4	a + 8d	1170	1190	20		1.7	2800
				34	-34		
		The Satellites of Saturn.		a = 112.	d = 31.1.		
0	a	115	112		- 3	2.7	300 ?
1	a + d	148	143		- 5	3.5	350
2	a + 2d	183	174		- 9	5.2	500
3	a + 4d	234	237	+ 3		1.3	500
4	a + 8d	327	361	34		9.4	1000
5	a + 16d	759	610		-149	24.2	2850
6	a + 32d	920	1108	188		17.0	300 ?
7	a + 64d	2210	2105		-105	5.0	800
8	(a + 128d)	-	4098	-	-	-	-
9	a + 256d	8034	8084	50		6.2	200 ?
				275	-271		
		The Satellites of Uranus.		a = 81.4.	d = 39.6.		
0	a	81	81.4	+ 0.4		0.5	-
1	a + d	119	121	2		1.7	600 ?
2	a + 2d	166	161		- 5	3.1	400 ?
3	a + 4d	272	240		- 32	13.3	1000 ?
4	a + 8d	364	398	34		8.6	900 ?
				36.4	- 37		

Satellite observed distances are taken from Baker's Astronomy.

AN EXPLANATION OF THE PECULIAR TWIN CRATERS MESSIER AND W. H. PICKERING

By: Patrick S. McIntosh, Lunar Recorder

The peculiar twin craters, Messier and W. H. Pickering, have long drawn much attention to Mare Fecunditatis. The elliptical shape of these craters is not in accordance with what is expected from foreshortening. The major axes of the ellipses are almost perpendicular to that of nearby foreshortened craters. This circumstance, plus the existence of a long, low hill passing between the craters, has led to the interpretation that Messier and W. H. Pickering are the two ends of a gigantic tunnel bored beneath the low hill by a meteorite hitting the moon at a very low angle. Some observers have even reported mysterious changes in the shapes of these craters throughout a lunation. Photographs, however, disprove that any such changes occur.*

Dinsmore Alter gives this description of Messier and W. H. Pickering from his lunar studies with the 60-inch Mt. Wilson reflector:[1]

"1. A saucer-like depression exists, partly between them.

"2. The southern ray is a series of bright spots; the northern one, under some illuminations, is observed to branch near the middle of its course, with a very faint component turning slightly northward.

* The Editor would disagree in this sense: changes in apparent shape with changing solar lighting do occur and have received support from photographs.

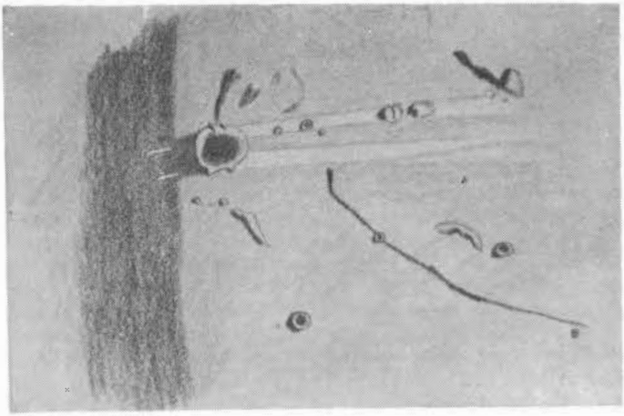

FIGURE 5. Lunar Crater W. H. PICKERING. Drawn by Patrick S. McIntosh with a 4-inch Unitron refractor at the Sacramento Peak Observatory, July 12, 1960. $7^{h}45^{m}$ - $8^{h}01^{m}$, U.T. 250X. Seeing 8-9. Transparency 5. Colongitude = 131°.9. The rays shown running east (right) from Pickering appeared rounded and elevated above the mare. See also text.

"3. The two main rays are tangent not only to W. H. Pickering but also to another crater of approximately the same size farther east.[2] This eastern crater, especially under a morning sun, is less conspicuous than the other, but merely because of a light background. In the afternoon it is more nearly comparable.

"4. The second of the four pictures [Moore-Chappell Lick photograph of June 2, 1938] shows three more craters of about their size farther east on the same line. These last ones may be merely coincidental.

"5. Bright spots similar to the line of the southern ray usually indicate craterlets.

"6. The conclusion is that probably an east and west fault line exists in the surface rock and that a minimum of three volcanic craters have formed along it, with 'blowhole' craterlets along the southern ray. If this is true, there is nothing mysterious about the pair."

Figure 5 is a view of the interesting pair as seen when the sun has set on Messier except for the north and south rims. The seeing was excellent, affording a chance to resolve the row of bright spots mentioned above into their true forms as shadow-holding crater cones and rough hills. It is noteworthy that the rays exist despite this row of features! It was noted that the rays appeared slightly rounded and were raised above the mare. It seems that this is in keeping with Dr. Alter's interpretation, since the volcanic pressure could have raised the mare floor along the length of the fault. The raised area would be bright because the lunar dust would settle into the lower mare, leaving the top of the arched ray uncovered. Notice the delicate rill that stops abruptly at the edge of the northern ray. It is likely that the rays of Messier and W. H. Pickering are younger than this fault; otherwise the fault might have crossed the ray.

References

[1] Alter, Dinsmore, P. A. S. P., Vol. 70, pp. 491-2, 1958.

[2] East as in the sky. The new ACIC Lunar Charts have east and west reversed from the sky directions, in accordance with an IAU resolution of 1961. [The A. L. P. O. needs to make a decision about how to use east and west on the moon. The I. A. U. resolution reverses the usage in lunar literature for a great many years. The Editor and the Lunar Recorders will welcome constructive discussion from members. - Editor]

JUPITER: A NEW DISTURBANCE AND AN "OLD" THEORY

By: Elmer J. Reese, Assistant Jupiter Recorder

A new Disturbance of major proportions has broken out in Jupiter's South Equatorial Belt. Congratulations go to Larry Bornhurst of Monterey Park, California for being the first observer to report this new Disturbance. Mr. Bornhurst observed a thin, dark festoon connecting the dark SEB_n and the delicate SEB_s at longitude (II) 234° on September 24, 1962. The Disturbance was also observed by Mr. B. M. Peek in England the following night, and by Mr. Alika Herring on September 27. Since then, the Disturbance has developed into a typical SEB upheaval. Transit observations of the Disturbance indicate that the center of eruption is remaining very nearly stationary at longitude (II) 245°. The retrograding SEB_s branch of the new Disturbance is remarkably active, and its influence seems to be spreading into the S. Tropical Zone in longitudes preceding the Red Spot. New members who are not familiar with the general appearance and characteristic behavior of the major Disturbances which occur in the SEB from time to time can find much useful background information in the references listed at the end, especially references 1 and 2.

A theory presented by the writer in 1953 suggested that the SEB upheavals on Jupiter are the result of eruptions from one or more sub-surface sources having a constant rotation period.[3] Two constant rotation periods for the hypothetical sources were found to be compatible with the observed longitudes of all the initial outbreaks of Disturbances that had been observed up to that time. The longer period, about $9^h\ 55^m\ 42^s.6$, was preferred to the shorter period, about $9^h\ 54^m\ 52^s.6$, because the former was in keeping with the fact that a characteristic feature of all the Disturbances was the continued ejection of spots from a seat of eruption that remained almost stationary in System II for many months.

When the SEB Disturbance of 1955 broke out directly over the primary source of the longer period, the theory appeared to be well established. A letdown came when the 1958 Disturbance failed to satisfy either of the two sources of the longer period. The theory seemed to be in trouble. However, independent studies by Mr. Takeshi Sato[4,5] and Mr. S. Cortesi[6] showed that the 1958 outbreak occurred directly over the main source of the shorter period, and that the residuals for the outbreaks of 1943B and 1955 were nearly identical - hence they could be attributed to a secondary source rotating in the shorter period. The observational evidence then seemed to be favoring the shorter period.

Observations of the new SEB Disturbance of 1962 and recent deductions concerning the unobserved 1937 outbreak have given very considerable support to the longer period sources. The 1962 Disturbance broke out directly over the secondary source. A daily drift of + 0°.0476 relative to System II for two sources of eruption results in zero residuals for the outbreaks of 1919, 1928, 1937, 1943, 1955, and 1962. Residuals of + 22° and + 18° for the outbreaks of 1949 and 1952 are too large to be attributed to observational error; however, B. M. Peek[7] and F. J. Hargreaves[8] have suggested that each source may be an extended area, or may contain two or more "volcanoes" in a compact group, and that sometimes one and sometimes another member of the group erupts. The residual of + 23° for the 1943B Disturbance could result from observational error since that Disturbance was only a partial one and lacked those features from which an accurate fix could be made on its actual center of eruption. Perhaps a future Disturbance will establish a third source of eruption which will account for the 1958 outbreak, which was far removed from either the primary or the secondary source of the longer period.

In a personal letter some years ago, Dr. Joseph Ashbrook pointed out that our "problem has some analogy to the variable star problem of finding the period of an Algol-star from a few widely separated times of minimum. In such a case, there is risk of lighting upon a spurious period which accidentally fits the observations. But obviously each additional observed

Longer Period Sources ($9^h\ 55^m\ 42^s.587$)

Disturbance (J. D.)	Observed (II)	Computed (II)	O-C	Source
1928, Aug.10 (2425469)	128°	128°	0°	1
1937, Aug. 5 (2428751)	285	285	0	1
1943, Feb. 7 (2430763)	20	20	0	1
1949, Jul.19 (2433117)	155	133	+22	1
1952, Oct.22 (2434308)	208	190	+18	1
1955, Feb. 4 (2435143)	229	229	0	1
1919, Dec. 8 (2422301)	221	221	0	2
1943B,Feb.27 (2430783)	288	265	+23	2
1962, Sep.23 (2437931)	245	245	0	2
1958, Mar.27 (2436290)	47	-	-	-

epoch considerably reduces the risk of this." With this in mind, I made a thorough study of the published B. A. A. Jupiter records in 1937 and 1938 in an attempt to deduce, if at all possible, the time and longitude of an SEB eruption which undoubtedly occurred either late in 1937 or early in 1938. Students of the Giant Planet might very well gasp when they see the data for the unobserved outbreak of 1937 listed above! I hasten to admit that the data are extremely uncertain - in fact they are based on deduction rather than on direct observation. Because of the importance of this outbreak to the theory being discussed, some details of the deduction may be in order. On page 9 of the Thirty-First Report[9] we read: "On August 31 Phillips recorded that the SEB_s which was quite distinct in the longitudes presented (350° II) lay very far south, making the S. Tropical Zone extremely narrow." Now it is a normal characteristic of SEB Disturbances for the SEB_s to be displaced southward in those longitudes occupied by the retrograding spots of the SEB_s branch, even though the spots themselves may not be readily visible (as in 1955). Though hardly convincing, this could indicate that the 1937 Disturbance was already in progress on August 31 and was centered somewhere near 300° (II). A little lower on page 9 of the same report we read: "The appearance of the preceding end of the Red Spot suggests that some of the white material from the S. Trop. Zone may be making an incursion on the Spot. On October 10 Phillips wrote that it certainly seemed to be fading." Now it is also a normal characteristic for the Red Spot to begin to fade about 66 days after the outbreak of an SEB Disturbance. This would fix the date of the outbreak near Aug. 5, 1937. Another characteristic of an SEB Disturbance is for the following end of a dusky section of the SEB Z to remain almost stationary near the longitude (II) of the initial outbreak for a month or two, sometimes for many months. Drawings of Jupiter made in late 1937 and early 1938 were scrutinized in the hope of finding a tell-tale following end of a dark section of the SEB Z. Such a marking was found near 285°(II) on a drawing by J. E. Phocas on May 30, 1938. Upon this flimsy evidence rests the data for 1937. I was unaware of the longitude of the hypothetical sources when making these deductions, and was greatly surprised when a zero residual was determined. This residual is hardly significant since the data are so uncertain or even dubious; however, the general agreement is very significant amd encouraging. But this little story does not quite end here. It was later realized that the following end of the dark section of the SEB Z on the drawing of Mr. Phocas was apparently caused by the intrusion of a large white oval in the S. Tropical Zone at the preceding end of the recently revived S. Tropical Disturbance. Now the graph of the preceding end of the S. Tropical Disturbance on Plate VIII of the Thirty-First Report indicates that that famous feature reappeared near 289°(II). This lends some indirect support to the deduction that the initial outbreak of the SEB Disturbance of 1937 did indeed occur near 285°(II). Time and again it has been found that Disturbances in the S. Tropical Zone tend to appear and disappear near the

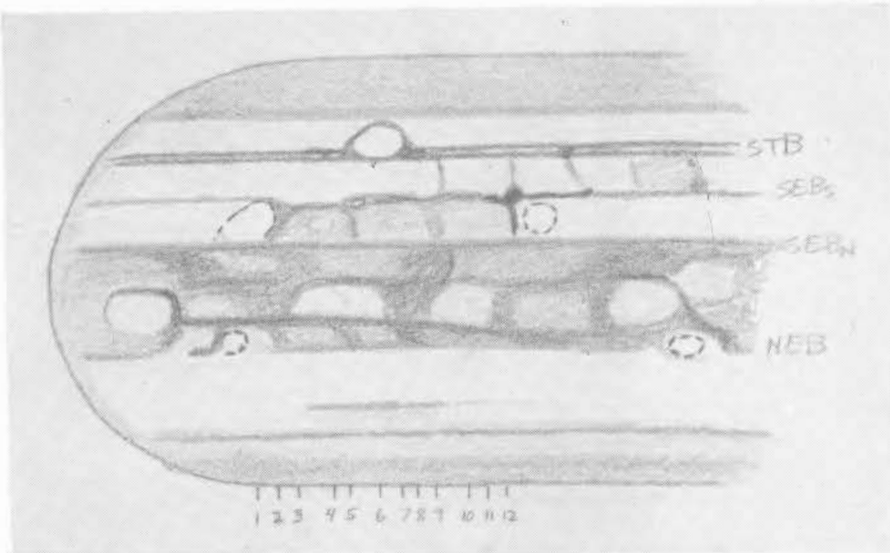

FIGURE 6. Continuous drawing of Jupiter by Patrick S. McIntosh with a 4-inch Unitron refractor at the Sacramento Peak Observatory. November 4, 1962. $2^h 25^m$ to $4^h 15^m$, U.T. 167X. S = 5-8, seldom below 6. T = 5 (no wind). $C.M._1 = 320^\circ$ to 27°. $C.M._2 = 173^\circ$ to 240°. The lines numbered 1 through 12 at the bottom are lined up in longitude with features of which central meridian transits were observed. Mr. Reese interprets the white spot in the SEB Z following mark 12 as the "eye" of the 1962 major SEB Disturbance. Marks 5, 6, and 7 refer to long-enduring oval BC in the STeZ. Note the abundance of detail associated with the SEB Disturbance in the SEB Z, the SEB_s, and the STrZ.

FIGURE 7. Drawing of Jupiter by Alika K. Herring with a 12.5-inch reflector at Haleakala, Hawaii. October 31, 1962. $4^h 48^m$, U.T. 208X. S = 7-8. T = 5. $C.M._1 = 135^\circ$. $C.M._2 = 19^\circ$. Note the extremely intricate internal structure of the Red Spot and two of the retrograding SEB_s spots prec. the Spot. It was found that such spots failed to pass the Red Spot when their motion brought them to its prec. end, and dusky material developed in the STrZ prec. the Red Spot in early November, 1962.

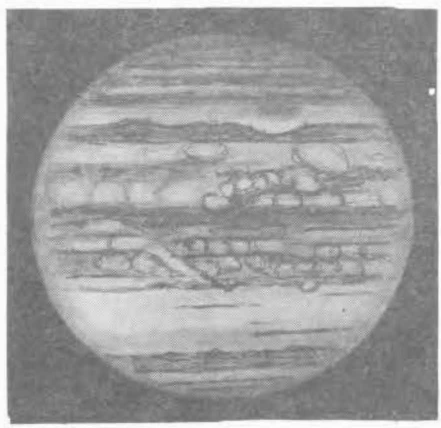

FIGURE 8. Drawing of Jupiter by Alika K. Herring with a 12.5-inch reflector at Haleakala, Hawaii. November 1, 1962. $5^h 7^m$, U.T. 208X. S = 8-9. T = 5. $C.M._1 = 305^\circ$. $C.M._2 = 181^\circ$. Note the complex structure of the SEB components and the intervening SEB Z. Mr. Herring stresses that it was quite impossible to draw adequately the tremendous wealth of detail revealed on Jupiter by the excellent seeing existing for Figures 7 and 8.

longitude either occupied or to be occupied by the center of eruption of a major SEB Disturbance [10,11,12]. Reference number 10 is a gem and should be studied by anyone interested in these matters.

Rev. T. E. R. Phillips observed the initial eruption of the SEB Disturbance of 1919 when it was still a small, round dark spot on December 8. Unfortunately the longitude of this spot was not indicated in the B.A.A. report for that year. Mr. B. M. Peek did some fine detective work and concluded that the initial eruption in 1919 took place somewhere between longitudes (II) 221° and 236°, most probably near 230°. Later, however, Mr. Peek obtained an original observation of the 1919 Disturbance from Mr. Harold Thomson. This observation places the following end of a series of dark festoons in the SEB Z at 216° and the preceding end of a series of SEB_s dark spots at 227°. This clearly indicates that the center of eruption must have been somewhere between 216° and 227°, most probably near 221°. This last figure is the one used in the table above.

It is a strange coincidence that the SEB Disturbances continue to erupt near hypothetical sources rotating in both the longer and shorter periods. Even though three major Disturbances have broken out since the theory was first suggested, it is still uncertain whether one, the other, or neither of the suggested periods has any physical significance. If the deduced data for the 1937 Disturbance could be trusted, the evidence in support of the longer period would be almost convincing.

References

1. B. M. Peek, The Planet Jupiter, Chapters 17 and 27, 1958.

2. The Strolling Astronomer, Vol. 13, pp. 58-81, 1959.

3. J.B.A.A., Vol. 63, No. 6, pp. 219-221, 1953.

4. The Strolling Astronomer, Vol. 13, pp. 148-152, 1960.

5. The Heavens, (O.A.A.), Vol. 40, No. 411, pp. 219-223, 1959.

6. S. Cortesi, "La formation des bandes de Jupiter", L'Astronomie (B.S.A.F.), pp. 63-70, February, 1960.

7. J.B.A.A., Vol. 63, No. 6, p. 222, 1953.

8. J.B.A.A., Vol. 63, No. 7, p. 278, 1953.

9. Memoirs of the B.A.A., Vol. 35, Part 1, 1942.

10. Memoirs of the B.A.A., Vol. 35, Part 4, p. 17, 1946.

11. J.B.A.A., Vol. 69, p. 256, 1959.

12. Sky and Telescope, August 1962, p. 74.

Postscript by Editor. The development of the 1962 SEB Disturbance may be studied in the illustrations which accompany this article and in the splendid front cover drawings. This material was supplied by Mr. Philip Glaser, the Jupiter Recorder. The details shown will clarify much of Mr. Reese's discussion above and also arguments in the references cited. These drawings will repay careful study. The front cover drawings illustrate beautifully the SEB_s spots (X and Y) moving in increasing longitude, the SEB_n detail (P) moving in decreasing longitude, the complexity of detail in the SEB Z as the Disturbance developed, and the persisting near-stationary location of the initial outbreak relative to System II (here at about 245°).

It should be noted that Mr. Reese wrote this article on November 25, 1962.

SOME IMPORTANT MARTIAN PHENOMENA IN 1958

By: Tsuneo Saheki, Director Mars Section

Oriental Astronomical Association

(Paper read at the Ninth A. L. P. O. Convention at Long Beach, California. August 24-26,1961.)

Abstract

A very rare phenomenon, a star being occulted by Mars, occurred on the night of November 21, 1958. It was, of course, unexpected; but some observers located at the region near 35° of latitude in Japan did observe it successfully. Next, very curious features on Mars, the appearance of flashes or flare-like spots (glowing up), were detected by four observers of our group, especially Mr. I. Tasaka, who has succeeded in recording these bright spots' flaring and fading.

Occultation of a Star by Mars

An unexpected occultation of a star by Mars occurred on the night of November 21, 1958. On that night, I was observing Mars with my 8-inch reflector; during this observation I saw a faint star, about 6 or 7 in stellar magnitude, at a small distance to the N.W. of the planet and approaching the N. limb of Mars very slowly. I was watching this decreasing distance from Mars to the star until $21^h\ 50^m$ J.S.T. (U.T. = J.S.T. - 9^h = $12^h\ 50^m$), and then I decided that there would not be an occultation. Hence, I stopped my observation that night owing to my condition of health. Unfortunately for me but very luckily for our studies, this occultation occurred a short time after I gave up the observations. Owing to the fact that the star was barely hidden by Mars' N.E. edge at Osaka (latitude 35°), the observers north of Osaka couldn't see this curious phenomenon.

The reported data about this phenomenon are as follows:

Occultation of B.D. +18° 459 (Mag. 7.3) occurring on Nov. 21,1958.(Time in U.T.)

Observer	Station	Telescope	Disappearance	Reappearance	Remarks
Ichiro Tasaka	Shingū, Wakayama	32.5cm.Refl.	$13^h\ 13^m$ ($\pm$ 5m)	-	9 mag.?
Tadanori Gotō	Osaka	20cm. Refl.	$13^h\ 20^m$	-	Time is exact.
Takeshi Satō	Hiroshima	15cm. Refl.	$13^h\ 24^m$-25^m	-	8 Mag.?
Sanenobu Fukui	Kōbé	25cm. Refl.	-	about $13^h\ 20^m$?	8-9 Mag.

The observers reported to me as follows:

Mr. Gotō observed this phenomenon hearing the time signals on radio, and so the time might be rather precise.

Mr. Sato saw the star pass behind Mars during the time interval $13^h\ 24^m$-25^m,U.T. At $13^h\ 47^m$ the distance between the E. limb of Mars and the star was about 7/10 of Mars' semi-diameter, using Saheki's estimation from Sato's drawing (Figure 9, drawing B).

Mr. Fukui found that the star reappeared at about $13^h\ 20^m$, but the time is very uncertain. Mag. 8 - 9; after half an hour, at $13^h\ 55^m$, he estimated that the distance from the E. edge of Mars to the star was equal to the diameter of Mars.

Mr. Tasaka observed that at $13^h\ 13^m$ ($\pm$ 5^m) , a 9 or 10 mag. star was occulted by Mars, the disappearance being at the N. limb where the Martian northern polar cap was bright and reappearance being at the E. limb of the planet where the prominent marking Sinus Margaritifer was seen. He wrote: "At the time the star was occulted, I found the star's brightness decreased due to the obscuring Martian atmosphere, I think. When the star approached to a distance from the limb about 1/10 of the planet's diameter, I could still easily see the star; but the distance between Mars and the star decreased until when within 1/20 - 1/25 of Mars' diameter, the star faded out. The sight of this occultation was very beautiful; I felt that the appearance of a twinkling star above the bright north polar cap was seen like a beautiful sunset landscape on the great snow field."

Identification of this faint star was made by Mr. Sigeru Kaho of Tokyo Observatory and by Mr. Ichiro Hasegawa, Director of the Computing Section of the O. A. A. The star is B.D. + $18^{\circ}459$, Mag. = 7.3, Spectral Type A0, AG885 = GC3971 = NZC480.

Curious Bright Spots Which Flared Up on Mars

Sometimes very bright but small white patches appear on Mars, as I have already reported. The first, in so far as I know, is a flare-like white spot observed by the late Sizuo Mayeda in 1937 near the dark spot Sithonius Lacus. The second is one of two which were detected by me, on December 9, 1951 at the western part of Tithonius Lacus, which remained bright for about 5 minutes. The third was found by me on the night of July 1, 1954; this bright spot flashed for 5 seconds only on the Edom Promontorium. Mr. C. C. McClelland observed a bright spot at Allegheny Observatory of the University of Pittsburgh, using a 13-inch refractor at $4^h\ 32^m$ on July 24, 1954 (U.T.), also on Edom Promontorium; and this bright spot was seen for about 58 seconds.

In 1958 very luckily I received reports of 5 bright spots from four observers, and these reports contain many valuable observational facts. I shall describe them one by one.

(a). Bright spots appearing near Tithonius Lacus and Solis Lacus

At $0^h\ 03^m$ on November 7, 1958, J.S.T. (U.T. Nov. 6, $15^h\ 03^m$) Mr. Sigeji Tanabe at Sizuoka, with his 8-cm. reflector at the power 190X, seeing 5 - 6, found a bright spot on the S.W. edge of Tithonius Lacus (using the direction as Areographic); and it was as bright as the Polar Cap. This brightness was estimated by him at about 8.5 on a standard scale (0 is black, 10 is brightest). This spot's brightness continued for about 4 minutes; after this time it quickly faded out. (Figure 10, drawing B).

At $0^h\ 05^m$ on November 11 (U.T. Nov. 10, $15^h\ 05^m$), only 4 days after Tanabe's observation, Mr. Sanenobu Fukui at Kōbé, using his 25-cm.reflector with the power 400X, also discovered a bright and white small spot near the N.E. portion of Solis Lacus. He recorded: "I found this curious bright spot when I was studying the details of Solis Lacus, at about $15^h\ 05^m$ (U.T.). It was as bright as the North Polar Cap, but I could see it for only about 5 minutes. I computed its diameter at about 250kms. from my drawing." (Figure 10, drawing A.)

(b). Bright Spots on Edom Prom. and the N. edge of Hellas

Brightening of Edom Promontorium was first detected by me at $13^h\ 15^m$ on July 1, 1954, as already referred to above; the second record of it was made by Mr. Clark C. McClelland of Pittsburgh on July 24, 23 days after my first observation, in the same year. His report, written by him on 30 October, 1958, is as follows:

"On July 24, while observing the planet Mars, I noticed an unusually bright flare appear on or near the planet's surface. This appeared in the region called Edom Promontorium. It grew in brightness from nothing to + 1 in Mag. and then diminished. (The Mag. I give above compares in

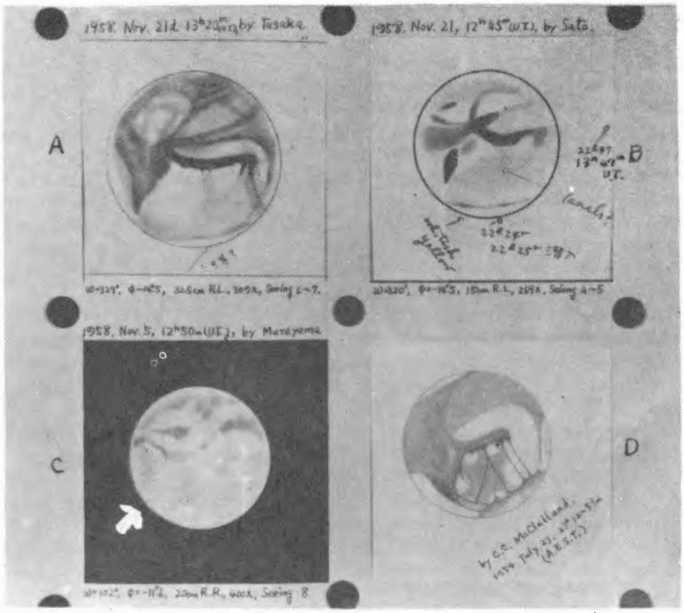

FIGURE 9. Drawings of Mars to show various unusual phenomena. See text of paper "Some Important Martian Phenomena in 1958" in this issue.
A. Drawing by I. Tasaka on November 21, 1958. Arrows show path of star occulted on this date. Bright "flare" over Edom Prom.
B. Drawing by Takeshi Sato on November 21, 1958. Note positions of star occulted.
C. Drawing by Sadao Murayama on November 5,1958. Arrow points to flare near Nix Tanaica.
D. Drawing by C.C. McClelland on July 24, 1954. Flare over Edom Prom.

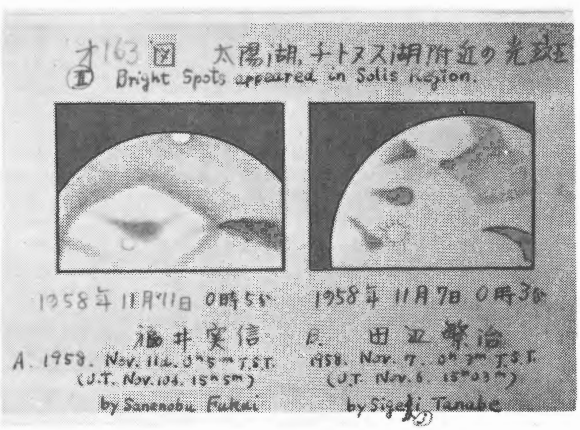

FIGURE 10. Two drawings of Mars showing a bright flare near Solis Lacus. Drawing A by Sanenobu Fukui on November 10,1958. Drawing B by Sigeji Tanabe on November 6, 1958. See also text of Mr. Saheki's article in this issue. (U.T. dates in captions of Figures 9 and 10.)

brightness as seen with the unaided eye.) The flare lasted for a duration of 58 seconds. It was no doubt something of great force, possibly of volcanic origin or meteoritic impact." He started this observation at 23^h 32^m, E.S.T. and stopped at 23^h 53^m, with a 13-inch refractor of

Allegheny Observatory at the power of 260X. (Figure 9, drawing D.)

Mr. McClelland's observation is a good and important confirmation for my object 23 days earlier. In 1958 Mr. Tasaka succeeded in detecting a similar phenomenon on this portion of Mars in greater detail and also saw an unusual glowing of the N. edge of Hellas on the night of November 21, when the occultation occurred.

As already stated, I was observing the planet Mars on the night of Mr. Tasaka's observation until $21^h\ 50^m$ J.S.T. (U.T. $12^h\ 50^m$). During this observation I sometimes remarked that the N. edge of Hellas and Edom Promontorium brightened abnormally, but seeing conditions were not very good (under 5 on Standard Scale), so that I didn't believe my impression valid. As soon as my observation ended, Mr. Tasaka started his; and he succeeded in seeing the occultation, and soon after this phenomenon he noticed the brightening of Edom and the N. edge of Hellas with his 32.5-cm. reflector, powers 309X and 240X and seeing 6 - 7. His report is as follows (Figure 9, drawing A):

"At about $22^h\ 25^m$ J.S.T. (U.T. $13^h\ 25^m$) I found Edom was brightening, and at $22^h\ 35^m$ it flared up suddenly and reached its brightest stage. It was a very distinct white (rather yellowish) patch. At the same time I found that the N. top of the whitish yellow cloud covering the northern half of Hellas increased in brightness to become as strong as the Edom Spot; these flares lasted for about 5 minutes and then began to fade, and at $13^h\ 40^m$ (U.T.) they had returned to their normal appearances. However, it is very interesting to note that they again started to flare up soon and reached their new maximum at $13^h\ 50^m$, as strong as at $13^h\ 35^m$. During this brightening and fading, I was watching Mars through my 32.5-cm.; and although sometimes the seeing conditions varied, I saw that there was no relation between these flares and the variation of seeing conditions, and so I am sure that I saw actual phenomena."

Mr. Tasaka's report gave me an explanation for these flares in that they may occur due to sudden development of white clouds as a special meteorological phenomenon of a limited area on the surface of the planet.

(c). Nix Tanaica? Or a Flare?

On the night of November 5, 1958, Mr. Sadao Murayama, at the National Science Museum of Tokyo, observed Mars with a 20-cm. refractor using a power of 400X, seeing 8. During this observation he found a bright but tiny spot near the terminator of the disk. It was seen of a whitish color and very bright. He thought at first that it was Nix Tanaica, but he later must reject this opinion because its position was too far south to be Nix Tanaica. He started his observation on that night at $21^h\ 50^m$ J.S.T. ($12^h\ 50^m$ U.T.); and as soon as he began his study, this spot was discovered. Near 22^h (13^h U.T.) this spot faded and almost disappeared. This flare continued for about 5 minutes, he said. The position of this tiny bright spot was estimated by me from Mr. Murayama's drawing to be longitude 42°, latitude 35° N. Hence, the spot appeared at the S.W. edge of Mare Acidalium or at the N.E. end of the N. component of the double band-like canal Nilokeras. (Figure 9, drawing C). A similar white patch in a similar position was observed several times by me (Saheki) from July 23 to August 3 in 1954, but at that time I recorded it as a small but very bright cloud in this position without any flare up or fading.

All of these curious flare-like bright spots show me many important facts:

(1) The spots brighten for about 5 minutes, except only one in 1954.
(2) The frequency of occurrence of these flare-like spots is rather high.
(3) The areas on Mars where these bright spots appear seem to me to be limited to complicated areas of topography, where there exist special conditions of Martian meteorology.

Considering these facts, I would like to explain these phenomena as the sudden development of white clouds of moisture brought about by rapid upward currents in the atmosphere due to very complex local meteorological phenomena over these limited areas, or else to the rapid development of clouds of moisture produced by the great force of active volcanoes which erupt intermittently. Unfortunately, however, we cannot examine these curious phenomena with any physical methods, and so I can't give any explanation. For this reason I present only reports of observations of them here.

OCCULTATION OF SATURN BY THE MOON ON SEPTEMBER 11,1962

By: C. F. Capen

The occultation of Saturn by the twelve-day-old gibbous Moon on September 11, 1962 was observed at the Table Mountain Observatory in Los Angeles County, California (lat. 34°22' N, Long. 117°41' W, Alt. 7,500 ft.). A battery of telescopes was employed for the observation: A 4-inch f/15 refractor using 120X for visual timed events, a 16-inch Cassegrain f/20 using a variable focal-length ocular 381X - 666X for visual timed events, and a 6-inch refractor with amplifier lens (-3X) at f/45 for photography with a Praktica reflex 35 mm. camera and a Miranda reflex 35 mm. camera. Both cameras contained Plus-X pan film.

The Plus-X pan was processed in fine grain developer Microdol X for 11 minutes at 68°F (20°C). Because of the considerable relative brightness difference between Saturn and the illuminated lunar limb a wide range of photographic exposures was chosen from 1 second to 1/50 second in order to record the various phases of events of emersion.

The seeing varied from 1 - 4 on a scale of 0 - 10 best. Transparency was 4 on a scale of 0 - 5 best.

The poor contrast condition encountered during the initial observation, due to the bright sky prior to sunset, was the decisive factor against using the 16-inch Cassegrain reflector for photography because of its intrinsic bright field. In fact, the faint planet, Saturn, was not located in a telescopic field until it was already half occulted by the dark limb of the Moon and was only noted with the aid of the 4-inch refractor during the immersion period.

WWV radio time signals, vocal comments, and camera shutter pulses were recorded on a tape recorder for timed events. The data were later reduced by the aid of a stop watch to 0.1 seconds accuracy, and the negatives and prints were critiqued for observational and photographic technique.

Although every photographic negative exposed after V. Capen first "marked" the Saturnian rings emersion from the bright lunar limb at $02^h\ 24^m\ 12^s.6$ U.T. recorded the rings, only a few negatives exposed later were chosen for printing because of the difficulty of reproducing (by dodging) the faint image of Saturn next to the bright limb of the Moon. Figures 11 and 12 show two stages of the emersion.

Virginia W. Capen recorded the visual timed events with the aid of the 4-inch refractor, Mars Capen maintained and recorded the WWV signals from the National receiver, and Charles Capen recorded the photographs through the 6-inch refractor operating at f/45.

The time required for the reappearance of the rings (from first contact to second contact) was $58^s.2$ with a relative error of 0.053, which was calculated from the given apparent diameters of Ring A and the planetary disk according to H. Struve, Pub. del'obs. Central Nicolas. XI, p. 226, 1898. The time required for the reappearance of the disk (first contact

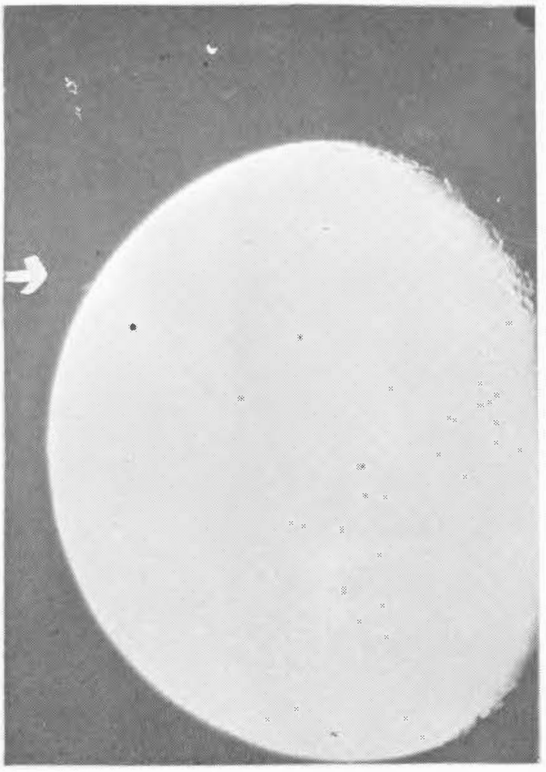

FIGURE 11. Occultation of Saturn by the Moon on September 11,1962. 6-inch f/15 refractor at Table Mountain Observatory. Photograph by C. F. Capen. Plus X pan, 1/50 sec. exposure. $2^h\ 25^m\ 45^s.9$, U.T. Arrow points to Saturn just off the bright limb of the Moon.

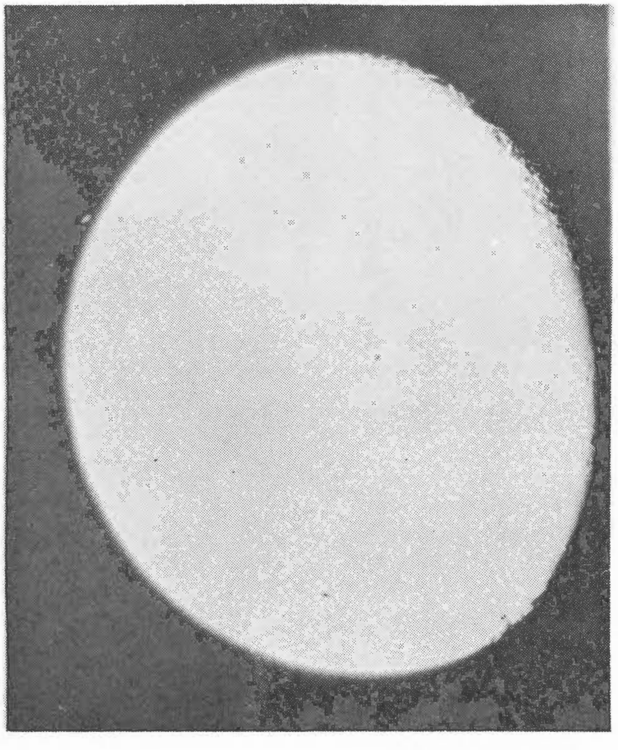

FIGURE 12. Occultation of Saturn by the Moon on September 11, 1962. 6-inch f/15 refractor at Table Mountain Observatory. Photograph by C. F. Capen. Plus - X pan, 1/25 sec. exposure. $2^h\ 27^m\ 1^s.2$, U.T.

FIGURE 13. Aerial view of the Jet Propulsion Laboratory's new Table Mountain Observatory in Los Angeles County, California. Figures 13, 14, and 15 contributed by C.F. Capen. Address Table Mountain Observatory, Box 259, Wrightwood, California.

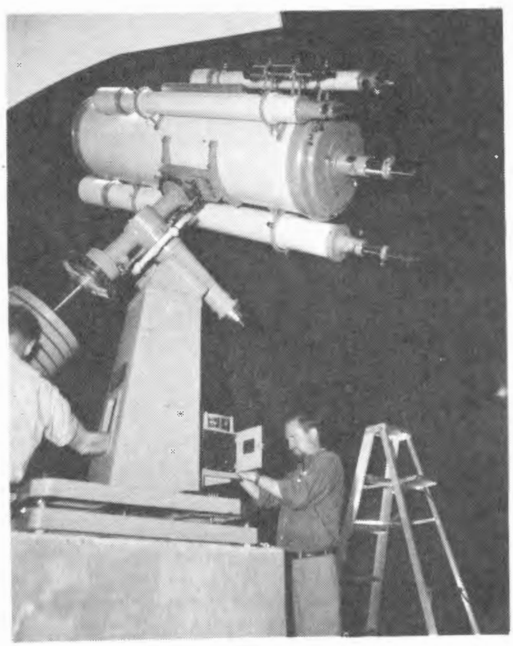

FIGURE 14. Attaching the clock-drive to the 16-inch Cassegrain reflector at the Table Mountain Observatory. Mr. C.F. Capen, Resident Observer, to right.

to second contact) was $27^{s}.2$ with a relative error of 0.054. The rings' emersion angle with a line tangent to the lunar limb at the point of reappearance was approximately 22° as observed from the Table Mountain Observatory location and was measured from enlarged prints.

Figures 13, 14, and 15 show something of the new Table Mountain Observatory.

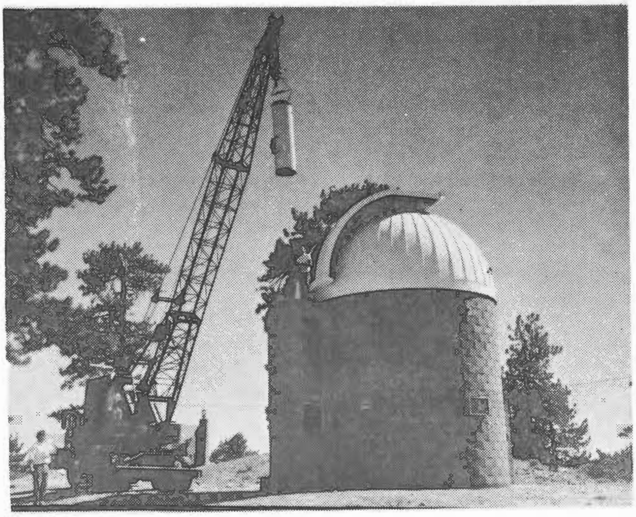

FIGURE 15. Installation of tube of 16-inch Cassegrain in J. P.L. Table Mountain Observatory. Summer of 1962.

Emersion Data

The rings were first noted visually upon emersion from the lunar bright limb at 7: 24: 12.6 P.M., P.D.T. or $02^h\ 24^m\ 12.^s6$, U.T.

$2^h\ 24^m\ 14.^s1$, U.T.	First photo $1/2^s$ exposure. Rings recorded on negative.
23.7	Saturn's disk edge noted visually (first contact).
26.1	Photo $1/2^s$ exp. Rings and disk edge recorded on negative.
48.6	Photo $1/50^s$ exp. Rings and partial disk recorded.
50.9	Saturn's full disk noted visually (second contact).
25^m 05.8	Photo $1/2^s$ full disk recorded. Rings tangent.
10.8	Rings noted complete visually (second contact).
16.8	Photo $1/2^s$ exp. Rings recorded full on negative.
25.4	Photo $1/2^s$ exp.
38.1	Photo $1/50^s$ exp.
45.9	Photo $1/50^s$ exp.
26^m 17.2	Photo $1/50^s$ exp.
29.2	Photo $1/50^s$ exp.
41.3	Photo 1^s exp.
27^m 01.2	Photo $1/25^s$ exp.
11.2	Photo $1/2^s$ exp.
24.0	Photo 1^s exp.
34.2	Photo $1/50^s$ exp.
32^m 34.9	Photo 1^s exp.
42.0	Photo $1/2^s$ exp.
$55.0 \pm 5.^s0$	Photo 1^s exp.
34^m 42.6	Photo $1/2^s$ exp.
50.0	Photo $1/50^s$ exp.
35^m 03.6	Photo $1/2^s$ exp.
09.9	Photo 1^s exp.
45.5	Photo $1/2^s$ exp.
58.0	Photo 1^s exp.

ABSTRACTS OF THREE PAPERS GIVEN AT THE A.L.P.O. CONVENTION AT MONTREAL

The Reported "Cloud Satellites" of K.Kordylewski, by Richard G. Hodgson

The "Cloud Satellites" reported by Kordylewski to be revolving around the Earth in the orbit of the Moon at Lagrangian point L 5 urgently await confirmation by other observers. G. Colombo of the Smithsonian Astrophysical Observatory has raised theoretical indications that particles at the Lagrangian points in the Earth-Moon system cannot be stable due to the perturbations of the Sun. Except for a few negative photographic observations by the Smithsonian, little has been done which might evidence their existence, stability, nature, and extent. Much of this work is probably within the range of amateur equipment. Observation requires special conditions of dark, transparent skies, free from moonlight, Gegenschein, aurorae, and Milky Way interference. The Lagrangian point also must have considerable altitude and be in opposition to the Sun.

The Reduction of Instrumental and Atmospheric Effects, by Rodger W.Gordon

Amateur and professional astronomers are plagued in their observations by the following disturbing factors: diffraction, secondary spectrum, glare or brightness, and atmospheric effects. Naturally any devices which reduce or eliminate these factors are of help in observations. To eliminate or reduce such effects a Metzger Glare Reduction Screen or apodizing mask and color filters were used on a 4-inch refractor at various powers from 120X to 375X during 1961 - 62. The screen was used mainly to reduce glare and atmospheric effects, while the filters were used to cancel secondary spectrum and thereby to increase contrast. The screen also modifies the diffraction pattern of extended images. For those interested, the Metzger Screen is fine wire mesh mounted in Kraftboard which slips over the objective. The wire is 1/16 inch thick; and the spacing between the wires is 1/4 inch, which is the correct size for a 4-inch aperture - for larger telescopes the sizes must be altered proportionately. The color filters used were mainly Wratten XI, K2, and 25A.

On most nights the use of the screen or filters will permit a 20% increase in usable magnification on a 4-inch telescope. For example, on a night when 167X was the maximum permissible magnification without the screen, the screen permitted the use of 214X with complete satisfaction. This range of magnification is most helpful for Jupiter and Saturn, although on extremely good nights 250X may be used on a 4-inch. For Mars and Venus 300X and 375X can be used with the screen due to these planets' greater brilliance per unit area. Color filters are also recommended for these planets to reduce glare and to increase contrast. It is true that these devices can exhibit spurious effects in telescopic images, but the careful amateur can usually avoid any such pitfalls.

I recommend that all planetary observers use such devices. They permit observations of comparatively high quality under mediocre conditions. I have discussed these matters also in the May, 1962 and July, 1962 issues of "The Observer", published by the Lehigh Valley Amateur Astronomical Society.

Current Atmospheric Research, by G. W. Rippen

Events that we observe as weather give rise to two major atmospheric electrical effects. The first of these is the 3.6×10^5 volt potential maintained between the surface of the earth and the ionosphere by cumulonimbus activity. The second also has its origin in cumulonimbus cloud activity. Some of the energy given off as lightning takes the form of electromagnetic waves. These waves are called "sferics". Each lightning discharge radiates at least one sferic. Some twenty million lightning discharges occur in the atmosphere every day. Part of the energy released by these discharges escapes into space. Most, however, bounces back and forth between the surface and the ionosphere until it is used up in the form of heat.

Precipitation and large wind-storms stem from cumulonimbus type cloud activity. This type of cloud activity is usually characterized by the separation of electric charge. In the absence of thunderstorm activity, a clear weather field-strength of a characteristic value is established. As the atmospheric disturbance approaches, the field strength decreases and may, on occasion, even go negative. The magnitude of the negative value increases to a maximum at the closest approach of the disturbance. As the disturbance moves away, the field slowly regains its original strength. Variations in the field strength can be explained, somewhat, by considering the disturbance as a giant electric dipole, with the center of positive charge oriented vertically above the usually negative earth.

Discharges from cloud to cloud, top of cloud to bottom of cloud, and cloud to ground are almost always preceded by an array of complex minor discharges called leaders. These leaders advance in stepwise fashion, following most highly stressed areas between centers of opposite charge. Leaders begin about 10^{-3} seconds before the main lightning arc and often advance as many as thirty to forty steps. Each step produces an electromagnetic disturbance and a sudden change in the field-strength. These disturbances, called 'Delta', have been and are being used to determine the distance and direction of storms from a station. There may be other sophisticated interpretations that can be extracted from them.

Sferics and earth field-strength data are extremely effective tools for forecasting. The reason lies in the fact that cumulonimbus clouds and some other types of clouds provide excellent indications of potentially turbulent air. The recording of sferics at a station constitutes a summation of the weather activity in that area. The profile recorded shows the birth, growth, and death of various cells. A set of simple formulas was recently developed that makes it possible to determine the direction and distance to a system from field observations only.

We expect to balloon launch sferics equipment to test its reception ability. The instrument package will consist of transistors and microminiature components. It is hoped to reach an altitude of between 80,000 and 100,000 feet. Two launches scheduled for the summer of 1963 are planned for altitudes of 200,000 feet. [Mr. Rippen wrote on November 12, 1962 that one very successful test to date has now cleared the way for the 200,000 feet launches in mid-1963.]

There are many areas in sferics research that are promising for the future. One of these is the development of the equipment to such a degree that it will be possible to determine within one-half mile at a range of at least one hundred miles the point where a tornado is going to strike.

Early in 1964 NASA and the Weather Bureau plan to launch a Nimbus satellite containing some sferics equipment. The first Nimbus will be launched from Vandenburg AFB early in 1963 aboard an Atlas-Agena B rocket.

PROSPECTS FOR THE A. L. P. O. LUNAR SECTION

By: John E. Westfall, Lunar Recorder

Goals

The Lunar Section of the A.L.P.O. is currently undergoing a revision of goals and methods with the object of increasing the value of amateur contributions to modern selenography.

It is my opinion that the greatest opportunity for amateur contributions is the intensive study of selected lunar regions.[1] These regional studies would result in the publication, in The Strolling Astronomer, of a series of topographic maps at a scale of 1:500,000 (about 8 mi./in). During the beginning phases of the project, it will probably be best to concentrate on a single region: this "trial area" is that of Aristarchus, Herodotus, and the "Cobra Head". Ultimately, depending on results and response, other regions should be added so that at least one will always be illuminated.

Program

The general plan of action is as follows:

(1) Construction, using Kuiper's Photographic Lunar Atlas, of an outline map of the region, on an orthographic projection and 1:5000,000 scale.

(2) Distribution of the outline map to interested observers who will revise it and add details and notes to it at the telescope.

(3) Determination of relative altitudes within the region, using both the shadow length method[2] and the shadow-terminator contact method.[3] These altitudes would be applied to the outline map.

(4) Construction of a relief model from (i) photographs, and (ii) the altitudes found in step (3). Contours would be taken from the 1:250,000 scale model.[4]

(5) Compilation of the final map (scale 1:250,000, to be reduced to 1:500,000) from the results of the previous steps.

Instrumental Requirements

Amateur observers could contribute to steps 2, 3, and 4 as follows:

Step 2 - Probably only instruments of aperture 8 inches or more would be useful, and results with larger instruments would be correspondingly more valuable. Given exceptional seeing or optics, or an experienced and careful observer, smaller apertures could be used, however.

Step 3 - With the shadow length method, a 4-inch refractor, or 6-inch reflector could be used although, as in step 2, larger instruments would be better. The shadow-terminator contact method, however, requires at least 8 inches of aperture and good transparency to be reliable.

Step 4 - High quality amateur photographs are essential. Usable results can be had with 8-inch reflectors, but there is special need for photographs taken with instruments of 12 inches or larger.[5]

Requests

The program outlined above won't, of course, get anywhere without cooperative effort. Thus, I have three requests to make:

(1) Information. (This can be ignored by those who have responded to Mr. Robinson's query in the Jan.-Feb., 1962 Strolling Astronomer, p. 39.) The Section requires the following information from those interested in participating:

1. Name.
2. Address.
3. Telescopic equipment. Do you have a micrometer?
4. Are you able to take lunar photographs? If so, briefly describe your equipment, methods, and results.
5. Hours per week usually available for observing.
6. Are you able to make morning observations?
7. Artistic ability.
8. Lunar books, charts, etc. available to you.
9. How long have you been an observing amateur?
10. Math background.
11. Would you be willing and able to calculate?

(2) Photographs. Photographs of the Aristarchus-Herodotus-"Cobra Head" egion are requested. We would include observatory photographs which might e available to an individual observer, but which have not been published. otographs contributed should be enlarged to the largest scale compatible

with clarity and lack of grain. Whole-disc photographs are on too small a scale to be usable.

(3) Since the Lunar Section is your section, it should reflect your wishes. For instance:

1. What do you think of the program as a whole? Do you think something else would be more valuable? If so, what?
2. What regions do you feel need concentrated study? Why?
3. Do you have any suggestions as to the methods outlined above?

Conclusion

It is hoped that more specific information can be supplied as the program is gradually implemented. For the time being, communications can be sent to me:

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

References

1. J. E. Westfall, "A Suggested Program of Lunar Research." Str.A.,13,Nos. 1-4 (Jan.-Apr. 1959), pp. 6-8.
2. Joseph Ashbrook, "Finding the Height of A Lunar Mountain." Str. A.,16, Nos. 9-10 (Sep.-Oct, 1962), pp. 214-216.
3. J. E. Westfall, "A New Method for Measuring Lunar Mountain Heights." Str. A., 10, Nos. 11-12 (Nov.-Dec. 1956), p. 127.
4. J. E. Westfall, "A Relief Map of Eratosthenes." Str. A., 16, Nos. 9-10 (Sep.-Oct. 1962), pp. 209-214.
5. F. Jack Eastman,Jr., "Lunar Photography." Str.A.,16,Nos. 7-8 (Jul.-Aug. 1962), pp. 145-154.

ON THE PROBLEM OF THE ENERGY NECESSARY TO PRODUCE THE LUNAR RING-MOUNTAINS

By: Péter Hédervári, Geophysical Institute, Budapest, Hungary

(Paper read at the Ninth A. L. P. O. Convention at Long Beach, Calif., August 24 - 26, 1961.)

Recently we have been occupied with a very interesting selenological and also vulcanological problem: how great was the energy involved in the formation of the lunar craters,or better, ring-mountains? Here we shall summarize our calculations.

As is well known, there are many theories about the origin of the craters on the moon. The author of this paper will here follow the volcanic hypothesis. Naturally it does not appear impossible that smaller craters may have originated by means of meteoritic impacts as well. However, the writer represents the geophysical point of view on this problem; i.e., he thinks that the most important forces which produced the moon's surface features must have originated from the interior of the moon.

In our present study we used the same method as in I. Yokoyama's research.[1] Dr. Yokoyama, a vulcanologist, studied very intensively the activity of several volcanoes in Indonesia and Japan. According to his interesting investigations, the most important of the several kinds of energy shown by active volcanoes is thermal energy, represented by the heat of lava. The energy of active volcanoes appears in the following different forms:

a. The energy of air-waves during and after an explosion.

b. The energy of volcanic tremors and earthquakes.

c. Potential energy, represented by the change in the lava level between the magma-chamber and the surface during an explosion of the volcano.

d. Kinetic energy, represented by the mass and velocity of ejected volcanic rubble and ash.

e. Thermal energy, as mentioned above. The amount of thermal energy is usually 10, 100, and even 1000 times greater than the other kinds of energy. This same large ratio also holds during the process of formation of volcanic islands. Therefore, the thermal energy is the total energy, for all practical purposes. When we want to calculate the energy required in the formation of volcanic islands, we need to compute the thermal energy and can neglect the other kinds of energy.

The thermal energy is Dr. Yokoyama's formula is a function of the total volume and the mean density of the volcanic islands. In our present calculations we applied this expression to lunar craters. We needed to determine the mass of the crater-walls; but we could ignore the existence of central peaks, which have very small masses compared to the total mass of the walls. We used Baldwin's data in calculating the mass of the walls.[2] According to our results, the thermal energy - that is, the total energy - for lunar craters is a function of diameter, rim-height, and mean density. We used for the density of the lunar surface rocks 2.7 gms. per cu. cm. We obtained for lunar craters:

Diameter (kms.)	Mass (gms.)	Energy (ergs)
1	2.7×10^{15}	3.39×10^{25}
10	3.0×10^{17}	3.77×10^{27}
50	9.2×10^{18}	1.16×10^{29}
100	3.6×10^{19}	4.52×10^{29}
150	7.0×10^{19}	8.79×10^{29}
200	1.1×10^{20}	1.38×10^{30}

We also used our formula to compute the thermal energy necessary to produce Mauna Loa in Hawaii and Aetna in Sicily.

Mauna Loa, mass 2.0×10^{20} gms., energy 2.6×10^{30} ergs.

Aetna, mass 2.3×10^{18} gms., energy 2.9×10^{28} ergs.

It is extremely interesting to note that the energy for Mauna Loa, one of the largest volcanic islands on the earth, is of the same order of magnitude as for Clavius, one of the largest lunar craters.

Let us compare the lunar data mentioned with the thermal energy in ergs computed by certain persons for some earthquakes and volcanic explosions!

Adatarasan volcano, Japan, 1900, 6.40×10^{21} (Yokoyama).

Una-Una volcano, Celebes, 1898, 1.80×10^{22} (Yokoyama).

Guntur volcano, Java, 1843, 6.50×10^{22} (Yokoyama).

Earthquake in Messina, 1909, 5.70×10^{23} (Sieberg).

Earthquake in San Francisco, 1906, 1.60×10^{24} (Sieberg).

Kilauea volcano, Hawaii, 1952, 1.80×10^{24} (MacDonald).

Earthquake in Mino Ovari, Japan, 1891, 2.20×10^{24} (Sieberg).

Mauna Loa volcano, Hawaii, 1907, 3.00×10^{24} (Hédervári).

Submarine explosion near the Azores, 1957, 3.70×10^{24} (Tazieff).

Earthquake in South Chile, 1960, 4.60×10^{24} (Hédervári).

Earthquake in Lissabon, 1775, 1.70×10^{25} (Gutenberg).

Aetna volcano, Sicily, 1669, 1.90×10^{25} (Hédervári).

Kluchewskaya volcano, Kamchatka, 1829, 6.70×10^{25} (Hédervári).

Skaptar Jökull volcano, Iceland, 1783, 5.20×10^{25} (Hédervári).

Tambora volcano, Indonesia, 1815, 8.40×10^{26} (Yokoyama).

Ooshima volcanic island, Japan, 2.00×10^{27} (Yokoyama).

Soofu-Gan volcanic island, Japan, 4.60×10^{27} (Yokoyama).

South Sulphur volcanic island, Pacific Ocean, 2.50×10^{28} (Yokoyama).

We can calculate that the energy necessary for the creation of all the craters on both hemispheres of the moon was at most about 1.364×10^{32} ergs. The energy necessary to produce all the lunar mountain ranges may have been about only 8.5×10^{29} ergs. According to the theory of the moon's expansion [3, 4], we can calculate the energy necessary to lift the lunar crust and mantle during the process of expansion. It turned out that the energy thus required was about $5.6 - 6.7 \times 10^{28}$ ergs per year at a time when the moon still had a metallic core. The moon's expansion lasted more than 10^7 years. If the craters formed during a period of, say, 2.0×10^7 years, then the energy demanded for crater formation in one year was only about 1/10,000 as large as the energy necessary to lift the surface layers as mentioned above. Therefore, during the expansion of the moon the energy available - the source was the transformation of the metallic core of the moon - was many, many times greater than that quantity necessary to produce tectonic processes on the surface of our moon.

References

1. Bulletin of the Earthquake Research Institute of Tokyo, 34, 185, 1956; 35, 75, 1957; and 35, 99, 1957.
2. The Face of The Moon, Chicago, 1949.
3. Hédervári, The Strolling Astronomer, Vol. 14, Nos. 9-10, 1960.
4. Hédervári, Magyar Fizikai Folyóirat (Hungarian Physical Review of the Hungarian Academy of Sciences), 1960, 4.

PETROLOGY OF THE LUNAR CRUST

By: Gary Wegner

In past papers the author has given reports on colorimetric and spectroscopic observations of the Moon which were an attempt to determine the basic composition of its surface by matching the color reflectivity curves of terrestrial and lunar materials. The results of these studies, which are in good agreement with earlier investigators, are basically as follows: The color reflectivities of the marial materials (those in the lunar maria) resemble terrestrial basalts, and those of the bright continental regions resemble terrestrial granites. This result could indicate that the basic mineral compositions of the Earth and the Moon are not much different when the effects of erosion and living organisms are neglected in the case of the Earth.

It must be remembered, however, that these results are only relative since no direct chemical analysis has yet been done for the Moon. Nevertheless, identifications of minerals on the Moon in terms of the different color reflectance species can be made. Studies of this type on the fine details of the Moon were made visually by the author using a 10-inch Dall-Kirkham reflector (f = 184 inches) and a deep red Wratten 70 filter. With the Wratten 70, the contrast between the bright continental materials and the darker marial materials is increased from what it is in white light, and an identification of the different minerals is easily made. In general, the bright areas appear brighter with the filter, and the maria appear darker.

The features studied by these means were domes and the faces of faults. The faults were observed to determine if their faces were of marial or continental materials and to see if any stratification was present. The domes were studied to determine their colors and to learn their relation to the colors of other lunar features. Most regions were studied over a period of a few lunations from September, 1961 to September, 1962. All areas were studied at different solar illuminations.

Usually the mineral identifications were made in two ways. At low illuminations, regardless of composition, the faces of some faults appear bright because they are inclined at angles so that they reflect more light to the Earth than do the other features which at that time have long shadows and appear darker. At high illuminations, the marial materials appear darker, while the continental materials are bright. This change in contrast aids in determining the relative compositions. With the Wratten 70 filter, this difference is more apparent. At low illuminations, if the face of a fault is of a marial composition, it will darken with the filter; but if it is of the continental materials, it will remain bright. The same general thing happens at the higher illuminations, but it is not so marked as at the lower illuminations.

The following regions have been studied to determine the composition of their faces and to check for stratification:

Region	Apparent Composition (M = marial, C = continental)	Number of Observations
Apennine Mts.	M and C	11
Altai Mts.	C	5
Leibnitz Mts.	C	6
Straight Wall	M (and C)	12
Alpine Valley	C	5
Hyginus Cleft	C	7
Ariadaeus Cleft	C	5
Rill Near Gassendi	C	4
Schroeter's Valley	M	5
Rill N. of Plinius	M	3
Rills near Sabine	M	3
Fault near Cauchy	M	3

One interesting result of these observations is that beneath the surface of the upper portions of the lunar crust, the composition still appears to be of the two materials already mentioned. Perhaps this indicates that the lunar surface may not be homogeneous in composition under a layer of dust. If this were so, all regions would probably show the same apparent composition.

The search for stratification gave negative results. All the above-listed fault features were checked for hints of stratification effects at magnifications of 241, 368, and 654 diameters, both with and without color filters. Even under the best conditions and with the highest powers, no signs of lunar stratification were detected, excepting possibly with the

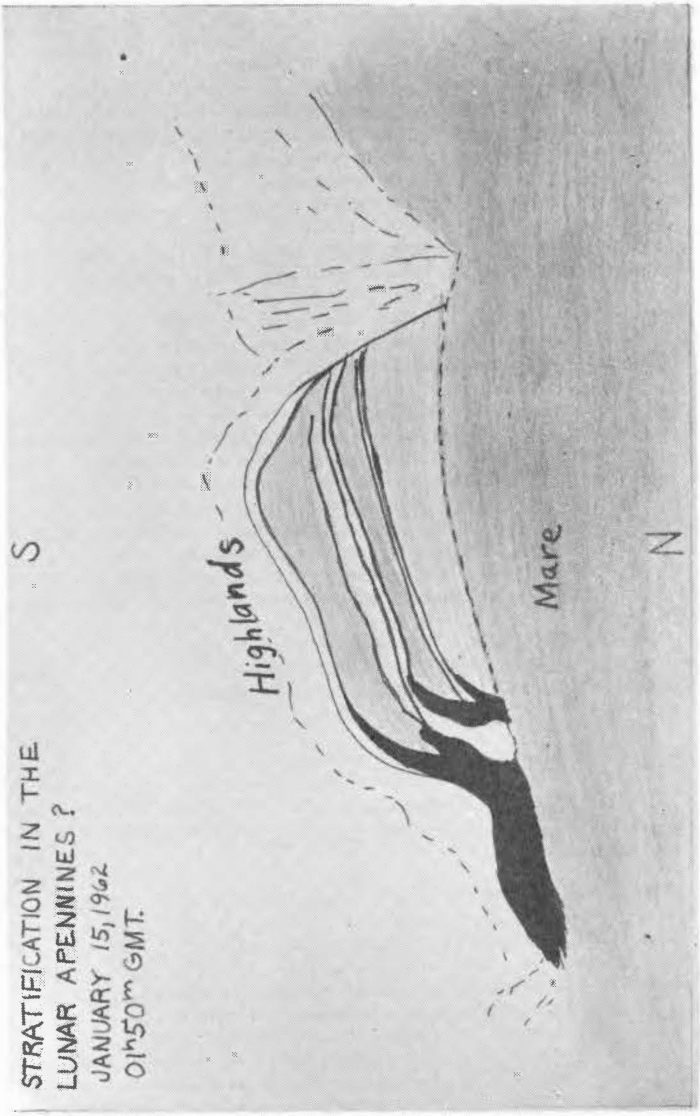

FIGURE 16. View of possible stratification in the lunar Apennines. Observation by Gary Wegner on January 15,1962 at 1^h 50^m, U.T. with a 10-inch reflector. Colongitude = 17°.7. See also text of Mr. Wegner's article.

Apennines. These mountains showed the presence of both the continental and <u>marial</u> materials. (Figure 16). These Apennines areas, however, may be too wide to be considered strata and could represent differences in lighting along fractures in the face of the cliffs. Perhaps the best explanation for the invisibility of strata is not that they do not exist, but instead that they are below the resolution of the instrument. If the lunar surface was formed in different stages, the different flows of whatever materials were there would have left a record in the form of strata. Perhaps if the lunar strata are thin and are composed of materials of very similar intensity and color, they cannot be detected even with the largest instruments.

The lunar domes gave no trouble in their detection, and were easily visible for study when they were at low illuminations. In all cases, these features were found to resemble the surrounding <u>maria</u> in their color reflectivities. The following domes were observed; the numbers given are the designations of Mr. Kenneth Schneller in his important catalog:[1]

1, 2, 66, 67, 83, 88, 116, 117, 118, 121 to 130,

138, 151, and some from 56 to 65.

Reference

1. Kenneth Schneller, "A Catalogue of Lunar Domes", <u>Journal of the Planetary and Lunar Spectroscopical Society</u>, <u>2</u>, 1, 1961.

BOOK REVIEW

TABULAE CAELESTES (Star Atlas), Schurig-Götz. Published in Germany. Available from the U.S. and Canadian distributor, Herbert A. Luft, 69-11 229th Street, Oakland Gardens 64, N.Y. Published in 1960, Epoch 1950, $3.85.

Reviewed by J. Russell Smith

Since star maps are more or less universal in character, one does not need to know German to use this atlas.

Two north polar maps are used to cover the region from the pole to + 30°, and two south polar maps are used to cover the region from the pole to - 30°. These maps are 14" in diameter, which is sufficiently large to prevent cluttering. The four equatorial maps, which measure 9½ x 13 inches each, are also sufficiently large and cover from + 40° to - 40°. Preceding the 8 charts, the authors list the Greek alphabet followed by a listing of the constellations with the abbreviation for each one, and the chart or charts on which the constellation is to be found. The following page lists the Messier (with N.G.C. numbers) objects. The maps, printed in three colors, are on heavy grade white paper. Magnitudes are shown in steps of thirds down to and including 6 and 1/3. Galaxies, nebulae, clusters, variables, and double stars are shown; and all objects are easily located in right ascension and declination by means of a plastic grid which is furnished with each atlas.

Following the star charts, there is an 11" diameter sketch of the moon, with which one is able to identify 130 lunar features.

ANNOUNCEMENTS

Present A. L. P. O. Address. Readers and other colleagues are reminded that the address of the A.L.P.O., The Strolling Astronomer, and the Director-Editor are, and have been since August, 1962:

Box 26
University Park,
New Mexico, U.S.A.

The cooperation of most of you in already using this new address is appreciated. Others are requested to employ it in the future.

Errors in July-August, 1962 Issue. Several errors were made with the illustrations for Mr. William K. Hartmann's Venus article on pp. 171-185 of this issue. In Figures 14e and 16b the U.T. should be increased by 12 hours, to 22^h 30^m and 23^h 30^m respectively. Figure 11b was published upside down. Figures 16b and 16d were published reversed left-for-right. Figure 22a was reproduced upside down. Figures 20b and 21b were not reproduced properly; the original ultraviolet photographs show detail. We are sorry for so many blunders in illustrating Mr. Hartmann's article.

Foreign Language Books Needing Reviews. We have recently received copies of the following books and are anxious to review them as soon as feasible:

1. A Hold Fizikája (in English The Physics of the Moon), by Péter Hédervári, in Hungarian. The reviewer would need to know Hungarian, English, and the subject matter treated.

2. Marte, o Planêta do Mistério, by Jean Nicolini, in Portuguese. The reviewer would need to know Mars, English, and Portuguese.

Both Mr. Hédervári and Mr. Nicolini have been valued contributing members of the A.L.P.O. for some years. We shall be grateful for help in eviewing these books. Qualified and interested persons should write ither to Mr. J. Russell Smith, the Book Review Editor, or to the Editor.

Patrick Moore Honored. The Astronomical Society of Edinburgh, Scotland, which is centered at the Calton Hill Observatory, is awarding its Gold Medal to Mr. Patrick Moore, English writer and lunar and planetary observer. We congratulate Mr. Moore on this distinction. We hope that he will be able to see more of us on his next visit to the States than on his quick trip here in 1962.

Mars Section Staff Changes and Policies. Mr. Leonard B. Abbey has been replaced as Assistant Mars Recorder by:

Mr. Klaus R. Brasch
224 Montée Sanche
Rosemere, Quebec, Canada.

We are grateful to Mr. Abbey for his help in the past in the work of the Mars Section and in other A.L.P.O. projects. We appreciate that he wished these efforts to be more than available time and other circumstances allowed. Mr. Brasch has been a contributing A.L.P.O. member for some time; his considerable help and numerous courtesies in assisting our Tenth Convention at Montreal some months ago will be remembered by all those who attended. He is the third Canadian to serve as an A.L.P.O. Section Recorder, as well as the third member of the Montreal Centre so designated.

Ernst E. Both, the Mars Recorder, has set up the following policies to assist the work of the Mars Section during the current 1962-63 apparition. All readers should cooperate in these policies - remember that Recorders are giving freely of their time, and it should not be needlessly wasted

1. All observations of Mars should be submitted to Ernst E. Both, Curator of Astronomy, Buffalo Museum of Science, Buffalo 11, New York. These will be immediately acknowledged by post-card. Routine questions should be directed to Mr. Brasch at the address above and will be answered by him.

2. Mars Observing-Forms are now available. The cost of printing them was borne by the Buffalo Museum of Science, to whom we express our gratitude. These forms are a tremendous convenience for the Mars observer. They may be obtained from Mr. Both, Mr. Brasch, or the Editor. Initially 5 to 10 forms will be furnished without charge upon request,and after that two blanks are sent automatically for each observation received. Each form has three blank discs of Mars, one for integrated light, one for a possible red filter view, and the thrid for a possible blue filter view.

3. Mr. Brasch is mimeographing certain basic, routine information about Mars, which will soon be available to interested persons.

4. An A.L.P.O. Mars Manual is making progress and should be available early in 1963.

Foreign Language Coordinator Position Dropped. This staff post is being discontinued because of lack of reader interest. Perhaps it can be revived at a future time and maybe in a different form if members then sufficiently want such a service. We thank Mr. Both for filling the position while it existed.

Eleventh A.L.P.O. Convention. Readers are reminded that the next A.L.P.O. meeting will be with the Western Amateur Astronomers at San Diego, California in late August, 1963. The General Chairman is Mr. Martin Sloan of Escondido, Calif. A special feature will be a visit to Palomar. More details will be given in future issues as plans develop.

New Books in A.L.P.O. Library. The following books have been added to the library since the list in the July-August, 1962 issue appeared.

Title	Author	Publisher	Date
Life on Other Worlds*	H. Spencer Jones	Mentor Books	1959
The Individual and The Universe*	A. C. B. Lovell	Mentor Books	1961
Instructions to Young Astronomers	H. P. Wilkins	Museum Press Ltd.	1957
The Picture History of Astronomy	Patrick Moore	Grosset & Dunlap	1961
Surface of the Moon	V. A. Firsoff	Hutchinson & Co.	1961
Introducing Astronomy	J. B. Sidgwick	Macmillan	1957
Amateur Astronomer's Handbook	J. B. Sidgwick	Macmillan	1955
Statistik und Physik der Kometen**	Nikolaus B. Richter	Johann Ambrosius Barth	1954
Looking at the Stars	Michael W. Ovenden	Philosophical Library	1958
Everyday Meteorology	A. Austin Miller and M. Parry	Philosophical Library	1959
L'Astrophotographie d' Amateur (in French)	Jean Texereau & Gérard de Vaucouleurs		1954
Practical Astronomy	W. Schroeder	Philosophical Library	1957
Astronomie (in German)	Joachim Hermann	C. Bertelsmann Verlag	1960
Changing Views of the Universe	Colin Ronan	Macmillan	1961
Guide to the Heavens	H. P. Wilkins	Frederick Muller Ltd.	1956
The Upper Atmosphere	H. S. W. Massey & R.L.F. Boyd	Philosophical Library	1959
Constructing an Astronomical Telescope	G. Matthewson	Philosophical Library	1957
Insight Into Astronomy (2nd edition)	Leo Mattersdorf	Lantern Press,Inc.	1959
The History of Mathematics	Joseph E. Hofmann	Philosophical Library	1957
Tabulae Caelestes (Eighth Edition)	Schurig Götz		1960
The Astronomical Universe (Second Edition)	Wasley S. Krogdahl	Macmillan	1962

Surely at least one of these books will appeal to every American and Canadian A.L.P.O. member. Librarian Funck is eager to be kept much busier!

Acknowledgment. Thanks are hereby expressed to Mrs. Beryl Haas for the typing of the present and the immediately preceding issue of The Strolling Astronomer and for the preparation of the mailing envelopes for both issues. Without this assistance, getting out these two issues would have been a matter of extreme difficulty.

A.L.P.O. Lunar Section. We have now added to our staff as an A.L.P.O. Lunar Recorder:

Patrick S. McIntosh
Sacramento Peak Observatory
Sunspot, New Mexico

* Donated by R. W. Russell.
** Donated by David Meisel.

Mr. McIntosh has been an active member of the A.L.P.O. for a number of years, and there are two lunar articles by him elsewhere in this issue. He obtained his Bachelor's Degree in Astronomy from Harvard in 1962 and is now engaged in solar research on the staff of the Sacramento Peak Observatory. Mr. McIntosh joins the two other Lunar Recorders, Messrs. John E. Westfall and Clark R. Chapman. On the basis of age, experience, and technical quality of lunar research so far carried out Mr. Westfall has been requested to act as head of the trio. Some of his ideas for our Lunar Section are presented in his article in this issue.

OBSERVATIONS AND COMMENTS

Herodotus. José Olivarez of Mission, Texas carried out a short study of this lunar crater after reading Dr. James Bartlett's "Herodotus - A Light that Failed", Str. A., Vol. 8, pp. 91-97, 1954. A curious intermittent visibility of an apparent central peak in Herodotus was the subject of this article. Mr. Olivarez submitted three drawings to illustrate his recent study, but for lack of space we here can use only one. He says in part: "My first serious examination of Herodotus was on July 25, 1961, using a 2.4-inch Unitron refractor. The colongitude was 58°.5. The small craterlet on the northeastern wall was seen without difficulty. No features were seen or suspected on the floor.

"A drawing on August 23, 1961 at 51°.7 shows some of the 'complex' structure of the western wall. It compares well with the area showing Herodotus in Section XVIII of the Wilkins map of the moon. No sort of central light was seen or suspected.

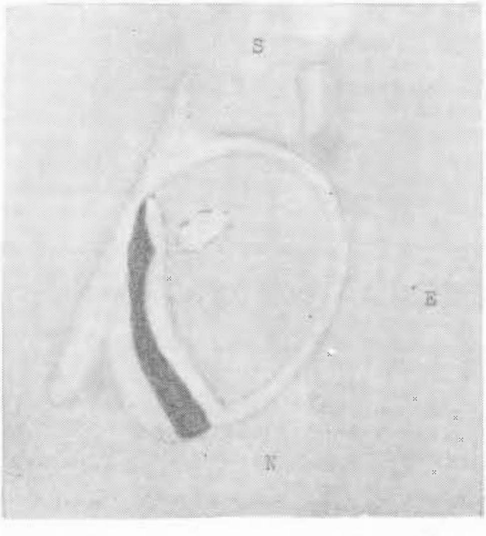

FIGURE 17. Lunar Crater Herodotus. José Olivarez. August 24, 1961. 3^h 25^m, U.T. 2.4-inch Unitron refractor, 100X. $S = 5$. $T = 4 - 3$. Colongitude = 64°.8.

"The third drawing was made on August 24, 1961 at colongitude 64°.8, Figure 17. Two white areas were seen on the floor, one in the southern part and the second in the western part adjacent to the shadow of the west wall. [A contrast-effect? - Editor.] Note the sharp points near the south end of the shadow of the western wall. I was especially gratified to see that this drawing agrees well with one by Elmer J. Reese, 6-inch reflector at 220X, on pg. 95 (Figure 9) of Dr. Bartlett's article."

Half-Filled Lunar Crater. On February 23, 1962 Leif J. Robinson wrote in part as follows: "I am making a project of Wargentin-like and Rümker-like lunar objects. One object deserving special mention is a half-filled crater near Reichenbach. It is shown well on Plate B6 - a,b of the Kuiper Photographic Lunar Atlas, at the very top of the plate and just under the word 'Fracastorius'."

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