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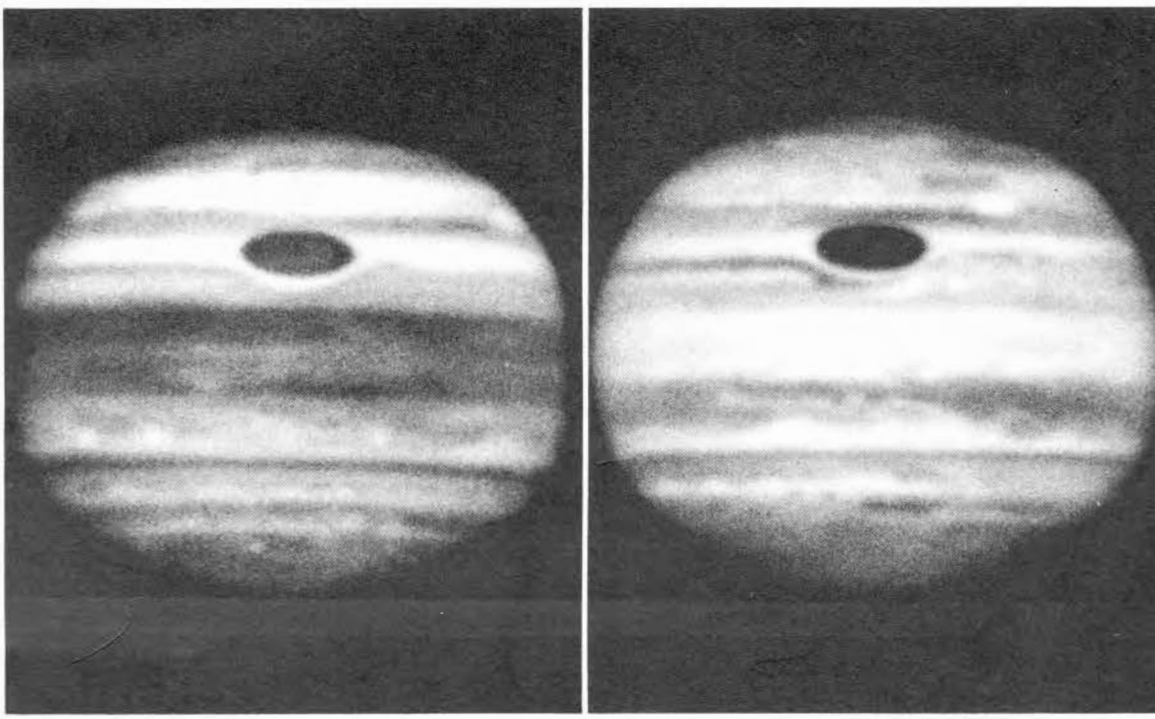

Two photographs of Jupiter with a 12-inch Cassegrain at the New Mexico State University Observatory. Left: October 23, 1964; 8hrs., 58mins., Universal Time; blue light; CM(I)=251°, CM(II)=17°. Right: December 12, 1965; 7hrs., 46mins., Universal Time; blue light; CM(I)=182°, CM(II)=22°. Note the very dark Red Spot, South Temperate Zone ovals, the great variation in the brightness of the Equatorial Zone, and activity in far northern belts. Are these events part of a pattern of unrecognized major zenological disturbances? See article by Mr. Wynn Wacker on pages 145-150.

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ALPO

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IN THIS ISSUE

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OBSERVING OLYMPUS MONS IN 1975

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

Measurements of stereoscopic photographs from the Mariner-9 spacecraft indicate that the Martian volcano Olympus Mons, associated with the Nix Olympica light spot, rises approximately 30 kilometers above the surrounding Tharsis region. The summit of this 500 kilometer-wide feature is located at 18°S latitude and 133° longitude. At the proper time before sunset, or after sunrise, when the shadow of Olympus Mons grazes the terminator, the shadow should extend about 450 kilometers. Likewise, the summit should be still illuminated when 450 kilometers within the night hemisphere (i.e., when the Sun is 7°.6 below the horizon at its base).

The above values suggest that Olympus Mons should be visible as a relief feature with moderate-size telescopes (say, 8-10 inches aperture or greater) even during the non-perihelic 1975-76 apparition. Given good conditions, the shadow should be visible 33-37 minutes before sunset; and a terminator projection should be visible after sunset, from late June through November, 1975 (before opposition).

In addition to being a test of observational and instrumental capabilities, such observations may be used independently to estimate the elevation of Olympus Mons. The following events should be timed to the nearest minute in order to do this (sunset, or pre-opposition, case):

1. Time when shadow first touches terminator;
2. Time when feature is bisected by terminator;
3. Time when summit of feature is last illuminated.

Any such timings, along with details of the observation (sketch, observer, instrument, magnification, filters if any, seeing, and transparency) should be sent to the writer for reduction to elevations. Such results will then be forwarded to Charles F. Capen, A.L.P.O. Mars Recorder.

The table below lists the Universal Time, for each day from June 24 to November 27, 1975, of theoretical sunset at Olympus Mons. Remember that you should begin to look for the shadow perhaps 40-50 minutes before the time given, and may also be able to see a terminator projection for some time after that time. The third column for each date gives the predicted maximum apparent shadow length, in seconds of arc. For the entire period, this length is at least 0".30, and reaches a maximum of 0".51 in late October.

A continuation of this table, for local sunrise conditions after opposition and in early 1976, will be published later.

Olympus Mons Terminator Transit Ephemeris (Sunset): 1975

U.T. Date	U.T.	Shadow Length	U.T. Date	U.T.	Shadow Length	U.T. Date	U.T.	Shadow Length
JUN 24	07:54	0".30	JUL 14	21:18	0".33	AUG 03	10:04	0".37
25	08:35	0.30	15	21:58	0.33	04	10:44	0.37
26	09:14	0.30	16	22:39	0.34	05	11:24	0.37
27	09:55	0.30	17	23:19	0.34	06	12:04	0.37
28	10:34	0.31	18	23:59	0.34	07	12:44	0.38
JUN 29	11:15	0".31	JUL 19	-----	0".34	AUG 08	13:25	0".38
30	11:55	0.31	20	00:39	0.34	09	14:05	0.38
JUL 01	12:35	0.31	21	01:20	0.34	10	14:45	0.38
02	13:16	0.31	22	02:00	0.35	11	15:25	0.38
03	13:56	0.31	23	02:41	0.35	12	16:06	0.39
JUL 04	14:36	0".32	JUL 24	03:21	0".35	AUG 13	16:46	0".39
05	15:16	0.32	25	04:01	0.35	14	17:26	0.39
06	15:56	0.32	26	04:42	0.35	15	18:06	0.39
07	16:36	0.32	27	05:22	0.36	16	18:47	0.39
08	17:16	0.32	28	06:02	0.36	17	19:27	0.39
JUL 09	17:57	0".32	JUL 29	06:42	0".36	AUG 18	20:07	0".40
10	18:37	0.33	30	07:22	0.36	19	20:48	0.40
11	19:17	0.33	31	08:03	0.36	20	21:28	0.40
12	19:58	0.33	AUG 01	08:43	0.36	21	22:08	0.40
13	20:38	0.33	02	09:23	0.37	22	22:48	0.41

Olympus Mons Terminator Transit Ephemeris (Sunset): 1975 (cont.)

U.T. Date	U.T.	Shadow Length	U.T. Date	U.T.	Shadow Length	U.T. Date	U.T.	Shadow Length
AUG 23	23:28	0".41	SEP 22	18:52	0".47	OCT 27	17:30	0".50
24	-----	0.41	23	19:32	0.47	28	18:10	0.50
25	00:09	0.41	24	20:12	0.47	29	18:49	0.50
26	00:49	0.41	25	20:52	0.48	30	19:29	0.50
27	01:29	0.42	26	21:32	0.48	31	20:09	0.50
AUG 28	02:09	0".42	SEP 27	22:13	0".48	NOV 01	20:48	0".50
29	02:50	0.42	28	22:52	0.48	02	21:28	0.49
30	03:30	0.42	29	23:32	0.48	03	22:08	0.49
31	04:10	0.42	30	-----	0.49	04	22:48	0.49
SEP 01	04:51	0.43	OCT 01	00:13	0.49	05	23:27	0.48
SEP 02	05:30	0".43	OCT 02	00:53	0".49	NOV 06	-----	0".48
03	06:11	0.43	03	01:33	0.49	07	00:07	0.48
04	06:51	0.43	04	02:12	0.49	08	00:47	0.47
05	07:31	0.43	05	02:53	0.49	09	01:27	0.47
06	08:11	0.44	06	03:32	0.50	10	02:07	0.46
SEP 07	08:51	0".44	OCT 07	04:12	0".50	NOV 11	02:46	0".45
08	09:31	0.44	08	04:52	0.50	12	03:26	0.45
09	10:12	0.44	09	05:32	0.50	13	04:06	0.44
10	10:51	0.44	10	06:13	0.50	14	04:45	0.44
11	11:32	0.45	11	06:52	0.50	15	05:25	0.43
SEP 12	12:12	0".45	OCT 12	07:32	0".50	NOV 16	06:04	0".42
13	12:52	0.45	13	08:11	0.50	17	06:44	0.41
14	13:32	0.45	14	08:52	0.51	18	07:24	0.40
15	14:11	0.46	15	09:32	0.51	19	08:04	0.39
16	14:52	0.46	16	10:12	0.51	20	08:43	0.38
SEP 17	15:32	0".46	OCT 17	10:51	0".51	NOV 21	09:23	0".37
18	16:12	0.46	18	11:31	0.51	22	10:02	0.36
19	16:52	0.46	19	12:11	0.51	23	10:42	0.35
20	17:32	0.47	20	12:51	0.51	24	11:22	0.34
21	18:12	0.47	21	13:30	0.51	25	12:02	0.33
			OCT 22	14:10	0".51	NOV 26	12:41	0".31
			23	14:50	0.51	27	13:21	0.30
			24	15:30	0.51			
			25	16:10	0.51			
			26	16:49	0.51			

MARS 1973-74 APPARITION - A.L.P.O. REPORT I

By: Robert B. Rhoads, A.L.P.O. Assistant Mars Recorder and

Virginia W. Capen, A.L.P.O. Mars Section

The planet Mars was favorably placed for telescopic observation from June, 1973 to February, 1974, and well north of the celestial equator. Mars reached opposition on October 25, 1973 with an apparent disk diameter of 21".2 and 91 days after perihelion passage on July 26th. The southern hemisphere was tilted toward the Earth during the apparition. This was the last favorable perihelic observing period for the planet until 1986. Refer to references 1 and 2 for more details.

1973-74 Observing Program

The Association of Lunar and Planetary Observers Mars Section coördinated a very successful international observing program in 1973-74. The interest in Mars was indeed great during this apparition as TABLE I of observers and their contributed observations acknowledges. Two observers contributed over 120 visual observations; and three observers contributed 30, 40, and 73 black and white quality photos, respectively. Many excellent color images on Kodachrome and Ektachrome film were received, some of which have been copied into black and white prints for reproduction in the A.L.P.O. Mars Reports. The data received were more homogeneous than in past apparitions, improving data comparison of surface vs. atmosphere, synoptic comparison of surface feature changes, etc. The spectrum was covered from the infrared through the visual to the violet. The use of standard Mars observing report forms, similar color filters, a standard intensity estimation scale, and systematic observations of Mars produced homogeneous data of high analytic value. There were 78 subscribers to the "Martian Chronicle '73", and 62 Mars Observing Kits and 26 packets of standard Mars observing forms were mailed to requestors for use during the apparition. Seventy-five observers contributed 1360 telescopic observations to the A.L.P.O. Mars Section. Thirty-five observers, or 45% of the total, were located outside the continental United States, thus improving the goal of a synoptic 24-hr. surveillance of all Martian longitudes. Coöperating international organizations were the Albireo Astronomy Society, Hungary; Société Astronomique de France; Observatorio del Teide, Teneriffe Island; Oriental Astronomical Society, Japan; and British Astronomical Association, England. The total visual observations received were 1,050 (96% useful), and photographs were 305 (99% useful). Several hundred intensity and color estimates were also received. These data have been evaluated and chronologically filed by the Mars Recorders (Ref. 3). We fully appreciate the care and time spent in reproducing copies of your original observations in a standard format and mailing them at regular intervals during the apparition. The A.L.P.O. Mars Recorders wish to thank all Martian observers for their many contributions which have made this Martian apparition such a success.

Summary of 1973-74 Martian Phenomena

The 1973 apparition began with an observation made on February 24, 1973 at $160^{O}L_{S}$ (longitude of the Sun) with a disk diameter of 5" by T. Osawa of Japan and ended with an observation made on May 19, 1974 at $50^{O}L_{S}$ with a diameter of 4".4 by H. Mullen of Armonk, N.Y.; which corresponds to Martian late winter, spring, and summer in the southern hemisphere. Refer to Fig. 1. The total observational coverage was $250^{O}L_{S}$ or 69% of the Martian year, which compares well with the 73% covered during 1971. A study of the 1973 Mars data showed the apparition to be characterized by major surface changes in five regions of the planet and by two yellow dust storm epochs. Refer to Prof. J. Dragesco's 1973 Mars Chart in Fig. 2 which illustrates the changes observed by European observers. Also see Figs. 3 and 4 by K. v. Knoepfel. A summary of events follows.

During June, 1973 Hellespontus-Serpentis formed a broad, dark arc on the disk of Mars. A bright yellow cloud was reported by several observers after mid-July (244^{O}-$248^{O}L_{S}$) just prior to perihelion passage ($250^{O}L_{S}$) over Yaonis-Serpentis. This cloud spread across Noachis-Argyre and Hellas-Ausonia in the usual west-east manner of previous yellow clouds. In late July and early August the contrasts of features were still low. The yellow haze also affected the visibility of the South Polar Cap. The visibility of the features improved after 10 August.

The Solis Lacus region (Eye-Of-Mars) has an observational history of changes in form and contrast. In 1973 this region underwent a significant change as it also had in 1878, 1911, 1926, and 1941. The Solis L. was enlarged and tilted SE to SW during April and May as compared to its 1971 appearance according to T. Osawa, H. Saito, and S. Miyamoto. In June a bright streak appeared across Phaethontis-Claritas-Thaumasia. Later a dark band was observed at the east end of M. Sirenum which extended across the Eye-Of Mars to the Bosporus, a distance of about 60^{O} or 3096 km at 30^{O}S lat. (Refs. 3 and 4). This major change was first reported by Osawa, Capen, Miyamoto, and Otis. The Nectar on the east end of Solis L. was also dark and enlarged at this time, according to photos by G. Fiedler, M. Otis, E. Owen, L. Thomas, and H. Zeh. This sudden darkening rivaled the secular change which occurred in the Nodus Laocoöntis-Alcyonius region during the 1950-60 decade. Refer to Figs. 2 and 3. The Bosporus, which lies to the SE of Solis L., has been a dark and impressive feature since 1969. In 1973 it was a light halftone feature, an opposite change compared to the new Daedalia-Claritas darkening. Excellent photos of these changes were recorded by Otis, Rhoads, Capen, Owen, Lines, Arakawa, Melka, Melvin, Gomez, Tomas, Viscardy, and Zeh in color and black and white photographs, using 8- to 21-inch aperture telescopes. Refer to the selection of photos and drawings at the end of Mars 1973-74 Reports.

Three initial yellow dust clouds suddenly formed in the Eye-Of-Mars on 13, 14, and 16 October. These active yellow clouds developed into a major storm system that spread westward into Phaethontis and eastward across Thaumasia and M. Erythraeum by 18 October. A second storm system developed from two initial clouds that formed in Deucalionis on 14 October according to photos by R. Richardson, P. Michaud, M. Otis, and G. Seaman. The second storm stopped the eastward motion of the first storm, coalesced with it, and expanded eastward. It crossed the Hellas and reached Ausonia by 20 October (Refs. 4 and 5). The SPC was affected by the yellow haze on the 20th and was not seen on 21 October. These dust storms ruined the contrasts of surface features mostly in the southern hemisphere until early December. A blue-light photo taken by G. Seaman on 16 October showed that the yellow storm over the Solis L. had a bright white cloud (blue) component during the morning hours. Excellent color and IR color photos were taken by P. Crump and C. Capen of the early stages of the storms. Good photographic coverage of this entire storm period was obtained by R. Rhoads,

TABLE I. Contributing Observers to A.L.P.O. Mars Section, 1973-74

NAME	LOCATION	NO. OBSERVATIONS VISUAL	NO. OBSERVATIONS PHOTOS	TELESCOPE(S)
Matei Alexescu	Bucharest, Romania	34		6"(15cm) Cass.
Tsuyoshi Arakawa	Nara, Japan		73	8"(20cm) refl.
Peter Brayton	Oklahoma City, Okla.	15		6"(15cm) refr.
Pal Brlas	Szarvas, Hungary	7		6"(15cm) refl.
Lionel Brown	Las Cruces, N.M.	147		10"(25cm) Cass.
				12.5"(31cm) Cass.
Charles Capen	Flagstaff, Ariz.	60	20	24"(60cm) refr.
				12"(30cm) refr.
Lawrence Carlino	Buffalo, N.Y.	11		10"(25cm) Newt.
E. H. Collinson	Suffolk, England	2		10"(25cm) Newt.
Eugene W. Cross, Jr.	Clovis, N.M.	7		6"(15cm) refr.
				8"(20cm) Cat.
P. Crump	Mauna Kea, Hawaii	1	15	24"(60cm) Cass.
Janos Danko	Szarvas, Hungary	5		6"(15cm) refl.
Kenneth Delano	Taunton, Mass.	22		8"(20cm) Cat.
William R. Demyan	W. Leechburg, Pa.	18		4"(10cm) refr.
				6"(15cm) refl.
Jean Dragesco	Orcines, France	21		7"(17cm) refl.
Shirō Ebasawa	Tokyo, Japan	2		26"(65cm) refr.
Tom Fetterman	So. Bound Brook, N.J.	7		10"(25cm) Newt.
G. Fiedler	St. Louis, Mo.		5	6"(15cm) Newt.
David M. Fliss	Buffalo, N.Y.	11		4"(10cm) refr.
M. Foulkes	Lincolnshire, England	2		6"(15cm) refl.
Geza Gombas	Kaposvár, Hungary	3		3"(7.5cm) refr.
Jose M. Gomez	Teneriffe Island		4	16"(40cm) Newt.
Curtis Haase	Moulton Texas	2		6"(15cm) Newt.
Jon Hanford	Reynoldsburg, Ohio	45		8"(20cm) Cass.
				10"(25cm) Cass.
Alan W. Heath	Nottingham, England	34		12"(30cm) Newt.
Otis Henderson	Madison, Alabama	8		8"(20cm) refl.
Zolton Hevesi	Kaposvár, Hungary	5		2"(5cm) refl.
Rick Hill	Greensboro, N.C.	9		6"(15cm) Newt.
Reiichi Horiguchi	Tokyo, Japan	2		10"(25cm) Newt.
Jozsef Iskum	Budapest, Hungary	1		8"(20cm) refl.
Dennis Jefferson	Bronx, N.Y.	12		8"(20cm) Cat.
Sandor Keszthelyi	Pecs-Vasas, Hungary	6		12"(30cm) refr.
Antal Kokeny	Szentes, Hungary	4		12"(30cm) refl.
Bruce Krobusek	New York, N.Y.	8		6"(15cm) Newt.
S. Kurisu	Amagasaki City, Japan		8	10"(25cm) refl.
Helen & Richard Lines	Phoenix, Ariz.; Mayer, Ariz.	1	8	16"(40cm) Newt.
Istvan Maczinko	Budapest, Hungary	1		8"(20cm) refr.
Michael Mattei	Harvard, Mass.	38		6"(15cm) refr.
E. H. Mayer	Barberton, Ohio	2		10"(25cm) refl.
R. Melvin & J. Melka	St. Louis, Mo.		4	8"(20cm) Newt.
Gil & Pat S, Michaud	Yucaipa, Calif.		16	8"(20cm) Newt.
Gyula Mohacsi	Szekesfehervar, Hungary	2		12"(30cm) refr.
Michael J. Morrow	Ewa Beach, Oahu, Hawaii	19		16"(40cm) Newt.
Jeff Mott	Franklin Lakes, N.J.	6		6"(15cm) Newt.
Hugh E. Mullen	Armonk, N.Y.	10		10"(25cm) Newt.
Toshihiko Osawa	Nara, Japan	125		8"(20cm) Newt.
Mike Otis	Aberdeen, S. Dakota	4	13	8"(20cm) Newt.
E. Ken Owen	Oklahoma City, Okla.		30	10"(25cm) Newt.
Janos Papp	Budapest, Hungary	2		6"(15cm) refl.
Peter F. Pastore	Massapequa, N.Y.	42		10"(25cm) Newt.
Alain Porter	Narragansett, R.I.	16		6"(15cm) refl.

TABLE I. Contributing Observers to A.L.P.O. Mars Section, 1973-74 (cont.)

NAME	LOCATION	NO. OBSERVATIONS VISUAL	PHOTOS	TELESCOPE(S)
Robert B. Rhoads	Scottsdale, Ariz.	8	13	14"(35cm) Newt.
R. Richardson	Hatboro, Pa.		2	7"(18cm) Cat.
John Rogers	Cambridge, England	3		12"(30cm) refr.
June Sacks	Gillette, N.J.	25		3.5"(8.9cm) Cat.
Hideaki Saito	Tokyo, Japan	49		8"(20cm) Newt.
Robb Sanderson	Little Silver, N.J.	7		6"(15cm) Newt.
Gary Seaman	Big Bear Lake, Calif.		5	8"(20cm) Newt.
J. Russell Smith	Waco, Texas	2		16"(40cm) Newt.
Laszlo Szabo	Szekesfehervar, Hungary	2		4"(10cm) refl.
Béla Szentmártoni	Kaposvár, Hungary	9		8"(20cm) refl.
Zoltan Szoboszlai	Hajdunanas, Hungary	3		6"(15cm) refl.
Richard Taibi	Elma, N.Y.	14		4"(10cm) refr.
L. Tomas	Teneriffe Island		40	16"(40cm) Newt.
Imre Toth	Eger, Hungary	38		10"(25cm) refl.
Sandor Toth	Hajdunavas, Hungary	2		6"(15cm) refl.
L. Trexler	Esztergom, Hungary	5		6"(15cm)
Antal Ujvorosy	Kaposvár, Hungary	2		4"(10cm) refr.
G. Viscardy	Reims, France		12	21"(53cm) refl.
R. Wessling	Milford, Ohio	4		12.5"(31cm) Newt.
John Westfall	San Francisco, Calif.	16	11	10"(25cm) Cass.
Wayne Wooten	De Funiak Springs, Fla.	25		6"(15cm) Newt.
Robert A. Yajko	W. Leechburg, Pa.	54		4"(10cm) refr. 10"(25cm) refl.
H. F. Zeh	Toledo, Ohio	3	26	8"(20cm) Newt.

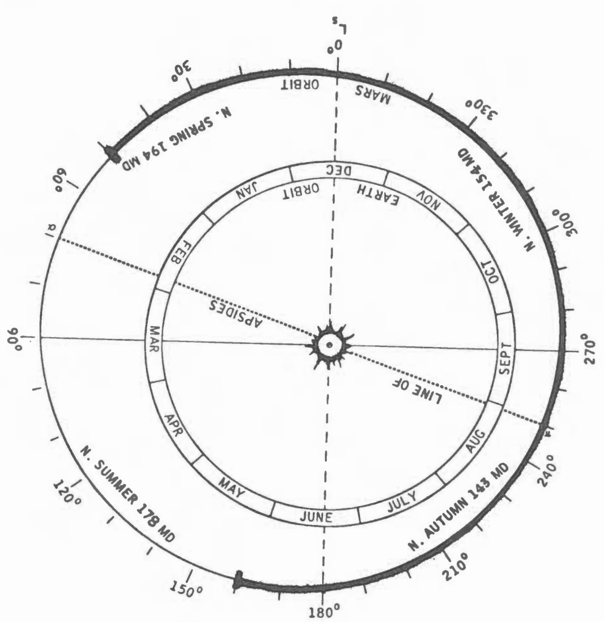

Figure 1. Plan view of orbits of Earth and Mars, showing observational coverage of the Martian year obtained by A.L.P.O. observers in the 1973-74 apparition. The orbit of Mars is indexed in 360 areocentric degrees (L_S, the longitude of the Sun) and is divided into seasonal quadrants. The period covered by A.L.P.O. observations is indicated by the heavily lined arc of the Martian orbit; it extends from $160^\circ L_S$ in the Martian northern late summer to $50^\circ L_S$ in the northern mid-spring.

E. K. Owen, T. Arakawa, J. Melka, R. Melvin, S. Kurisu, M. Otis, J. Westfall, and H. Zeh. A detailed daily study of the two, and possibly three, storm systems is possible because of the approximate 24-hr. coverage of the planet made by visual and photographic observers around the world. Tom Fetterman, S*T*A*R Mars Recorder, has furnished observations and a preliminary dust storm report from six observers of his Mars Section (Ref. 6).

Observations and photos made from June to August, 1973 by L. Brown, T. Osawa, S. Keszthelyi, J. Hanford, H. Saito, G. Viscardy, R. Yajko, C. Capen, T. Arakawa, and W. Demyan showed that the Syrtis Major had the same general appearance and shape as it did in 1971 prior to the Major Yellow Dust Storm. This is an important fact to the understanding of the behavior of surface albedo feature changes. Later, measurements made by K. v. Knoepfel on photos received from L. Tomas, G. Viscardy, T. Arakawa, E. Owen, and

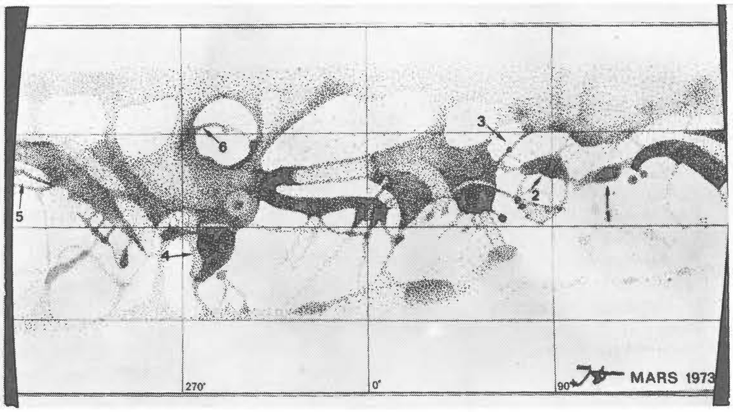

Figure 2. A Mars 1973 Chart by Professor J. Dragesco, Société Astronomique de France, showing the appearance of the telescopic albedo features and indicating the six following areas which exhibited salient changes: (1) A major secular darkening in the Daedalia-Claritas. (2) The Solis Lacus was enlarged and dark, with much fine internal structure. (3) The Bospouus faded to a halftone feature. (4) Sudden changes at the boundaries of Syrtis Major and within it were noted in September and October, 1973. (5) The Symplegades region exhibited a seasonal halftone aspect, as it has done in the past history of Martian observations. (6) The Hellas area resembled its 1941 appearance as depicted by A. Dollfus. M. Hadriacum, Peneus, and Zea Lacus were most prominent during the 1973 opposition period.

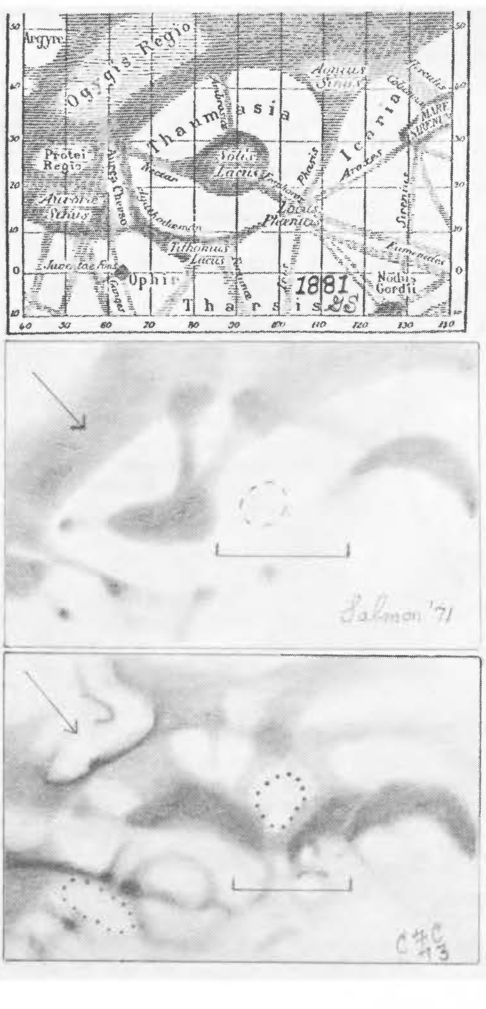

Figure 3. Three regional maps of the Solis Lacus illustrating changes in the albedo features during three different Martian summer seasons in the southern hemisphere. Top: Map drawn in 1881 by Giovanni Schiaparelli. Middle: Map from Bruce Salmon's 1971 observations. Bottom: Map made from C. F. Capen's 1973 observations with color filters. The bars and arrows indicate areas of change. Figure 3 prepared by K. v. Knoepfel.

* *

P. Michaud covering August through September, 1973 ($264^{o}-292^{o}L_{S}$) showed that the east, west, and north boundaries of the Syrtis Major slowly expanded. According to the new Mariner 9 topo-relief charts, the Syrtis expansion was chiefly westward up-slope onto the Nymphaeum and Antigones Fons, and covered the floors of two large ring-craters known today as "Antoniadi" and "Baldet". Refer to Fig. 5. In 1916 Antoniadi published "The Phenomena of the Martian Year," a Martian calendar based on 56 years of observations, 1856-1912. He deduced from these observational data that the boundary of the Syrtis varies with the Martian seasons. The changes which occur can be explained by the uncovering and covering of the dark base terra of the Syrtis Major by ocher-colored dust.

On the northeast border of Mare Cimmerium a significant seasonal change was observed from mid-August to the end of the apparition. A large halftone oval marking developed in the Symplegades (Rasena) area, which enhanced fine structure to the north in Atlantidum. The fine structure had low contrast and required good seeing for detection. This entire region had a similar

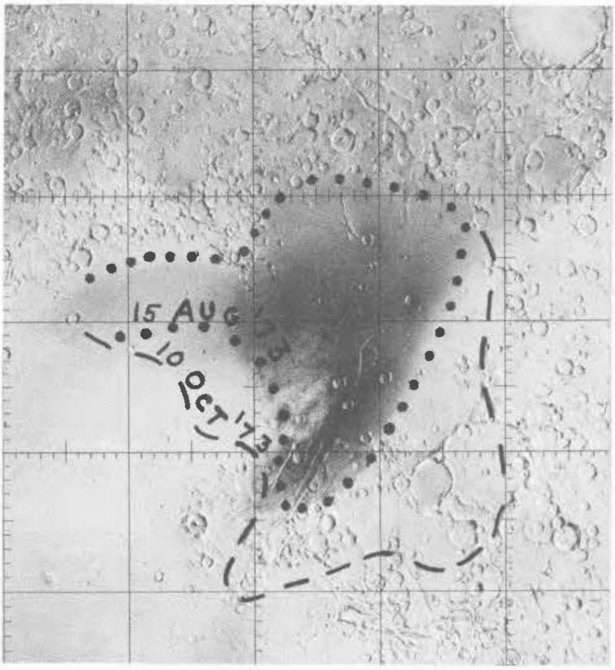

Figure 4. U.S.G.S. Topo-Relief base map showing rapid changes in the Syrtis Major. Up to mid-August, 1973, it exhibited the same shape as before the Great 1971 Dust Storm. Photographic measurements showed that its boundaries expanded from mid-August to early October, as indicated by the dotted and dashed lines on the map. This figure prepared by K. v. Knoepfel.

appearance to the 1909, 1926, 1941, 1943, and 1958 apparitions. The Symplegades area has been dark throughout most of the last decade (Ref. 7).

A more detailed analysis of the 1973 dust storms, white clouds, and surface changes is possible due to the quantity of quality observations and photos received covering all longitudes of the planet. Only a small sample of disk drawings and photos accompany this first report and are shown in Figures 5 and 6. An atlas of all 1971 and 1973 photographs that have data information is in preparation. The 1973 apparition was undoubtedly the most interesting and exciting one in over a decade to those who observed the Red Planet in 1973.

Martian Notes

The Mars Observing Kit has been up-dated as of October, 1974 and is available for cost and postage at $3.50 from the Mars Recorders. For those who received their kits before October, 1974 an appendix Mars Observing Kit - B is available at cost for $2.00. It contains an orbital planview chart of the coming 1975-1988 oppositions and a seasonal protractor corrected for the latest axial position of Mars, the latest reprint about yellow dust clouds relative to the Mariner 9 topo-relief features, seasonal comparison Mars Charts (also useful as work maps at the telescope for plotting clouds, whitenings, and feature changes), and a supply of standard A.L.P.O. Mars observation report forms. A package of 20 standard Mars observing report forms is still available for $1.00. For mailing outside U.S.A., add $0.50 to the above items; and use an International Money Order for payment.

When the disk of Mars is abnormally bright due to Martian clouds, contrasts are low because of obscuring hazes and irradiation within the eye. C. Capen has found that the use of an orange filter (W23A) or magenta (W30) with crossed polaroids will then effectively dim the image to a comfortable level and improve contrasts on the planetary disk (Ref. 8). Polaroid systems are available from Optica b/c Company and Vernonscope & Company. The Wratten Filters can be ordered thru an Eastman Kodak dealer, allowing 1 to 3 months for delivery.

References

1. Capen, C. F. (1973). "The Planet Mars in 1973". Sky & Tel., Vol. 46, No. 1, July.

2. Capen, C. F. & Capen, V. W. (1973). "Observing Mars V - The 1973-74 Martian Apparition". J. A.L.P.O., Vol. 24, Nos. 7-8, Oct.

3. Rhoads, R. B. (1974). "The A.L.P.O. Mars 1973 Observing Program." Proceedings of 26th Annual Convention WAA/ALPO, UCLA, Aug.

4. Capen, C. F. (1973). "Mars", IAU Central Telegram Bureau, Circular No. 2587, Oct.

Figure 5. Identification (year, month, date, color filter, and Universal Time) data, and remarks for the visual disk drawings and photographs.

1. 73 02 24 I 2100UT. CM 291°; L_S 160°; 20cm Newt. 400X by T. Osawa, Nara, Japan. The Syrtis Major region appears similar to 1971. SPC large.
2. 73 04 22 R & B 1330UT. CM 344°; L_S 192°; 40cm Newt. 200X by Helen Lines, Mayer, AZ., USA. Normal aspect. Pandorae Fr. weak.
3. 73 05 27 I 1905UT. CM 82°; L_S 213°; 20cm Newt. 410X. H. Saito, Tokyo, Japan. Solis Lacus normal. SPC large and bright.
4. 73 06 24 Y & B 0830UT. CM 09°; L_S 230°; 10cm refr. 395X by W. R. Demyan, W. Leechburg, PA, USA. Features normal. A.M. limb haze.
5. 73 06 30 R,G,B,V,M. 1100UT. CM 350°; L_S 234°; 60cm refr. 1000X. C. F. Capen, AZ, USA. Pandorae Fr. weak. Novus Mons (Mts. of Mitchel) and Argentus Mons bright and distinct.
6. 73 06 30 R,G,B,V 1812UT. CM 94°; L_S 234°; 20cm Newt. 286X. T. Osawa, Nara, Japan. The Novus Mons is evident. The Solis L. is very dark and enlarged. A.M. limb bright haze.
7. 73 07 13 R,G,B 1845UT. CM 336°; L_S 242°; 20cm Newt. 286X. T. Osawa, Japan. Note the yellow cloud across the Hellespontus and Deucalionis R.
8. 73 07 31 I 0210UT. CM 280°; L_S 254°; 26cm refl. 400X. I. Toth, Eger, Hungary. The SPC is shrinking in size. The Syrtis appears normal.
9. & 10. 73 08 05 I 0815UT. CM 321°; L_S 256°; 20cm Newt. 266X. A photovisual disk drawing and related photo by H. F. Zeh, Toledo, Ohio, USA. Note that the Noachis and Argyre I are abnormally bright.
11. 73 08 08 R,I 0900UT. CM 302°; L_S 259°; 25cm Cass. 520X. L. Brown, Las Cruces, NM, USA. A yellow cloud is present across Hellas, Hellespontus, and Noachis.
12. 73 08 08 I 1855UT. CM 88°; L_S 259°; 20cm Newt. 410X. H. Saito, Tokyo, Japan. The new secular Claritas-Daedalia darkening and a brightening on its northern border. A.M. limb haze.
13. 73 08 16 R 0630UT. CM 190°; L_S 264°; 10cm refr. 232X. R. Yajko, Leechburg, PA, USA. A yellow cloud is seen over Ausonia-Eridania. The Trivium Charontis-Cerberus is dark.
14. 73 08 31 I 2145UT. CM 271°; L_S 273°; 15cm Cass. M. Alexescu, Bucharest, Romania. Note the doubling on the east side of Syrtis.
15. 73 09 02 I 0750UT. CM 48°; L_S 275°; 20 cm Newt. efl. 1000". By J. Melka and R. Melvin, St. Louis, MO, USA. The Solis L. is enlarged and tilted. A bright cloud is over Claritas. SPC is smaller.
16. 73 09 05 R 0405UT. CM 325°; L_S 276°; 25cm Newt. 305X. L. Carlino, Buffalo, NY, USA. The Hellas and A.M. limb are bright.
17. 73 09 11 I 0425UT. CM 276°; L_S 280°; 15cm refl. 100X. A. Porter, Narragansett, RI, USA. Note how the Syrtis Major east and west borders show change. Note the dark and light markings in Hellas.
18. 73 09 13 R 0710UT. CM 297°; L_S 281°; 25cm Newt. 500X. H. Mullen, Armonk, NY, USA. The Syrtis is still changing shape in several directions. Subtle detail within Hellas.
19. 73 09 19 R 0103UT.. CM 153°; L_S 285°; 40cm Newt. L. Tomas and J. Gomez, Teneriffe Island. Excellent photo showing the new detail within the Symplegades-Laestrygonum region right of CM. Small SPC.
20. 73 09 21 Y 0620UT. CM 212°; L_S 286°; 15cm refr. 290X. M. Mattei, Harvard, Observatory, USA. The arrow indicates new detail within Symplegades-Laestrygonum region.
21. 73 09 23 R 1210UT. CM 280°; L_S 288°; 61cm refr. 830X. Photovisual reproduction. C. Capen, Flagstaff, AZ, USA. New development on east border of Syrtis. Note fine features in Japygia, Hellas, and Gomer.

* *

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5. Smith, B. A., Murrell, A. S., and Knuckles, C. F. (1974). "Photographs of a Recent Martian Dust Storm." Sky & Tel.,.Vol. 47, No. 3, March.

6. Fetterman, T. (1973). "The Great Martian Dust Storm of 1973." Cluster, Vol. 2.

7. Capen, C. F. (1973). "A 1969 Photovisual Chart of Mars-ALPO Report III." J.ALPO, Vol. 24, Nos. 5-6, June.

8. Barbera, R. F., et al. (1973). Astrofilters for Observation and Astrophotography. Optica b/c, Oakland, CA.

Note by Editor. Those observers able to undertake post-midnight observations of Mars in the next few months should watch for a repetition of the major yellow cloud storms of 1971 and 1973. The value of L_S, which measures the seasons on Mars, will be 243° on June 1, 1975, 262° on July 1, and 281° on August 1. Perihelion falls at 250°.

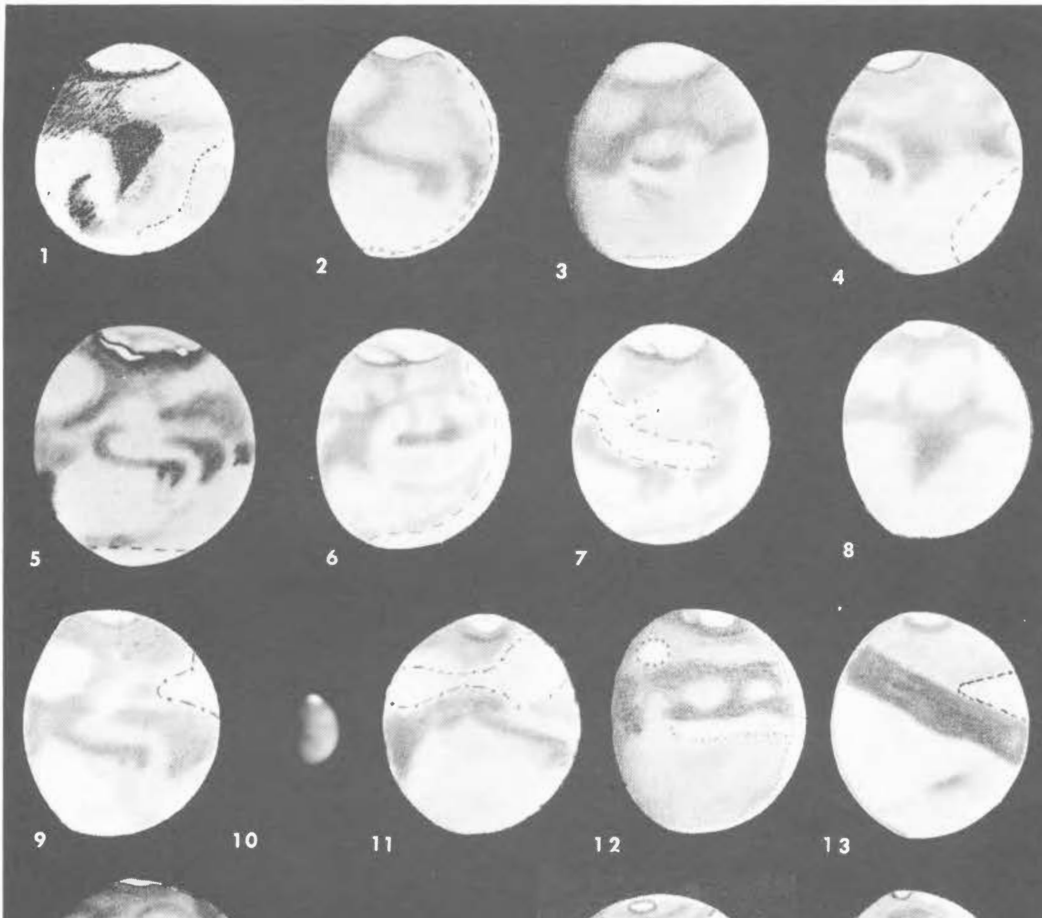

Figure 5. A selection of photographs and drawings of the planet Mars obtained by A.L.P.O. observers during the 1973-74 apparition. The identification and remarks regarding these illustrations are listed in the text on page 136.

Figure 6. Identification, data, and remarks for disk drawings and photographs made by A.L.P.O. Mars observers.

22. 73 09 29 Y 0112UT. CM 65°; 53cm refl. by G. Viscardy of Reims, France. One of the first good photos of the new secular dark marking across Daedalia-Claritas, see arrow. Note the NW-SE tilt of Solis L. and the light halftone Bosporus.
23. 73 09 29 R 0630UT. CM 142°; L_S 291°; 20cm Newt. by M. Otis, Aberdeen, S. Dak. The new dark marking across Daedalia-Claritas (left half of disk) and the halftone area in Symplegades (right) are shown in this photo.
24. 73 10 09 B 0229UT. CM 354°; L_S 297°; 40cm Newt. L. Tomas, Teneriffe Island. This broad blue-light photo (W-38A) shows a bright patch in Hellas, North Polar Hood, A.M. limb haze, and vague surface features.
25. 73 10 09 I 0250UT. CM 00°; 31cm Newt. 422X. R. Wessling, Milford, Ohio. For comparison 20 minutes later, this drawing in integrated light shows similar items in Hellas, Sabaeus, Margaritifer regions and a NPH as does the photo for No. 24. Note the small SPC.
26. 73 10 12 R 0138UT. CM 316°; L_S 299°; 40cm Newt. L. Tomas, Teneriffe Island. The strange appearance of the Syrtis Major is shown.
27. 73 10 12 I 0220UT. CM 326°; L_S 299°; 15cm refl. 150X. J. Mott, Franklin Lakes, N.J., USA. Note that the detail in Hellas and Syrtis is the same as seen in the photo for No. 26.
28. 73 10 14 R 0600UT. CM 02°; L_S 300°; 20cm Newt. Photovisual drawing by M. Otis, S. Dak. is photographic evidence of first two initial yellow clouds in Deucalionis-Meridiani region. These later formed a large storm system. See text.
29. 73 10 14 I 1217UT. CM 93°; 25cm refl. by S. Kurisu, Amagasaki City, Japan. Two initial yellow clouds obscure the Solis L. region (arrows).
30. 73 10 15 CI 1016UT. CM 55°; 61cm Cass. P. Crump, Hawaii. A color integrated light photo shows the sharp boundaries of the 3-day-old yellow dust cloud over the Solis L. region.
31. 73 10 16 B 0800UT. CM 13°; L_S 302°; 20cm Newt. by G. Seaman, Big Bear, CA, USA. A spectacular photo in blue-light (W-82A) of the blue volatile particle component of the yellow storm system over the Solis L. Region. The Meridiani is enlarged and dark in blue light. Is this due to the second yellow storm system?
32. 73 10 17 I 0636UT. CM 343°; L_S 302°; 25cm Newt. f/112. E. K. Owen, Oklahoma City, OK, USA. The initial yellow dust cloud of the second storm system is now seen over the east prong of Meridiani S.
33. 73 10 19 I 0630UT. CM 325°; L_S 303°; 20cm Newt. by Pat and Gil Michaud, Yucaipa, CA, USA. The yellow dust clouds have expanded over the Martian globe and have made features unrecognizable.
34. 73 10 23 I 0430UT. CM 261°; L_S 306°; 20cm refl. 200X. D. Jefferson, N.Y., USA. The dust clouds had obscured most of the albedo features by this date. The SPC was not observed.
35. 73 10 25 V 1201UT. CM 353°; 20cm refl. by T. Arakawa, Nara, Japan. Violet light shows no bright part of the yellow dust storm.
36. 73 10 25 Y 1247UT. CM 04°; 20cm refl. T. Arakawa, Japan. Yellow light shows the bright parts of the dust clouds.
37. 73 11 07 R 0220UT. CM 96°; L_S 314°; 20cm Newt. f/133 by H. F. Zeh, Toledo, Ohio, USA. Albedo features are starting to return, but they are still vague. Note that the tilted Solis L. and environs can be identified in red-light (W-25). Still no SPC noted.
38. 74 03 16 O 0220UT. CM 318°; L_S 021°; 35cm Newt. 500X by R. Rhoads, Scottsdale, AZ, USA. The surface albedo features appear about normal on the small disk of Mars.

* *

A PROPOSED ASTROGEOGRAPHICAL SECTION

By: James Powell

A.L.P.O. member James Powell is interested in forming an Astrogeographical Section within the Association. While astrogeography might be defined as the study of any terrestrial feature which is--or is suspected of being--of cosmic origin, the proposed A.L.P.O. Section would probably concentrate, at least initially, on the search for meteorite craters, whether recent or fossil ("astroblemes"). In this new and hybrid field everyone is in a sense an "amateur"; even Robert Dietz, to date its most successful practitioner, is by profession a marine geologist. Dr. Dietz estimates that there are at least 130 astroblemes in North America alone. Extrapolating, there should be roughly 1,000 on the total land surface of the Earth, with perhaps another 130 on the submerged continental shelves. Only a small fraction of these have been discovered.

While most A.L.P.O. members may be primarily interested in observation, there are probably some to whom exploration is equally fascinating. If so, astrogeography offers

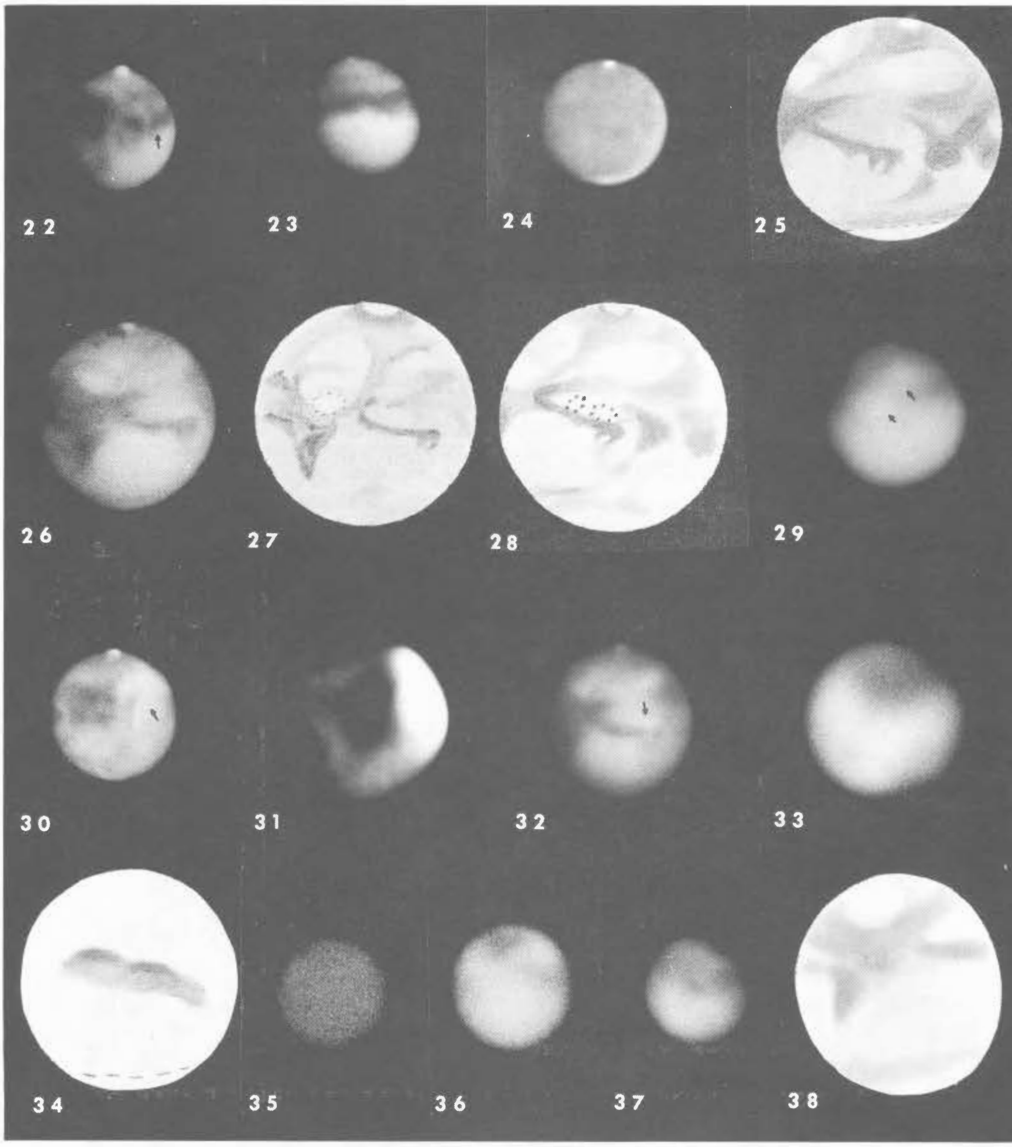

Figure 6. A selection of photographs and drawings of the planet Mars obtained by A.L.P.O. observers during the 1973-74 apparition. The identifications and remarks for these illustrations are listed in the text on page 138.

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A PROPOSED ASTROGEOGRAPHICAL SECTION (cont.)

a unique challenge. The discovery of a meteorite impact site is rarer, and certainly no less important scientifically, than the discovery of a comet. For this type of field work it is not necessary to be able to afford expeditions to remote areas, though such regions doubtless offer the best hunting for Quaternary sites. Astroblemes are where you find them; fossil craters are often difficult to identify, and several recent discoveries have been made in such populous regions as the U.S.A. Midwest and southern Ontario.

Anyone interested in this project should contact Mr. James Powell, 1110 Kokomo Street, Plainview, Texas 79072, U.S.A.: Phone (806) 296-5402. A special invitation is extended to geologists, meteoriticists, aviators, Scuba divers, or any others with specialized relevant skills, and to observers in areas such as Africa, Canada, Asia, Australia, or South America.

Figure 7. ALPO Mars Section Observers and Their Activities

ALPO Assistant Mars Recorder and master observer, Robert B. Rhoads, and his own designed 356mm(14")Newt. refl. on assymetric mount which is in a roll-off building located in Scottsdale, Az. Bob's artistic observing skills & filter techniques are unexcelled. He specializes in color photos.

The Mars Section exhibit prepared by C.F. Capen for the National AL/ALPO 1973 Convention held at Creighton University, Omaha is digested by Jose Olivarez, Director of the A.L.P.O. Training Program and William R. Demyan, Leechburg, Pa. and Mike Otis, Aberdeen, So. Dak., both of whom are ALPO Mars Sec. observers. The latest Mars maps, yellow cloud photos, and observing kits were popular items on display.

Nelson Travnik and his 152mm f/15 refractor at the Observatorio Do Flammarion (02^h53^m W; 21°52'S), Matios Barbosa, Brazil. Observations from this part of the world help to complete the 24-hour surveillance of the planet Mars. Astronomer N. Travnik is an astute observer of the planets who contributes to the ALPO, SAF, and BAA planetary programs. Note his observing accessories and the adjustable CM bands on the Mars chart.

JUPITER IN 1972: ROTATION PERIODS

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

The highlights of the 1972 apparition were the acceleration of the period of rotation for the Great Red Spot and observations of South Equatorial Current A, North Tropical Currents A and B, and the North North Temperate Current A.

Some data pertinent to the apparition follow:

Date of Opposition: 1972, June 24.
Dates of Quadrature: 1972, March 27; September 21.
Declination of Jupiter: 23°S (at opposition).
Equatorial Diameter: 46.7 seconds (at opposition).
Zenocentric Declination of Earth: -2°.1 (at opposition).
Stellar Magnitude of Jupiter: -2.2 (at opposition).

This report is based on 1800 visual central meridian transit observations submitted by 11 observers of the A.L.P.O. When plotted on graph paper, 1461 transits form usable drifts for 67 Jovian spots distributed in 7 different atmospheric currents. The contributing observers are listed below by name and by number of transits submitted, along with the station of observation and telescope(s) employed.

Budine, Phillip W.	Walton, N.Y.	4-in.refr.	625t.	
Capen, C. F.	Flagstaff, Ariz.	24-in.refr. *	1t.	& RS Measures
Doel, Ron E.	Willingboro, N. J.	8-in.refl.	961t.	
Gordon, Rodger W.	Nazareth, PA.	3½-in.refl.	6t.	
Haas, Walter H.	Las Cruces, N. M.	12½-in.refl.	58t.	
Lonak, Gene	Chicago, Ill.	10-in.refl.	37t.	
Mackal, Paul K.	Mequon, Wisc.	6-in.refl.	24t.	
Roginski, Dr. Tom C.	Mertztown, PA.	8-in.refr.		
		8-in.refl.		
		2.4-in.refr.	12t.	
Smith, J. Russell	Waco, Texas	16-in.refl. **	51t.	
Travnik, Nelson	Minas, Brasil	6-in.refr. ***	13t.	Strip Sketch
Winkler, William R.	Rockville, Md.	8-in.refl.	12t.	

*Lowell Observatory
**Skyview Observatory
***Flammarion Observatory

The distribution of transit observations by months is as follows:

1972, February	3	1972, May	492	1972, August	290
March	14	June	123	Sept.	174
April	10	July	484	Oct.	178
				Nov.	29
				Dec.	3

In the tables which follow the first column gives an identifying number or letter to each object; the second column indicates whether the object was dark (D) or bright (W) and whether the preceding end (p), center (c), or following end (f) was being observed. The third column gives the first and last dates of observation; the fourth column, the longitudes on those dates. The fifth column gives the longitude at opposition on June 24, 1972. The sixth column gives the number of transits recorded. The seventh column indicates the number of degrees in longitude that the marking drifted in 30 days, negative when the longitude decreased with time. The eighth column shows the rotation period in hours, minutes, and seconds.

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

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
B	Wp	June 2 - Oct. 16	57° - 327°	44°	32	-19°6	9:55:14
1	Wc	June 2 - Oct. 16	65 - 335	52	32	-19.6	9:55:14
C	Wf	June 2 - Oct. 16	72 - 342	59	32	-19.6	9:55:14
2	Dp	July 2 - Aug. 6	68 - 45	--	11	-19.1	9:55:15
3	Wp	July 2 - Sep. 17	137 - 68	--	15	-26.6	9:55:04
4	Wc	July 2 - Sep. 17	145 - 75	--	16	-26.9	9:55:04
5	Wf	July 2 - Sep. 17	153 - 82	--	15	-27.3	9:55:03
D	Wp	May 25 - Oct. 7	203 - 111	186	26	-20.7	9:55:12
6	Wc	May 25 - Oct. 7	210 - 118	193	26	-20.7	9:55:12
E	Wf	May 25 - Oct. 7	217 - 125	200	26	-20.7	9:55:12

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

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
7	Dp	Apr. 30 - Sep. 26	250° - 148°	208°	16	-20°.4	9:55:13
F	Wp	May 11 - July 20	356 - 306	326	17	-20.8	9:55:12
8	Wc	May 11 - July 20	3 - 313	333	17	-20.8	9:55:12
A	Wf	May 11 - July 20	10 - 320	340	17	-20.8	9:55:12
				Mean Rotation Period:			9:55:11

The three long enduring white ovals of the STeZn were prominent during the apparition. All of the ovals remained stable in length. Their mean length for the 1972 apparition is as follows: FA - 14°, BC - 15°, and DE - 14°. The oval FA was in conjuction with the center of the Red Spot on May 12, 1972 at 3°(II). The long-enduring oval BC was in conjunction with the Red Spot center at a longitude of 356° (II) on September 15, 1972.

In the table above No. 2 is the preceding end of a dark section of the STB following the oval BC. Nos. 3, 4, and 5 are a bright oval in the southern portion of the STeZ preceding the oval DE. The object was moving more nearly like the SSTeZ Current with a period of 9:55:04.

Red Spot Region. System II.

Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
RSp	Mar. 4 - Nov. 13	359° - 343°	349°	45	-1°.85	9:55:38
RSc	Mar. 4 - Nov. 13	10 - 354	0	45	-1.85	9:55:38
RSf	Mar. 4 - Nov. 13	21 - 5	11	45	-1.85	9:55:38
			Mean Rotation Period			9:55:38

The Great Red Spot continued to be a very prominent and striking object of the Giant Planet. It was still dark in 1972 and had been so since 1962: a period of ten years! During the entire apparition the mean length of the Red Spot was 22°. This length is 2° longer than during the 1971 apparition. The rotation period of the Red Spot was the shortest the author has witnessed since he has been observing, since 1951. The mean period of 9:55:38 was two seconds shorter than in the previous 1971 apparition. As a matter of fact, the period for two portions of the 1972 apparition was 9:55:35. The RS from May 13 - June 2, 1972 had a drift of -5°.0 in thirty days, and the period was thus 9:55:35. Also, from July 31 - August 15, 1972 the drift was -4°.4, which also gives a period of 9:55:35. During the first period of acceleration the RS was shifted from 2° to 357° (II). In the second period of acceleration the RS was moved from 0° to 356° (II). The first acceleration occurred as the oval FA was passing conjunction with the RS and was pulling the RS along in the direction of decreasing longitude. During the early part of the apparition the RS was at 10° (II). Near opposition it was at 0° (II); and after August 24, 1972 the RS was near 356° (II) and remained there until near the end of the apparition.

It might be noted that the most recent previous apparition in which the Red Spot was rotating with a mean period of 9:55:38 was in 1931 - 32! Also, the most recent previous apparition which had an acceleration with a period of 9:55:35 was in 1919 - 20!

Middle South Equatorial Belt. System II.

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
I	Wp	June 2 - July 19	25° - 12°	18°	18	-8°.7	9:55:29
2	Wc	June 2 - July 19	30 - 17	23	18	-8.7	9:55:29
3	Wf	June 2 - July 19	35 - 22	28	18	-8.7	9:55:29
				Mean Rotation Period			9:55:29

Nos. 1 - 3 above are a very bright oval in the southern portion of the SEB Z. The oval was near the longitude of the Red Spot (following end) and represents the only prominent feature in the SEB Z during the apparition. The region was at times made up of smaller ovals near the same longitudes as the above object. Usually the features in the SEB Z exhibit rotation periods very nearly that of System II, except when there is a SEB Disturbance.

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Note by Editor. Mr. Budine's present report is necessarily closely related to Mr. Paul Mackal's article, "The 1972 Apparition of Jupiter", in our preceding issue (JALPO, Vol. 24, Nos. 5-6, pp. 104-116). Indeed, many of the features mentioned in Mr. Budine's article can be found on the 43 Jupiter drawings in Mr. Mackal's report. While cross-referencing would certainly be helpful, the interested reader may find it instructive to make his own comparisons. Finally, readers who would like to participate in Jovian rotation-period studies are warmly invited to write to Mr. Budine at his address on the back inside cover.

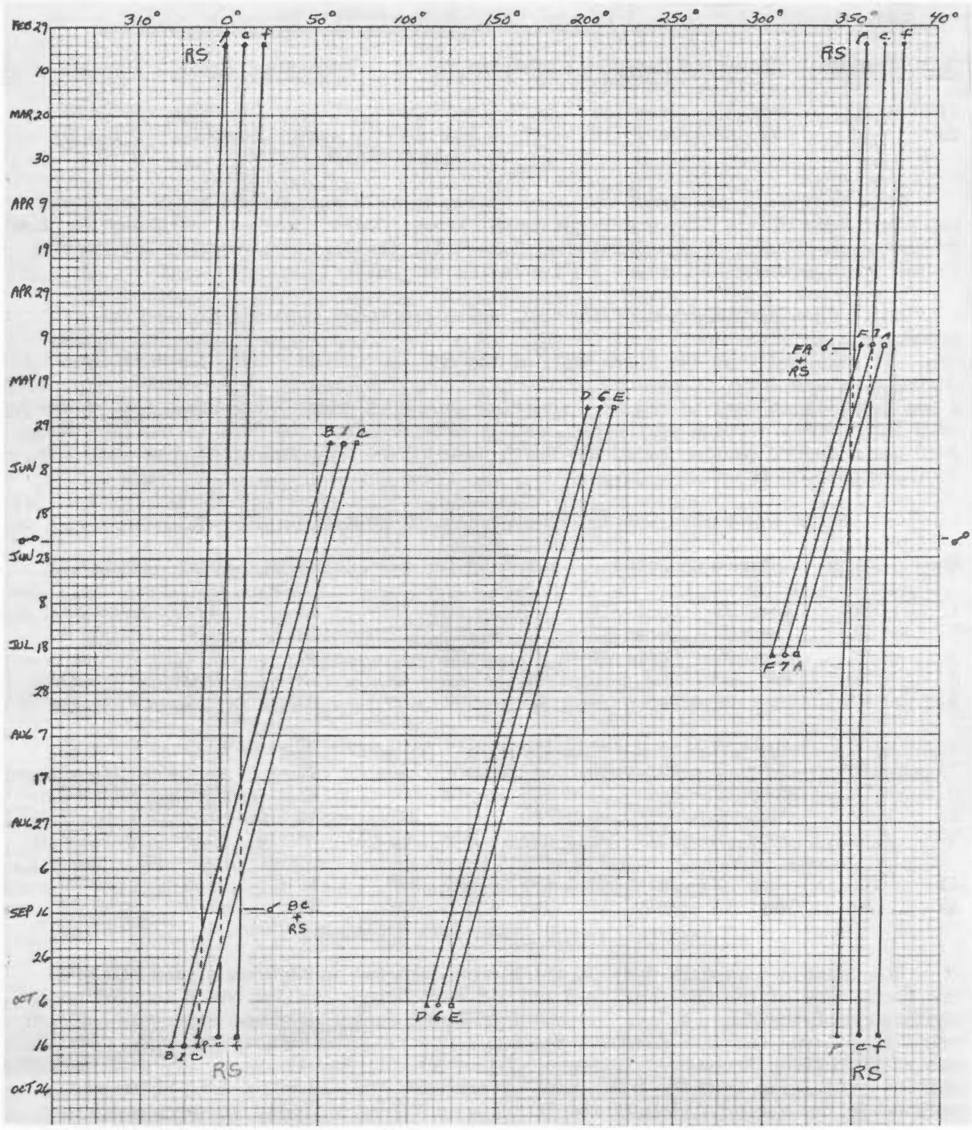

Figure 8. Drift-lines, longitude (II) vs. time, of the Great Red Spot and the three long-enduring South Temperate Zone ovals in 1972. Observations by the A.L.P.O. Jupiter Section. Graph constructed and contributed by Mr. Phillip W. Budine.

* *

South Equatorial Current A (N.edge SEB_n, S. part EZ). System I.

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Dc	May 27 - Sept. 16	7° - 4°	6°	27	-0°.8	9:50:29
2	Wp	May 29 - Sept. 17	41 - 20	37	24	-5.5	9:50:23
3	Wc	May 29 - Sept. 17	52 - 26	49	26	-6.8	9:50:21
4	Wf	May 29 - Sept. 17	63 - 32	60	24	-8.2	9:50:19
5	Wc	May 29 - Aug. 9	85 - 79	58	17	-2.4	9:50:27
6	Dc	June 3 - July 29	140 - 134	137	15	-3.2	9:50:26
7	Wc	July 29 - Aug. 20	137 - 137	---	7	0.0	9:50:30
8	Dp	May 29 - July 12	315 - 315	315	15	0.0	9:50:30
9	Dc	May 29 - July 12	320 - 321	321	17	+0.6	9:50:31
10	Df	May 29 - July 12	325 - 326	326	14	+0.6	9:50:31

South Equatorial Current A (N.edge SEB_n, S. part EZ). System I. (cont.)

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
11	Dp	May 13 - July 12	342° - 340°	340	22	-0°.9	9:50:29
12	Df	May 13 - July 12	347 - 345	345	22	-0.9	9:50:29
			Mean Rotation Period				9:50:27

This region of the planet was very active in 1972 with bright ovals and gaps in the north edge of the SEB_n and large bright areas, ovals, patches, and dusky sections in the southern part of the Equatorial Zone. All the features observed were moving in the South Equatorial Current A (the faster current).

No. 1 is a dark section of the SEB_n which protruded into the EZ_s and was preceding a brighter section of the EZ_s. Nos. 2-4 are a large bright oval in the EZ_s. It extended from the north edge of the SEB_n to the EB. Very large in size during June and July, it was one of the brightest features in this current. No. 5 is a small brilliant oval in the EZ_s bordering the north edge of the SEB_n. No. 6 was a very large dusky section of the EZ_s, and it extended from the SEB_n to the EB. Nos. 8-10 was a darker section along the north edge of the SEB_n and protruding into the southern part of the EZ_s.

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

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Dc	May 29 - Sept. 17	19° - 13°	16°	43	-1°.6	9:50:28
2	Wp	May 29 - Sept. 17	35 - 28	32	36	-1.8	9:50:28
3	Wf	May 29 - Sept. 17	45 - 38	42	34	-1.8	9:50:28
4	Wp	May 29 - Aug. 9	48 - 48	48	23	0.0	9:50:30
5	Wf	May 29 - Aug. 9	55 - 56	55	23	+0.4	9:50:31
6	Dc	June 2 - Aug. 21	135 - 127	133	36	-3.0	9:50:26
7	Wc	June 2 - Aug. 21	150 - 137	145	39	-4.8	9:50:24
8	Dc	June 2 - Aug. 21	158 - 142	153	27	-5.9	9:50:22
9	Wc	June 2 - July 18	245 - 239	242	18	-4.0	9:50:25
10	Wc	June 2 - July 26	260 - 263	262	16	+1.7	9:50:32
11	Dc	June 2 - July 23	283 - 280	279	13	-1.8	9:50:28
12	Wc	May 13 - July 12	340 - 335	337	22	-2.3	9:50:27
			Mean Rotation Period				9:50:28

No. 1 was a very dark festoon which connected the south edge of the NEB with the north edge of the EB. Nos. 2-3 and 4-5 were bright smaller ovals located on the south edge of the NEB. A loop festoon from No. 1 encircled these two ovals. No. 6 was a very large and dark diagonal festoon connecting the NEB_s to the SEB_n. No. 7 was a very bright large oval following object No. 6. No. 11 was a very wide dark festoon projecting from the south edge of the NEB. No. 12 was a long white streak located in the north portion of the EZ.

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

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Dc	July 4 - Aug. 7	100° - 76°	---	13	-20°.0	9:55:13
2	Dc	May 27 - July 12	206 - 174	186°	19	-18.8	9:55:15
3	Dc	May 27 - July 12	213 - 180	193	16	-19.4	9:55:14
			Mean Rotation Period				9:55:14

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

Table I

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Wc	July 4 - Aug. 23	53° - 344°	---	16	-43°.0	9:54:42
2	Wc	July 19 - Aug. 10	55 - 29	---	8	-32.5	9:54:56
3	Dc	May 15 - July 28	295 - 215	253°	28	-32.0	9:54:57
4	Wc	May 15 - July 28	310 - 225	266	32	-34.0	9:54:54
5	Wc	May 13 - July 28	315 - 230	271	31	-32.7	9:54:56
6	Wc	May 13 - July 28	320 - 235	276	33	-32.7	9:54:56
			Mean Rotation Period				9:54:53

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

Table II

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Dc	July 4 - Aug. 18	90° - 51°	---	15	-26°.0	9:55:05
2	Dp	May 29 - Nov. 13	152 - 10	134°	38	-24.9	9:55:07
3	Df	May 29 - Sep. 17	162 - 70	138	32	-24.2	9:55:08
4	Wp	July 4 - Sep. 17	141 - 75	---	23	-26.4	9:55:05
5	Wc	July 4 - Sep. 17	148 - 84	---	23	-25.6	9:55:06
6	Wf	July 4 - Sep. 17	155 - 93	---	23	-24.8	9:55:07
7	Dc	May 29 - Sep. 17	190 - 98	167	37	-24.2	9:55:08
8	Dc	May 27 - July 28	248 - 193	223	19	-26.2	9:55:05
9	Wc	May 27 - July 28	259 - 201	233	22	-27.6	9:55:03
10	Wc	May 15 - July 28	277 - 209	239	34	-27.2	9:55:03
11	Dc	Oct. 29 - Nov. 26	300 - 278	---	6	-24.1	9:55:08
12	Wc	May 14 - July 22	347 - 288	314	30	-25.6	9:55:06
			Mean Rotation Period				9:55:06

In the North Tropical Current A No. 1 was a dark projection located on the north edge of the NEB and projecting considerably into the NTrZ. Nos. 2 and 3 were very dark elongated condensations in the NEB_n.

In the North Tropical Current B - Table I, Nos. 1-6 were all located on the north edge of the NEB. Nos. 1-2 and 4-6 were small bright ovals. No. 3 was a very dark elongated condensation. The average period for this sub-current was shorter than at any time since 1943 and 1967 when the period was 9:55:00. The mean period of 9:54:53 in 1972 for this sub-current was even shorter than the 9:54:56 of Marking No. 5 of the 1967-68 report. However, that feature was for a period of time moving at 9:54:29!! Note that Marking No. 1 is moving at 9:54:42 in Table 1!

Table II is also the North Tropical Current B with a period for most of the markings averaging to that for Current B, which is 9:55:06. The outstanding features of this table are objects Nos. 2-7. They were all located just south of the center of the NTrZ. Nos. 2-3 was a very dark elongated condensation with its major axis in the direction of NW-SE. Following Marking Nos. 2-3 was a very bright somewhat oval shaped area, which is Nos. 4-6 in Table II. Following the bright area was another very dark elongated condensation, which is Marking No. 7 in the table.

North North Temperate Current (NNTB,NNTeZ). System II.

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Dc	May 13 - July 18	16° - 15°	16°	9	-0°.4	9:55:40
2	Wc	June 3 - July 4	57 - 59	59	7	+2.0	9:55:43
			Mean Rotation Period				9:55:41

The above markings were moving in the North North Temperate Current A.

LARGE-SCALE DISTURBANCES ON JUPITER

By: Wynn K. Wacker, A.L.P.O. Jupiter Section

The relatively recent discovery that Jupiter emits more energy than it receives from the Sun has altered our view of the interior of that planet. Jupiter has been described as a star which didn't quite make it, generating large amounts of heat at its core. This heat must be transported, at least part of the way, by a convective process. Convective processes on Earth are responsible for earthquakes and other geological disturbances. It becomes reasonable to inquire whether analogous zenological disturbances occur on Jupiter. In searching through past observations I have found evidence of what I consider to be a type of large-scale disturbance on Jupiter. I do not know whether or not it has its origin near Jupiter's core. It occurs on a scale, in both space and time, which is to my knowledge unprecedented in other types of Jovian activity. I will start with chronological descriptions of what I feel are the two most striking examples of these zenological disturbances, and then go on to describe some others. Unless otherwise noted, the material mentioned may be found in Peek's The Planet Jupiter[1] or the Memoirs of the British Astronomical Association.

1936 - The Red Spot accelerated abruptly, increasing its rotation period by 2 seconds from $9^h\ 55^m\ 39^s$ in 1935 to $9^h\ 55^m\ 41^s$ in 1936.

1937 - An SEB Disturbance apparently occurred unobserved in the late part of this year.

1938 - There was great activity in the Equatorial Zone. The south portion was dusky, and there were many long bright oval areas in the north part. Disturbances of the normal atmospheric currents are possibly indicated by the motion of large dark masses in the S. part of the EZ. These started with a rotation period of $9^h\ 51^m\ 40^s$, unusually long; but an acceleration soon set in, and within two months the period had decreased to $9^h\ 50^m\ 30^s$, where it remained nearly constant for the rest of the apparition. The color of the E.Z. was, as is usual for active regions containing dark material on Jupiter, reddish, described variously as orange, brick-red, coppery brown, and yellow-brown.

1939-40 - The S. part of the E.Z. was darker than in the previous apparition, although the activity was less. The N. part was intensely active, again with chains of white spots. The dark material in the E.Z. changed color so that it was described as greenish, metallic grey, leaden, and bluish slate. This red to blue color change in the dark material is a normal process which takes place usually at the edge of zones. It can be seen under more normal conditions in the dark projections along the NEB_s, and in inactive or faded belts. There is some evidence this change occurs because the dark material has been transported to a different altitude[2]. Activity increased farther north with an outbreak of dark spots along the S. edge of the North Temperate Belt. In the south, the S.S.Temperate Current invaded areas normally controlled by the S.Temperate Current. Up to this time three light ovals, each with a constant 14^o of length, had been observed fairly frequently since around 1915[3]. In 1939 these ovals disappeared and were replaced with features destined to become the South Temperate Zone Ovals of today. The current ovals started out very large and shrank, rapidly at first and then more gradually, until today they average less than 12^o in length. At the same time the transition was occurring the rotation period of the oval features shortened from $9^h\ 55^m\ 20^s$ to $9^h\ 55^m\ 06^s$. Finally, the South Tropical Disturbance, a permanent feature of Jupiter since 1901, disappeared.

1940-41 - Activity in the E.Z. had died away, and the zone was described as bright and white. Some possible remnants of activity were present in the north with an outbreak of spots along the S. edge of the North North Temperate Belt. More of these spots appeared in 1941-42 and again in 1942-43. A few persisted until 1944-45. Oscillating spots were seen in the S. Tropical Z. in this apparition and in 1941-42.

The next major zenological disturbance appears to have started in 1960.

1960 - Near the beginning of this year the rotation period of the Red Spot lengthened rather abruptly by about 1.01 seconds. According to Smith et al[4] a drift in Jupiter's decametric radio sources started a little later in the same year. The change of radio source rotation period was on the same order as that of the Red Spot. Smith's conclusions have since been disputed[5] so that the radio aspects of the apparition will not be discussed further here.

1961 - Activity began in the E.Z.[6]. The $E.Z._n$ contained some prominent white oval masses tinted with varying amounts of yellow and orange. Dark masses in the $E.Z._s$ had a rotation period of about $9^h\ 50^m\ 38^s$.

1962-63 - The drift in longitude of the Red Spot caused by its change in rotation period appears to have leveled off around Jan., 1963[4,7]. The Spot appears to have remained stationary in System II following this event, but the end of the apparition makes this conclusion uncertain. The E.Z. was extremely turbulent, changes being visible in as little as 15 to 30 minutes[8,9]. The N.E.B., E.Z., and $S.E.B._n$ appeared as one huge belt across the planet. The E.Z. was described as rich yellow, orange, and reddish brown. The activity began to die down late in the apparition. An SEB Disturbance broke out in late Sept. and there was much duskiness and activity in the S. Tropical Z. near its SEB_s branch. The N.T.B. darkened somewhat at the end of the apparition, indicating a possible increase in activity there.

1963-64 - The Red Spot remained virtually at rest in System II. The E.Z. was still active, although it had lost some of the orange hue seen in the previous apparition[10]. There was a good deal of activity in the north, with the warm golden hue of the N.N.T.B. and N.N.N.T.B. much commented on.

1964-65 - The Red Spot resumed a slow positive drift of about 5^o per year. The central portion of the E.Z. was light early in the apparition; but later on the whole zone became dusky and orange[11,12], eventually spreading to cover the entire northern hemisphere of the planet in an orange veil[13]. An SEB Disturbance started in June. At least one rapidly moving dark spot appeared on the N.T.B.$_s$[14].

1965-66 - The Red Spot remained dark and prominent, continuing its slow rate of positive drift. The orange veil continued to hang over the planet north of the NEB. The material in the E.Z., however, changed to a beautiful soft blue. Development of the SEB continued, with rapidly moving spots on the S.E.B.$_s$ and S.T.B. It may be indicative of an alteration of atmospheric currents that this was the first apparition in which rods and spots were observed near the S. Temperate Ovals in the S.Te.Z.[15]

In both of these zenological disturbances it is difficult to tell exactly where the direct effects of the disturbance end. It may be that some of the phenomena I have listed are not direct effects.

Two more phenomena which appear to be associated with these disturbances should be mentioned. First, after each of the above mentioned disturbances the pattern of SEB Disturbances changed. Up to 1937 SEB Disturbances appeared to occur with about a 9-year period, with Disturbances in 1919, 1928, and 1937. The next SEB Disturbance occurred in 1943 and was unusual in that material erupted from two sources. After this period, SEB Disturbances appeared to exhibit a periodicity of about 1085 days, approximately a 3-year cycle[16]. This cycle was maintained with Disturbances in 1949, 1952, 1955, and 1958. The two SEB Disturbances which occurred in the wake of the 1960 zenological disturbance, in 1962 and 1964, were rather weak. The Red Spot, which previously had vanished during SEB Disturbances leaving a bright Red Spot Hollow, merely faded in the 1962 Disturbance. In the 1964 Disturbance, which broke the 1085-day cycle, development was slow and gradual with none of the localized eruption characteristic of the usual SEB Disturbance. The Red Spot appeared to be virtually unaffected by this activity. No more SEB Disturbances occurred after this time until 1971. The changes in the pattern of SEB Disturbances and their effect on the Red Spot have resulted in discontinuities in at least two theoretical discussions of the Red Spot, both of which are described in the Appendix to this paper. A final possible effect of the 1960 zenological disturbance involves the oscillations in longitude of the Red Spot discovered by Reese and Solberg[7,17]. These oscillations have a period of about 90 days and an amplitude of about 1 degree and have been occurring since the photographic measurement program which revealed them began in 1962[18]. Analysis of visual transit observations by Reese revealed that the Spot has oscillated in longitude since his observations began in 1946, but the oscillation was not regular until 1960[19].

A number of other zenological disturbances appear to have occurred, some aspects of which are listed below.

In the period from 1878 to 1882, the Red Spot rose to great prominence in terms of both size and darkness. Around 1878 or 1879 its rotation period lengthened. In 1879 the E.Z. was covered with reddish material, which persisted to 1880. Exact chronology is impossible because of limited records.

Around 1909-10 the Red Spot's rotation period shortened. There followed a period of irregularity in Red Spot drift. Throughout this period the trend appears to have been towards a decreasing rotation period. It was ended by a sudden increase in period around 1919-20. Activity in the E.Z. intensified in 1913, and in 1914 the E.Z.$_s$ was dark while the E.Z.$_n$ contained egg-shaped white ovals. No special color was noted, however. The first recorded invasion of the S.S.Temp. Current into the S.Temp. Current latitudes occurred in 1911. From at least 1892 to 1908 the S.E.B. was the most prominent belt on the planet, while the N.E.B. appears to have had something of the character of the S.E.B. as it is today. NEB Disturbances occurred in 1893, 1906, and 1912[20]. After this period of zenological disturbance the two equatorial belts assumed their current roles. The changes in this period are somewhat confused, perhaps because the Red Spot rotation period was changing continuously.

Around 1919-20 the Red Spot rotation period lengthened by several seconds. This change lasted until 1923, when the period shortened once again. The first recorded SEB Disturbance occurred at the end of 1919. In 1919-20, 1920-21, and 1922 the S.S.Temp. Current invaded again the realm of the S.Temp. Current. The E.Z. was strongly shaded in 1919-20, with the usual warm color descriptions varying from dull gold to pale orange. This color persisted through 1920-21 and died out in 1922.

In 1926 the Spot's rotation period again lengthened, the longer period persisting until the 1936 zenological disturbance. In 1927-28 the E.Z. again darkened and became reddened, this change persisting until the 1929-30 apparition.

In 1928-29 the S.S.Temp. Current invasion occurred again. Near the end of 1928 an SEB Disturbance broke out. In 1929-30 activity increased in the north with outbreaks of dark projections along the $N.T.B._s$ and $N.N.N.T.B._s$.

Finally, there was probably the start of a zenological disturbance near the beginning of 1971. The Red Spot suddenly accelerated on Dec. 23, 1970 from a rotation period of $9^h\,55^m\,41^s.63 \pm 0^s.02$ to one of $9^h\,55^m\,40^s.41 \pm .02$[21]. This was followed in June of 1971 by the first SEB Disturbance since 1964. It turned out to be the first two-source Disturbance since 1943. We may still be in the midst of activity from this zenological disturbance. [Written in June, 1974].

Although every zenological disturbance I have mentioned differs in some aspects from every other one, there do appear to be a number of common characteristics. I have listed these in a rough timetable (Table I). It is meant to indicate approximately the sequence, and very roughly the timing, of events associated with zenological disturbances.

The above has by no means been a complete description of zenological disturbances. Williams[22] describes a number of observations of reddish coloration in the E.Z. which may have been associated with earlier zenological disturbances, and we have neglected entirely high latitude activity (which also appears to follow the disturbance pattern). We must, however, move on to a discussion of the cause of the change in Red Spot rotation period.

The Red Spot acceleration which occurred on Dec. 23, 1970 was clearly involved with a dark disturbance in the S. Trop. Z. which had appeared during the previous apparition. The preceding end of that disturbance arrived at the following end of the Red Spot Hollow on Dec. 23 and apparently imparted a 3.24m/sec increase in rotational velocity to the Red Spot. Looking back through the records, we find that it is apparent that the 1901-40 South Tropical Disturbance had a considerable influence on the motion of the Red Spot. The Red Spot and the S. Trop. Disturbance came in and out of conjunction every few apparitions from around 1902 to 1919-20, perhaps accounting for the irregular motion of the Red Spot during this period. The R.S. came out of conjunction with the S. Trop. Disturbance around 1909-10 and 1919-20. The two features stayed out of conjunction until around 1913 and 1922 respectively. The S. Trop. Disturbance faded to invisibility, along with the Red Spot Hollow and $S.E.B._s$, in 1926 and 1936. The exact relationship between the S. Trop. Disturbance and the changes in Red Spot rotation is not clear, but that a relationship exists appears certain.

There may also be a relationship between disturbance features in the S. Trop. Z. and the outbreak of S.E.B. Disturbances. The outbreak of SEB Disturbances in the wake of zenological disturbances has already been mentioned. SEB Disturbances also followed the outbreak of dark South Tropical Streaks in 1941 and 1946, and preceded the outbreak of a streak in 1955. Reese[23] discusses this interrelation and shows a drift chart of the relationship between the South Tropical Zone features and the SEB outbreaks in the period from 1940 to 1960. Current data may not fall on the same drift line, since the massive changes in Jupiter's atmospheric currents following zenological disturbances may have altered the drift of these features, however constant they were in the period between disturbances. It may, for example, be too much to expect the sources of dark material in SEB Disturbances to have a uniform rotation period throughout the observational records. A semi-uniformly rotating source hypothesis might be more realistic. In the same paper Reese shows that a number of disturbances in the S. Trop. Z., over a period of 80 years, may have had a common origin in a source rotating with a period of about $9^h\,55^m\,21^s.208$. Again, there is no reason why this rotation period should remain constant forever. It does, however, hold forth promise for a means of predicting probable occurrences of zenological disturbances, and through this relation a whole host of other events.

In summary, the start of zenological disturbance is indicated by a change in the rotation period of the Red Spot. Such changes in rotation period appear to occur in a complex interaction with disturbance features in the South Tropical Zone. The effects of the zenological disturbance gradually spread, increasing activity on the whole planet. It may take up to 3 years for the northern-most reaches of the planet to be affected. Changes in patterns of Jovian activity caused by the disturbance may persist for much longer periods.

This paper has barely scratched the surface. It appears clear that the zenological disturbance concept ties many of the previously noted patterns of activity into one unifying pattern. There are, however, many many questions left unanswered. If this paper stimulates a search for some of those answers, I will consider the effort to have been well worthwhile.

TABLE I

Activity Pattern of a Zenological Disturbance

T = 0 The rotation period of the Red Spot changes.

T = +1 yr. Start of activity in the Equatorial Zone. E.Z. becomes duller. South Temperate Current is disrupted (S. S. Temperate Current "invasions"). SEB Disturbance outbreak.

T = +2 yrs. Peaking of activity in the Equatorial Zone. $E.Z._n$ is filled with light ovals while $E.Z._s$ is dark. The whole E.Z. becomes reddish in coloration, described variously as orange, dull yellow, or tawny.

T = +3 yrs. Tapering off of E.Z. activity. The warm color of the Equatorial Zone starts changing to a cool bluish or slate. Increase in activity in the northern part of the planet, usually taking the form of dark rapidly moving spots or projections along the $N.T.B._s$ and $N.N.T.B._s$. These may persist for several years.

Long Term Changes in the pattern of SEB Disturbance activity, and through them in the visibility of the Red Spot. Changes in the features and atmospheric currents in the S. Tropical and S. Temperate regions. Possible changes in the rotation periods of the sources of dark material for the S.E.B. and other belts.

Appendix

The zenological disturbances have had a definite effect on Jupiter's South Equatorial Belt. Particularly important in this regard were the disturbances starting in 1936 and in 1960. Following the first the frequency of SEB Disturbances increased three-fold. It may be that this was actually the start of a prolonged interaction between the Red Spot and the causative agent of the South Tropical Disturbance, since the rotation period of the Disturbance's preceding end had slowed down to nearly that of the Red Spot at this time. Whatever the ultimate cause, this new pattern of SEB Disturbances lasted until the time of the 1960 zenological disturbance. Up to around 1960, the Red Spot had faded to near invisibility for a time following every SEB Disturbance. In 1962 and 1964, however, the Spot was virtually unaffected; and no more SEB Disturbances occurred until 1971. Thus, it is not surprising that the Red Spot was much less conspicuous than usual from about 1937 to 1960, and quite prominent following this time. This circumstance has affected two attempts to explain changes in the visibility of the Red Spot. I would like to describe these here as examples of how zenological disturbances have affected past attempts at explaining Jovian phenomena.

Peek[1] (p.236-244) attempts to correlate the prominence of the Red Spot with acceleration of its rotation period. The SEB fades preceding an SEB Disturbance, and at that time the Red Spot becomes prominent. I have already mentioned in the main body of the paper that SEB Disturbances followed zenological disturbances by about a year. Thus, the Red Spot is usually quite prominent in the initial stages of a zenological disturbance, and faded in the following stages of it. In fact, the start of a zenological disturbance may initiate fading of the S.E.B., so Peek may have been right at least that far. Thus, it is natural to find that Peek got a high correlation between these two factors ($r=+0.56$) up through 1939. After this, however, the increased S.E.B. activity caused the long-lasting fading of the Red Spot, so the eight remaining apparitions in his series had a large negative correlation. This lack of correlation following 1936 caused his proposal to fall into disfavor; yet it is now possible to see that it contained an essential element of truth. It is interesting to note that most of the significance of Peek's high positive correlation rested on the years 1920, 1926, 1927, 1936, and 1937, all initial years of major zenological disturbances.

An attempt was made by Graf et al to correlate the prominence of the Red Spot with sunspot numbers[24]. In a follow-up paper Basu[25] smoothed the data using 5-year moving averages. He got a good correlation ($r=+0.57$) for the period from 1894 to 1945. He ran into the same trouble Peek did following this time so that the correlation for the entire period, 1894-1965, is much lower ($r=+0.24$). It turns out that the zenological disturbances in 1919-20, 1926, and 1936 occurred close to peaks in sunspot numbers, giving the high positive correlation in those years.

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THE 1971-72 EASTERN (EVENING) APPARITION OF VENUS

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

Introduction

The 1971-72 evening (eastern) apparition of the planet Venus included the period from 1971, August 27 (superior conjunction) to 1972, June 17 (inferior conjunction). The planet reached the point of greatest eastern elongation (46°) on 1972, April 8, at which time Venus exhibited an apparent visual magnitude of -4.0. Greatest brilliancy was attained on 1972, May 11, the planet having an apparent visual magnitude of -4.2 on that date and a disc that was nearly 30% illuminated.

The following fifteen individuals contributed observational reports to the Venus Section during the 1971-72 apparition:

	Observer and Location		Number of Observations	Basic Instrumentation
1.	Capen, Charles F.	Flagstaff, Arizona	4	24" (60 cm) refractor
2.	Colligan, Tom	Port Washington, New York	7	8" (20 cm) reflector
3.	Constantino, Joe	Latham, New York	6	4¼" (11 cm) refractor
4.	Heath, Alan W.	Nottingham, England	21	12" (30 cm) reflector
5.	Hockstein, Stephen	Bronx, New York	12	6" (15 cm) reflector
6.	Keel, Billy	Nashville, Tennessee	6	2.4" (6 cm) refractor
7.	Krisciunas, Kevin	Naperville, Illinois	15	6" (15 cm) reflector 12" (30 cm) reflector
8.	Louderback, Daniel	South Bend, Wash.	2	2" (5 cm) refractor
9.	Manning, George G.	Bronx, New York	16	3½" (9 cm) reflector
10.	Moore, Guy	Arlington, Virginia	3	3" (7.6 cm) refractor
11.	Patton, Chet	Buchanan, Michigan	5	5" (12.5 cm) refractor
12.	Pazmino, John	Brooklyn, New York	5	7" (17.5 cm) refractor
13.	Schaefer, Brad	Littleton, Colorado	1	12½" (31 cm) reflector
14.	Webb, Brian R.	Redondo Beach, Calif.	1	6" (15 cm) reflector
15.	Wessling, Richard J.	Milford, Ohio	1	12½" (31 cm) reflector

A total of 105 observations was received from the program participants listed above, and the following distribution of submitted reports by month should prove of interest to the reader:

1971, September	0	1972, February	8
October	0	March	16
November	0	April	38
December	5	May	26
1972, January	3	June	9
		Total:	105

From the distribution analysis presented above, it can be seen that the greatest mass of observational reports was accumulated during the months of 1972, March, April, and May. A serious neglect of the very early portions of the 1971-72 apparition becomes immediately apparent, and the writer would like once again to appeal to observers to begin their studies of Venus much earlier than has been the common practice in recent years. A long-term visual systematic investigation of the planet is needed, one possessing a high degree of internal continuity and consisting of as many simultaneous observations as possible. The Recorder stands ready to assist anyone who has a serious interest in observing Venus on a regular basis; and a complete description of the Venus Section observing programs can be found in "An Introduction to Observing the Planet Venus," available from the Section Recorder at a cost of $2.50.

At this point, the writer would like to express his sincere gratitude to those persons who actively participated in the various observing programs of the Venus Section throughout 1971-72. Such persistent, enthusiastic support from individuals such as these is appreciated and is very much needed in the coming years.

Visual Observations of Surface Details

The conventional method of studying visually the rather elusive markings of Venus in detail involves making a continuous series of drawings of the planet, recording any apparent or suspected detail seen at visual wavelengths with the highest attainable degree of precision and objectivity. It is known that the real surface features of the planet are apparently permanently obscured by a generally opaque atmospheric blanket which appears light yellow. When Venus is observed or photographed in infrared or red light, the disc of the planet usually appears quite featureless, while at much shorter wavelengths a variety of markings, which appear to favor an extremely dense cloud layer, become obvious. Rather large, typically diffuse, and roughly parallel (or perhaps even radial) banded dusky markings, which commonly are noticed in the equatorial regions of the planet, are frequently visible on photographs taken at visual and ultraviolet wavelengths of light. In addition, drawings made by observers using a number of color filters of known transmissions, as well as in integrated light, show similar dusky features from time to time. Such markings are known to change their shape and orientation within a relatively short period of time, often within a day or so. Other low-contrast, quasi-permanent markings can be detected in yellow light, while bright clouds may be seen at one time or another near the cusps of the planet.

In all, recent investigations have revealed only a slight to moderate correlation between markings typically seen in ultraviolet light and those visible at visual or longer wavelengths. Studies of the wavelength dependence of features on Venus with narrow-band interference filters have indicated that the contrast of the markings falls off rapidly at wavelengths longward of about 3800 Å, becoming almost zero at 4200 Å. This upper limit is extremely close to the lower limit of visibility of the average human eye, probably precluding their visibility to most visual observers. It is possible that the infrequent yellowish markings may be detected by the experienced eye with some confidence, but a great deal is dependent upon the contrast conditions at the time of observation as well as upon one's own visual sensitivity to delicate contrast differences. Ideally, visual work should be carried out during periods when Venus is seen against a light sky (twilight or full daylight sky); the glare so characteristically encountered when Venus is studied against a dark sky, as well as the effects of differential refraction at low altitudes, will usually reduce one's chances of actually seeing real atmospheric shadings.

Examination of the observational data accumulated over the years by visual observers and through more sophisticated photographic means (both at visual and ultraviolet wavelengths of light) reveals a tentative pattern for the markings usually detected at the surface of Venus. These categories of visible features might be described as follows:

1. Banded Dusky Markings: dusky streaks which characteristically run parallel to one another across the illuminated portion of the planet and lie perpendicular to the line of the cusps.
2. Radial Dusky Markings: typically bear a resemblance to a spider's web or a "spoke" pattern, the streaky markings often converging at the subsolar point.
3. Irregular Dusky Markings: elongated or roughly linear streaks exhibiting no evident real pattern.
4. Amorphous Dusky Markings: dusky features showing no recognizable form or any specific pattern.
5. Bright Spots or Regions: exclusive of the cusps, these are brightenings which typically appear much lighter in intensity than the surrounding portions of the illuminated disc.

The reader is encouraged to examine Figures 9 and 10 in connection with the discussion in the balance of this article.

It is clear from a statistical examination of the data that the amorphous dusky markings, irregular dusky streaks, parallel banded markings, and various bright areas appear commonly at visual wavelengths and are detected at various times by the trained or experienced, systematic observer of Venus. Those markings which are detectable only at ultraviolet wavelengths may well conform to a similar pattern as do those just discussed, but the correlation between those features recorded in ultraviolet light and those seen visually is rather poor. The radial or "spoked" pattern appears to be more characteristic of ultraviolet photographs; however there is some scanty evidence in the Venus Section files which suggests that a faint radial pattern is visible with red filters. Furthermore, Capen has suggested in recent years, upon an investigation of photographs taken in various colors, that there is a possible reversal of intensity of markings at longer wavelengths (i.e. those areas which appear dark at ultraviolet wavelengths show up bright in red light). Clearly, any recognizable correlation between the data accumulated by the different methods can prove to be of great significance, while simultaneous observations of features at the surface of Venus at different wavelengths and under varying contrast conditions can shed some additional light on the morphology and visibility of the elusive markings on the planet.

For the current observing period, there were no ultraviolet photographs received by the Section for analysis. Consequently, it has been necessary to base this report upon visual drawings and a few photographs taken at visual wavelengths of light. There also were no clear instances of simultaneous observations. The data for this apparition appeared to be moderately coherent, although a higher incidence of continuity is to be desired, especially with respect to drawing technique.

An exhaustive analysis of the great variety of sketches and drawings of Venus contributed to the Section during the 1971-72 period revealed that nearly every class of marking previously outlined in this report was represented, with the possible exception of the controversial radial pattern more common to ultraviolet photographs. Following a practice introduced several years ago by Bartlett and Hartmann, the writer has prepared the following table based upon a survey representing an attempt to determine the percentage of observations in which each type of marking categorized above was recorded.

TABLE I. VENUS 1971 - 72: SURFACE MARKINGS AND THEIR FREQUENCY OF OCCURRENCE

$\underline{k}$ = 0.909 to 0.079

Type of Marking	Percentage of Observations (105 Drawings)
1. Banded Dusky Markings	38%
2. Radial Dusky Markings	$<$ 1%
3. Irregular Dusky Markings	30%
4. Amorphous Dusky Markings	39%
5. Terminator Shading	63%
6. No Markings	28%
7. Bright Spots or Regions (exclusive of cusps)	1%

Notes:

A. Assuming that the bright illuminated portion of Venus is typically assigned a relative numerical intensity of 9.0 on the standard A.L.P.O. scale (0 = black shadows to 10 = brightest objects), it was found that the average assigned numerical intensity for the dusky markings on Venus during 1971-72 was about 7.0 (items 1 through 5 in the table); bright spots or regions, exclusive of the cusp areas, had an average value near 9.8.

B. Observers utilized the conspicuousness scale on enough occasions to permit the conclusion that the numerical average for all features in the table was near 4.5, an indication that most of the markings were at least moderately suspected, although nothing was certain.

C. Seeing conditions, appraised using the standard A.L.P.O. scale from 0 (worst) to 10 (perfect), were found on the average to be near 5.0; most observations were made against a light (just prior to sunset) or twilight sky rather than a dark background. Atmospheric transparency was usually fair to moderately good.

It is at once apparent that the method of reduction employed in the preparation of the foregoing table is unavoidably subjective, although it does represent at least an attempt to derive a suitable means for a quantitative evaluation and analysis of the data. Several rather tentative conclusions may be drawn from our table as well as from the bulk of observational material accumulated throughout the 1971-72 period, and we shall consider several of these in brief in the next few paragraphs.

Nearly one-fourth of the drawings submitted to the A.L.P.O. Venus Section depicted absolutely no markings at all on the illuminated portion of the planet. This category is most affected by new observers, who frequently draw the disc of Venus completely devoid of detail at the outset. Once these individuals have gained some experience, they begin to detect faint differences in contrast; and consequently the incidence of observations in which nothing is suspected decreases substantially.

On the other hand, many experienced observers on occasion report a completely blank disk; and rarely are even these individuals completely certain of anything on Venus. Furthermore, a great deal is dependent on one's contrast perception, the instrument employed, the atmospheric conditions, and a number of additional factors too numerous to mention here.

Although from our table the category entitled "Terminator Shading" actually might be considered to be of great significance, in truth it does not have very much to do with the nature of Venus; and the data presented serve only to show that observers frequently detect a marked intensity gradient from the planet's limb toward the terminator. Ample photographic evidence exists to support this impression.

Virtually no evidence for the faint radial pattern of dusky markings on Venus was suggested by the drawings submitted to the Section during 1971-72. These results are not surprising, however, when it is recalled that this rather subdued "spoke" system is most prominent on photographs taken at ultraviolet wavelengths; no ultraviolet photographs, unfortunately, were made available to the Section for this apparition.

Exclusive of the cusp-caps and suspected cusp brightenings, a few persons reported that a series of bright amorphous patches, lighter in intensity than the background of the disc, were apparent on Venus. Most of the brightenings were detected up to and surrounding the time of dichotomy. Observers concurred that, for the most part, these bright areas were quite well-defined; and it was virtually impossible to tell whether they were indeed real features or were the result of some contrast effect.

Again referring back to Table I, we may summarize our conclusions by noting that throughout the 1971-72 apparition visual observers recorded numerous dusky markings on Venus which fell within the following categories with nearly the same relative frequency: banded dusky markings, amorphous dusky markings, and irregular streaks. Most of the contributing observers remarked that it was possible to see these dusky markings in integrated light with only a fair level of confidence, while a few individuals using color filter techniques indicated:

(i) The banded pattern was clearly visible with an orange (W23A) filter; the terminator shading was less obvious (Krisciunas).

(ii) The visibility of dusky markings was enhanced in a blue (W47B) filter; the terminator shading was prominent as well as being broadened along its length in the blue (W47B) filter. The banded pattern was most obvious during the months of 1972, February through April, with the same filter (Capen).

(iii) Markings on Venus were dusky and quite prominent with a red (W25) filter and a yellow (W21) filter; the terminator shading was not particularly enhanced over its appearance in integrated light (Pazmino).

To accompany the foregoing discussion are several selected drawings of Venus (Figures 9 and 10) which perhaps suffice to illustrate the various kinds of features reported by visual observers during the 1971-72 apparition. It is essential that the reader recognize that there is inherent in the data a tremendous diversity of observing experience, drawing ability and style, and the way in which different individuals see and record the faint, rather vague shadings at the visible surface of Venus. Consequently, these data may consititute, at best, a realistic example of some of the tremendous problems encountered by visual observers of the planet Venus as well as a few of those which appear perpetually to confront the analyst, who must ultimately take a diverse and seemingly unrelated mass of material and attempt to ascertain whatever thread of observational continuity may well exist.

Cusps, Cusp-Caps, and Cusp-Bands

Lengthy series of drawings made with and without color filters, as well as numerous photographs taken at visual and ultraviolet wavelengths of light, quite frequently reveal that the most prominent and contrasty markings on Venus are to be found at the cusps. Usually these features take on the form of "cusp-caps," intensely white areas (usually brighter than the background illumination of the disc) which are especially noticeable when the numerical phase value of $\underline{k}$ is somewhere between 0.8 and 0.1.

Dark, narrow bands which extend from the terminator and border the region of the cusp-caps, referred to as "cusp-bands," can be seen on occasion. Evidence exists which suggests that there are possible systematic, short and long term fluctuations in the brightness and size of both the cusp-caps and the cusp-bands, although more extensive studies are required before any really meaningful inferences can be made.

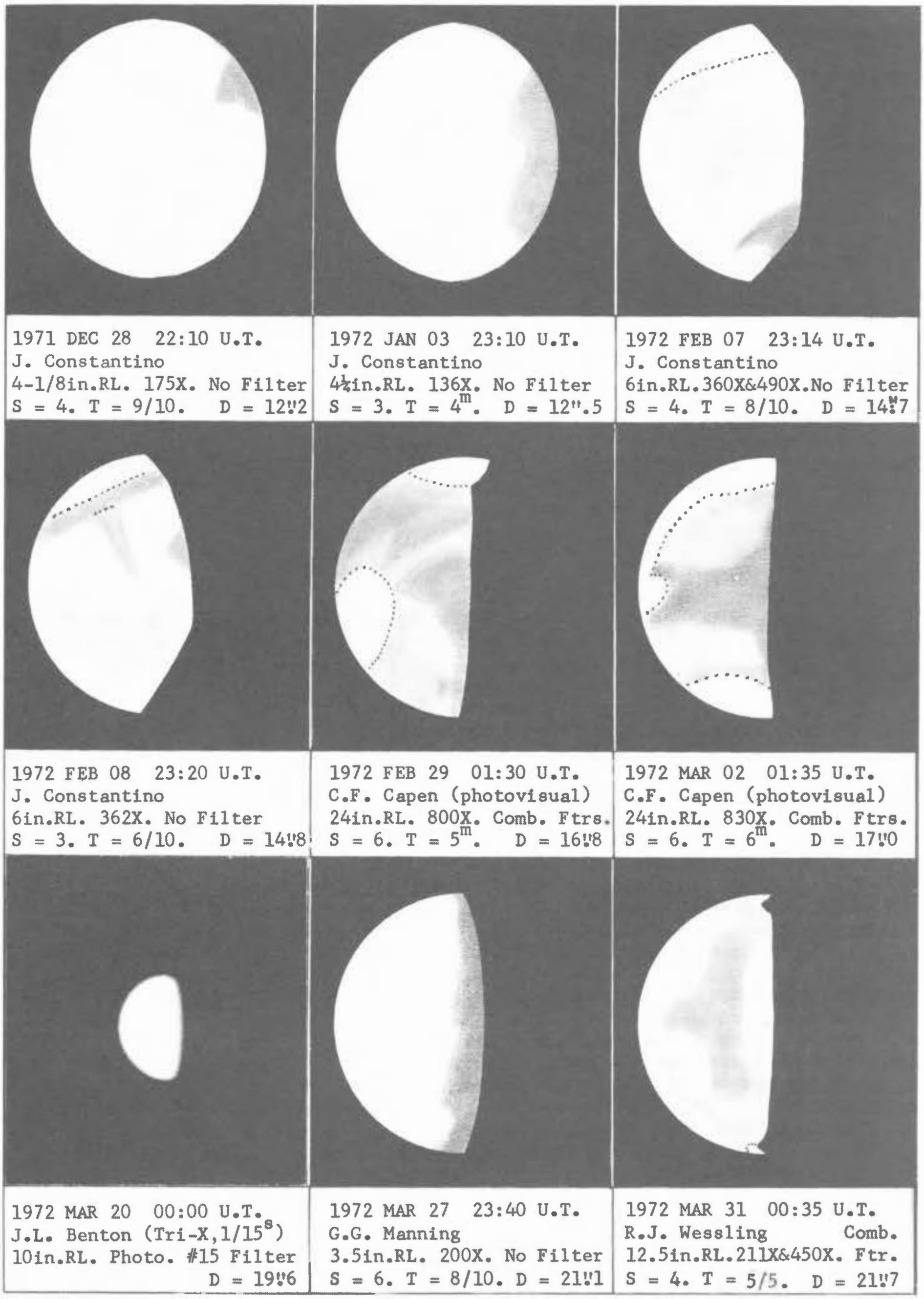

Figure 9. Selected drawings and photographs of Venus during its 1971-72 eastern (evening) apparition by members of the A.L.P.O. Venus Section. Copied and/or arranged for publication here by Dr. John E. Westfall. The seeing (S) is on a scale of 0 to 10 with 10 best. The transparency (T) is given either on a scale where 10 is perfect (e.g., 6/10) or as the limiting stellar magnitude (e.g., 5^m). Dates and times are by Universal Time (U.T.). The orientation is that of a simply inverted telescopic image with south at the top. D is the angular diameter of Venus in seconds of arc.

* *

Using the observational data for the current apparition, it has been possible for the writer to perform a statistical investigation of the visibility of the cusp-caps and associated cusp-bands, following a procedure introduced and kept reasonably up to date by Hartmann, Bartlett, and Cruikshank.

Table II. Cusp-Cap and Cusp-Band Statistics: 1971 - 72 (Evening)

(105 Observations: $\underline{k}$ = 0.909 to 0.079)

South Cap Alone Visible	5 %
Both Caps Visible	49
North Cap Alone Visible	7
Neither Cap Visible	25
South Cap Larger	15 %
Caps of Equal Size	28
North Cap Larger	19
South Cap Brighter	16 %
Caps of Equal Brightness	26
North Cap Brighter	23
South Band Alone Visible	3 %
Both Bands Visible	12
North Band Alone Visible	5
Neither Band Visible	76

Notes

i) Assuming a relative numerical intensity of 9.0 for the average illuminated portion of Venus, the average assigned numerical intensity for the cusp-caps was 9.9 during the 1971-72 apparition; the average value for the cusp-bands was 7.0 (A.L.P.O. numerical intensity scale employed, where 10 is maximum brightness and 0 is black or shadows).

ii) Appraisal of seeing conditions using the standard A.L.P.O. scale revealed an average of about 5.0; most observations were attempted during daylight or in twilight (light sky). Atmospheric transparency was fair to moderately good.

The cusp-caps and cusp-bands have long been subjects of great controversy, particularly because it is not certain whether they are produced by a contrast effect or are instead genuine. Observational records indicate that at least a few visual reports have been confirmed by ultraviolet photography.

One might very possibly question the overall significance and validity of such data as are presented statistically in Table II. In truth, there do exist numerous ambiguities when it comes to deciding which drawings by observers show cusp-caps and cusp-bands and which ones clearly do not. Even though a large number of our observers employ visual photometric techniques in assigning numerical relative intensities to features seen or suspected on Venus, a sizeable number of these same individuals frequently neglect to accompany their observations with descriptive notes as to their own specific visual impressions. All individuals are strongly urged to make strict use of the new standard observing forms for Venus provided by the Section, taking care to fill in each blank as accurately as possible with the basic information requested. Through such efforts, the Venus Section will be able to accumulate and maintain a more reliable, coherent mass of data; and a more satisfactory quantitative treatment of the submitted material will subsequently be made possible.

From an examination of the available data presented in Table II, the following conclusions may be drawn with some reservation:

1. Most observers reported that the northern and the southern cusp-caps were seen at the same time rather than individually.
2. Observers remarked that the northern and southern cusp-caps were usually of equal size and brightness, while on the average there was an indication of a slightly greater prominence of the northern cusp-cap during 1971-72.
3. While most individuals observed the cusp-caps in integrated light, a few noticed a greater prominence of these features in a blue (W47B or Dufay) filter.
4. The dark bands bordering the cusp-caps were not usually reported; but when they were noticed by observers, they were more frequently seen at about the same time.
5. No clear indications of short-term variations in the relative prominence of the cusp-caps and cusp-bands were noted during 1971-72.

Reference to Figures 9 and 10 should convey to the reader some of the visual impressions of our observers during the 1971-72 observing period.

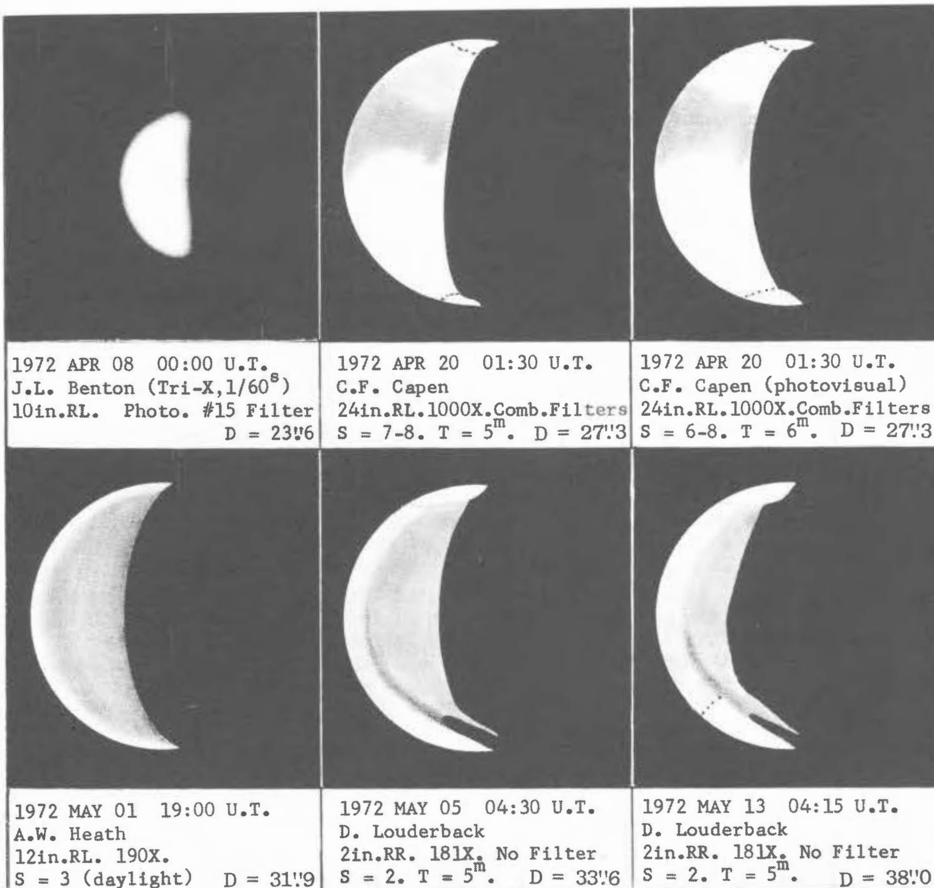

Figure 10. Selected drawings and photographs of Venus during its 1971-72 eastern (evening) apparition by members of the A.L.P.O. Venus Section. Copied and/or arranged for publication here by Dr. John E. Westfall. See caption of Figure 9 for other details.

* *

Extensions of the Cusps

Only slight extensions of the cusps of Venus were reported during the apparition, and most of the observations were made without using color filters. Capen was the only individual who described cusp extensions with a blue (W47B) filter and in integrated light.

Table III lists those observations which depicted extended cusps. Ordinarily, cusp extensions are particularly prominent at times when Venus is nearing inferior conjunction, then having a phase angle, i, somewhere near 180°. Observers have remarked that, on the average, cusp extensions are seen in two parts: (1) a fairly bright geometric extension of the crescent "horns" of Venus; (2) in addition, on occasion a much fainter extension which may encircle the entire unilluminated hemisphere of the planet, taking the form of a halo. Unfortunately, very few observations were received in 1971-72 which indicated any significant cusp extensions; and no instances of a faint halo around the dark hemisphere were reported. Members are requested to follow Venus up to inferior conjunction and thereafter into the next (morning) apparition to observe for this phenomenon.

Table III. Cusp Extensions (Measured from Drawings).

Observer Date and Time (UT)	North Extension	South Extension	Confirmational Reports	Phase Angle
1972 March $25^d23^h44^m$ Good Seeing; No filter (Manning)	29°	-	none	i = 81°
1972 April $09^d18^h30^m$ Good Seeing; No filter (Heath)	22°	21°	none	89°
1972 April $20^d01^h30^m$ Good Seeing; W47B, No filter (Capen)	9°	9°	none	97°
1972 May $01^d00^h07^m$ Seeing Fair; No filter (Manning)	43°	49°	none	105°
1972 May $05^d04^h30^m$ Seeing Fair; No filter (Louderback)	11°	-	none	110°
1972 May $13^d00^h15^m$ Seeing Fair; No filter (Louderback)	8°	8°	none	118°

Bright Limb Band

At times when the numerical phase value, k, of Venus lies between 0.8 and 0.2, visual observers frequently report that the limb of the planet opposite the terminator is abnormally bright in reference to the overall intensity of the rest of the illuminated disc. This limb-brightening phenomenon has been attributed to a contrast effect of some kind; however, more intensive studies are needed before any final conclusions can be reached.

Although most contributing observers noticed the presence of a bright limb band, Heath was the only individual who attempted a long-term colorimetric study of the phenomenon despite highly variable weather conditions. Using Dufay red, yellow, and blue filters, Heath examined the planet carefully from early February through the middle of April, 1972; and his conclusions are summarized below:

(i) The limb was always abnormally bright from cusp to cusp in integrated light and with the red, yellow, green, and blue filters.
(ii) With the red filter, the limb band was quite narrow as it extended along the limb from cusp to cusp.
(iii) In the yellow filter the brightness of the limb band was enhanced over what was noticed in the red filter.
(iv) In integrated light the impression of the limb band was similar to the view with the yellow filter.
(v) In the green filter the limb band was bright from cusp to cusp as in other wavelengths, but the greatest incidence of contrast was evident between the disc and the limb brightness.
(vi) With the blue filter there was revealed a broader limb band extending from cusp to cusp; brightness was enhanced as well over the preceding values with no filter and with the red, green, and yellow filters.

Heath remarked that the seeing conditions always were fair to moderately good, but the limb band was noticed regardless of the quality of the seeing; there was no significant variation in the appearance of the limb band as seeing conditions became different. The same observer did not attempt relative numerical intensity estimates in his observations, but he did notice a variation in the appearance and brightness of the limb band at different wavelengths. Quantitative treatment of such observational material requires that one employ at least some fairly objective criterion for estimating or measuring brightness variations of features on Venus. Observers are requested to use the standard scale for making intensity estimates, with and without filters, in future work.

Over the years quite a few observers have studied this anomalous brightness variation at the limb of Venus' illuminated hemisphere; and as noted earlier, it is almost surely an effect of contrast. When different color filters are used, the appearance of the bright limb band varies in relation to the amount of contrast that the filter provides; and one may inquire as to what relation, if any, the color as well as the density of the filter may have on the visibility of the phenomenon.

Irregularities in the Terminator

The boundary which separates the unilluminated and sunlit hemispheres of Venus is usually referred to as the terminator, ideally a perfectly smooth half-ellipse, entirely symmetrical with the apparent equator of the planet. The fundamental shape of the terminator varies in relation to changes in phase, but a number of irregularities have been reported from time to time. These are often attributed to an effect of contrast of the bright disc against a darker sky and perhaps of the dusky bands sometimes present.

It was noted much earlier in this report that observers have frequently described a marked intensity gradient from the planet's limb toward the terminator, referred to as the terminator shading. This shaded apparent nature of the terminator was observed to be most prominent at shorter wavelengths (i.e., with blue and violet filters).

Various localized deformations of the terminator, often described as "dents" or "bumps" along the otherwise straight or curved line (depending on the phase), were reported on a few occasions by observers throughout the 1971-72 period (Constantino, Manning, Capen, and Louderback).

Observational evidence supports the contention that the appearance of the terminator varies when different color filters are employed. One is led to the assumption that the image contrast is dependent upon the transmission characteristics of the filter used. Furthermore, it is entirely likely that the appearance of the bright limb band may be attributable to the density of the filter rather than to its actual color.

Ashen Light and Other Dark-Side Phenomena

During the 1971-72 apparition there were no confirmed reports of the elusive Ashen Light nor of any other unusual dark-side illumination. A few individuals, however, were able to suspect anomalous features:

1972 April $01^d18^h50^m$ UT 12" reflector, 190X, Seeing 4 (ALPO Scale), twilight sky, no filter (Heath). "...possible detection of an illuminated dark hemisphere with no occulting bar; very pale yellow hue." "...when Dufay blue, green, and yellow filters were employed, the effect was not noticed; visible in red light."

1972 April $05^d01^h04^m$ UT 10" reflector, 270X, 550X, Seeing 5, dark sky, no filter (Keel). "...dark side illumination strongly suspected; brighter than the background sky."

1972 May $01^d00^h20^m$ UT 6" reflector, 150X - 300X, Seeing 4, light sky, no filter (Hockstein). "...outline of unilluminated portion possibly discernible against sky; as a whole, unilluminated portion faintly visible."

1972 May $05^d01^h35^m$ UT 10" reflector, 270X, dark sky, Seeing 6, no filter (Keel). "...dark side more definitely seen; companion suspected this illumination also; most prominent near cusps and terminator."

1972 May $17^d19^h00^m$ UT 12½" reflector, 360X, Seeing 4, light sky, no filter (Krisciunas). "...dark hemisphere possibly seen against background sky."

In general, any faint illumination of the dark side of Venus, if present, is most difficult to detect; it is quite rare, and necessarily requires that the planet be observed against a dark sky. Because the detection of the phenomenon is dependent upon the perception of contrast, color, and tonal differences near the threshold of human vision, simultaneous observations are extremely valuable in these areas. Observations with an eyepiece equipped with a crescentic occulting bar can enhance one's chances of seeing any possible genuine dark-side illumination.

Phase and Dichotomy Estimates

The observed phase of Venus is sometimes a little different from the predicted phase in The American Ephemeris and Nautical Almanac, this discrepancy being most easily detected at half-phase or dichotomy. The difference between the dates of observed and predicted dichotomy constitutes what has been named the Schroeter Effect, and its value frequently amounts to about four to ten days.

The predicted date of dichotomy from the Ephemeris was 1972, April 10; and the observed dichotomy derived from data submitted by Heath was 1972, April 7, a discrepancy of three days. No other observational estimates of dichotomy were received during the apparition.

Concluding Remarks

The planet Venus received a minimum of attention during the 1971-72 evening apparition; and as in past years, a serious neglect of the early portion of the observing period continues. Individuals are requested to give Venus more concentrated study at such times. Throughout the whole apparition intensive simultaneous observations are needed in order to help clarify some of the problems associated with the planet. Those persons interested in Venus programs, or anyone else who needs some assistance and advice regarding observing the planet, are cordially requested to communicate with the Recorder.

LIST OF MATERIALS AND SERVICES SUPPLIED BY A.L.P.O. RECORDERS

By: J. Russell Smith

COMETS - Dennis Milon, 378 Broadway, Cambridge, Mass. 02139. Observing Forms, 50 for $2.00 or duplicate your own. An announcement service for recent discoveries may be obtained by sending Mr. Milon a supply of self-addressed, stamped, long envelopes.

JUPITER - Paul K. Mackal, 7014 West Mequon Rd., 112 North, Mequon, Wi. 53092. Elmer Reese's Jupiter Handbook, 50¢ each. Advanced Observer's Handbook for Amateur Jupiter Observers, 1970 edition, $1.50, 1972 edition, $3.00. Jupiter Forms for drawing Jupiter, 20 for $1.50. Mr. Mackal asks you to send your order for the Handbooks to 770 N. Marshall, #408, Milwaukee, Wi. 53202. However, please send all observational data to him at 7014 West Mequon Rd., 112 North, Mequon, Wi. 53092.

Phillip W. Budine, Box 68A, R.D. 3, Walton, N.Y. 13856. Central Meridian Transit Forms - free. Strip Sketch Forms - 20 for $1.00.

LUNAR - John E. Westfall, San Francisco State College, 1600 Holloway Avenue, San Francisco, Ca. 94132.

ALPO Lunar Photograph Library Catalog, ALPO Lunar Eclipse Observation Form (3 pgs.), and ALPO lunar Photograph Support Data (3 pgs., deals with positional reductions), all available on request. Operates a loan library, comprising about 800 amateur, professional, and NASA lunar photographs, and a reference library of about 2650 large format Orbiter lunar photographs. Can supply Luna Incognita observing schedule, Nix Olympica shadow/terminator projection ephemeris, and Saturn central meridian ephemeris.

Lunar Transient Phenomena - Winifred S. Cameron, NASA Goddard Space Flight Center, Code 641, Greenbelt, Md. 20771. Report Forms with observing instructions, including Elger's albedo scale - free.

Selected Areas Program - Christopher Vaucher, 6130 S.E. Reed College Pl., Portland, Or. 97202. Observing Forms for each of the Six Selected Areas Program craters and peaks - free. Renders services personally and describes methods of observing, techniques of observing, etc., individually with each new observer, and thereafter.

Dark Haloed-Craters Program - Kenneth J. Delano, 22 Ingell St., Taunton, Mass. 02780. A two-page introduction to the program outlining goals and procedures, a list of confirmed dark-haloed craters, a list of unconfirmed dark-haloed craters, and a supply of reporting forms. All free. A set of 16 finder charts for dark-haloed craters drawn by John Westfall for $2.00 postpaid. These charts are quite useful but not necessary.

Central Peaks Program - Michael Fornarucci, 136 Midland Avenue, Garfield, N.J. 07026. A two-page instruction sheet and a number of observing forms, free. Forms may be duplicated by the observer. Mr. Fornarucci is considering providing maps of the areas covered in the program. Inquire about the maps.

Messier-Pickering Program - Roy C. Parish, Jr., 208 Birch St., Milton, Fl. 32570. Report Forms for shadow estimates and one for intensity estimates and/or drawings. Detailed instructions for using the forms and for making visual estimates for vertical studies are included. A provisional chart of the Messier-Lubbock area is available for vertical studies of the escarpment near Lubbock H. All are free, but postage will be appreciated.

LUNAR AND PLANETARY TRAINING PROGRAM - José Olivarez, Hutchinson Planetarium, 1300 N. Plum, Hutchinson, Ka. 67501. Mr. Olivarez will send the following free for a long, self-addressed envelope and 20¢ postage: 1. An outline of the Lunar and Planetary Training Program requirements. 2. A list of outstanding articles on lunar and planetary methods from the pages of the ALPO Journal. (Photocopies of the articles are available from Mr. Olivarez at 10¢ per page and 10¢ postage per article). 3. A copy of the 1975 tables of the longitude of the central meridian of Jupiter. 4. A chart of the Jupiter nomenclature.

MARS - Charles F. Capen, 223 West Silver Spruce, Flagstaff, Az. 86001. New Mars Observing Kit - chuck full of useful materials including maps of mars (1967 to 1973), reprints about Martian characteristics, filter techniques, CM rotation tables, 1975-88 apparition graph, season protractor, place-names gazetteer, reporting observational data, etc. at $3.50. Overseas mailing $4.00, International Money Order. For those who received Observing Kits before Oct. 1974, an Appendix Mars Observing Kit that contains new items plus a supply of observing report forms is available at $2.00. Overseas, $2.50. ALPO Mars observing report forms are 20 for $1.00. Overseas, $1.50, International Money Order. For correspondence requiring a reply, please accompany your letter with a stamped, self-addressed envelope.

MERCURY - Rev. Richard G. Hodgson, Dordt College, Sioux Center, Iowa 51250. Observing Forms, set of 20 postpaid, $1.00 and An Observer's Guide to the Planet Mercury at $2.00.

MINOR PLANETS - Rev. Richard G. Hodgson, Dordt College, Sioux Center, Iowa 51250. Minor Planet Bulletin, $3.00 a year. Subscription includes interim circulars called Minor Planet Memo and Minor Planet Alert postpaid, overseas airmail $1.00 extra.

REMOTE PLANETS - James W. Young, Table Mountain Observatory, Box 367, Wrightwood, Ca. 92397. No special materials or services. Requests interested observers to send their observations for publication in the Journal ALPO.

SATURN - Julius Benton, Piedmont Station, Highland Point Astronomical Observatory, P. O. Drawer 839, Clinton, South Car. 29325. Saturn Observing Kit, includes an introductory manual and a complete set of observing forms for $4.75. Saturn Handbook, advanced, $4.00. Additional set of observing forms, 25 for $2.50. Saturn Observing Bulletin, beginning January 1975 and issued periodically to observers sending the Recorder five stamped, self-addressed, long envelopes. The Saturn Newsletter is being discontinued. Those who already have a subscription will receive the Saturn Observing Bulletin without charge until further notice.

VENUS - Julius Benton, Piedmont Station, Highland Point Astronomical Observatory, P. O. Drawer 839, Clinton, South Car. 29325. A Venus Observing Kit which includes a manual and a complete set of observing forms at $3.75. Additional set of 25 observing forms at $2.50.

DIRECT SUNLIGHT ON NORTH-FACING WALLS

By: Professor Michael Trombetta, Queensborough Community College

It is a well known fact that for an observer north of the Tropic of Cancer the Sun at noon is always to the south. Because of this fact, it is sometimes erroneously concluded that a north-facing wall situated north of the Tropic of Cancer is never exposed to direct sunlight. However, that such a wall is in fact exposed to direct sunlight is shown by a simple analysis. At the vernal equinox for all latitudes the Sun rises due east and sets due west. After that date the Sun rises north of east and sets north of west, and this relation too is true for all latitudes. It is clear, therefore, that after the vernal equinox there is some period each day when a north-facing wall, even one situated north of the Tropic of Cancer, is exposed to direct sunlight. In this paper we would like to answer the more interesting question of how the exposure to direct sunlight of a north-facing wall varies with its latitude and with the Sun's declination. For convenience, we will carry out the analysis for a north-facing wall in the northern hemisphere; but it should be understood that the analysis applies equally to south-facing walls in the southern hemisphere. Since the exposure of a north-facing wall to direct sunlight is non-zero only when the Sun's declination is positive, that is, between the vernal and autumnal equinoxes, in the following discussion we assume that the Sun's declination is positive.

The analysis proceeds by determining the relationships among the Sun's altitude h (the angular distance of the Sun above the horizon), azimuth A (the Sun's compass bearing, measured from the north), declination d (the angular distance of the Sun from the equator), and hour angle t (which indicates the time, measured in degrees, since the Sun passed the wall's meridian) and the wall's latitude ϕ. The above is a common astronomical problem, known as "solving the astronomical triangle," and the solution is given in many advanced astronomy books.[1] Two available relationships are:

$$\sin h = \sin \phi \sin d + \cos \phi \cos d \cos t \qquad (1)$$
$$\cos h \cos A = \cos \phi \sin d - \sin \phi \cos d \cos t \qquad (2)$$

A north-facing wall is exposed to direct sunlight in the morning between sunrise and the time the Sun passes the east-west parallel (or prime vertical) and again in the evening between the time the Sun passes the east-west parallel and sunset. These two periods are equal if we suppose d to be constant. We find it convenient to determine the afternoon exposure and to calculate the total daily exposure by then simply multiplying by 2.

(1) See, for example, Chauvenet, W., "A Manual of Spherical and Practical Astronomy," Dover, 1960.

Sunset occurs when h = 0. (In fact, to account for atmospheric refraction and the finite size of the Sun's disk, sunset is actually defined to occur when $h = -0^{o}50'$; but for our purposes the simpler condition, h = 0, is sufficiently accurate). Setting h = 0 in equation (1) and solving for t, we find:

$$\cos t_1 = -\tan \phi \tan d \qquad (3)$$

It is to be clearly remembered in this discussion that ϕ and d both lie between 0 and 90 degrees, inclusive.

In general there are two solutions to equation (3); the angle between 90 and 180 degrees, inclusive, corresponds to sunset; and the other angle, to sunrise. However, if $\phi + d > 90^{o}$ the right side of equation (3) is algebraically less than -1; and there is then no angle which satisfies equation (3). This simply means that there is no sunrise or sunset, but instead 24 hours of daylight.

To determine the hour angle when the Sun is due west, we set $A=90^{o}$, and solve equation (2) for t, thus:

$$\cos t_2 = \tan d / \tan \phi \qquad (4)$$

If $d > \phi$, there is no solution to equation (4). This result means that the Sun is always north of the east-west parallel so that a north-facing wall is exposed to direct sunlight from sunrise to sunset. Otherwise, we choose t_2 to fall between 0 and 90 degrees, inclusive.

To calculate the total daily exposure of a north-facing wall to direct sunlight, we subtract t_2 from t_1, multiply by 2 to account for morning and afternoon, and divide by 15 to convert from degrees to hours. The final result is:

$$H_N = \frac{2}{15}\left\{\arccos\left(-\tan \phi \tan d\right) - \arccos\left(\frac{\tan d}{\tan \phi}\right)\right\} \qquad (5)$$

Figure 11 shows H_N plotted against latitude for several selected dates. The Sun's declination is the same on 4/21 and 8/23 so that one curve applies to both dates. The same is true for 5/21 and 7/24. As we expected, H_N is greatest at the summer solstice and zero at both equinoxes. Figure 11 shows the surprising result that H_N is symmetrical about 45^{o} latitude, and that it has two maxima. The maxima occur at the latitude equal to the Sun's declination and equal to 90^{o} minus the Sun's declination. Both of these latitudes have simple physical interpretations. The latitude equal to the Sun's declination is the northern-most latitude for which the Sun is always north of the east-west parallel. The latitude equal to 90^{o} minus the Sun's declination is the southern-most latitude for which there is 24 hours of daylight.

For all positive values of d, both the equator and the pole have H_N equal to 12 hours, but for entirely different reasons. When d is positive, at the equator the Sun is always north of the east-west line, so that a north-facing wall is exposed to sunlight from sunrise to sunset; and since at the equator the time from sunrise to sunset is always 12 hours, H_N=12 hours. At the pole, if we neglect the small daily change in the Sun's declination, the Sun moves around the sky at a constant altitude above the horizon. Now it is not clear exactly what is meant by a north-facing wall since at the pole all directions are south. But every wall is exposed to 24 hours of sunlight, 12 hours on each face; and so no matter how a north-facing wall is defined, we may conclude that its daily exposure to direct sunlight is 12 hours. Thus H_N at both equator and pole is 12 hours.

BOOK REVIEWS

Astrophotography - From Film To Infinity, by Jack Newton and Dale Roy Hankin. Astronomical Endeavors Publishing Co., 18 Fairhaven Dr., Buffalo, N.Y. 14225, 1974. 42 pages, paperbound. Regular price is $3.00 but only $2.00 to members of the A.L.P.O.- by special arrangement.

Reviewed by J. Russell Smith

This small volume is based on the experiences of the authors and many other well-known amateur astronomical photographers. It is suggested that the beginner learn to process his own films, prints, and enlargements. This reviewer learned this from his own experiences when he started astrophotography in the late 1930's. Special handling by you, an interested amateur, will aid greatly in producing excellent astronomical photographs.

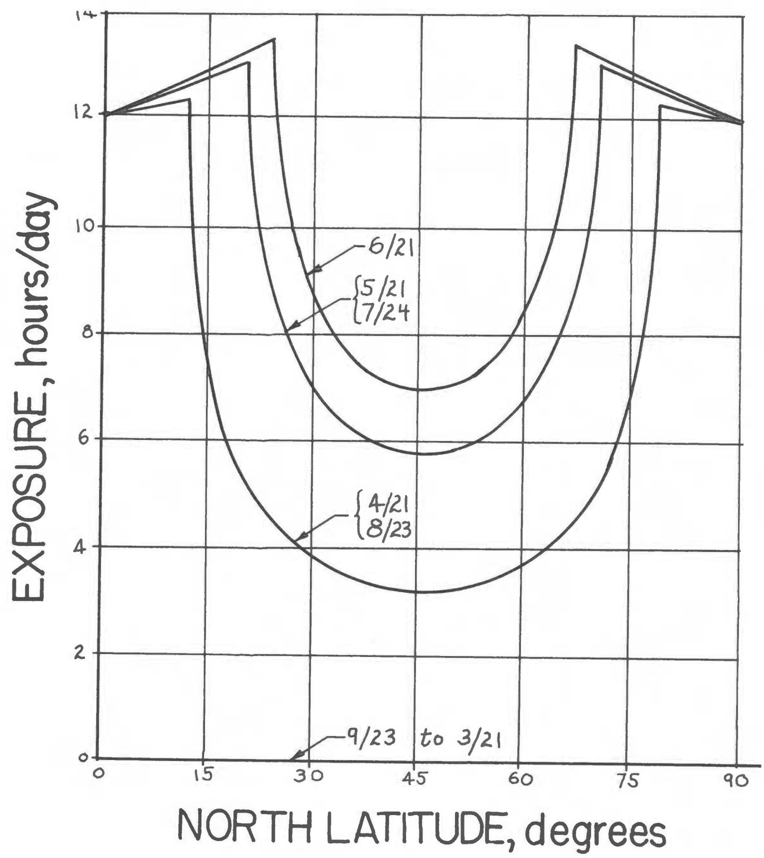

Figure 11. Hours of direct sunlight on a north-facing wall as a function of north latitude on selected dates when the Sun's declination is positive. Prepared and contributed by Professor Michael Trombetta. See text of his article on pages 161 and 162.

* *

One important part of the booklet is an excellent discussion of the problems faced by the beginning astrophotographer. It is written by Mr. Alan McClure, who is one of our best qualified persons in this field. He covers topics such as films, lenses, definition, sky fog, reciprocity law, developers, grain, enlarging, and guiding problems as well as other problems. This section is well illustrated with a number of black and white photographs and several others in color.

A section devoted to deep sky photography shows examples of about 15 such photographs by various amateurs. There is also a list of the Messier objects which will be handy for your reference.

The last section of the book by John Sanford, a well-known astrophotographer, considers Solar System photography. He describes detailed procedures on how to photograph planets, and he also suggests <u>your own processing</u>.

One excellent contribution to this booklet is a graph on exposure times for the Moon as well as one for exposure times for the brighter planets.

I recommend the booklet, and I feel it is well worth the $2.00 to A.L.P.O. members who are interested in attempting the interesting and useful hobby of astrophotography.

* *

<u>The Milky Way</u>, 4th. edition, by Bart J. Bok and Priscilla F. Bok. Harvard University Press, Cambridge, Mass., 1974. 273 pages. Price $15.00.

Reviewed by Ron Doel

The fourth edition of Bart and Priscilla Bok's The Milky Way is a well-written, fluid narrative of a detailed and concise excursion through our sparkling home galaxy. Those familiar with current astronomy texts will appreciate the splendid variety of illustrations-219 in all-a good many previously unpublished. The single injustice suffered by our Milky Way is the unforgivable absence of color photography. However, the crisp typeface is appealing to the eye; and the high gloss quality of the pages is superb.

Bok's latest edition should not be regarded as an introductory text in galactic astronomy...the reader is well-advised to pursue this book with a well-ordered knowledge of elementary astronomy and astrophysics already at hand. The Milky Way is thorough without a rigid order--consequently several sections of the book seem to unfold awkwardly. Explanations of various terms, including emission and absorption spectra, are alluded to a score of pages prior to the definitions of these concepts. Unfortunately, this problem crops up frequently in the beginning of the text, to the embarrassment of the novice. "Presenting the Milky Way," a careening and abrupt introduction to a vast arena of studies from naked-eye observations to telescope structure and theory, is a weak start for what soon becomes a highly enjoyable and challenging book. As it is presently written, Chapter One merely bewilders the beginning astronomer and does little to refresh the minds of those already informed.

The style is all the more enjoyable for the historical perspectives Bok offers. Current theories are enhanced by presenting the ideas--and frustrations--which preceded them. The Milky Way treats the reader to a host of unusual but nevertheless interesting detail--one closes the cover feeling he or she has just gained an intimate understanding of the Milky Way, beyond the dry textbook patter of musty facts.

The book's remaining pitfalls are trivial compared to the momentum the book generates on the whole. I question the frequent interchanging of yardsticks--the all too numerous meanderings from angstroms to microns, color indices to Henry Draper classifications, and light-years to parsecs interrupt the continuity of the narration. A few diagrams show no familiar reference points. Yet Bok certainly deserves credit for providing references covering topics which are only peripherally discussed in his text.

The Milky Way is a fine and timely study of our galaxy--Bok excels by clearly delineating the present boundaries of our knowledge against the realm of speculation. We are never allowed to forget the vastness of the unknown, the still-to-be explored, even while deeply immersed in one of the most comprehensive studies of our galaxy ever undertaken!

* *

Space Optics, by A. Marechal and G. Courtes. Gordon and Breach, Science Publishers, New York, N.Y. 1974. 389 pages. Price $26.50.

Reviewed by Robert E. Cox, Associate Editor of Gleanings for ATM's

Technical meetings are of great value to those attending, but often a large number of interested persons have other commitments and are unable to be present. Consequently, most such meetings publish proceedings for those attending as well as for those who could not attend but would like to know what transpired. Space Optics is the proceedings of a six day summer school organized by the International Commission of Optics and the National Center of Space Studies and held in Marseille, France, in the summer of 1970. The papers are printed in a hard covered book of standard size (about 6 x 9 inches) instead of the usual paperback and loose leaf publications of many American technical proceedings.

Of the twenty-five papers, approximately half discuss the aspects of modern optics as well as space environment and constraints. After these basic considerations, the remaining papers are concerned with space experiments, which is a practical application of the ideas and theories of the first half of the papers.

The amateur astronomical and optical worker will find that about half of the articles are in French; and unless one reads this language, a study of the diagrams is about all one can manage. However, those who can read French will find some excellent material for study. One example is the material on geometrical optics by M. Cagnet on pages 9 through 42. Its quality is indicated from just examining the diagrams, which make a good introduction to the subject. The average amateur will find depth of coverage of the mathematical aspects of the articles outside his scope of understanding because calculus and matrix algebra are involved.

For the scientist who is involved in space research and who has studied French, this book has many fine articles and undoubtedly can be of value in his reference library. It is too bad that such a long period, five years, has elapsed between the original meetings and the publication of the proceedings. Materials of this nature are most beneficial to workers in the field by early distribution whenever possible.

Because of its specialized interest and future distribution, it has been necessary to put a fairly high price on this book; but this will not discourage persons curious about the field of space optics from securing a copy. The amateur will have to have a lot of curiosity to part with such a sum of money. For students and institutions wishing this book as a reference, the price is not exorbitant since most technical publications today are priced at a similar cost level.

* *

Planets, Comets, Meteors, and Reference Guide, by Charles Capen. Twenty super 35mm color slides, Hansen Planetarium, 15 South State St., Salt Lake City, Utah 84111. Price $6.00.

Reviewed by J. Russell Smith

All photographs and drawings in this Solar System color slide production by the Hansen Planetarium are the work of the planetary astronomer, Charles F. Capen of Flagstaff, Arizona. The color photographs are a selection of the best from years of observations with 6- to 82-inch telescopes and wide angle cameras.

The tour of the Solar System begins with the crescent Venus against the daytime blue sky. Mars is covered by three photos obtained during its most colorful season with blue cloud and haze activity, and one high-resolution 31-inch reflector drawing showing the break up of the south polar cap and other fine details. Jupiter is represented by four unique color photographs which exhibit Jovian satellite phenomena and yearly changes in the Red Spot made with 6- to 82-inch apertures. Saturn is shown with its rings edge-on in 1966 when the disc colors could be photographed without interference from the bright light of the rings, and another slide shows this majestic planet with its rings open in 1968. A rare color photo of Uranus, which was made with the McDonald Struve 82-inch reflector, is included. A color drawing of Neptune with the renowned optician C. H. Nicholson's 12.5-inch Newtonian by Capen is presented. This drawing appeared in R. Baum's book, The Planets. One slide shows the colorful early morning twilight planetary configuration of August 14, 1966. It includes four bright planets, Mercury, Venus, Mars, and Jupiter, as well as the crescent Moon and Gemini. This one is the key-note slide often used by Mr. C. Capen in his popular planetary lectures. The 1966 Leonid meteor shower is shown in three slides - the shower, a fireball, and a Leonid long-enduring train. The Great Comet 1965 Ikeya-Seki is represented in two slides. The tour is completed by re-enactment of the discovery of Planet-X by Prof. Clyde W. Tombaugh at the Zeiss blink comparator at the Lowell Observatory.

The color control and reproduction is above average and is good for projection or display. Some images are rather large for the slide format, and one has suffered from increased contrast. The helpful reference guide to the planetary objects is up to date and well edited. This unique collection of photographs is recommended for teaching lectures, for planetarium programs, and for the planetary observer's enjoyment.

* *

Pioneer Odyssey - Encounter With A Giant, by R. O. Fimmel, W. Swindell, and E. Burgess. 171 pages. NASA SP-349 Stock No. 3300-00584. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price $5.50 paperback.

Reviewed by Virginia W. Capen

Technical reports of the Pioneer 10 Mission to Jupiter became available to scientists shortly after its flyby, in Science, 183, 4122, 1974, and in a special issue of The Journal of Geophysical Research, Vol. 79, No. 25, Sept., 1974. Later in the same year this present popular volume was produced by NASA and the above three authors, who were intimately concerned with the Pioneer Project from its beginning.

The Pioneer Odyssey has a large format of 11¼" x 9" and is tastefully layed out with large artistic modern-style color paintings illustrating the subject matter and philosophic quotes for each of the 8 chapters. A unique dedication is given on the first page: "This book is dedicated to all the citizens of the United States of

America who made this program of interplanetary exploration possible and who, along with mankind, will benefit from the increased awareness of the universe and how the Earth and its peoples relate to it." This is the new philosophy of NASA and research planetologists to educate the taxpayer in order to demonstrate the importance of planetary exploration. Indeed, we should all be proud of our nation's space exploration achievements.

This comprehensive NASA book describes the early history, telescopic observations, and Jupiter's relationship to its Solar System companions. However, the main topic is the Pioneer Project and its results. Details are presented in a popular, readable style with more than a hundred diagrams and photographs. Most of the photos are reproduced in high quality color, and include all planets from Mercury to Uranus. The satellites Ganymede and Europa imaged by Pioneer 10 are also shown in color! Their surface details agree well with telescopic high-resolution drawings. A most complete selection of spin-scan Jupiter images is presented. The production of color spin-scan images from the red and blue data channels required construction of a green image to combine with the red and blue images. Without the green photo an objectionable magenta Jupiter would result. This procedure is dramatically shown in color. The proper color balance was obtained from Earth-based telescope color photographs and visual color estimates.

An epilog entitled "Interstellar Cave Painting" describes completely the idea behind the extraterrestrial communication gold-anodized aluminum plaque carried on Pioneers 10 and 11 into interstellar space. Four appendices describe the imaging photopolarimeter and list technical details of spin-scan images, the 1974 Pioneer Jupiter team, and the NASA award recipients. Our very own Elmer Reese appears in the list for "Suggested Further Reading," and a useful index completes the book.

Once acquired, this beautiful volume is difficult to put down because a complete, accurate, picture of one of the most interesting space missions of the decade is clearly described. The Pioneer Odyssey - Encounter With A Giant deserves a hard cover.

* *

The Planet-Girded Suns, by Sylvia L. Engdahl. Antheneum Publishers, New York, N.Y., 1974. 201 pages. Price $7.50.

Reviewed by Bruce M. Frank

This book is the history of the idea that innumerable inhabited planetary systems exist throughout the universe. It is a topic which has fascinated the scientist and the layman alike for many years, and the idea is brought out quite explicitly in the course of discussion throughout The Planet-Girded Suns.

The discussion is divided into three parts, which develop the theme through historical progression. In the first section Sylvia Engdahl describes the extensive, but now largely forgotten, speculations on the existence of planetary systems besides our own. An especially interesting part of this first section is documentary evidence which indicates one possible reason for the famous Renaissance scholar Giordano Bruno's death in 1600. It may have been his refusal to recant his belief in the existence of other possibly inhabited worlds. The remainder of the first section chronologically traces the course of discussion, on the whole favorable, on the subject of life in the universe by such well-known personages as John Wilkins, René Descartes, and Christian Huygens. According to Ms. Engdahl, a turning point occurred in 1900 when Sir James Jeans and Edgar Wallace presented the collision theory of planetary formation, which strongly ruled against the existence of numerous solar systems beyond our own. The last part of the initial discussion takes us up to the early 1960's when the collision theory lost favor and popular belief was re-established that a sizeable portion of stars have planets circling them.

In the second section of the book, Ms. Engdahl summarizes current scientific speculation on not only how numerous other solar systems may be throughout the universe, but also on possible methods to contact any advanced life forms which may reside on certain of these worlds. An extensive part of the discussion is devoted to Project Ozma, or Dr. Frank Drake's program attempting to establish interstellar contact via radio telescope, and to what form of message it might be best to use to make ourselves understood to an alien race, if one should be contacted in this manner.

While the first two sections present a narrative history of theories on the existence of other planetary systems, the third part consists largely of a discussion by Frank Drake and Carl Sagan on the possibility that Earth has been visited in the past (and possibly will be again in the future) by extraterrestrial spacecraft (UFO's) and of our traveling to other stellar systems.

All those interested in what others have thought, and why, on this popular speculative topic will find this book interesting reading. Judging from the extensive bibliography, Ms. Engdahl has done extensive research on the topic, including many quotes from sources probably not reprinted anywhere else. If the book has a shortcoming, it could be that it is too ambitious an undertaking to attempt to cover such a broad topic area in only 200 pages. The discussion in certain areas had to be necessarily brief. Nevertheless, The Planet-Girded Suns should prove worthwhile reading on a cloudy night.

* *

Dynamic Astronomy, Second Edition, by Robert T. Dixon. Prentice-Hall, Inc., Englewood Cliffs, N.J., 1975. 440 pages, paperbound. Price $10.50.

Reviewed by J. Russell Smith

The first edition of this book, which has been used in over 200 colleges and universities, has now been brought up to date. It is designed as a basic elementary text suitable for the student, amateur, or general reader who has no background in astronomy.

Since the United States is changing to the use of the International System of Units (the metric system), this system has been used throughout the book. To help one become acquainted with the system, the author provides a table with the English equivalents in Appendix 2.

The author, an Associate Professor of Astronomy, has certainly learned what the teacher needs in an introductory text. It is very similar to a course developed by the reviewer who taught a course for beginners in a university for some time. The principal difference is that here we have a suitable textbook, while the reviewer made and used his own mimeographed sheets to supplement the text.

The book is well illustrated with excellent photographs and diagrams, which are necessary for visualizing certain concepts related to the universe. To aid the student in visualizing certain concepts of motion in the universe, the author has developed an eight-flip page sequence in the margin of the text. By flipping the pages, the reader makes the illustration appear to move. Flipping the pages for Halley's Comet was so interesting that this reviewer had to repeat the process several times! This is the first flip-page set up the reviewer has seen since Max Born's Restless Universe (1951).

Each of the fourteen chapters is followed by a suitable number of review questions as well as a suggested reading list. There is a glossary of some 580 words and an appendix of eleven useful tables followed by an adequate index.

A probable worthwhile addition to the book would be a list of films and slides (with source) to be used as an instructional aid. A recent advertisement on this book states that an Instructor's Manual is included, but this reviewer does not know what it includes since one was not sent with the review copy of the text.

NEW MARTIAN CHARTS AND THEIR NOMENCLATURE

By: Virginia W. Capen, ALPO Mars Section

The first chart of Mars was constructed in about 1834 by the renowned lunar cartographers, Wilhelm Beer (1797-1850) and Johann Heinrich von Mädler (1794-1874), from visual drawings they made in 1830 and 1832 with a Fraunhofer 4-inch (10 cm.) achromatic refracting telescope using an ocular magnification of 400X. They used single letters of the alphabet to identify the basic light and dark albedo markings on their rectangular-type chart. Later observations made from 1835 to 1839, with a 9-inch telescope, were used to complete north and south polar projection maps published in 1840. In 1858 the astute observer, Padre Pietro Angelo Secchi (1818-1878), was the first person to assign names to several of the colored features which appeared repeatedly in his superior 9-inch Merz telescope at the College Observatory of Rome. The first chart to use a system of names was drawn in 1867 by the English astronomer, Richard Anthony Proctor (1834-1888). Proctor used twenty-seven high quality drawings of Mars which were made by the Rev. William Rutter Dawes (1799-1868) in 1864-65 to produce a two-hemisphere orthographic chart. The Martian features were named after astronomers who had studied the planet, following the precedent set by Giovanni Battista Riccioli (1598-1671) in naming the features of the Moon. This nomenclature

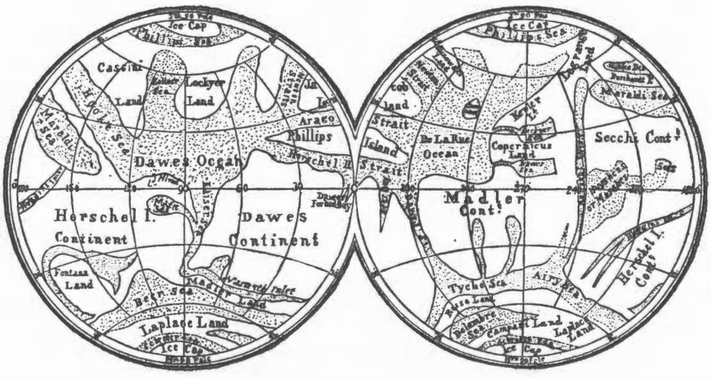

Fig. 127. — Carte de la planète Mars, par R.-A. Proctor, en 1867.

Fig. 12. The first chart of Mars to use a system of names was drawn in 1867 by the English astronomer, Richard Anthony Proctor. The Martian features were named after observers of the Red Planet. (From La Planète Mars, Vol. I, 1892 by C. Flammarion)

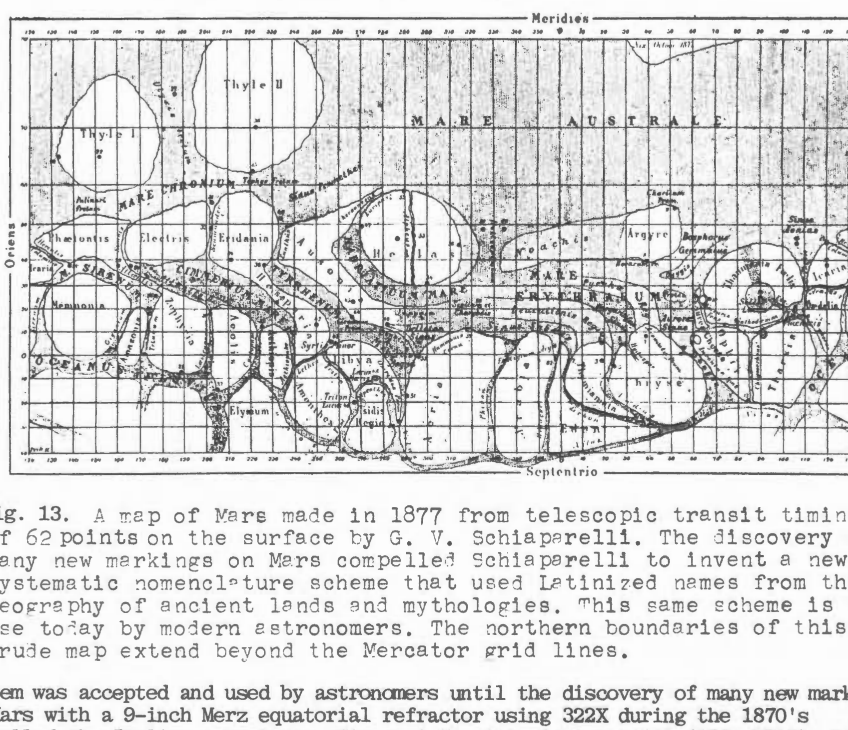

Fig. 13. A map of Mars made in 1877 from telescopic transit timings of 62 points on the surface by G. V. Schiaparelli. The discovery of many new markings on Mars compelled Schiaparelli to invent a new systematic nomenclature scheme that used Latinized names from the geography of ancient lands and mythologies. This same scheme is in use today by modern astronomers. The northern boundaries of this crude map extend beyond the Mercator grid lines.

system was accepted and used by astronomers until the discovery of many new markings on Mars with a 9-inch Merz equatorial refractor using 322X during the 1870's compelled the Italian astronomer, Giovanni Virginio Schiaparelli (1835-1910), Director of the Royal Observatory of Brera, to invent a new and romantic nomenclature scheme which is used by scientists today. The Schiaparellian system employed names from mythologies and the geography of ancient lands in a Latinized form. Some examples of equivalent feature names used by both Proctor and Schiaparelli are listed below for comparison:

Proctor's 1867 map	Schiaparelli's 1877 map
Dawes Forked Bay	Meridiani Sinus
Delambre Sea	Mare Acidalium
De La Rue Ocean	Aurorae Sinus
Lockyer Sea	Solis Lacus
Mädler Continent	Ophir-Tharsis
Secchi Continent	Memnonia

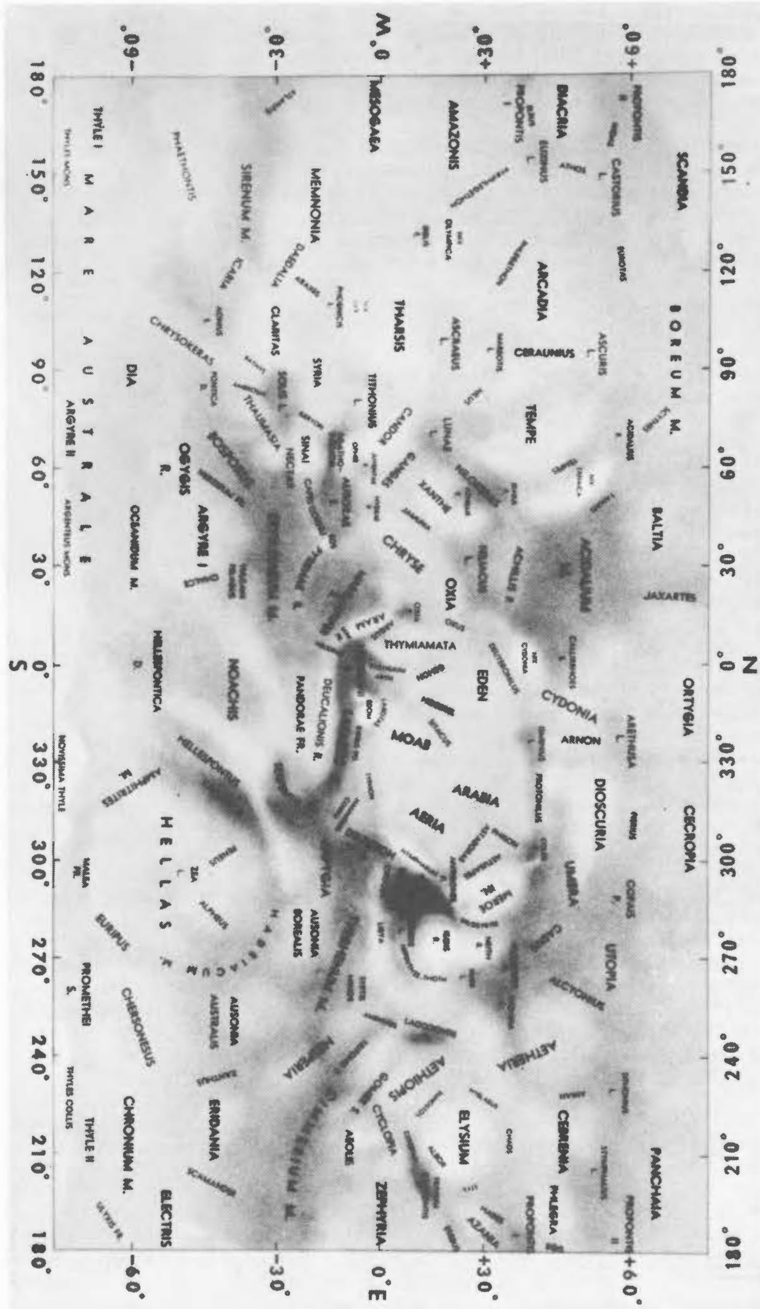

Fig. 14. A modern general map of Mars showing a common traditional Martian nomenclature selected by C. F. Capen. The base map is a combination of north (1969) and south (1971) albedo features from the Lowell Observatory Map Series.

<u>Proctor's 1867 map</u>

Maraldi Sea
Fontana Land
Herschel I Continent
Hooke Sea
Kaiser Sea
Dawes Continent

<u>Schiaparelli's 1877 map</u>

Mare Sirenum
Elysium
Zephyria-Amenthes
Mare Tyrrhenum
Syrtia Major
Aeria-Arabia

The successful orbiting of Mariner IX about Mars in 1971 and the subsequent acquisition of 7,232 high resolution TV photographs of topographic features raised the number of new Martian features by several hundred. A whole new scheme of topographic names was devised to extend, and to be compatable with, the existing

Schiaparellian system by the Working Group on Martian Nomenclature of the International Astronomical Union. The entire surface of Mars was divided into 30 geometric regions each designated by the name of a prominent classical telescopic feature within its confines, which corresponded to quadrangle charts used in the new USGS cartographic Atlas of Mars as shown in Figure 15.

Fourteen classes of Martian topographic features have been recognized and given names. These topographic names are used as generic terms to the classical feature names originated by Schiaparelli and Antoniadi; e.g. Elysium Planitia (220°W; 28°N) or Pavonis Mons (113°W; 01°N). The Martian valleys are treated differently and are named after the planet Mars in various languages; e.g., the Arabic "Al Qahira" Vallis (197°W; 20°S). These new names are as follows:

Catena (kə-tā́-nä). A crater chain.
Chasma (käs'mä). A canyon.
Dorsum (dôr'sŭm). Ridge.
Fossae (fô'sā). Long, shallow ditches.
Labyrinthus (lă-brĭn'to͝os). A valley complex.
Mensae (mĕn'sā). Mesas; flat-topped prominences with steep edges.
Mons (mōnz). A mountain.
Montes (mōn'tĕz). A chain of mountains.
Patera (pə-tĕr'ə). A complex or irregular crater.
Planitia (plă-nē'sē-ə). Plain.
Planum (plä'no͝om). Plateau.
Tholus (tō'lo͝os). A hill.
Vallis (väl'ĭs). A sinuous valley.
Vastitas (vä-sē'täs). Extensive plain.

The largest Martian craters have been given names after prominent, deceased astronomers, telescope builders, rocket pioneers, science fiction writers, geologists, biologists, and others who have contributed to the study and the lore of the Red Planet. Those so honored number 200 individuals, which include the late, renowned planetary astronomer, G. P. Kuiper, Lunar and Planetary Laboratory, and the Viking '76 Mission team biologist, W. Vishniac, who met with an accidental death while studying Martian life problems in the Antarctic. A complete list of the new IAU approved topo-relief feature names, their pronunciations, and their locations are presented in the author's new book: Martian Dictionary and Gazetteer of traditional Martian nomenclature, to be published sometime in 1975.

Today, the old and the new names appear together on the modern topographic charts and globes of Mars. The USGS Dept. of Astrogeology's Atlas of Mars is in preparation, and consists of shaded relief maps at scales of 1:25 million and 1:5 million. Overprints showing telescopic albedo features, elevation contour lines at 1 km. intervals, and names of the new topographic morphology will be superimposed on the shaded relief maps. These significant Mars charts should become available prior to the time the Viking lander spacecraft orbits Mars in July, 1976. A 16-inch Visual-relief Mariner 9 Mars Globe has been produced in color by the USGS and JPL at a scale of 1:17 million and printed by Denoyer-Geppert Co., Chicago.

The map illustrations used in this paper (Figures 12-15) were selected from the C. F. Capen Historical Martian Chart Collection and Nomenclature File.

ANNOUNCEMENTS

Reminder about Proposed ALPO Constitution. Those persons wishing to examine this document before the ALPO Business Meeting in August, 1975 are reminded that they can obtain a copy by writing to Dr. John E. Westfall, 2775 39th Ave., San Francisco, Calif. 94116. They will need to provide a return, stamped, self-addressed envelope. The constitution fills 14 typed pages and weighs between two and three ounces.

Sustaining Members and Sponsors. These are persons who generously support the ALPO by paying higher dues, $10 for Sustaining Members and $25 for Sponsors. Their help is greatly appreciated.

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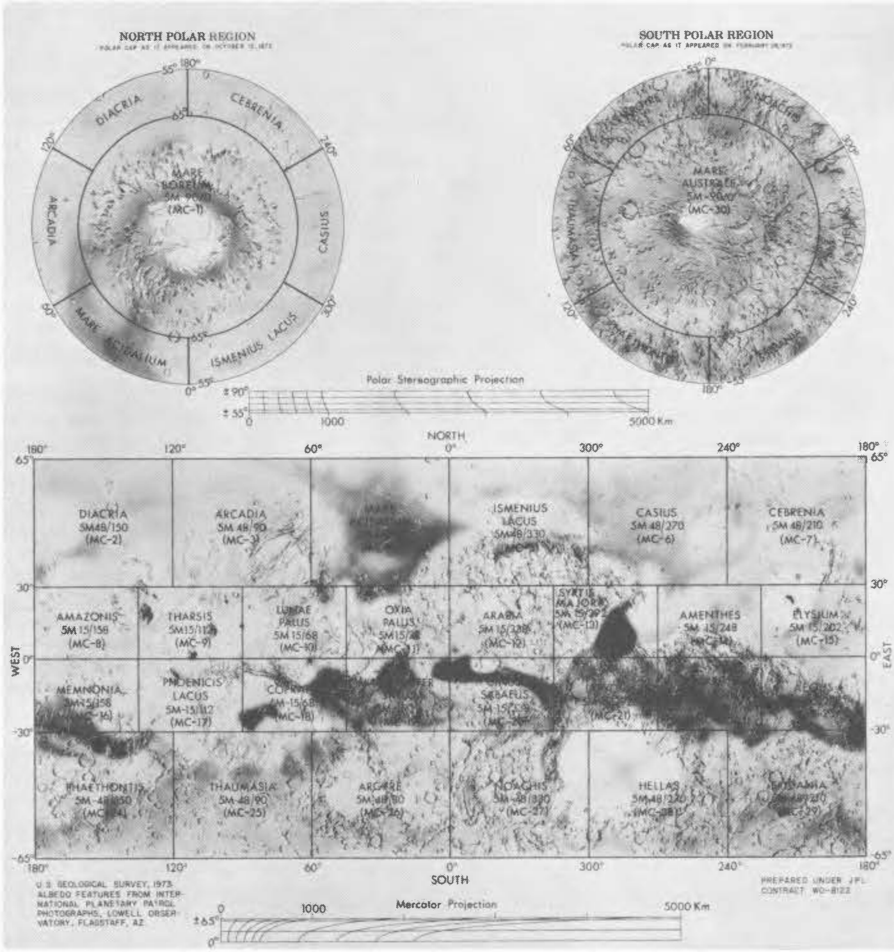

Fig. 15. A layout of quadrangles of the new USGS ATLAS OF MARS. The 1:5,000,000 scale quadrangle charts are identified by traditional Martian feature names. USGS, Dept. of Astrogeology map.

* *

B. Traucki, Lyle T. Johnson, H. W. Kelsey, Philip Wyman, Daniel H. Harris, the Junior Texas Astronomical Society, W. King Monroe, James W. Young, Dr. Klaus R. Brasch, Dr. George W. Rippen, Dr. Joel W. Goodman, Harry D. Jamieson, Commander W. R. Pettyjohn, Robert M. Adams, Orville H. Brettman, Brad Dischner, Dr. Juan Homero Hernández Illescas, Dr. Julius L. Benton, Jr., Hoy J. Walls, Robert M. Peterson, Christopher Vaucher, Winifred S. Cameron, Charles S. Morris, Richard J. Wessling, Sheila B. Cassidy, Joan and Phillip Budine, Darryl J. Davis, and Bill Pierce.

This Year's ALPO Convention. The WAA-ALPO-AANC Joint Conference on Astronomy will be held at the Golden Gateway-Holiday Inn in San Francisco on August 7-10, 1975. Two inserts in this issue will give much basic information, one a pre-registration form and the second a letter of invitation to the ALPO from Mr. Frank Miller with many descriptive details on its back side. Readers are strongly encouraged to contribute papers, even in absentia ones of good quality; the Paper Chairman is Mr. Terence C. Terman, 1450 Todd St., Mountain View, Calif. 94040. He needs an abstract of 110 words or less by July 26* if at all possible and must receive the paper itself during the Conference. (The Editor would appreciate a pre-Convention copy of the paper). Exhibit items and related correspondence are in charge of Mr. Alan Friedman, Lawrence Hall of Science, University of California, Berkeley, CA 94709. Readers are urged to display their work; photographs, drawings, and charts are usually the most suitable items. The Convention will open formally on Thursday, August 7, with registration and papers in the morning. There will be field trips to either NASA/Ames or the Stanford University Linear Accelerator in the afternoon and a Star Party at the Lick Observatory in the evening. Attendance at Lick will not be limited, but transportation there will be by chartered bus. August 8 will be filled with papers and the ALPO Business Meeting in the evening. Saturday, August 9, will include paper

*Good news - the deadline of July 5 mentioned on one of the inserts has been extended.

sessions, a professional panel of experts, and the Dinner Banquet in the evening. The last day, August 10, will concentrate on the exciting topic of possible extra-terrestrial life. There will be a variety of outings to the many sights of San Francisco for non-astronomical family members. Early registration is encouraged and will be extremely helpful to Chairman Frank Miller and his hard-working committees.

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

STAFF


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