The Strolling Astronomer

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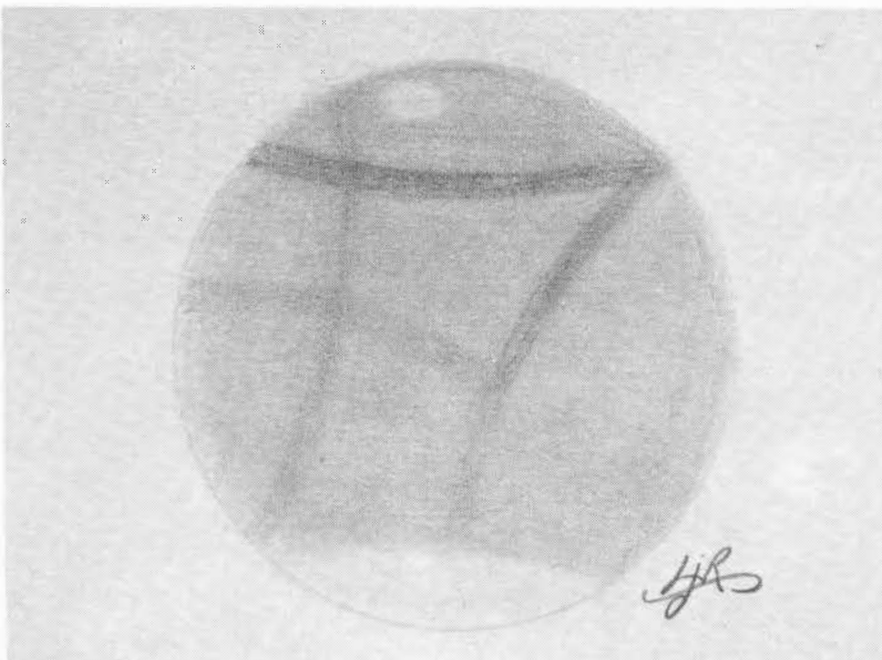


Composite drawing of Ganymede, or Jupiter III, constructed by Mr. L. J. Robinson from eight independent drawings made on August 26, 1961, $6^h 30^m - 7^h 30^m$, Universal Time. Two 10-inch reflectors, about 650X, seeing good. Only markings seen by more than one observer appear on the composite, and the number of observers seeing a given marking has been used as a measure of that marking's visibility. This group-effort carried out during W.A.A.-A.L.P.O. Convention at Long Beach, California. See pages 218 and 219 for the individual drawings and additional discussion.

THE STROLLING ASTRONOMER

Pan American College Observatory
Edinburg, Texas

IN THIS ISSUE

PLANETARY APPULSES AND OCCULTATIONS OF STARS IN 1962

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

Planet	Date in 1962	Time of Conjunction	Star	Mag.	Geocentric separation*	Horizontal Parallax
Mars	Apr. 7	17^h37^m, U.T.	B.D.- 5°5999	6.2	+21"	4"
"	June 23	10 45	B.D.+16°392	8.2	- 3	2
"	July 17	22 12	B.D.+20°735	8.7	+ 3	2
"	Aug. 21	02 01	B.D.+23°1128	9.0	-18	3
"	Aug. 28	10 19	B.D.+23°1293	7.8	+17	3
"	Oct. 21	13 53	B.D.+20°2108	8.5	+20	4
"	Nov. 15	19 53	B.D.+18°2165	5.8	-17	4
Jupiter	Apr. 10	10 18	B.D.-11°5821	8.9	- 7	2
"	June 17	13 34	B.D.- 8°5989	8.8	- 6	2
Saturn	Jan. 14	12 36	B.D.-20°5874	8.7	-29	1
"	July 23	06 35	B.D.-19°5925	8.6	+ 4	1

*The geocentric separation given here is in the sense $\delta_p - \delta_*$.

2. The following occultation by Mars has been predicted:

Date	Star	Area of Visibility	Station	Disappearance U.T.	P	Reappearance U.T.	P
July 17	B.D.+20°735 $(8^m.7)$	Asia	Hyderabad	22^h07^m	97°	22^h10^m	241°
			Alma-Ata	22 08	62	22 11	276

3. The following occultations by Jupiter have been predicted:

Date	Star	Area of Visibility	Station	Disappearance U.T.	P	Reappearance U.T.	P
Apr. 10	B.D.-11°5821 $(8^m.9)$	Part of N. America	Univ. of Alabama	9^h51^m	42°	Sun	
		S. America	Santiago	9 48	48	Sun	
			Quito	9 49	45	Sun	
June 17	B.D.-8°5989 $(8^m.8)$	N. America	Mt. Hamilton	10 56	55	Sun	
		Australasia	Wellington	Low		16^h32^m	266°
			Perth	Low		16 22	267

4. The following occultation by Saturn has been predicted:

Date	Star	Area of Visibility	Station	Disappearance U.T.	P	Reappearance U.T.	P
				(Ball of Planet)			
July 23	B.D.-19°5925 $(8^m.6)$	N. & S.America	Montreal	05^h56^m	234°	07^h28^m	91°
			Mt. Hamilton	06 00	234	07 27	93
		New Zealand	La Plata	06 00	225	07 22	102
			Wellington	Low		07 31	100
				(Rings)			
			Mt. Hamilton	05^h51^m	235°	08^h19^m	84°
			Montreal	05 47	236	08 14	83
			La Plata			08 16	87
			Wellington			08 22	88

5. No passage of planets in front of radio sources is predicted.

Postscript by Editor. The information above has been kindly communicated by Dr. Gordon E. Taylor, H. M. Nautical Almanac Office, Royal Greenwich Observatory, Herstmonceux Castle, nr. Hailsham, Sussex, England. We again urge our readers to make serious efforts to observe these phenomena and to let us hear their results. As described above, the occultations are limited in their geographical areas of visibility; and colleagues in other countries may have opportunities lacking to observers in the United States. Perhaps greatest interest will attach to the occultation of BD-19°5925 by Saturn and its rings on July 23, 1962; but a large telescope and good seeing will be needed to see the phenomenon well since the star's magnitude is 8.6.

A TRIBUTE TO
BEAUFORT S. RAGLAND--AMATEUR ASTRONOMER

By: David D. Meisel

It was with shock that A.L.P.O. members attending the Detroit Convention in early July, 1961, received word of the death of Beaufort S. Ragland. The announcement that Mr. Ragland had passed away only a few days before the convention brought sorrow to those of us who had known him personally and worked with him.

Beaufort Ragland, known and addressed by the nickname "Blu," was in his 65th year when his untimely death occurred. He was born in Richmond, Virginia, and received his precollege education in that city. Blu attended and graduated from the University of Virginia in the early 1920's with a degree in mechanical engineering. He was first employed with the C & O Railway Company in Richmond. In 1931, he joined his brother in the firm of W. L. Ragland and Sons. He continued there until he died. He held membership in various professional engineering societies both local and national. Although his only formal education in astronomy was a one year course at U. of Va., Blu's interest in astronomy goes back a good many years. He was about 16 years old when his brother gave him a book for Christmas entitled "Astronomy with the Naked Eye," by Serviss. At about this same time, he acquired a $3.00 telescope from Montgomery-Ward. His interest did not wane over the years because he participated in amateur activities on both a local and national level right up to his death. He was one of the motivating forces behind the Richmond Astronomical Society and held its presidency from 1952 on. He represented Richmond in the Astronomical League, even serving as the latter's Middle East Regional Chairman for two years.

Beaufort loved astronomy, its beauty, its laws, and its precision. He was not a telescope maker, but rather an observer. For many years he scanned the skies. His constant observing was systematic, not casual. He recorded the results in a proper manner and forwarded them to the proper people so that they could be used. He believed that only in this way could an amateur contribute significantly to the general knowledge of astronomy. In addition to being an A.L.P.O. member, he held membership in the A.A.V.S.O. and the American Meteor Society. His special interest was the timing of lunar occultations.

Blu believed in organized and cooperative effort among amateur astronomers. During his tenure as Chairman of the Middle East Region of the League he advocated that the League and other amateur groups adopt a standard observing form and procedure. Although this has been done by various Sections of the A.L.P.O., the League has yet to act on Mr. Ragland's recommendations. He also believed that it was the serious amateur's responsibility to encourage others to study astronomy and constantly to improve one's own knowledge of the subject. He had an extensive library and used it for the assimilation of knowledge for himself and others. Although he remained a bachelor throughout his life, his interest in young people was like that of a father. Many times he would join discussions with them even to the wee hours of the morning. When they were discouraged with their work, he would give them honest praise and opinion, in addition to financial support if necessary.

Mr. Ragland was a visionary. He worked for the day when amateur astronomy would present a united front. He felt that international cooperation was absolutely essential to the progress of amateur astronomy. By his example of careful observation, he led others to do the same. While many of his ideas will probably remain dreams, this unassuming gentleman should be given credit for attempting to do the things many of us just talk about. Unlike many people today who assume the title of amateur astronomer simply by joining a local astronomy club, Beaufort Ragland earned the title by hard work and dedication to an ideal. Although some progress has been made by the A.L.P.O. toward creating a more scientific attitude among amateurs, we owe it to his memory and to that of those like him to continue to improve our study of astronomy on the highest plane we know.

It can be truthfully said that the hundreds of friends he made for himself and for astronomy will feel this loss and experience an emptiness that somehow cannot be filled. It is comforting to know that his final moments of consciousness were spent in devotion to the three things he enjoyed most--being among friends--discussing astronomy--over a cup of coffee...

(The above tribute was adapted from notes on a speech to the Richmond Astronomical Society by the Vice President of the R.A.S., Mr. T. W. Stone. The writer would like to thank Mr. Stone for permission to draw from his notes and statements so freely.)

COMET BURNHAM 1959K: FINAL REPORT. PARTS I AND II.

By: David D. Meisel, Comets Recorder

Form Abstract. Part I deals with the listing of observers and acknowledgements. Part II deals with the pre-perihelion period of observation. Part III deals with the post-perihelion observations. Photometry and the study of physical features is emphasized with special interest in solar and terrestrial correlations. Part IV deals with interesting individual observations.

Part I. Preliminary Data

Introduction

Comet 1959k was discovered by Robert Burnham, Jr., of the Lowell Observatory. Burnham, an amteur recently turned professional, was continuing research on stellar proper motions using the 13-inch photographic refractor when the discovery was made. This was Mr. Burnham's fifth discovery of a cometary object. About a month after the discovery of 1959k, Burnham found a very faint periodic comet 1960a. While 1960a faded after discovery, Comet 1959k was due to get much brighter than its discovery magnitude of 10. Elements of the orbit computed by B. G. Marsden of Yale Observatory indicated that 1959k was going to pass within 20 million miles of the earth in late April. With nearly two months of preparation behind them, observers all over the world made numerous observations of this comet. An appeal for amateur reports on the object was made in The Strolling Astronomer and in Sky and Telescope. The response to the appeal was very gratifying. This paper, although somewhat belated, is a result of a reduction of all available information on Comet 1959k, including the reports of amateur astronomers as well as of professional astronomers. The Recorder would like to thank all observers who submitted their work to the Section. If every comet that came along were observed as well as this one was, there would be no lack of observational material on comets.

Observers

The following is a list of observers who contributed directly to the Comets Section. The order of listing has no particular significance.

Pre-perihelion Observation Period

Leonard B. Abbey	Decatur, Ga.	30" Refr.
J. Russell Smith	Eagle Pass, Tex.	16" Refl.
Craig L. Johnson	Boulder, Colo.	4" Refl.
Dennis Milon	Houston, Tex.	6"&8" Refls.
Paul Knauth	Houston, Tex.	8" Refl.
Ken Steinmetz	Denver, Colo.	20" Refr.
Frank Kelly	St. Petersburg, Fla.	4" Refr.
Alan McClure	Los Angeles, Calif.	6" Refl.
Gary Wegner	Bothell, Wash.	10" Cassegrain.

Post-perihelion Observation Period

Alan McClure	Mt. Pinos, Calif.	7" Astrograph, Binoculars.
John E. Bortle	Mt. Vernon, N. Y.	Camera, 2.4" Refr., 6" Refl., Naked Eye.
Dennis Milon	Houston, Tex.	6" Refl., Naked Eye.
A.G.F. Morrisby	Salisbury, S. Rhodesia	Camera, 4" Refr., Eye.
Craig L. Johnson	Boulder, Colo.	4" Refl., Camera, Binoculars, Eye.
J. E. Newman	Roanoke, Va.	1" Camera.
L. Bartha, I. Fejes, Cs. Szekely, K. Thaly	Budapest, Hungary	4" Refr., 8" Refr. with extinction photometer.
Dale Chapman	S. Euclid, Ohio	2.4" Refr.
D. Meisel	Fairmont, W. Va.	8" Refl., 1.5" Refr.
Wilfried Schröder	Bremen-Rönnebeck, Germany	2" Refr., Opera Glasses.
Menchem Raviv	Kibbuz Hasorea, Israel	3" Refr.
William K. Hartmann	New Kensington, Pa.	3" Refr.
Kenneth Shafranko		
Donald Loose	Harrisburg, Pa.	4" Refl., Binoculars, Eye.
David Spier		
Lewis Dewart	Sunbury, Pa.	4" Refl.
Darrell Conger	Elizabeth, W. Va.	2" Refr., Binoculars, Eye.
William Westbrooke	San Francisco, Calif.	4" Refl.
Frank J. Kelly	St. Petersburg, Fla.	80 mm. Refr.
H. J. Willis	Lone Oak, Tex.	2.4" Refr., eye.
Bob Shayler	Randolph AFB, Tex.	8" Refl., 1.5" Refl.
J. Hudson	Randolph AFB, Tex.	8" Refl., 1.5" Refl.
Jeremy Knowles	Jamaica, N. Y.	6 x 30 Binoculars
Steve Bieda	San Jose, Calif.	3" Refr., Binoculars
Gary Wegner	Bothell, Wash.	4" Refl., 10" Cass.

In addition to the reports submitted by the above observers, the published observations of the following observers were utilized in this report.

Robert Burnham	Lowell Observatory	Flagstaff, Arizona
Elizabeth Roemer	U. S. Naval Observatory	Flagstaff, Arizona
A. F. Jones		Timaru, New Zealand
Thomsen		Wellington, New Zealand
Archer		Sidmouth, England
Swindin		Bristol, England
Waterfield, Hendrie,	Ridley, & Siddorn	Ascot, England
M. Antal	Skalnate Pleso	Czechoslovakia
Dem P. Elias	National Observatory	Athens, Greece
Arend	Uccle	Belgium
Charles Bertaud	Meudon	Paris, France
S. Vsessviatsky		Kiev, U. S. S. R.

Summaries of group reports used in this report were:

Royal Astronomical Society of Canada, Toronto Centre
- L. Jewitt
- R. V. Ramsay
- Kurt Frenkle

Amateur Astronomers Association, New York, N. Y.
British Astronomical Association, London, England.
Polish Society of Amateur Astronomers, Warsaw, Poland.

It is hoped that no omissions have ocurred in this list. Instrument diameters were not known in many cases and hence were then omitted.

Of special note are the observations of the following:

Alan McClure	Two Color Photographs
A. G. F. Morrisby	Early Visual and Photographic Observations in the Post-perihelion Period

Gary Wegner	Spectral and Color Studies
Menchem Raviv	Magnitude Estimates
William Hartmann	Magnitude and Coma Diameter Estimates
Lewiss Bartha, et al.	Estimates with Extinction Photometer
R. V. Ramsay	Observation of a Suspected Occultation
Wilfried Schröder	Magnitude Estimates
Polish Amateur Astronomers	Magnitude Estimates
Waterfield, et al.	Observation of Possible Direct Solar Action on Cometary Material

Supporting Data

Supporting information concerning solar and terrestrial activity was taken from the data published in the following periodicals.

Transactions of the American Geophysical Union
Sky and Telescope
Journal of the British Astronomical Association
Monthly Bulletin of Photospheric Data, American University Observatory

Magnitude estimates and other relevant data on the comet were taken from the following publications, using observations from those observers or groups already listed.

B.A.A. Circulars
Harvard Announcement Cards
Sky and Telescope
Review of Popular Astronomy
I. A. U. Circulars
The Strolling Astronomer

Sunspot numbers and facular zone numbers were obtained from the above publications using data supplied by the A.A.V.S.O. Solar Division, the Zurich Observatory, and the American University Observatory, Beirut, Lebanon. Flare and atmospheric data are taken from the report of the World Warning Agency. The Recorder is grateful to the staff at Allegheny Observatory at Pittsburgh, Pa., for making their library available to the Comets Section for tabulation of solar data.

The Recorder would like to thank again all those who contributed to this report in one way or another. Also, their patience displayed while waiting for this report to appear is appreciated.

Orbital Elements, Comet 1959k

Since no definitive orbit has yet been published for this object (Sept. 13, 1961), the Recorder used the provisional orbit computed by Marsden for the data reduction of this report. Although the ephemeris computed from these elements was several degrees of declination and right ascension in error at the time of closest approach to the earth, the error in the heliocentric and geocentric distances is assumed to be small. Marsden's provisional elements are given here along with those computed by Candy.

Assuming parabolic orbit.

Computer:	B. G. Marsden	M. P. Candy
Time of Perihelion	March 20.9623, 1960 E.T.	March 20.9005, 1960 E.T.
ω	306°7438	306°8758
Ω	251.9533	251.9359
i	159.5864	159.5577
q	0.503058 A.U.	0.500982 A.U.
	1950.0	1950.0

Here ω is the argument of perihelion, Ω is the longitude of the ascending node, i is the inclination of the orbital plane, and q is the perihelion distance in the orbit. A definitive orbit is not expected to change the above elements appreciably.

TABLE 1. Physical Observations of Comet 1959k Obtained During the Preperihelion Observation Period, Jan. 17, 1960 to Feb. 16, 1960.

Date (U.T.) 1960	Coma Diameter	Nucleus	Coma Condensation*	Tails	Observer	Inst.	Method
Jan. 17.06		slight	2		Smith	16"	Vis.
18.14	¼'	nearly stellar	4		Wegner	10"	Vis.[1]
18	76"x130"		3?	Coma elliptical p.a. 90°	Roemer	40"	Photo.[2]
19.15	8'		2		Milon	6"	Vis.
21.14	7'		0		Milon, Knauth	6"	Vis.
22.06	7'		0		Milon	8"	Vis.
22.20			3		Smith	16"	Vis.
24.06	1'	stellar	3		Johnson	4"	Vis.
25.07	2'	3 stellar nuclei	5	8' p.a. 85° (tail curved)	Johnson	4"	Vis.
25.07	6'	faint central condensation	5		Abbey	30"	Vis.
27.08		fair nuclear development	5		Smith	16"	Vis.
28	128"x140"		3?	10' p.a. 120° 1' p.a. 90° (shorter curved)	Roemer	40"	Photo.[3]
28.14	7'		0		Milon	8"	Vis.
31.06	9'		1		Knauth	8"	Vis.
Feb. 8.04	3'x3'	slight	2		Milon	8"	Vis.
15.06	4'x8'	1' arc diameter	6		Milon	8"	Vis.
15.14	5'		2	12' p.a. 60° (tail linear)	McClure	6"	Vis.

Notes: *Estimates based on scale: 0=no apparent condensation, 10=stellar condensation, no coma.

1) Coma small because of excessive magnification in Cassegrain system.
2), 3) Photographs from Sky and Telescope and Monthly Evening Sky Map. Reduced by Meisel.

TABLE 2. Physical and Photometric Observations of Comet 1959k

Date (U.T.) 1960	Aperture Corrected MAGNITUDE	Average Magnitude	Sunspot Number	COMA Diameter	COMA Condensation	Observer
Jan. 17.06	8.8	8.8	120	-	2	Smith
18.14	9.8	9.8	95	¼'	4	Wegner
19.15	10.4	10.4	93	8'	2	Milon
21.14	10.4	10.4	107	7'	0	Milon
22.06	10.1 }	9.3 ± 0.7	134	7'	0	Milon
22.20	8.6 }				3	Smith
24.04	9.4	9.4	154	1'	3	Johnson
25.44	9.3	9.3	170	2'	5	Johnson
27.08	8.3	8.3	199		5	Smith
28.14	8.3	8.3	182	7'	0	Milon
31.06	9.6 }	8.7 ± 0.9	195	9'	1	Knauth
31.07	7.8 }					Smith

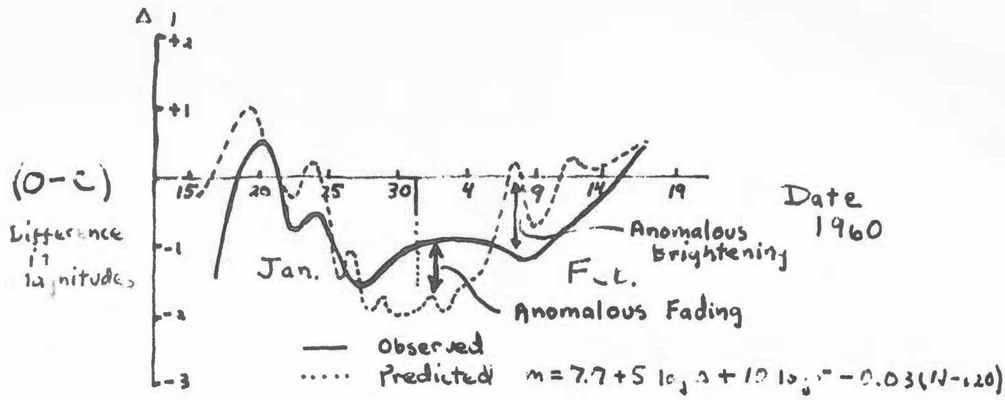


Figure 1a.

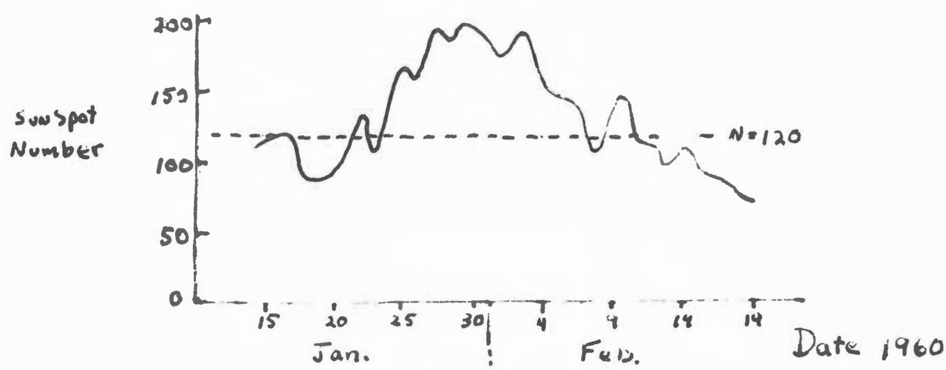


Figure 1b.

FIGURE 1. Photometric Fluctuations Comet 1959k--Preperihelion. Figure 1a--The "observed minus computed" values versus the date are plotted. Here $(O-C) = M_0 - 7.7 - 5 \log \Delta - 10 \log r + 0.03\ (N-120)$, where M_0=the estimated stellar magnitude, Δ= the comet's geocentric distance, r=the comet's heliocentric distance, and N is the relative sunspot number. (The logarithms are base ten.) Dates are given in U.T. Figure 1b--The relative sunspot numbers, as compiled at Zurich, plotted as a function of date (Universal Time).

Table 2--continued.

Date(U.T.) 1960	Aperture Corrected MAGNITUDE	Average Magnitude	Sunspot Number	COMA Diameter	COMA Condensation	Observer
Feb. 8.05	9.1 }	8.0 ± 1.2	119	3' x 3'	2	Milon
8.05	6.8 }					Smith
15.06	8.1 }	8.5 ± 0.4		4' x 8'	6	Milon
15.14	8.9 }			5'	2	McClure

MERCURY IN 1960

By: Geoffrey Gaherty, Jr.

I. Introduction

During the period covered by this report, January 26, 1960, to January 5, 1961, a total of seventy-five drawings and twenty-three sets of intensity estimates were made. This represents the greatest activity in the

Mercury Section of the A.L.P.O. since 1950. It is also pleasing to note the substantial increase in the number of intensity observations, actually more than the total of all such observations in the years 1951-1959. The solar transit of Mercury on November 7, 1960, was well observed and will be dealt with in a separate report.

II. The Observations

The writer would first of all like to express his sincere thanks to all who contributed observations of Mercury during 1960. The observers are listed below along with details of their locations and instruments.

Observer	Station	Instrument
Clark R. Chapman	Buffalo, N. Y.	10" Refl.
John Cooper	Edmonds, Wash.	4" Refl.
	Bothell, Wash.	10" Refl.
Dale P. Cruikshank	Williams Bay, Wisc.	40" Refr.
Lewis Dewart	Sunbury, Pa.	6" Refl.
Stanley & Stuart Emig	Leavenworth, Wash.	8" Refl.
Walter H. Haas	Edinburg, Tex.	6" Refl.
Craig L. Johnson	Boulder, Colo.	4" Refl.
Jim Low	St. Lambert, Quebec	4" Refl.
	Dawson Creek, B. C.	4" Refl.
Tod Markin	Lakeland, Fla.	6" Refl.
Gary Wegner	Bothell, Wash.	10" Refl.
		4" Refl.
		8" Refl.
William J. Westbrooke	San Francisco, Calif.	4" Refl.

If any observer should be singled out for special mention, it is Gary Wegner whose series of observations constituted fully 45% of the Section's work in 1960. Mr. Wegner has made a specialty of Mercury observing and has shown what can be done on this difficult object with an aperture which is, after all, fairly common in the A.L.P.O. today.

The table below shows the distribution of the observations amongst the six 1960 apparitions which are covered by this report. The first line of the table gives the dates of greatest elongation and the directions of these elongations (E. or W. of the Sun). The second line gives the periods covered by our observations. The figures listed opposite the names of the various observers are the numbers of drawings and intensity estimates respectively.

Elongation Period	Feb.23(E) Feb.14 - Mar. 2	Jun.19(E) Jun. 4 - Jun.25	Aug. 5(W) July28 - Aug.16	Oct.15(E) Oct. 1	Nov.24(W) Nov.17 - Dec.18	Totals
Chapman	1, 0		1, 0	1, 0	2, 0	5, 0
Cooper	8, 0					8, 0
Cruikshank			2, 0			2, 0
Emigs					2, 0	2, 0
Haas	4, 4					4, 4
Johnson	1, 1	2, 2	2, 1			5, 4
Low	3, 0	4, 0	1, 0			8, 0
Markin					2, 0	2, 0
Wegner	12, 1	7, 4	5, 5		5, 5	29, 15
Westbrooke	5, 0	5, 0				10, 0
Totals	34, 6	18, 6	11, 6	1, 0	11, 5	75, 23

Note: No observations were received for the April apparition (elongation west April 7, 1960).

III. Drawings

Figure 2 shows twelve drawings selected from the seventy-five received. In choosing drawings for reproduction there was a deliberate concentration on drawings made more or less simultaneously by different observers.

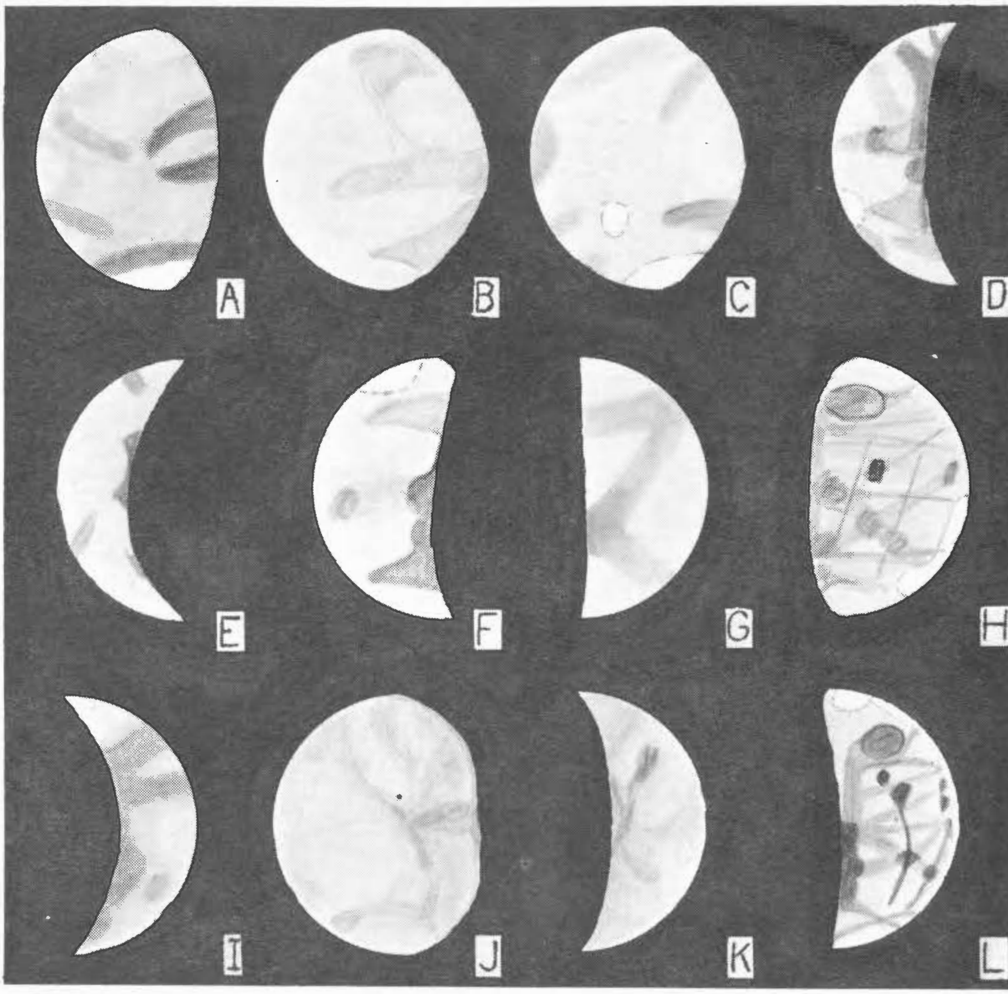


FIGURE 2. Selected Drawings of Mercury by A.L.P.O. Members in 1960.

Letter	Observer	Date 1960	Time U.T.	Telescope	Magn.	S	T
A	Haas	Feb.17	00:34	6" refl.	298X	1-2	2-3
B	Wegner	Feb.17	02:07	10" refl.	241X	4	3
C	Johnson	Feb.18	01:10	4" refl.	124-295X	3	4½
D	Wegner	Mar. 1	02:28	10" refl.	241X	6 plus	5
E	Cooper	Mar. 1	02:50	4" refl.	152X green filter	4	4
F	Wegner	Jun.18	05:01	4" refl.	130X	5 plus	5
G	Low	Aug. 7	11:33	4" refl.	167X	4 plus	2-4
H	Wegner	Aug. 7	12:29	10" refl.	368X	4-2	5
I	Cruikshank	Aug. 7	16:30	40" refr. 24"-30" stop	550X	5-7	4
J	Chapman	Oct. 1	21:30	10" refl.	270X Wr.23A filter	2-3	4½
K	Chapman	Nov.22	12:30	10" refl.	300X Wr.15G filter	4	3
L	Wegner	Nov.22	14:45	10" refl.	241X	3-4	4-1

The reasons for this are twofold; first, with a planet whose detail is far from easy, considerable weight can be assigned to observations which confirm each other independently, and secondly, most observers are interested in comparing their work with that of others and can usually profit by such comparison. It was also hoped to include some drawings made near maximum favorable librations; but as luck would have it, these occurred near Mercury's conjunctions with the Sun except during the November-December apparition. Drawings K and L were made at a fairly favorable libration (19°), yielding a central meridian of -105° and placing the terminator at a longitude of -109°. (Note that the latter is a theoretical value and does not take into account the phase effect which is quite evident in these drawings--the predicted value of "k" is .54 while the mean value obtained from the drawings is .43.)

I would here like to thank Mr. Klaus R. Brasch for his invaluable help in the preparation of Figure 2 for publication.

IV. Intensity Observations

The four sets of intensity estimates by Haas and five of Wegner's fifteen sets were made on the 0 (darkest) -5 (brightest) scale now adopted as standard for Mercury. The remainder of Wegner's observations and the four sets by Johnson were made on the more common 0-10 scale. In this analysis, these latter observations have been "calibrated" simply by dividing through by two. The table gives the mean of each observer's estimates for the features shown on Antoniadi's map. The writer takes full responsibility for such misidentifications as have inevitably occurred but feels that they are fairly few and do not affect the overall results to any great degree. The figures in parentheses are the numbers of estimates on which the means are based.

The features have been listed in the order of frequency of observation; it is interesting to compare this order with that given in the table on p. 36 of Antoniadi's La Planète Mercure. Our frequencies are not wholly comparable with Antoniadi's since ours only refer to occasions when intensity estimates were made; there were several cases of a feature's being shown on the accompanying drawing with no intensity indicated. Greater care during the observation would prevent this lack.

Attention is drawn to the apparent disparity in the estimates of the intensity of the north cusp cap. This cap was unusually bright on February 17 when Haas estimated it at 4.5/5 (see drawing A), and also on February 18 when Johnson saw it as 10/10 (drawing C). Another observation by Haas on the 19th found it still brilliant. Wegner's intensity observations were made later in the year when the cap had returned to its normal appearance.

Observer Estimates	Haas 4	Johnson 4	Wegner 15	Mean 23
Surface	3.0 (4)	3.4 (4)	3.1 (9)	3.1 (17)
N. cusp band	1.4 (4)		2.0 (9)	1.8 (13)
S. cusp cap	3.8 (4)		3.6 (9)	3.6 (13)
S. Criophori	1.5 (4)	1.0 (2)	2.4 (5)	1.8 (11)
S. Aphrodites	1.6 (4)	0.6 (3)	2.0 (3)	1.4 (10)
S. Lycaonis		1.7 (1)	2.0 (9)	1.9 (10)
S. Promethei		2.2 (1)	2.0 (9)	2.0 (10)
Neptuni V.	2.0 (1)	1.0 (1)	2.3 (8)	2.2 (10)
Admeti V.		1.5 (1)	2.3 (9)	2.2 (10)
N. cusp cap	3.8 (4)	5.0 (1)	2.9 (5)	3.5 (10)
S. Dionysi	1.5 (4)	1.2 (2)	1.8 (2)	1.5 (8)
S. Jovis		1.0 (1)	1.8 (7)	1.7 (8)
S. Atlantis	2.0 (1)	1.2 (2)	2.4 (5)	2.0 (8)
Horarum V.		1.6 (1)	2.2 (5)	2.1 (6)
Argyritis	4.0 (2)	4.2 (3)		4.1 (5)

Observer Estimates	Haas 4	Johnson 4	Wegner 15	Mean 23
S. Lyrae			1.8 (4)	1.8 (4)
S. Martis		2.2 (1)	1.7 (3)	1.8 (4)
S. Phoenicis	2.0 (3)			2.0 (3)
S. Maiae			2.1 (3)	2.1 (3)
S. Argiphontae			2.3 (3)	2.3 (3)
S. Persephones		2.8 (1)	2.0 (1)	2.4 (2)
S. cusp band	2.0 (1)			2.0 (1)
Ixionis V.			3.0 (1)	3.0 (1)

V. Conclusions

It is hoped that the format of this report presents the results of our observations in a more accessible manner than the descriptive reports of recent years.

It will be noted that there is still considerable disagreement between different observers in the representation of the markings of Mercury. The agreement in the observed intensities is somewhat better although some refinement is still possible. The steady increase in the number of these semi-quantitative observations is encouraging, and perhaps we can look forward to a time when all drawings submitted will be accompanied by intensity estimates.

The chief criticism which can be levelled at the work of the Mercury Section to date is its lack of continuity over a long period of time. Of the forty-one observers who have contributed drawings to the section between 1949 and 1960, only eight have observed Mercury for longer than two years. This large turnover in personnel renders long-term studies almost impossible. Therefore, the writer would urge those who have observed at any time in the past to continue to do so, and remind all observers that if one good observation is valuable, two such observations are more than twice as valuable.

SURFACE FEATURES ON MARS IN 1956 AS OBSERVED FROM JAPAN

By: Tsuneo Saheki, Director, and Takeshi Sato,
Mars Section, Oriental Astronomical Association

Introduction and General Remarks

In this paper we shall report observations of the planet Mars made during its closest approach in 1956 by the members of the Mars Section of the Oriental Astronomical Association. Undoubtedly, the main event of that apparition was the emergence and development of the Great Yellow Cloud, whose emergence was first detected in Japan over Noachis on August 20; subsequently it covered most of Mars' south hemisphere and even invaded the north hemisphere. However, in this paper we would like to deal mainly with the surface markings. Perhaps cloud activities and the behavior of the Polar Caps will be reported in a future paper.

Since Mars has a rotation period nearly equal to the earth's, only a part of the Martian surface can be favorably observed on any given night from a limited area of our earth's surface. For this reason, the coöperation of observers in America, Europe, and Japan is most important because they divide the earth's surface into three nearly equal parts in longitude; and there are many enthusiastic and experienced Mars observers in all three regions. In this connection, we hope that this paper will be interesting and of some value to many of the readers of this periodical.

The dates and times used here are all by Universal Time, and the direction is areographical; i.e., east on Mars is the direction of decreasing longitude.

The International Astronomical Union adopted, at its Moscow congress held in August, 1958, a new nomenclature for the Martian surface markings upon the recommendation of its Subcommission 16a, but we cannot accept the I.A.U. nomenclature because it is quite insufficient and useless for a detailed study of the Martian topography. The names of the surface markings used here are all according to the General Map of Mars by Shirō Ebisawa, which has been published in the September-October, 1960, issue of this periodical. Most of the names in Ebisawa's General Map of Mars are identical with those in Antoniadi's famous General Map of Mars published in 1930, though some new names are added in Ebisawa's map. (The names of the surface markings that are underlined later on are the new names proposed by Ebisawa.)

Mars was fairly well observed in Japan in 1956, though the interval covered by the observations was regrettably rather short compared to the several immediately preceding apparitions; the first observation was made by T. Ebizuka on May 19, 1956, and the last by T. Osawa on January 7, 1957. In this interval of seven months and a half, more than 700 drawings of the planet's disk and many other observations were obtained by 29 individual observers and by two groups of observers in our Mars Section. Of these observations, most were obtained in July, August, September, October, and November. A list of the observers follows:

Observer	Station (Japan)	Telescope
H. Araki	Hiroshima	6" refl., 12" refr.
S. Ebisawa	Nat. Science Museum, Tokyo	8" refr., 12" refr.
T. Ebizuka	Kochi	6" refl.
S. Fukui	Kobé	10" refl.
K. Fujimori	Nagano	8" refl.
T. Hanayama	Fukui Obs., Fukui	6" refr.
J. Hirukawa	Mié	8" refl.
M. Kawamura	Kawasaki	6" refl.
S. S. Kibé	Kibé Obs., Shiga	12" refl.
H. Kobayashi	Mié	10" refl.
H. Koiké	Tokyo	5" refl.
M. Minami	Fukui Obs., Fukui	6" refr.
Dr. S. Miyamoto	Kwasan Obs., Kyoto	7" refr., 12" refr.
A. Murata	Fukuoka	6" refr.
S. Murayama	Nat. Science Museum, Tokyo	8" refr.
M. Nakajima	Tokyo	5" refl.
T. Nakajima	Fukui Obs., Fukui	6" refr.
K. Okamoto	Tokyo	4" refr.
M. Oonishi	Hyogo	6" refl., 18" refl.
T. Osawa	Osaka	6" refl.
T. Otani	Chiba	8" refr., 6" refl.
T. Saheki	Osaka	8" refl.
Y. Sakai	Gifu Obs., Gifu	6" refl.
T. Sakanoue	Kyushu Univ. Obs., Fukuoka	12" refl.
T. Sato	Hiroshima	3" refl., 4" refl.
Y. Tanaka	Chiba	6" refl.
I. Tasaka	Wakayama	13" refl.
H. Yamada	Higashiyama Obs., Nagoya	6" refl.
Dr. I. Yamamoto	Yamamoto Obs., Shiga	18" refl., 6" refl.
Otemaé High School	Osaka	
Shizuoka Astr. Assoc.	Shizuoka	

Since the Martian winter solstice for the northern hemisphere occurred on September 27, 1956, the Martian season varied from late autumn to middle winter in the north hemisphere or from late spring to middle summer in the south hemisphere during the best observed part of the apparition.

Surface Markings

The dark markings for the most part were as intense as usual, though extremely faint and difficult in August and September during which period the Great Yellow Cloud covered great areas on Mars.

It is very interesting to note that many canals were observed as double, or even triple or double double, and also that many canals were resolved into chains of numerous small dark spots. The large dark markings, the maria, were also resolved into innumerable small dark spots, especially by Ebisawa.

1. Region of Mare Erythraeum and Solis Lacus

The north point of Margaritifer Sinus was flattened and so was located near latitude 3^{o}N., 7^{o} to 9^{o} south of its normal position. In spite of this abnormality, Oxia Palus was well observed at its normal position. Refer also to Dr. R. S. Richardson's photograph of Mars on August 10, 1956, published on the front cover of the July-September, 1958, issue of this periodical, in which the flattened Margaritifer Sinus and Oxia Palus are both very well shown. Oxus was rather wide and was occasionally observed as double.

Mare Erythraeum was intensely blue. In this mare many dark bands were recorded by such observers as Ebisawa, Tasaka, and Saheki; and under very excellent seeing Ebisawa resolved some of them as double. He also reported that Argyre I and Argyre II, which both are usually seen under ordinary seeing conditions as circular or elliptical were observed under excellent seeing to be a non-equilateral quadrangle and a triangle respectively, bordered by some of these dark bands.

Aurorae Sinus was very intense and showed nothing abnormal. Agathodaemon was wide, very intense, and strikingly straight. Baetis and Juventae Fons were so intense as to be easily seen in 6-inch telescopes.

Ganges and Ister constituted a very wide double canal, and a third component was occasionally observed between them; they were all under excellent seeing resolved into chains of many small dark spots. Clytaemnestrae Lucus, whose sudden development was detected at the junction of Jamuna and Hydraotes canals in April, 1950, by Murayama, Ebisawa, and Saheki independently, had begun to fade away in 1954 and became very faint and difficult in 1956, though very large.

The most interesting changes in this region of Mars were those in Solis Lacus and Tithonius Lacus. On May 17, 1954, a sudden development of Ambrosia was detected by Saheki; and thereafter Solis Lacus was seen as curving southward, contrary to the aspect observed in 1926 and some other apparitions. (See Dr. E. C. Slipher's photograph on July 14, 1954, on the front cover of Sky and Telescope, July, 1955, issue and Dr. H. M. Jeffers' photograph on July 18, 1954, in the Publications of the Astronomical Society of the Pacific, June, 1958, issue.) Though in 1956 this abnormality was present at the end of June, Ambrosia then began to fade; and this abnormality disappeared. Tithonius Lacus had been very faint since 1941, but some dark nuclei were recognizable in it until 1954. However, in 1956 this Lacus, especially its western half, became much fainter and was only seen as a very large diffuse shading.

In 1954 Phasis was unusually wide and intense, and Araxes was a faint wide canal as usual. In 1956, however, Phasis was weak; and Araxes was very much intensified and was observed as a very prominent wide band of irregular outline.

Mare Acidalium was observed only in outline because it was often obscured by haze in addition to being near the north edge of the disc.

2. Region of Mare Sirenum and Mare Cimmerium

Mare Sirenum was very intense, as usual; but very remarkable changes had occurred in 1954 on the northern shore of this mare. In August, 1954, Ebisawa, Murayama, Otani, and J. Hoshino detected the remarkable growth of Gigantum Sinus toward the northern desert regions; simultaneously Titanum Sinus was much weakened. In 1956 this abnormality was still present.

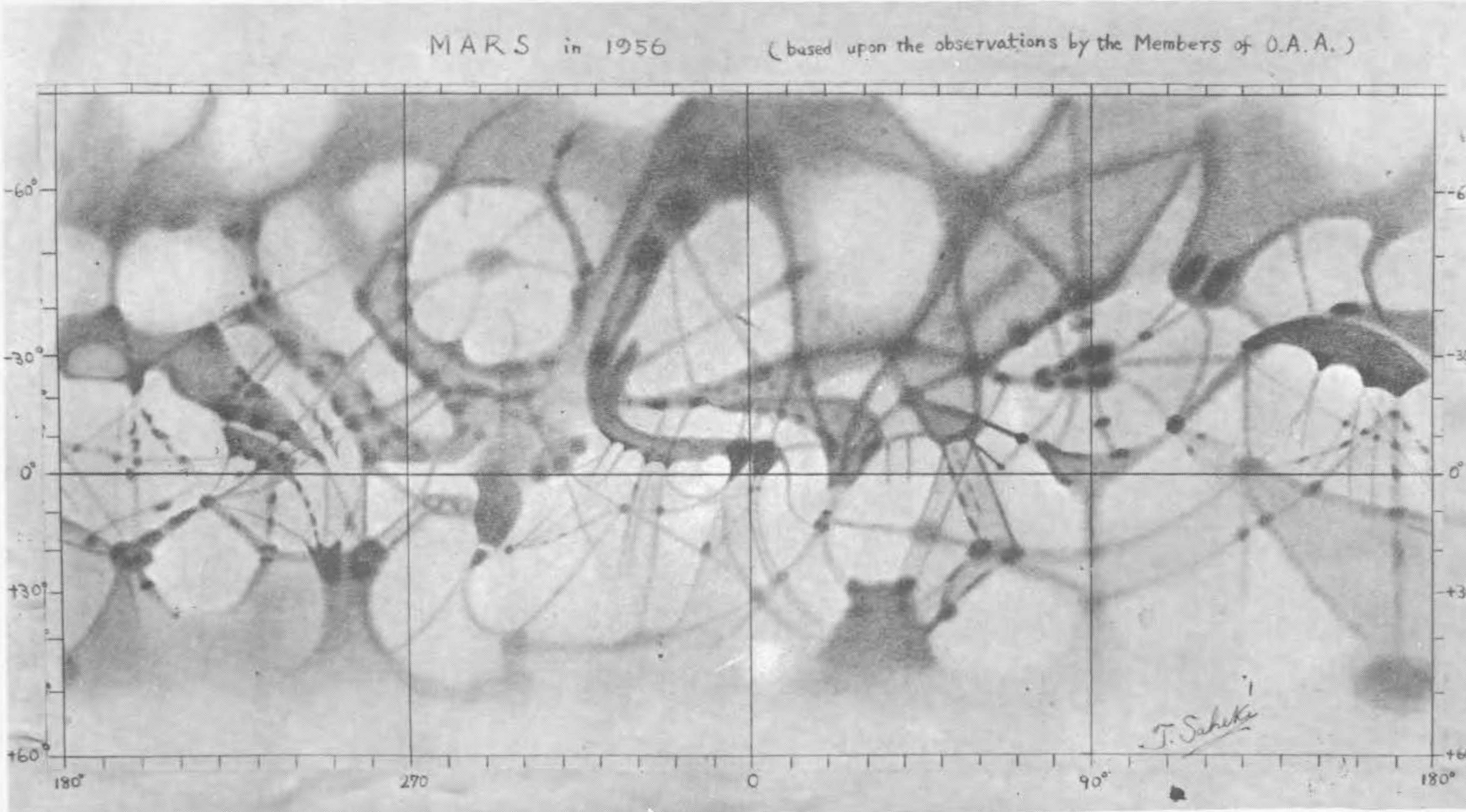
FIGURE 3(above). Drawing of Mars by Shirō Ebisawa on August 20, 1956, at $14^h\ 15^m$, U.T., C.M.=341°, D_E= -19°.2. 8-inch refractor of National Science Museum, Tokyo, Japan. First view of developing Great Yellow Cloud over Noachis.

FIGURE 4(on p. 195). The Oriental Astronomical Association Map of Mars in 1956. Drawn by Mr. Tsuneo Saheki, Director of the Mars Section of the O.A.A. and Chairman of the National Mars Committee of Japan. Based upon more than 700 drawings and many photographs obtained by the members of the O.A.A. →

The network of canals covering the desert regions north of Mare Sirenum was occasionally observed as quite Lowellian. Some canals were seen by Ebisawa, and one time on September 7 by Saheki, as double. Titan increased its prominence, and several dark spots were observed on this canal.

Mare Cimmerium was fairly complex in detail: Simplegades Insulae was very difficult, though it could be distinguished as a large oval; and farther west Laestrygonum Sinus projected conspicuously northward, and Draconis Promontorium was well seen. Laestrygon and Antaeus were resolved into many irregular dark spots.

One of the markings which has attracted the greatest interest of many students of Mars is Sinus Gomer. On June 2, 1937, very remarkable northward development of the Sinus was detected by Saheki and was soon confirmed by S. Mayeda and Kibé, and also in the next apparition by Dr. E. C. Slipher photographically. In its early days, this Sinus was separated from Mare Cimmerium by a bright bridge, but afterwards this bright bridge was not


MARS in 1956 (based upon the observations by the Members of O.A.A.)
-60°
-30°
0°
+30°
+60°
180°
270
0
90°
180°
T. Saheki

visible; and Sinus Gomer was seen as a very large projection on the northern shore of Mare Cimmerium, though possibly due to the great distance of Mars from our earth. However, in 1954 and 1956, Sinus Gomer was again observed as a gigantic and very complex marking separated from Mare Cimmerium by the bright bridge. Ebisawa observed many dark nuclei in the Sinus and also observed Cyclops and Cerberus II running through it farther south. The northwest end of Sinus Gomer was pointed, and a very intense canal, Serpentinus, connected it with Nodus Laocoöntis. Serpentinus was quite prominent in 1956 and was observed by Dr. Miyamoto, Ebisawa, Araki, and Saheki as a chain of many irregular dark spots.

The southern continents Phaethontis, Electris, and Eridania were often observed to be covered by bright clouds white and yellow-white in color; however, apart from the Great Yellow Cloud, these clouds did not affect the shapes of these continents.

In Mare Chronium a great number of very small dark spots were recorded by such observers as Ebisawa, Araki, Tasaka, and Saheki; and Ebisawa observed the same aspect in some other dark regions as well. On August 5 Oonishi recorded a brown color in this mare with the 18-inch reflector of the Yamamoto Observatory. This observation is very interesting when we remember Antoniadi's observations in which dark regions when the seasonal quickening reaches them become, not green in color, but brown. Antoniadi's observation has long been attributed by some students of Mars to the color aberration of the great refractor which he employed, but the present observation by Oonishi was made using a reflector of considerable aperture.

In the northern hemisphere, a faint large dusky spot, Nodus Gordii, was observed at the east end of the dusky and triangular Amazonis Regio. Near the north limb Propontis I, Propontis II, Euxinus Lacus, and Castorius Lacus were observed as a united dusky area. Trivium Charontis and Cerberus I were both very intense, and in the former some dark nuclei were observed by Ebisawa; and the latter was seen easily as a chain of a few dark sections, though Saheki observed it on September 7 as a double canal. To the southeast of Cerberus I, Scorpii Palus was observed as an irregular dark spot. Ebisawa and others observed Elysium as a beautiful pentagon bordered by Cerberus I, Eunostos I, Hyblaeus, Chaos, and Styx canals.

3. Region of Syrtis Major and Sinus Sabaeus

In Mare Tyrrhenum many dark spots were easily observed. Hesperia was rather dusky, and Hyria Lacus was observed in it as a very irregular dark streak. Ebisawa observed Cyclops and Cerberus III in Hesperia.

Ausonia was rather bright. Hellas appeared as a beautiful circular continent, but careful observations distinguished therein Portus Bucoleontis, Nerei Depressiones, and some other projections from the surrounding dark regions.

A very remarkable change occurred in Chersonesus. During July and August Chersonesus was as bright as usual, but it was very much darkened in September when this region reappeared from under the fading Great Yellow Cloud. In October the darkening was much more pronounced, and Chersonesus became a large and very intense dark region combined with Promethei Sinus. One may wonder whether this darkening was an effect of the Great Yellow Cloud.

Hellespontus was very dark and wide during July and August when the South Polar Cap was melting rapidly. During these months Hellespontus appeared as double; and Helles Depressiones, Depressiones Hellesponticae, and some other dark markings were observed in it. After the middle of September, Hellespontus decreased in intensity, though at least in part because of the thin haze over it; and then Mare Serpentis became a separate marking, and at the same time Yaonis Regio began to increase in brightness. In October and November Hellespontus became a weak band in spite of the absence of haze. This change may be a very typical example of seasonal changes on Mars.

Syrtis Major was comparatively small and simple in detail, as is usually so in this Martian season.

Moeris Lacus was very faint, as it was in 1954; but Ebisawa, Araki, and Tasaka were able to observe some details in it. Nepenthes was at times observed clearly as double.

One of the most striking changes which ever took place on Mars throughout the history of our observations is undoubtedly the emergence and development of Nodus Laocoöntis. Our first record of this new marking goes back to Kibé's observation of April 13, 1935. On that night Kibé detected a faint dusky spot to the east of Thoth I. Afterwards, this spot was not observed again until 1946, but on January 8 of that year Saheki detected, with the 18-inch reflector of the Yamamoto Observatory, the reappearance of Kibé's spot, for which Ebisawa later proposed in 1953 the name Nodus Laocoöntis. In 1948 it became much more prominent and was very widely observed by the members of both the O.A.A. and the A.L.P.O. It is extremely curious that such a gigantic marking escaped the attention of most professional astronomers for a number of years until Dr. E. C. Slipher and other "discovered" it in 1954. In fact, this feature was clearly photographed by Murayama on May 12, 1952, with the 8-inch refractor of the National Science Museum in Tokyo. In 1954 Japanese observers had an impression that it was somewhat less prominent than in 1952. (See Saheki's article in Sky and Telescope, August, 1956, issue. In that paper read "Japanese Standard Time" for "U.T.", J.S.T.=U.T.+9^h00^m). However, in 1956, Nodus Laocoöntis was again observed to be very prominent in spite of the large southern tilt of the axis of Mars.

Antigones Fons, first detected on June 2, 1937, by Saheki and confirmed during the next apparition by Dr. E. C. Slipher photographically, was rather easily observed; and the narrow canals Asopus and Apis and a few other canals were observed to run from it into Aeria.

Deltoton Sinus was rather faint though large, and a few dark nuclei were observed in it. Typhon ran through the Sinus from Aeria into Iapygia Viridis.

Sinus Sabaeus was very wide and intense as usual; especially in July and August its westernmost part, Sinus Meridiani, appeared extremely dark. Two small projections of Sigeus Portus and two other similar projections east of Sigeus Portus were well observed. From the latter projections to the east end of Sinus Sabaeus the northern coast of the Sinus was very much intensified. It is very interesting to note that the western component of Sinus Meridiani was very much shortened. To the north of it two small dark spots, Fontis Valkyrii, were well observed. Sinus Sabaeus was often affected by clouds or haze: when the Sinus was near the morning limb (or terminator), its western half was very faint or even invisible. This aspect most frequently occurred from the end of September to early October.

Between the west end of the western component of Sinus Meridiani and Oxia Palus a very prominent canal, Brangaena, was observed. In the A.L.P.O. Maps of Mars for 1954, '56, and '58 this canal is labeled as Cantabras; but Cantabras is really the canal connecting the north point of the western component of Sinus Meridiani with Oxia Palus, and it was observed at its normal position, though very faintly, in 1956. Brangaena was photographed in 1939 by Dr. E. C. Slipher and in 1941 by Dr. B. Lyot and also is very well shown in Dr. R. S. Richardson's photograph of August 10, 1956.

Gehon and Hiddekel were observed as double. Ebisawa resolved each component of the double Gehon into a double so that Gehon was thus a double double canal, according to Ebisawa.

Pandorae Fretum was very intense and wide in 1956, though it had been very faint and narrow in 1952 and '54. Before August in 1956 it was intense but much fainter than Sinus Sabaeus. In August Dori Depressiones, Xuthi Depressiones, Sextantis Depressiones, and some other dark markings became conspicuous; and the Fretum was very much intensified, and after the end of September Pandorae Fretum became as intense as Sinus Sabaeus.

(text continued on page 202)

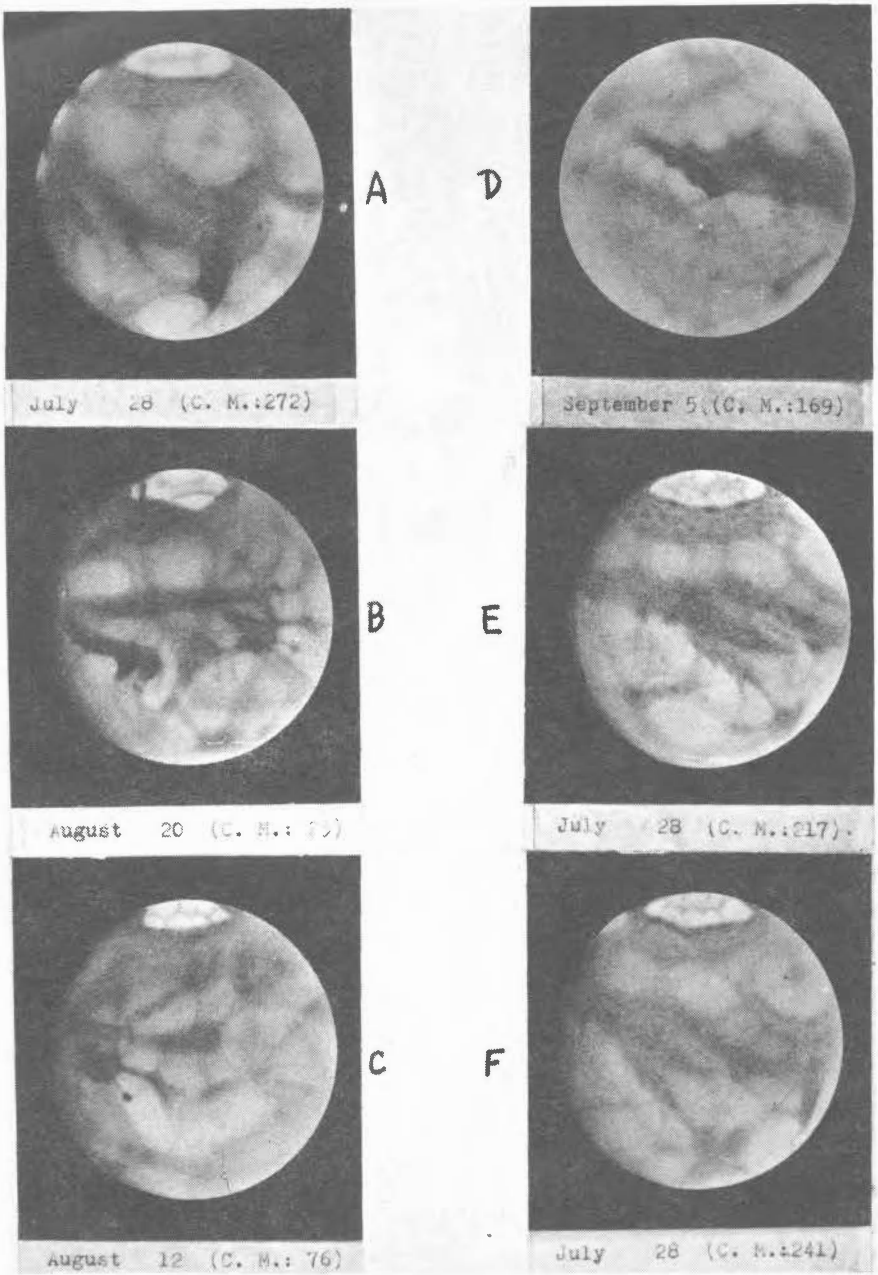


FIGURE 5. Drawings of Mars in 1956 by Shirō Ebisawa with an 8-inch refractor at 288X, 400X, and 500X.

Date	U.T.	C.M.	D_E
A.1956,Jul.28	$19^h 50^m$	272°	-20°.1
Three clouds on the terminator.			
B.1956,Aug.20	17 05	23	-19.2
Great Yellow Cloud over Noachis.			
C.1956,Aug.12	15 50	76	-19.5
D.1956,Sept.5	12 15	169	-19.2
Great Yellow Cloud covers the South Polar Cap.			
E.1956,Jul.28	16 00	217	-20.1
Note the mottled structure of maria and canals.			
F.1956,Jul.28	17 40	241	-20.1

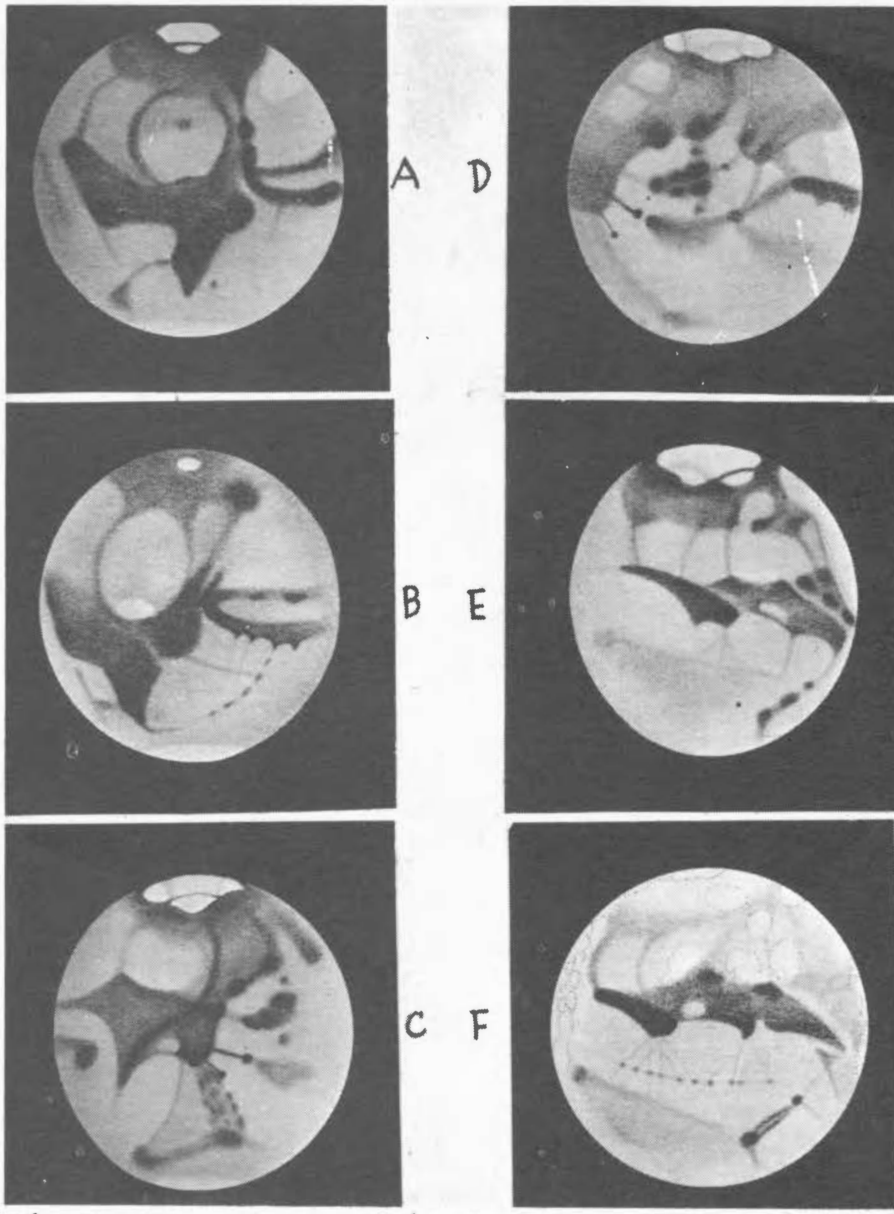


FIGURE 6. Drawings of Mars in 1956 by Tsuneo Saheki with an 8-inch reflector at 333X and 400X.

	Date	U.T.	C.M.	D_E	Seeing	Power
A.	1956, Aug. 25	13^h40^m	287°	$-19^\circ.2$	4 ~ 3	330X
B.	1956, Sept. 28	12 00	322	-20.1	4 or 5	330X
C.	1956, Aug. 15	15 35	45	-19.4	6	400X
D.	1956, Aug. 14	18 15	93	-19.4	6 ~ 7	400X
E.	1956, Aug. 2	15 55	168	-19.8	5 or 6	400X
F.	1956, Sept. 7	14 45	188	-19.2	4 or 5	330X

Great Yellow Cloud had covered the South Polar Cap.

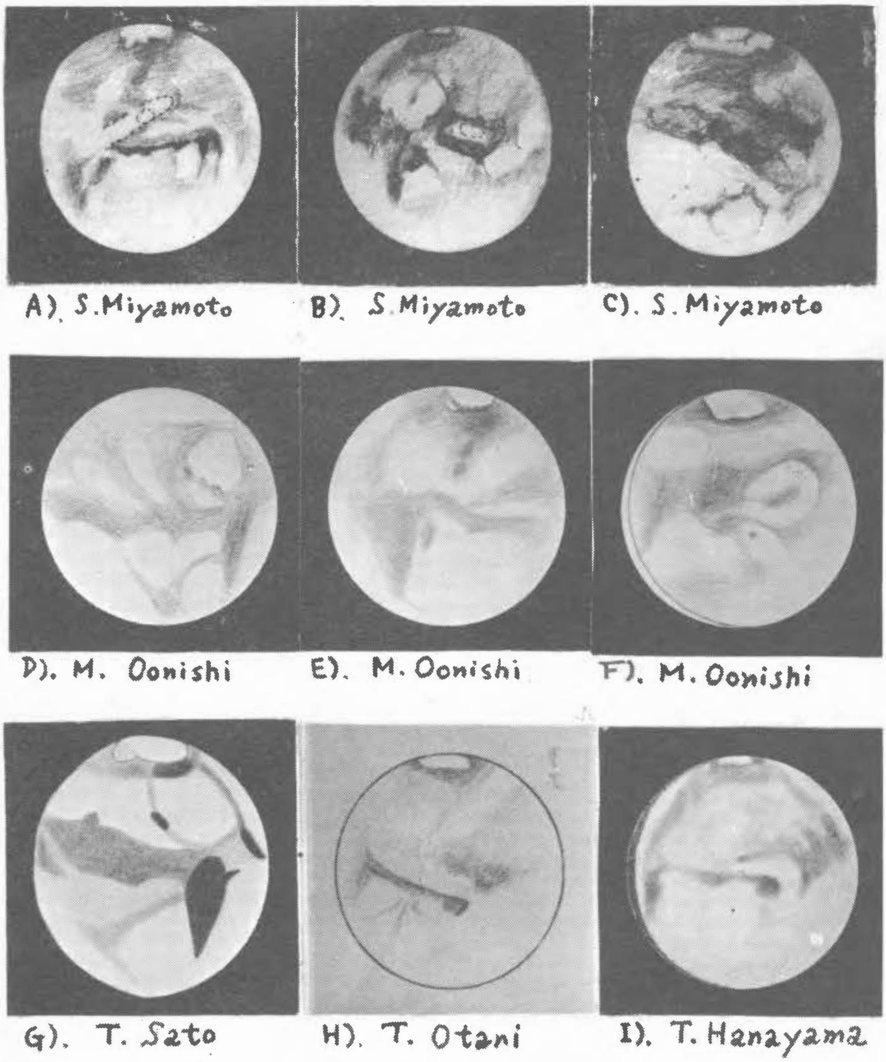


Figure 7. Drawings of Mars in 1956 by various members of the O. A. A.

Observer	Date	U.T.	C.M.	D_E	Seeing	Telescope
A)[1] S. Miyamoto	1956, Aug. 20	13^h45^m	333°	-19°	Moderate	12"(7") refr., 360X.
B)[2] S. Miyamoto	1956, Oct. 3	14 30	313	-20	Good	12"(8") refr., 360X.
C) S. Miyamoto	1956, Jul. 31	17 30	210	-20	Good	12"(7") refr., 420X.
D) M. Oonishi	1956, Sept. 2	16 40	260	-19	6~7	6" refl., 200X.
E)[3] M. Oonishi	1956, Aug. 25	16 05	323	-19	3~5	6" refl., 200X.
F) M. Oonishi	1956, Aug. 14	16 15	64	-19	8	6" refl., 200X.
G) T. Sato	1956, Jul. 29	19 40	260	-20	5	3" refl., 200X, 133X.
H)[1,4] T. Otani	1956, Aug. 25	17 30	343	-19	4	8" refr., 400X.
I)[1] T. Hanayama	1956, Aug. 22	16 06	349	-19	6~8	6" refr.

[1] Early stages of the Great Yellow Cloud are shown.
[2] A yellow cloud over Deucalionis Regio.
[3] A yellow cloud over Argyre I.
[4] This drawing was made from the image on a television screen. This TV technique was applied under the directorship of Sadao Murayama at the National Science Museum, using a Toshiba Image Orthicon.

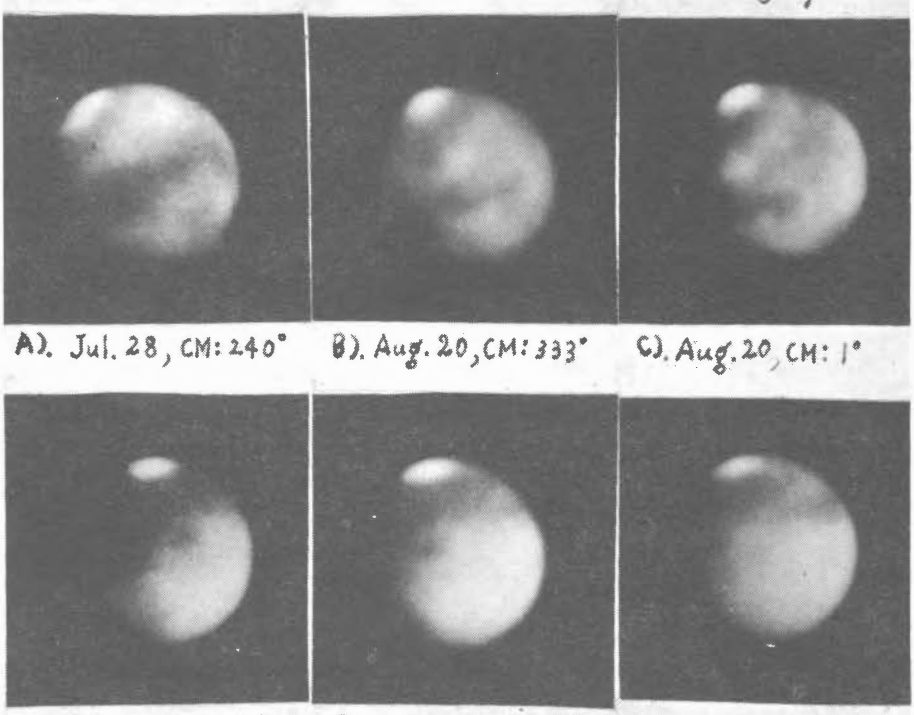


FIGURE 8. Top row: drawings of Mars in 1956 by O.A.A. members. Central and bottom rows: photographs of Mars taken by Sadao Murayama in 1956 with an 8" refr. and an orange filter. The originals show such canals as Cerberus I, Hiddekel, Gehon, and Agathodaemon; some of the finer details are lost in reproduction.

	Observer	Date, 1956	U.T.	C.M.	D_E	Seeing	Telescope
J)	H. Araki	Sept. 27	14^h25^m	6°	-20°		6" refl.
K)	I. Tasaka	Aug. 20	15 00	351	-19	3	13" refl., 176X, 309X.
L)	I. Tasaka	Aug. 14	17 40	84	-19	6	13" refl., 309X, 540X.
A)		July 28	17 40	240	-20		
B)		Aug. 20	13 45	333	-19		
C)		Aug. 20	15 40	1	-19		
D)		Aug. 12	14 58	63	-19		
E)		Aug. 12	16 52	91	-19		
F)		Aug. 12	18 20	112	-19		

An interesting phenomenon occurred in Noachis. On July 16 Saheki detected a wide but faint canal in Noachis running from Mare Serpentis into the middle of Chalcoporos. This new canal disappeared soon after its discovery, but it was again observed by Kobayashi on August 26 (through the weaker parts of the Great Yellow Cloud?) and by Araki on September 27 and 28 and on November 7. This canal rather resembled in its rapidly changing character the very temporal canal of 1928, though the present object was much fainter and lay farther south at its west end than the one of 1928.

Acknowledgements and Concluding Statements

In concluding this paper, we wish to express our most hearty thanks to the late Dr. Issei Yamamoto for his very unselfish guidance in Japanese lunar and planetary astronomy for many years since 1920, the year when Dr. Yamamoto organized the Oriental Astronomical Association. In fact, almost all Japanese lunar and planetary observers have been guided by Dr. Yamamoto directly. We are also very grateful to Prof. Walter H. Haas and others of the Association of Lunar and Planetary Observers for their very kind support to us in various ways. Of course, we heartily thank all the participating observers for their very invaluable observations, without which this paper could not exist.

Since the future A.L.P.O.-O.A.A. coöperation must be closer and closer, we would like to carry on correspondence with many of the active members of the A.L.P.O. Please write to us at the following postal addresses:

Tsuneo Saheki, Osaka Planetarium, Yotsubashi, Osaka, Japan.

Takeshi Sato, Rakurakuen Planetarium, Itsukaichi, Hiroshima, Japan.

THE NINTH CONVENTION OF THE A.L.P.O.

By: L. J. Robinson

As has become the custom, the A.L.P.O. held its second 1961 convention in conjunction with the annual convention of the Western Amateur Astronomers--at the Lafayette Hotel, Long Beach, California, on August 24, 25, and 26. Truly, this was one of the finest meetings that this writer can remember. In contrast to other years, the A.L.P.O. session was not held separate from the general W.A.A. meeting, but was integrated into the W.A.A. program--a policy to be recommended for the future.

The quality of the papers, the extensiveness of the exhibit, and the superb seeing at the star-party were only augmented by the attendance of several paramount members of the A.L.P.O., many of whom we of the West Coast met for the first time. Among these, the names of J. Goodman, P. Glaser, D. Zahner, W. Shawcross, J. R. Smith, and C. H. Giffen were appended to the register. Conspicuous by his absence was our Director, Walter Haas. However, on the first day of the convention a telegram from Florida assured all that he was there in spirit if not in person.

The seventeen papers presented came from many parts of the world, giving the convention an atmosphere of internationality. Since many of these papers will be reproduced later in The Strolling Astronomer, they will not be discussed here *per se*; this writer would, however, like to mention several healthful tendencies as brought out in the papers as a whole. The moon held master during much of the meeting, with no less than seven papers being devoted to that body (including a Morrison Lecture by Dr. Dinsmore Alter). Also, the theoretical study of the formation of lunar features formed a great part of this aspect. Indeed, it was apparent to all that mathematics, physics, and logic played a major role in such papers. This is most laudable, for it demonstrates that the comtemporary amateur is no longer content merely to make observations; it shows that he wishes to know the "why" of his observations as well. Let us hope that such a tendency continues in future years! Secondly, Dr. Goodman, Chairman of the A.L.P.O. session, attempted to have as long as possible a discussion period after each paper--a point of great merit. This writer, for one, hopes this format will continue; he would also

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FIGURE 9. The Ninth Convention of the A.L.P.O. at the Lafayette Hotel, Long Beach, California, on August 24-26, 1961. Photograph by Jack Eastman, Jr.

FIGURE 10. Mr. George Carroll observing solar prominences with his 3-inch coronagraph during W.A.A.-A.L.P.O. Convention at Long Beach. Photograph by Jack Eastman, Jr.

FIGURE 11. Presentation of an A.L.P.O. Award to Mr. Alan McClure (standing, left) during the W.A.A.-A.L.P.O. Convention Banquet. Photograph by Eugene Fair, Redondo Beach, California.

FIGURE 12. Presentation of the Western Amateur Astronomers G. Bruce Blair Award to Mr. Carl Wells (standing, right) by Tom Cave, Convention Chairman, during the 1961 Convention Banquet. Photograph by Eugene Fair.

like to make a suggestion for future conventions. In the future, let us have those persons who are present give their papers first, having as lengthy a discussion period as needed after the paper for the complete audience response--subject to control from the Chair. Then, after these papers are finished, have the in absentia papers read. The question and discussion period is the most helpful part of any paper, and I am sure that the authors would appreciate the opportunity to defend their views against the criticism of their colleagues.

The A.L.P.O. had a magnificent exhibit under the direction of Mr. Alika Herring. Jupiter, Mars, the moon, and Mr. Chapman's simultaneous observing project accounted for much material of interest. Also presented was a 3" coronagraph constructed by Mr. George Carroll, a telescope and instrument maker of renown. This instrument, with its 4.5 Å bandpass monochromator, was set up beside the hotel's swimming pool so that the delegates could view the solar prominences. The first day the sun obliged with no less than 12 prominences; the second day 14 were visible, including a giant "surge" which could be observed to grow by the hour! A view not soon forgotten! Speaking of observing: at the star-party the delegates were blessed with seeing 7. As a matter of fact no less than eight persons saw detail on Ganymede--there was good agreement among all drawings. The observations were made with two ten-inch f/7 telescopes--a homemade job by Fread Alrich and an ANRA commercially made telescope with a mirror by the same craftsman, who is chief optician for that firm. The magnification used was approximately 650X.

The final night of the convention included the banquet, during which Alan McClure was presented the A.L.P.O. Award by Dr. Goodman. Of course, this award was given in recognition of the unparalleled skill Mr. McClure has shown in wide-field astrophotography. It is rather anti-climactic, but McClure had his photographs of Comet Wilson on no less than three magazine covers in September, 1961: Sky and Telescope, The Review of Popular Astronomy, and The Griffith Observer.

Lastly, on behalf of all A.L.P.O. members, this writer wishes to express his most heartfelt thanks to Dr. Goodman for his superb management of the A.L.P.O. session, to Mr. Alika Herring for the fine production of the A.L.P.O. exhibit, and to the W.A.A., under the direction of Mr. Thomas Cave, President, for making its facilities available to the A.L.P.O.

AN ANALYSIS OF THE SEEING AND TRANSPARENCY SCALES AS USED BY AMATEUR OBSERVERS

By: L. J. Robinson

There is little doubt in the minds of the more experienced observers that seeing and transparency scales, as currently used by amateurs, are vitually useless. The scales themselves are subjective and/or ill-defined; also, there is mystery surrounding the exact nature of these scales, and little mention of them as unique entities reaches the journals. Due to these facts that the scales are inadequate and that few persons know what the existing scales really mean, we have an ideal opportunity to review the entire system. Let me begin by relating a couple of stories, which I hope will efficaciously demonstrate the above facts.

One night, about two years ago, I had the occasion to estimate the seeing concurrently with three observers of high repute. The instrument in use was a 12-inch refractor; the overall conditions might be described as "average." The first observer went to the telescope and made his estimate of the seeing; keeping this value to himself, he stepped down, and the next observer went up. So things progressed until all four persons had made their estimates. The results were that two observers rated the seeing as "2-3"; one of the others said "3"; and the last stated, with supreme confidence, "6-7." Recalling that all these observers were seasoned, one can only reach the conclusion that one observer used greatly different criteria in making his estimate (it was stated before the observations were made that all were to use the "A.L.P.O. scale").

Concerning transparency, I recall a quite similar instance. I had just moved to a new home which lies in proximity to the Pacific Ocean. The sky is hazy most of the time, making the sky condition, in general, much poorer than I had been accustomed to in my former location (which, by the way, was at a considerable altitude next to the San Gabriel Mountains, which form the eastern border of Los Angeles). One night I was observing with a very good friend who is deservedly a highly reputed amateur. I asked him about the transparency; he estimated the transparency as "4+" (sic!). Mentioning the fact that conditions nowhere approximated "4+" since the faintest star visible was third magnitude, I asked why and how he had made the estimate. His answer follows: "...well, it never gets much better here, and if I used your scale I would never be able to rate the transparency better than 3." With chagrin, I pointed out the fact that there is nothing magical about rating the transparency high and that a low estimate does not necessarily mean a loss of value to the observation. Also, I pointed out that it may be well for him to use his own scale except for the fact that no one else knows about it.

The point I have been attempting to make is that the observer's location has a direct influence regarding his "education" relating to subjective matters such as seeing and transparency. He may read, for example, that seeing "10" is "perfect" or "is the best seeing possible"; but if this observer never experiences true seeing better than 5, he will be prone to relate this true 5 to his personal 10. How is it possible for one to discern a fractional part of a perfection which he will never be able to see? An analogy might be attempting to measure a length of lumber with a piece of material of some standard length. Our subject knows the second piece to be a standard but is ignorant of which standard it is. He knows what it is for but does not know how much of it there is. The following discussion will consist of an analysis of the meaning of "seeing" and "transparency", an analysis of two seeing scales, and a suggested revision of the seeing and transparency scales in use today.

Seeing

Fundamentally, "seeing" is defined to be that quality of the atmosphere which produces an instability in the image of an object as seen in an astronomical telescope. There are two principal types of seeing: (1) The "slow" seeing pattern which moves the image in a lateral manner about the field. (2) The "fast" seeing pattern which distorts and blurs the image. In visual observation, which is the only aspect of observing being considered in this paper, it is this fast pattern which accounts for the major loss in recorded detail; the slow pattern is not usually detrimental. It has been found that a slow pattern may be resolved into a fast pattern with a sufficient increase in aperture. In other words, slow seeing is merely a summation of fast seeing patterns. The nomenclature "fast" and "slow" was probably derived from researches by Ellison and Seddon (1), who concluded that seeing waves showed a frequency of from 5 to 100 cycles per second. It was Douglass (2), however, who determined the actual length of seeing waves. It was his conclusion that such waves vary from 0.7 to 4.0 inches in length.

It has been mentioned that an increase in the aperture D will resolve a slow pattern into its faster counterparts. Using the empirical relations:

$D < 5\lambda$ produces lateral motion in the field (slow seeing),

$D > 5\lambda$ produces blurring and distortion (fast seeing),

and $0.7 \leq \lambda \leq 4.0$ inches,

we may conclude that under mean conditions, a telescope larger than about 8.5 inches in aperture will show a fast pattern, while a smaller instrument will show slow seeing. Of course, this relation is subject to much variation, i.e., 3.5 inches to 20 inches in aperture.

The above are the basic characteristics of seeing *per se*; seeing, however, is subject to localized variations: altitude and object location. The aspect of altitude, more commonly referred to as Zenith Distance, may be approximated by the well known function, sec Z. In other words, the seeing at $Z \doteq 60^\circ$ will be twice as poor as at $Z = 0^\circ$; also, at $Z \doteq 75^\circ.5$ the seeing will be twice as poor as at $Z \doteq 60^\circ$. The object location factor stems from the fact that some portion of one's unique sky may always be subject to much different conditions than another. An example of this effect would be the seeing conditions directly to the N.E. of my old home. The reader will recall that a mountain range was found in that direction; the updrafts caused by that range *always* deteriorated the seeing in that direction by 2 or 3 points as compared to, say, the S.W. Many similar effects could be found for other locations.

Seeing Scales

The fundamental purpose of a seeing scale is to describe, as accurately as possible, the stability of the atmosphere during a given observation. Such a determination is necessary in order to relate the degree and quality of one person's observations to those of another. For this reason, it is paramount that a precise method be arrived at which will allow for such a determination; also, by the condition of this relation, it is necessary to have a scale which is applicable to widely separated observers.

The criteria for an adequate seeing scale are described below; they are also reproduced in Table I, which relates several contemporary seeing scales to each other.

Seeing Scale Criteria

(Physical Criteria)

(1) *The location of the object under observation*. For a seeing scale to meet this most important requirement (sec Z), the seeing estimate must be made at the same celestial location as that of the object under observation.

(2) *Consideration for the aperture of the instrument*. It has been shown above that the aperture of a telescope affects the type and amount of seeing; it is apparent that any useful scale must relate the seeing "limits" to which a given telescope may penetrate.

(3) *Emancipation from instrumental quality*. All estimates of the seeing should be independent of the degree of perfection of the instrument through which they are made.

(4) *Recording the best moments*. Any seeing scale should indicate the best moments of seeing, for only at that time is the greatest accuracy or greatest amount of detail realized.

(5) *Frequency of the best moments*. As the finest observations are made during the best moments, the overall quality will be realized by the number of these optimum periods experienced during the observing session.

(6) *Non-subjective standard*. It is necessary to have a standard or basis for subsequent fractional estimates formed on a non-subjective maximum condition. It is also necessary that this maximum condition be attainable or in some other way be capable of precise visualization.

(Personal Criteria)

(7) *Impersonality*. As it is necessary to have a standard reference, it is necessary to have a standard criterion for fractional division, again allowing no possibility for misinterpretation. The use of *constant* and uniform differentials is paramount.

(8) *Simplicity of use*. Any system which will be used by large numbers of persons with widely differing backgrounds and abilities *must* be the ultimate of simplicity.

(9) Efficiency. When dealing with volunteer labor, it is desirable that any supplementary observation or condition consume as little excess time as possible. The ultimate is that such additional material be procured while the principal observation is being made.

(10) Universal application. It is necessary that any comparative system be constructed so that all observers may use the same points of comparison as well as the same criteria.

Table I. Seeing scale criteria described by L. J. Robinson in his article in this issue. Evaluation by Mr. Robinson of several scales in current use.

	#1	#2	#3	#4	#5	#6		#7	#8	#9	#10	Total Physical	Total Personal	Grand Total
Pickering	1	0	0	3	0	1		1	1	1	3	5	6	11
Tombaugh-Smith	0	3	1	3	0	3		3	1	0	1	10	5	15
Robinson	3	3	3	3	3	3		1	3	3	3	18	10	28

0 no consideration
1 partial consideration
3 total consideration

The realization of all, or even a vast majority, of the above criteria is very difficult to procure. The first real effort in this direction was undertaken by W. H. Pickering. Indeed, it is this noble but somewhat inadequate accomplishment which is in widest use today. In principle, this system utilizes the visibility and quality of the diffraction disk and of the surrounding diffraction rings as its criteria. This scale was designed for a 5-inch objective being used with a magnification greater than 300X on a first or second magnitude star. From Table I, one will see that Pickering's scale is quite lacking in physical criteria, less so in personal criteria. Its major faults are: it fails to relate all telescope sizes to a common system; it fails to consider the quality aspect of the telescope; it fails to record the frequency of the best moments of seeing. Remaining partial deficiencies are: it only approximates, due to the necessity of locating a first or second magnitude star, the location of the object under discussion; it is subject to personal estimations of degree; it is only relatively simple to use; it is inefficient to some degree, due to the fact that the observation of seeing must almost always be made on a separate star; lastly, the fundamental standard is somewhat subjective, i.e. "...virtually [sic!] stationary." This phrase Pickering used to define seeing 10. The points which it fully realizes are: it does record the best moments of seeing, and it also has universal application.

A major advance in the methodology of seeing estimation came from Messrs. C. W. Tombaugh and B. A. Smith (3). Here, indeed, we find a much improved method of seeing estimation as compared to Pickering. In general, the Tombaugh-Smith Scale is based on the appearance of the "confusion disk", progressively poorer seeing giving rise to larger diameter disks. It is significant to note that Tombaugh and Smith bring into consideration two major facts. First, the seeing is recognized as a function of the telescope's size; also, it is necessary to have measurable quantities in order to arrive at a factual estimate of the seeing. Much of the subjectiveness has been removed, though at a sacrifice of efficiency. The total deficiencies are: a complete lack of consideration for the location of the object under observation since all estimates of the seeing are made using "standard" double stars near the north celestial pole; it also fails to record the frequency of the best moments of seeing; lastly, as previously mentioned, much time is consumed in making the estimate. Partial realization of the optimum is found in: a consideration of the quality of the observing telescope (lacking but superior to Pickering); its simplicity of use once the stellar estimate has been made; its limited application because its fundamental standard is located about the north celestial pole. Total optimum conditions are found in its consideration for the size of the observing telescope, its recording of the best moments of seeing, its non-subjective standard, and lastly, in its impersonality. In all, it is easy to see a vast improvement in many areas over the old Pickering scale--especially in areas of physical criteria. In conclusion, it should be stated that the principles presented in the Tombaugh-Smith Scale were heavily relied upon by the author in his construction of another scale.

A Practical Seeing Scale For Visual Observers

It was soon apparent to this writer that in order to create a seeing scale which would meet all the basic criteria it would be necessary to relate all seeing estimates to the object under observation. In this manner criteria #1, #8, #9, and #10 would be fulfilled. Upon making this decision, any consideration of a system of constants like those used by Tombaugh-Smith is ruled out. In its stead, time was chosen as the constant, thereby fulfilling criteria #4, #5, #6, and #7. The final major aspect, that of relating all telescopes to a common system, was solved by the application of the well known relation for the resolving power of a telescope, 4".56/A. With this choice criteria #2 and #3, the last ones, were carried into the relations below. As all inter-relations for the scale are now established, the seeing may be expressed as:

$$S_f = k\bar{E}, \qquad (1).$$

where S_f is the value of the fast seeing pattern.
k is a constant and is equal to the reciprocal, A/4.56, for any one telescope, A being the aperture in inches.
$\bar{E}$ is the mean estimate of the portion of the time, to the nearest 10% and taken at 10 minute intervals throughout the observation, during which the image was so steady as to show no perceptible blurring under observational magnification.

$$S_s = k\bar{\bar{E}}, \qquad (2).$$

where S_s is the value of the slow seeing pattern.
k is the same constant as above.
$\bar{\bar{E}}$ is the mean estimate of the portion of the time, to the nearest 10% and taken at 10 minute intervals throughout the observation, during which the image showed no perceptible lateral motion in the field of view.

It is necessary to estimate both the fast and the slow pattern due to the fact that a given "bundle" of seeing waves will contain some odd length waves, leading to this dual impression.

With these relations we may calculate some of the following extreme limits ($0\% \leq \bar{E} \leq 100\%$) for the seeing, using different apertures in order to demonstrate the maximum variation.

(1).	0"	$0 \leq S \leq 0.000$
(2).	4"	$0 \leq S \leq 0.877$
(3).	8"	$0 \leq S \leq 1.754$
(4).	12"	$0 \leq S \leq 2.632$
(5).	16"	$0 \leq S \leq 3.509$

It is immediately obvious that this sytem is both cumbersome and insufficient. To correct this state, it was decided to refer the above scale to a specific telescope under specific conditions. Hence, let seeing 10 be defined as that which is experienced by the observer using a 10-inch telescope under 100% atmospheric steadiness, and allow all other telescopes and conditions to be expressed as a function of this standard. It is now possible to express (1) and (2) as:

$S_f = A\bar{E}$, and

$S_s = A\bar{\bar{E}}$, where A is the aperture in inches.

Let us now recalculate the limits as expressed above.

(1). 0" $0 \leq S \leq 0.0$
(2). 4" $0 \leq S \leq 4.0$
(3). 8" $0 \leq S \leq 8.0$
(4). 12" $0 \leq S \leq 12.0$
(5). 16" $0 \leq S \leq 16.0$

The conclusions are obvious: the maximum seeing that can be experienced with a telescope of given aperture is a function of that aperture only. The following is an example of this method in use with a six and a twelve and one-half inch instrument; the duration of the observation is thirty minutes.

Six-Inch

First 10 minutes	$E_1 = 20\%$	Mean:	$\bar{E} = 27\% \doteq 30\%$.
Second 10 minutes	$E_2 = 30\%$		$S_f = (6)(.30) =$
Third 10 minutes	$E_3 = 30\%$		$1.8 \doteq 2$.

Twelve and One-Half Inch

First 10 minutes	$E_1 = 20\%$	Mean:	$\bar{E} = 27\% \doteq 30\%$.
Second 10 minutes	$E_2 = 30\%$		$S_f = (12.5)(.30) =$
Third 10 minutes	$E_3 = 30\%$		$3.75 \doteq (4)$.

From these two examples it is well shown that the actual seeing is a function of aperture alone--the time factor being equal. In addition, a reference to Table I will show that this revised seeing scale fully meets all the basic criteria, with the possible exception of #7, which alone is left to some interpretation. However, any variation here is apt to be minor and will probably be insignificant--especially in the case of smaller instruments.

Transparency

The question of transparency, as referred to visual observation, is much more easily solved than that of seeing. For the visual observer we may define "transparency" as being "that quality of the atmosphere which, in any physical way, hampers the transmission of light." There are two mechanisms which affect this transmissiveness: (1) Innate atmospheric properties which prevent, in part or in whole, the passage of particular waves of light, and (2) the obscuration of light by foreign matter suspended within the atmosphere.

Property (1) is essentially a constant for visual observers; as such it will only be necessary to give a fundamental explanation of this condition.

Let

$$l = l_o \sec Z \qquad (3),$$

where l_o is the vertical height of the atmosphere, and l is the actual length of any light-path.

Then, if I_o is the original intensity of light and I is the received intensity, we may say:

$$I = I_o e^{-kx*} \qquad (4).$$

*Should light of intensity I pass through a medium of thickness dx, it will be diminished as follows:

$$dI = -kIdx.$$

Hence, $$dI/I = -kdx.$$

But, $dI/I = d(\log_e I)$; therefore, $\log_e I = -kx + \log_e I_o$, or $I = I_o e^{-kx}$.

But, by letting C become the transmission coefficient for any wave length, equation (4) becomes

$$I = I_0 \, C^l \qquad (5).$$

Substituting (3), we have,

$$I = I_0 \, C^{l_0 \sec Z} \qquad (6).$$

Property (2) above is more difficult to define, for it is a function of every situation and every condition. The fact, however, that we have shown (1) to be a constant (excluding, of course, the function of altitude) allows us to extend a scale to this variable.

<u>A Practical Transparency Scale for Visual Observers</u>

The formation of a transparency scale must accord itself with much the same basic criteria as have been enumerated in a previous section of this paper. The only contemporary scale which I am at all familiar with is so nebulous that it is impossible for me to make a comprehensive analysis of it. For this reason, I shall merely propose my suggested revision of that 0-5 scale.

In order for one to describe the total clarity of the atmosphere through which an observation is made, all that is required is that the observer note the <u>faintest</u> star visible, to the nearest one-half magnitude, within a <u>tolerable distance</u> from that object. The phrase "tolerable distance" requires some expansion. It will be recalled that the extinction of starlight is a function of sec Z. Therefore, as the zenith distance* is increased, the extinction becomes greater. Figure 13 shows the tolerable distance limit to which one may extend his observations of the transparency before exceeding Δ magnitude = 0.5.

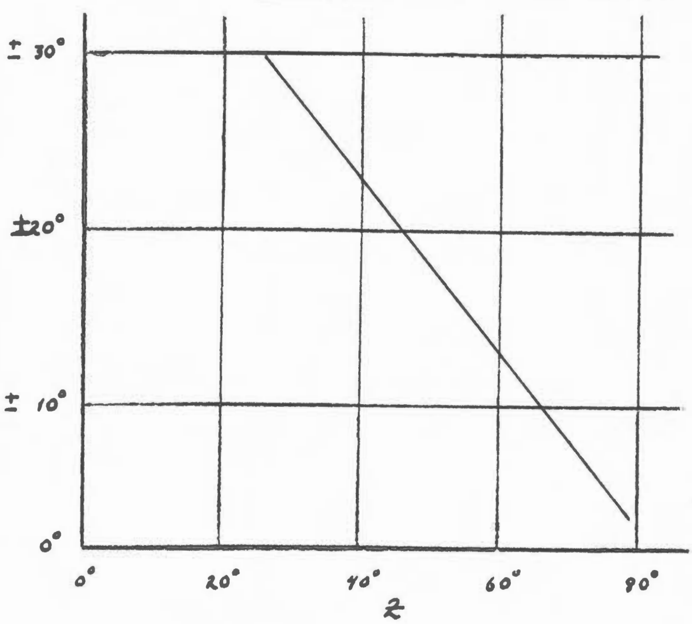


FIGURE 13. Relation between zenith distance Z (horizontal scale) and "tolerable distance" (vertical scale) for selecting a star for a transparency estimate. The criterion is that differential atmospheric extinction between object and star employed should not exceed 0.5 stellar magnitudes. The graph gives the corresponding maximum permissible differences in zenith distance, or also in elevation above horizon, between object and star. This chart by L. J. Robinson. See also text of his article.

* The zenith distance may be computed from latitude, declination, and hour angle by means of spherical trigonometry; or it may often be estimated directly to the degree of accuracy needed here.

The scale itself would read:

Transparency	0	stars	≤0.5 mag.	visible
"	1	"	≤1.5 mag.	visible
"	2	"	≤2.5 mag.	visible
"	3	"	≤3.5 mag.	visible
"	4	"	≤4.5 mag.	visible
"	5	"	≤5.5 mag.	visible
"	6	"	>5.5 mag.	visible

Hence, if one were able to see a 4.4 mag. star within the tolerable distance, the transparency would be "4."

Concluding Remarks

The two sclaes presented within this paper are my attempt to revise the subjective and inadequate scales currently in use by amateur observers. I make no pretense that these revised scales answer all of the problems of massed estimations of conditions, but I do say that they take a step in the right direction. I invite others to take similar steps in order that final scales will be found; also, I invite persons to comment on these scales. Something must be done quickly lest we lose sight of the small foundation which we have at this point.

References

(1) M. A. Ellison and H. Seddon, "Some Experiments on the Scintillation of Stars and Planets", M.N., Vol. 112, No. 1, p. 73.

(2) A. E. Douglass, "The Study of Atmospheric Currents by the Aid of Large Telescopes, and the Effect of Such Currents on the Quality of the Seeing", Metr. Jour., U.S.A., March, 1895.

(3) C. W. Tombaugh and B. A. Smith, "A Seeing Scale for Visual Observers," Sky and Tel., July, 1958, Vol. XVII, No. 9, p. 449.

Also see: W. H. Haas, "Some Remarks Upon the Tombaugh-Smith Seeing Scale", Str. A., Vol. 12, Nos. 10-12, pp. 144-145.

THE 1961 APPARITION OF JUPITER-- FIRST INTERIM REPORT

By: Clark R. Chapman

I. Introduction

This report will serve as the first article concerning Jupiter's appearance in the 1961 apparition. This paper is based primarily on a summary of my own observations which was first prepared in August, 1961, and was revised in September, 1961. The report was revised again in November, 1961, for publication here and summarizes not only my own work but also the work of some of the other members of the A.L.P.O. from the beginning of the apparition through October.

II. Changes from 1960--The General Appearance

The most obvious change from 1960 was the brightening of the NTrZ-NTeZ so that it was brighter than, and sometimes even more prominent than, the STrZ-SEB Z. As the middle of the 1961 apparition approached, the NTrZ-NTeZ became somewhat less prominent but nevertheless remained considerably more prominent than its dullish appearance of 1960.

Another obvious change occurred in the equatorial regions. The 1960 aspect had been characterized by well-formed humps and projections along the south edge of the NEB which had generated loop festoons into the EZ. These loop festoons had been very narrow, though well seen. The aspect in 1961 was considerably different: large dark features, of considerable breadth, with bases on the NEB_s looped up nearly to the SEB_n and occupied a considerable amount of space within the EZ. The activity was considerable. Smaller apertures generally resolved these features as merely "darker sections" of the EZ.

The STB continued to contain the three long-enduring white ovals along its south edge. There had been some changes in that belt, however. Oval DE was probably the most prominent oval, situated between two extremely dark sections of the belt. Oval FA followed it rather closely but was very poorly defined. As FA was passing the Red Spot around August 1, it was unrecognizable as an oval to many A.L.P.O. observers, including the author. The region of the STB between FA and BC was extremely faint. This had been true in 1960 but not to the same extent. Oval BC formed the leading edge of an extremely dark section of the STB which continued to DE. This section was so dark as to make the belt about as prominent as the NEB in those longitudes.

The SSTB also showed considerable variation with longitude. The SSTB between the longitudes of FA and BC (where the STB was so faint) was very dark, while it was somewhat weaker on the other side of the planet. The SSTB was clearly double in the longitudes of BC; however, about 50 degrees following BC the northern component of the SSTB abruptly ended. A number of observers with larger apertures have reported white spots along the northern edge of the SSTB, particularly in the longitudes of the Red Spot (see Figures 17, 18, and 21).

In association with the variations of the STB and the SSTB, the STeZ and the SSTeZ showed changes of brightness with respect to longitude. The brightest part of the STeZ was between the following end of the above-mentioned north component of the SSTB and oval DE. The darkest section of the zone coincided with the dimmest section of the STB and the brightest section of the SSTeZ (following FA).

The north component of the NEB was definitely separated from the NEB_s and was somewhat more active than in 1960. There were a number of small projections into the NTrZ associated with some ovals along the southern edge of the NTrZ which were very poorly defined. There was one big exception: there was a very prominent white oval in the northern component of the NEB which was located near λ_{II} 270° in June drifting to about 240° in September. It resembled in size and shape the ovals in the STB-STeZ (see Figures 16, 19, and 20). During August and September there was an unusually dark projection on the NEB_n near λ_{II} 15° (see Figure 15).

The NNTB was usually the fourth belt in prominence except when the darkest part of the SSTB out-ranked it. The belt was generally double and exhibited spots of considerably more prominence than in 1960. There were several features of special interest: near λ_{II} 120° there was a very dark section of the south component of the belt (see Figures 15 and 16). The belt seemed to be single immediately preceding this section. Moreover, the faint NTB looped down and connected with the preceding end of this section of the $NNTB_s$. In the longitude of the NEB_n white oval, there was another darker section of the $NNTB_s$; however, the south component was faintly visible preceding it. Between the longitude of the Red Spot and λ_{II} 120° the NNTB tended to be single and rather faint.

The NTB was an exceedingly inconspicuous belt this year but exhibited some very interesting aspects. In the regions immediately following the longitude of the Red Spot the belt was rather broad with a very dark (but exceedingly thin) southern border. It was probably most prominent in this region and it remained slightly to the north of the center of the combined NTrZ-NTeZ. It then looped north (as mentioned before) to connect with the preceding end of the $NNTB_s$. In nearly this same longitude the belt began again in the southern half of the combined NTrZ-NTeZ and continued on, looping slightly north again with increasing longitude. About forty degrees

The three figures on this page are extended-longitude drawings of Jupiter. The upper diagram shows Elmer Reese's interpretation of the southern parts of the EZ and the SEBn. The bottom drawing covers practically all of Jupiter's surface showing well the longitudinal changes in the prominence and positions of the various belts.

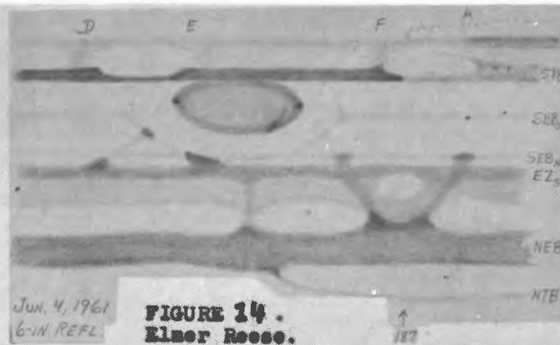
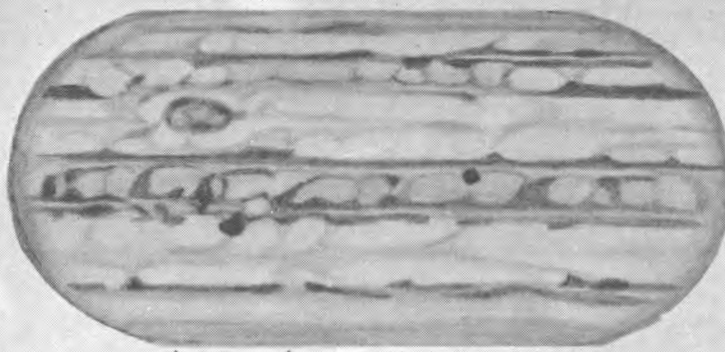


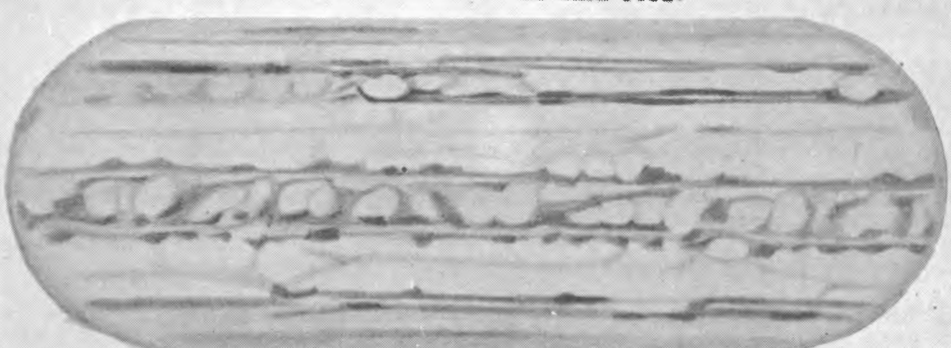
FIGURE 14. Elmer Reese.



0:25 UT
$C.M._I = 230^\circ$
$C.M._{II} = 355^\circ$

FIGURE 15. Clark Chapman
Sept. 17, 1961
10-inch refl.

3:40 UT
$C.M._I = 348^\circ$
$C.M._{II} = 113^\circ$



3:20 UT
$C.M._I = 219^\circ$
$C.M._{II} = 81^\circ$

FIGURE 16. Jupiter.
Clark R. Chapman
July 19, 1961
10-inch reflector 280X.

8:38 UT
$C.M._I = 51^\circ$
$C.M._{II} = 272^\circ$

---

preceding the white oval in the NEB_n it abruptly looped south, connecting with a small projection on the NEB_n. There was another loop south connecting to the preceding end of the white oval. From the following end of the oval the belt again dropped into the northern portions of the NTrZ-NTeZ and was reinforced by a loop festoon from the $NNTB_s$ shortly preceding the longitude of the Red Spot. (Some of these aspects of the NTB can be easily seen in Figure 16.)

There are some indications that the NNTeZ also varied in brightness with longitude. The NNNTB was a faint border to the NPR. The SSSTB was usually seen bordering the SPR, and occasionally a belt was seen within the SPR.

III. The Regions of the South Equatorial Belt

The SEB_n generally ranked third in prominence, except that it was second when the faint portion of the STB was central. It showed a considerable number of rather prominent spots, particularly along its southern edge. One spot that was visible in July and August near λ_I 20° yielded a rotation period of $9^h 50^m 30^s$ (stationary with respect to System I, but not stationary with respect to NEB features). This period is in rather good agreement with a period given by Peek[1] but is significantly different from the period for the SEB_n found by Reese for 1960[2]. It is also significantly different from the two possible periods I found from examination of spots on my drawings of 1960. There is no doubt about the identity of this spot. It was a very prominent hump on the south edge of the SEB_n and exerted considerable influence into the SEB Z (Figure 16). There was a white rift in the SEB Z south of this spot. I suspect that detail in the SEB Z was rotating with System I; surely it was in the immediate vicinity of this dark spot. A cursory examination of some of my drawings early in the apparition indicated a rotation period near $9^h 54^m 43^s$ for several other SEB_n spots. This would be a most peculiar period. From much more detailed records, Elmer Reese has found instead that the periods of $9^h 50^m 30^s$ and $9^h 51^m 00^s$ are much more in evidence, which substantiates the rotational period of the large dark spot mentioned earlier.

The SEB_s was a faint but easily seen band generally located slightly south of the center of the combined STrZ-SEB Z. The portion of the SEB Z bordering it was dusky while the portion of the SEB Z bordering the SEB_n was considerably brighter, very probably a series of bright ovals that were considerably more prominent than the vague suspicions of such features in 1960. These aspects sometimes gave the SEB_s the appearance of being widely double, as is best shown in Figures 19 and 20. Elmer Reese has suggested a somewhat different interpretation. As shown in Figure 14, he considers this northern component of the SEB_s to be the SEB_n itself, while the dark band most observers considered to be the SEB_n he calls the southern boundary of the dark EZ. One of his reasons for considering this possibility is the extreme northerly latitude of the apparent SEB_n. Nevertheless, most observers with larger instruments have estimated the intensity of the apparent SEB_n to be as dark as those of the NEB_s and the STB, which would seem to be far too dark for a dark boundary of the EZ. (See also section IV of this report.)

During the early part of the apparition, considerable faint activity was seen by the author (and confirmed in part by other observers) within the SEB Z. The activity continued but died down considerably as the apparition progressed. As Elmer Reese has commented, the SEB Z and STrZ seem to have been covered by a bluish haze. Observations of the relative prominence of the zones with different Wratten Filters by the author have dramatically confirmed this aspect of the brilliant blue color of the SEB Z and the northern portions of the STrZ, as well as of the SEB_s (which had been yellow in 1960). It does not seem impossible that we have been witnessing another SEB Disturbance, this time nearly completely obscured by an overlying bluish haze.

IV. The Equatorial Band

During the early part of the apparition I was unable to recognize the EB; however, from the extreme northerly position of the apparent SEB_n, it was evident that this belt was really a combined SEB_n-EB. It was not until June 16 that I was able to observe fragments of the band. By late July, the EB was easily resolved even with poor seeing, although it remained much nearer to the SEB_n than in 1960. Paul Knauth confirmed my impression that the EB seemed to disappear in 1961[3]. Nevertheless, David Meisel, observing with the 17-inch reflector of the Pan American College Observatory, reports seeing the EB in its entirety in June in substantially the same form as I observed it in 1960 (that is, composed of the southern boundaries of the festoons, despite the fact that the festoons were of a somewhat different nature this year).

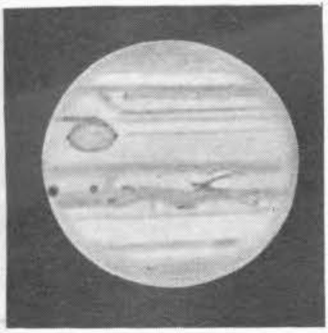


FIGURE 17. Jupiter.
Dennis Milon.
8-inch reflector 250X.
July 18, 1961. 6:16 U.T.
S = 5 T = 4
$C.M._I = 166^\circ$. $C.M._{II} = 37^\circ$.

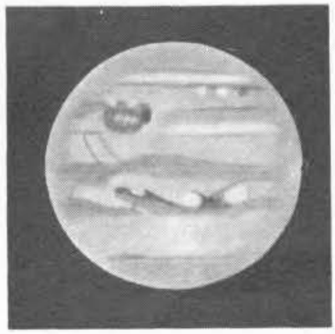


FIGURE 18. Jupiter.
L. J. Robinson
10-inch reflector 210X,
July 25, 1961. 6:35 U.T.
S = 4 - 3 T = 2
$C.M._I = 206^\circ$. $C.M._{II} = 22^\circ$.

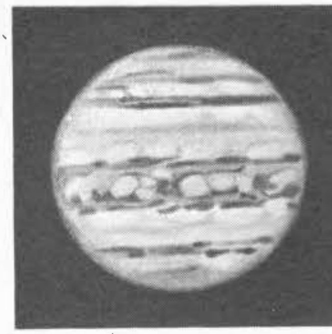


FIGURE 19. Jupiter.
Clark R. Chapman
10-inch reflector 270X.
August 16, 1961. 3:50 U.T.
S = 6 T = 3.5
$C.M._I = 183^\circ$. $C.M._{II} = 200^\circ$.

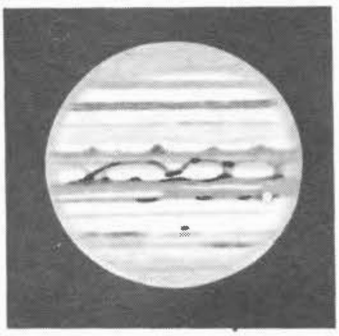


FIGURE 20. Jupiter.
Elmer J. Reese
8-inch reflector 250X.
September 6, 1961. 1:39 U.T.
S = 6 T = 3
$C.M._I = 338^\circ$. $C.M._{II} = 187^\circ$.

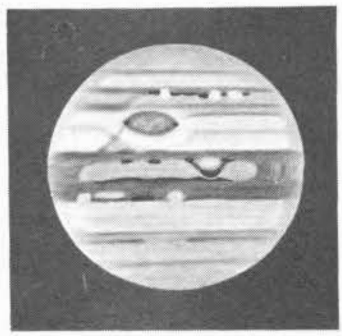


FIGURE 21. Jupiter.
Elmer J. Reese
8-inch reflector 250X.
October 23, 1961. 0:58 U.T.
S = 4 T = 4
$C.M._I = 170^\circ$. $C.M._{II} = 21^\circ$.

V. The Red Spot Region

The Red Spot continued to be very prominent. From looking over past Jupiter Memoirs of the British Astronomical Association, I conclude that the Red Spot was about as prominent, if not even more so, than it had ever been before during this century. I suspect that it was even darker than in 1960, though not by much. To me the Red Spot has seemed to be a brilliant orange color. Other observers have used such terms as "pinkish-orange," "bronze," and many other variations of red and yellow; but nearly all observers agree that the Red Spot has rarely been as colorful before. Some observers, including the author, have found the darker perimeter of the Red Spot quite colorless. The Red Spot was noted by several observers to have a slight slant at times--the following tip somewhat more northerly. It was also noted by several observers to have a slight point on the following tip which seemed at times to connect to the SEB_s and, during August, perhaps even to the STB as oval FA passed by. The southern portion of the Red Spot was definitely slightly darker than the northern parts. Also, the interior was slightly lighter, probably small white spots not easily resolved (see Figures 15, 18, and 21).

The Red Spot Hollow was quite prominent during the early part of the apparition but became less prominent by opposition. I suspect that the STrZ-SEB Z as a whole brightened up slightly, rendering the Hollow less visible.

VI. Other Comments

As far as colors go, aside from the orange of the Red Spot and the blue of the SEB Z already mentioned, some other colors were observed. Although it is too early to list the colors of all the features, these comments have basis: the brownish NEB was substantially less colored than in 1960; the SEB_n seemed to be orange; the STB was distinctly reddish; the EZ was a rather deeply saturated yellow, though not so strongly colored as in 1959; the NTrZ was probably yellowish, or perhaps more nearly cream.

As a whole, Jupiter was very active with many interesting features this year, probably more active than in 1960. With the possibility that a true SEB Disturbance will materialize, the remainder of the apparition and the beginning of the 1962 apparition deserve to be closely followed.

A wealth of material has been turned in to the Jupiter Section this year; and it will be some time before the final reports will appear that will carefully summarize all the central meridian transits, intensity estimates, drawings, prominence estimates, satellite phenomena timings, latitude measurements, color filter work, etc., that have been contributed by active A.L.P.O. Jupiter observers. Please turn in all 1961 observational data to either of the Jupiter Recorders as soon as possible. Their addresses are listed on the back inside cover of this issue.

References

1. B. M. Peek, The Planet Jupiter, Page 190.
2. The Strolling Astronomer, Vol. 15, Page 75, May-June, 1961.
3. Paul Knauth, personal correspondence, June 13, 1961.

ANNOUNCEMENTS

Error in September-October, 1961, Issue. In the caption of Figure 17 on page 177 the 4-inch refractor belongs to Dr. William Blocker, not Brashear. Editor's blunder, no excuse!

Season's Greetings. While the yet uncertain mailing date of this issue may make such wishes very late, we do want to extend to all A.L.P.O. members our best wishes for

A VERY MERRY CHRISTMAS

and

A MOST HAPPY NEW YEAR.

Some Astronomical Meetings in 1962. The A.L.P.O. is meeting at Montreal near Labor Day, as described elsewhere in this issue. The Western Amateur Astronomers are meeting with the Hawaiian Astronomical Society at the Bishop Museum in Honolulu, probably in late August, 1962. Dr. Earle G. Linsley and the Hawaiian Astronomical Society have graciously invited the A.L.P.O. to take part in this Convention. While no final decision has yet been reached, the extent of our official participation appears likely to be limited by the large geographical distances involved, associated costs, and what persons attend from the mainland. The Astronomical League is holding its next National Convention at Albuquerque, New Mexico. We have no further details on that meeting at this time.

Donation to the A.L.P.O. The dissolved Fairmont (West Virginia) Amateur Astronomers in disposing of their assets very kindly gave a check of one hundred dollars ($100.00) to the A.L.P.O. The money will be used to advance the goals of our Association. We express our thanks to the members of the group for their gift. They are dissolving because their active members are attending college or have otherwise left Fairmont.

Availability of The Strolling Astronomer in Libraries. We would remind our readers that there are two complete files of all issues of The Strolling Astronomer available to them at these places:

1. The Library of Congress, Washington 25, D. C.

2. The Library of New Mexico State University, University Park, New Mexico. The Head Librarian is Mr. Chester Linscheid, who has been most coöperative in meeting requests from A.L.P.O. members.

We are glad to supply back issues on request when we can, but many of them are out of stock.

COMING MONTREAL CONVENTION OF THE A.L.P.O.

In 1962 the A.L.P.O. will hold its Tenth Convention with the Montreal Centre of the Royal Astronomical Society of Canada at Montreal, Quebec, Canada. The date will be on or near Labor Day (September 3) in order to allow a holiday week-end for travelling. The invitation was extended by the Council of the Centre and was communicated by their Secretary, Mr. W. J. Cullinan.

Montreal has long had an active amateur astronomy group. Their monthly society newsletter, Skyward, has grown since 1948 to around eight pages and reports society meetings, astronomical lectures, coming events in the sky, and observations by members. The quality and quantity of these observational programs could well be a model to other amateur societies; they include meteors, lunar eclipses, the moon and the planets, solar studies, aurorae, and nova patrols. It is no accident that the Montreal Centre in recent years has made most of the useful observational patrols in the A.L.P.O. Lunar Meteor Search, demonstrating in so doing a talent for organized, systematic, scientific studies and a properly scientific state of mind that perseveres in a project in spite of persistently negative results. Several members of the Montreal Centre contribute regularly to our current lunar and planetary studies; one of them, Mr. Geoffrey Gaherty, Jr., is the Mercury Recorder of the A.L.P.O. A number of Montrealers attended the Astronomical League-A.L.P.O. Conventions at Haverford in 1960 and at Detroit in 1961.

Details about the Tenth A.L.P.O. Convention in Montreal will be announced in this periodical as plans develop. The Centre's Observatory will be open to those attending. There will be the usual program of papers, and we invite A.L.P.O. members to contribute papers early to help our planning. We shall certainly again want an exhibit showing current work by our members. We shall need to know the probable attendance as soon as we can. At present it is tentatively thought that a suitable hotel might serve as Convention Headquarters. Montreal offers much of scenic, cultural, and historical interest to the families of attending A.L.P. O. members, who, strange as it may seem to us, are often not much interested in astronomy. A Committee of Arrangements has already been formed of Messrs. W. A. Warren (Chairman), W. J. Cullinan, G. Gaherty, Jr., and G. Wedge.

We urge everyone who can to come to this Montreal meeting next Labor Day. A well-planned astronomical program is assured; and the opportunity to make new astronomical friends and to exchange ideas with our fellow lunarians and planetarians is valuable and rewarding. This meeting will be the first A.L.P.O. Convention not held with either the Astronomical League or the Western Amateur Astronomers. It will also be the first A.L.P.O. Convention outside of the United States. Surely, however, such internationalism is fitting in a group that has sought from its beginning to promote international teamwork in lunar and planetary studies. The year 1962 will mark the fifteenth anniversary of the founding of the A.L.P.O., and we hope for some corresponding good historical papers on the program. With your help we expect this Montreal Convention to be an important milestone in the development of the A.L.P.O.

OBSERVATIONS AND COMMENTS

The study of Ganymede, or Jupiter III, by eight independent observers during the W.A.A.-A.L.P.O. Convention at Long Beach, California, in August, 1961, is shown in Figure 22; the composite drawing constructed by Mr. L. J. Robinson from the individual drawings is on the front cover.

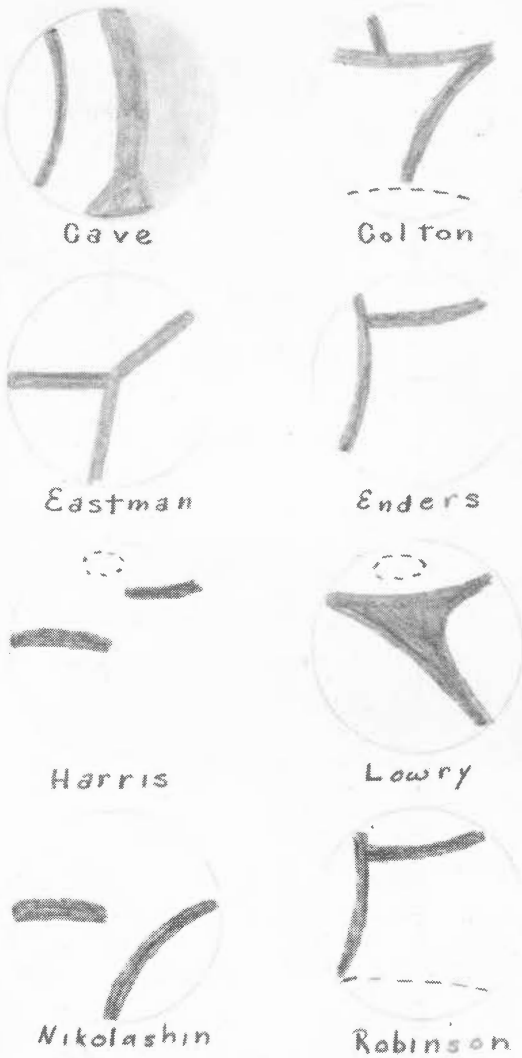


FIGURE 22. Eight drawings of Ganymede (Jupiter III) by different observers on August 26, 1961. Copied and contributed by L. J. Robinson. These drawings are the basis of the composite drawing on the front cover of this issue. Drawings made with two 10-inch reflectors at about 650X in seeing 7 (0 to 10 scale, with 10 best) between 6^h 30^m and 7^h 30^m, U.T.

Readers may wish to compare the composite to the individual drawings. It is, of course, well known that all markings on the satellites of Jupiter are extremely difficult for ordinary apertures. Group studies of this kind are very meritorous in helping to show what features on the small disc are objective. Since Ganymede has been found always to turn the same face toward Jupiter, the markings change with the changing position of the satellite in its orbit. These observations in Figure 22 were made with the satellite 6 days and 23 hours past superior geocentric conjunction. The angular diameter of Ganymede on August 26, 1961, was 1".6 (assuming a linear diameter of 3100 miles). The Dawes Limit of a 10-inch aperture is 0".46. One suspects that many of the markings on the drawings are shown smaller and narrower than diffraction theory permits.

<u>Fault West of Epigenes</u>. Mr. Manasek describes his lunar drawing (Figure 23) as follows: "West of Epigenes lies the crater Epigenes A, part of a pronounced fault which does not appear on the maps of Neison, Goodacre, or Wilkins. The southern part of the fault does not appear to be continuous with the crater, but rather separated from it by a somewhat gentle slope. There are indications of either a ridge or of a ravine with a raised edge situated close to the eastern base of the fault at α. Further observations are necessary to clear this point up. The northern extension of the fault (β) is continuous with the east wall of the crater. The crater itself has smooth walls with no indications of terracing. Two hills appear on the western side of the fault at β. The larger southern hill was damaged by the faulting, since a portion of its slope is found on the eastern side of the fault. The smaller northern hill appears intact."

<u>Capuanus</u>. A sketch by Jose Olivarez on July 4, 1960, with a 2.4-inch Unitron refractor, colongitude=31°.3, shows three domes on the floor, two in the south part and one in the north part. There is fair agreement with a more detailed drawing by Clark Chapman with a 10-inch reflector at 35°.6, Figure 36 on page 61 of the March-April, 1960, <u>Str. A.</u> Other possessors of small telescopes might find these Capuanus floor domes of interest.

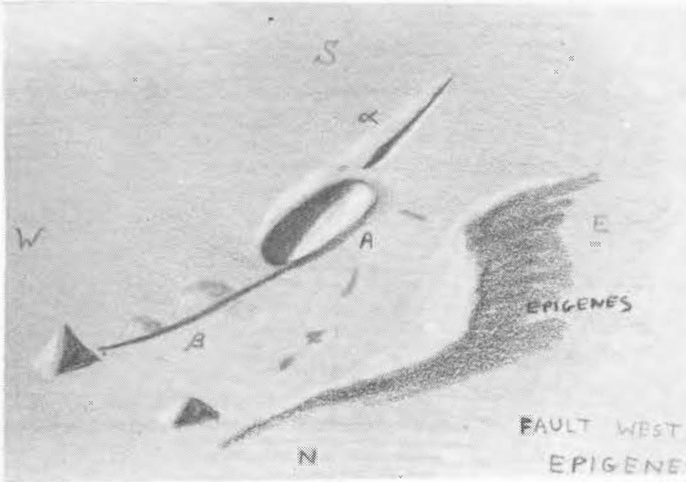


FIGURE 23. Fault west of lunar crater Epigenes. Drawn by F. J. Manasek on May 25, 1961, $2^h\ 30^m$-$2^h\ 45^m$, U.T. 6-inch reflector, 300X. Seeing 6, transparency 3. Colongitude 32°5.

FIGURE 24. Photograph of Comet Seki, 1961 f, by Jack Borde, Concord, California, 2.8-inch F:8 refractor at prime focus, film 103a0, exposure 15 minutes. Photograph taken on November 5, 1961, at $12^h\ 5^m$, U.T. Position right ascension $10^h\ 52^m\ 30^s$, declination +6°02', epoch 1855.0. The parallel scratches on the film are blemishes.

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