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NOTICE: In order to facilitate the reproduction of drawings in future issues, readers are requested to exaggerate contrasts on drawings submitted. Extremely faint marks cannot be reproduced. Outlines of planetary discs should be made dark and distinct. It is not feasible to reproduce drawings made in colors. Following these precepts will permit better reproductions.

Figure 1. Miyamori's Valley.
T. Saheki. 8-inch refl. 80X, 285X
May 8, 1952. $13^h 35^m$, U.T.
Colong. = 79°.4

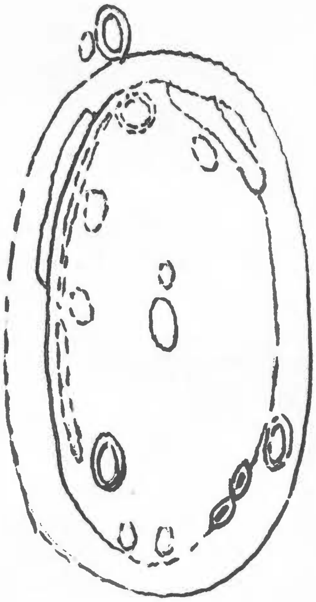


Figure 2. Crater Marius.
H. P. Wilkins
33-inch refr. 320X.
April 7, 1952. 22^h, U.T.
Colong. = 65°.4

Figure 3. Mars.
E. E. Hare. 12-inch refl.
375X, 525X.
April 26, 1952. $5^h 30^m$, UT
C.M. = 303°.

Figure 4. Mars.
E. E. Hare. 12-inch refl.
375X, 525X.
May 1, 1952. $5^h 30^m$, U.T.
C.M. = 260°.

Figure 5. Mars.
E. E. Hare. 12-inch refl.
375X, 525X.
May 5, 1952.
$5^h 0^m$, U.T.
C.M. = 217°.

Errata in July, 1952 Issue. Pg. 97, line 13. Read "width and intensity", not "width of intensity".

Pg. 104, line 44. Read "intersecting ridges", not "interesting ridges".

Pg. 94, bottom line. Mr. Wilkins observed Plato near $20^h 45^m$, U.T.: the colongitude was then 16°1.

A.L.P.O. Authors. In the August, 1952, Sky and Telescope we were pleased to see articles by two A.L.P.O. members. Mr. Thomas R. Cave, Jr., 265 Roswell Ave., Long Beach 3, Calif. has written a popularized account of "Our Neighbor Mars", illustrated by three of Mr. Cave's recent drawings of the planet. Dr. Alex G. Smith, Dept. of Physics, University of Florida, Gainesville, Florida has written on "Double Star Tests for Small Telescopes". Probably such tests are the best of all for an observational determination of the optical quality of a telescope. Dr. Smith has prepared a graduated list of suitable double stars for such tests with separations ranging from 2".87 to 0".59, and we hope that our members will use this list for testing their telescopes. We are glad to see that Dr. Smith has pointed out that the separation of the components of Epsilon Lyrae is no real test of resolving-power for apertures of three inches and more - dividing the "double-double" with an 8-inch, for example, means only that the telescope is not extremely bad.

Foreword by Editor. We are glad to present a second article on lunar and planetary photography by Mr. T. E. Howe, Eckhart Library, University of Chicago, Chicago 37, Illinois. His first appeared on pp. 36-38 of the March, 1952, Strolling Astronomer. Although Mr. Howe is primarily concerned with techniques for improving lunar and planetary photography with telescopes only a few inches in aperture, many of his ideas will surely apply to lunar and planetary photography with larger telescopes, which naturally have greater opportunities for valuable work in this field. We would be delighted to have more of our members make photographic studies of the moon and the planets, and we urge them to experiment with the techniques described in Mr. Howe's article. Mr. Howe will welcome correspondence from all interested persons.

MORE LUNAR AND PLANETARY PHOTOGRAPHY WITH SMALL TELESCOPES

by T. E. Howe

It will be seen that, if the image of a marking on the film is below a certain size determined by the grain size of the film, the image will not be recorded in its original form; and if it appears at all, it will be shown as a circular clump of a few grains rather than an image of the marking photographed. From various considerations, it can be shown that a marking of low eccentricity must have a diameter of 7.6"/a, where a is the diameter of the telescope objective in inches, if it is to be shown in its original shape as an image-that is, if the image is to represent the object; and a line (great eccentricity) must have an angular width of 4.5"/a to be shown as such at the focus. Under exceptional conditions lines as fine as half this width may be shown-that is, 2.2"/a. Now, the linear resolving power of a high-speed emulsion developed to a very high speed is on the order of 40 lines/mm., which corresponds to a recognisable image of a circular marking of 1/24 mm. The image of a barely resolved marking, according to the above criterion, will be .092 mm. in diameter at f:100, and will therefore be .042 mm. (1/24) at f:46. Therefore, for maximum resolution of low-eccentricity markings, the focal ratio must be in excess of F;46. A similar claculation carried out for linear detail will show precisely the same figure since the resolution of the objective and emulsion for markings of different eccentricity varies in precisely the same fashion. However, when very fine lines are to be photographed, or irregularities in lines are to be recorded, focal lengths around F:90 are in order. Unfortunately, the resolution of a film decreases with decreasing contrast so that markings of very low contrast should be photographed at very great focal ratios, at least twice and in extreme cases three times the f:46 limit quoted above.

On this basis, we may calculate the maximum exposures with an unguided telescope for a given aperture. Since the moon and planets have a diurnal motion of about 15 seconds of arc per second of time and since a marking will in general not be shown recognisably unless it subtends a diameter or width at least twice that of the angular drift during the exposure, we may set the following upper limits for exposure:

Near-Circular markings	1/(4a)	seconds
Lines in general	1/(7a)	seconds
Finest linear detail	1/(14a)	seconds,

where a is the aperture in inches.

In determining the actual exposure required, we may set as a standard the exposure required for the full moon, which proves to be 1/3 second at f:46 with a film rated at ASA 100. If the required exposure proves to be less than 1/3 second, higher film speeds must be used. The exposure is inversely proportional to the ASA film rating.

Since the brightnesses of most celestial bodies differ considerably from that of the full moon, the exposures must be varied proportionately. To find the required film speed, find the film speed required to produce a satisfactory image of the full moon with the exposure time and focal ratios used (the brightness of the image varies according to the inverse square of the focal ratio) and multiply by the following factors:

Planets:

Mercury-Full	1/6	Venus-Full	1/8	18 days from inferior conjunction	1
Gibbous	1/3	Gibbous	1/7	13 " " " "	2
Half	1	Half	1/4	8 " " " "	4
Crescent	3	Crescent	3	3 " " " "	20

Mars-Full	1	Jupiter	6	Saturn	23
-Gibbous	$1\frac{1}{2}$	Satellites (For detail)	10	Satellites	200
		Satellites (as Stars)	60		

Moon: (Days before or after Full)

1	1.3	6	4.3	11	20
2	1.5	7	5	12	26
3	2.0	8	6	13	36
4	2.6	9	10	14	80
5	3.2	10	13		

Portion of Moon in which greatest detail is desired:

Continental	1	Brightest Spots	1/3
Maria	2	Terminator	4

Turning to practical considerations, it will occasionally be found impossible to give exposures according to the figures set forth above since the calculated exposure ratings come out above ASA 4000, which is the highest speed to which it is practicable to raise the speed of any standard film. However, there are several bright spots in the picture not mentioned in the tables. First, unless the air is perfectly still, the contrast of the subject very great, and superimposed images are to be used, it is impossible to catch the fine detail represented by the formula 2.2"/a. Secondly, low-contrast subjects will be found to show up strongly even if the exposure is reduced to 1/4 the calculated value. The author's best photographs of Jupiter were printed from images so faint as to be nearly invisible on the negative. Images taken at the same time of normal and greater than normal density produced very little detail.

If, however, the exposure rating required is still in excess of 4000, more drastic steps must be taken. First and most obvious is that of increasing the exposure time or decreasing the focal ratio. It is evident that the least impairment of resolution per increase in image illumination will occur if the two are altered together, in the following manner: Take the cube root of S/4000, where S is the film speed required, and divide the focal ratio by it while multiplying the exposure by the same figure. By using somewhat more complicated procedure, the original resolution may be maintained by increasing the resolution of the film without affecting its speed. One way of doing this is to develop the film positive, which increases the resolving power by a factor of about 1.7, thereby decreasing the focal ratio by a factor of .6 and increasing the image brightness by one of 3. The procedure is as follows:

1. Develop
2. Expose film to bright light
3. Bleach
4. Wash
5. Redevelop
6. Fix

Use the bleach and fixer sold with Ansco Color processing kits (these may be obtained separately). For the sake of the amateur's composure, it will be best to obtain these by mail, since the effort required to satisfy the curiosity of the sales clerk as to why one would want those particular components is very tiring. It will probably be found that the film will be much too dark (underexposed). This may be avoided by vast overdevelopment or by reducing the image after fixing and washing. Also, the resolution of a film may be considerably increased by superimposition of the images. This is done by printing a number of positives from the various images on the negative and superimposing them. The positives should be at least 1/2 inches in diameter and should be in the most accurate possible register. They should be printed on sheet film. I have found it convenient to take three or more positives, fasten them at the corners with rubber cement or seccotine, and register them while the glue is still wet, a condition which persists for about 10 minutes. This will result in an increase in resolution of 2.5 times with three images or 4 times with 8 images, with corresponding decrease in focal ratio. Using these processes in combination, it might be possible to obtain quite respectable images of very faint subjects at maximum resolution with a small aperture and no driving clock. Unfortunately, every complication of the processing increases the number of possible disasters - so that it is generally advisable to use the simplest methods compatible with a good image.

I have compiled a list of films which seem to be eminently suitable for this work. Unfortunately, I have found no American roll film wich is particularly good for this field so that most amateurs with roll cameras will have to use either Super-XX or Superpan Press. The latter has a slight edge in speed, but is granier. The list follows:

			ASA
Ansco	Triple-S Pan	Sheet Film	200
	Triple-S Ortho	Sheet Film	125
	Ultra-Speed Pan	35-mm Cart.	100
Dufay	Super 100 Pan	Roll Film	125
	Super 80 Ortho	Roll Film	100
Dupont	Type 428	Sheet Film	160
Gevaert	Gevapan 33	35-mm. Roll	125
Ilford	HP 3	35-mm.	125
	HS 3	Plate	400
Kodak	Linagraph Pan	35-mm Cart.	400
	Linagraph Ortho	"	320
	Infra-Red	"	50
	Microfilm	"	16
Super-Tomic	Black & White	"	250
	Color	"	125

Microfilm was included in the above list because of its very high resolving power (175 lines per mm. with a coarse-grain contrast developer), its great capacity for speed increase (70 to 80 times), and its low fog level.

Super-tomic color, with a speed three times greater than that which may be squeezed out of any other color film, may make it possible to take color photographs of the moon and the brighter planets with quite simple equipment. Of course, very great compromises will have to be made in the focal ratio and the exposure time; but the fact that the film has a resolving power of about 50 lines/mm. helps a little, and image superimposition may be used if nedessary. Photograph the image, with the enlarger or through a microscope (which can generally be borrowed from the local 'vet', if used on the premises), onto Ansco Color or Ekta-Chrome; and superimpose the results. Since all of these color films are positive, the superimposing positives should be slightly overexposed.

Mr. Allyn Thompson has written in the February 1952 <u>Sky and Telescope</u> advising the method of photography in which the objective is retained in the camera, and the camera is placed against the eyepiece, which is focussed visually. I have found that this method does not produce results quite so satisfactory as those obtainable by the projection method, but I must admit that it has a great deal to recommend it in the matter of simplicity. The speed of the whole system is given by the ratio of the diameter of the exit pupil (which in turn is equal to the aperture divided by the power) to the focal length of the camera objective. At focal ratios on the order of f:50, not too much trouble will be had in achieving correct focus because of the great depth of focus. A setting between $3\frac{1}{2}$ and 5 feet will generally be satisfactory. However, if shorter ratios must be used or great accuracy is desired, I would suggest that the eyepiece be focussed visually, a ground-glass camera be placed against it, and the lens at the camera racked in and out until a sharp image of the sun or moon is seen on the focussing screen. Note the setting on the distance scale. This setting is to be used for all subsequent photographs, on any camera, ocular, or telescope. The great simplicity of the method is that the camera may be hand-held if the exposure is less than about 1/20 second so that photographs may be simply taken to confirm any visual observation of a bright subject. I have found that the greatest steadiness with a hand-held camera may be achieved by tripping the shutter by means of a cable release held in the teeth and tripped with the tongue. A cable release or air release should be used in any method, for the greatest steadiness.

It is generally a good idea to use focal ratios well in excess of f:46 if possible, for the greatest clarity. Large images are clearer, more conveniently handled, and will be relatively freer from obvious blemishes than the smaller ones. One notes that most good observatory photographs of the moon and planets were made with focal ratios of at least f:90.

In the choice of secondary optical equipment, it is almost imperative that achromatic, and orthoscopic if possible, eyepieces of about one inch focal length be used. Shorter focal-lengths, if necessary, should be obtained with a Barlow Lens. Care must be taken to have the image of the subject on the axis of the optical system and to have the plane of the film perpendicular to the axis. If the lens-in-camera method is used, the camera may be moved along the axis, and perpendicular to the axis, without distorting the image (though with some risk of vignetting); but on no account may the camera be rotated along any axis during exposure. The camera must be used at its widest aperture. It is very probable that the exposures calculated by the formulas given above will not coincide with any known shutter setting. In this case it will be necessary to use the next setting below the maximum exposure. I might mention in passing that the resolution of a single negative may be improved considerably by making two enlarged positives from it, one sharply focussed and the other somewhat unsharp. Superimpose these as described above. The unsharp positive should be given considerably less exposure than the sharp one. For the most exacting work, it is a good idea to have the camera mounted directly on the telescope by means of a brace of some kind, which may be easily made.

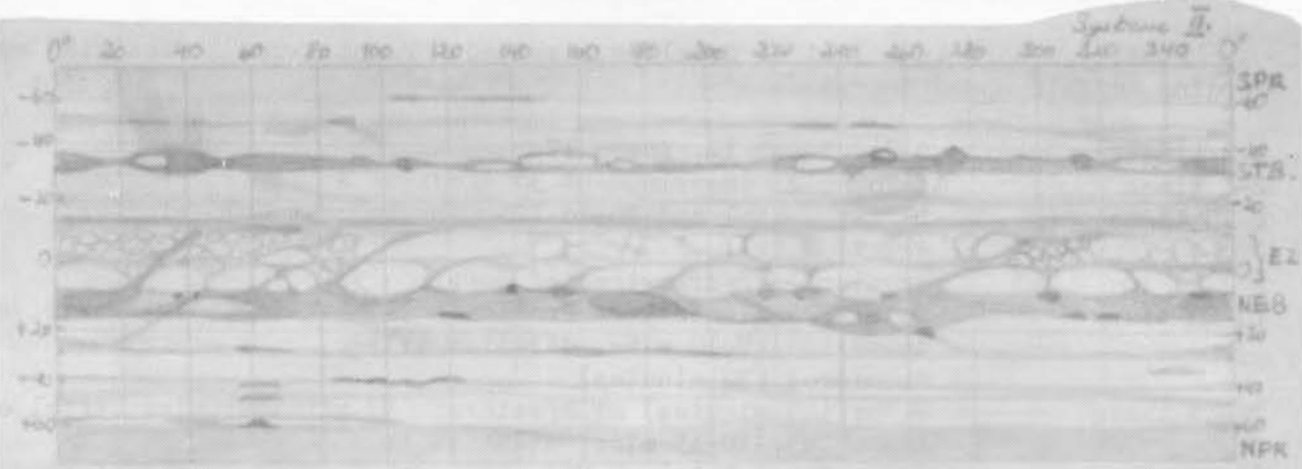
There are circumstances in which the quality of the image may be improved considerably through the use of filters. Jupiter, for instance, produces an image of very much higher contrast with a green filter. An orthochromatic film would have the same effect, although it would be offset in part by the intrinsically lower contrast of the film. The only way in which it would be possible to record detail on Venus, for all intents and purposes (there have been exceptions), is with a blue or violet filter. Very interesting photographs may be obtained by photographing through polaroid slanted at various angles at the various phases of the moon and of the planets near the sun than the earth. Finally, photography in the infra-red will show aspects of the planets quite different than those common to visual observation. A table of filter factor follows:

		Factors:		
Filter	Color	Orthochromatic	Panchromatic	Infrared
C-5	Blue	3	5	
K-2	Yellow	3	2	
G	Orange	5	3	
B	Green	8	6	
A	Red	-	8	2
F	Dark Red	-	11	3
Polaroid	Neutral	2	2	2

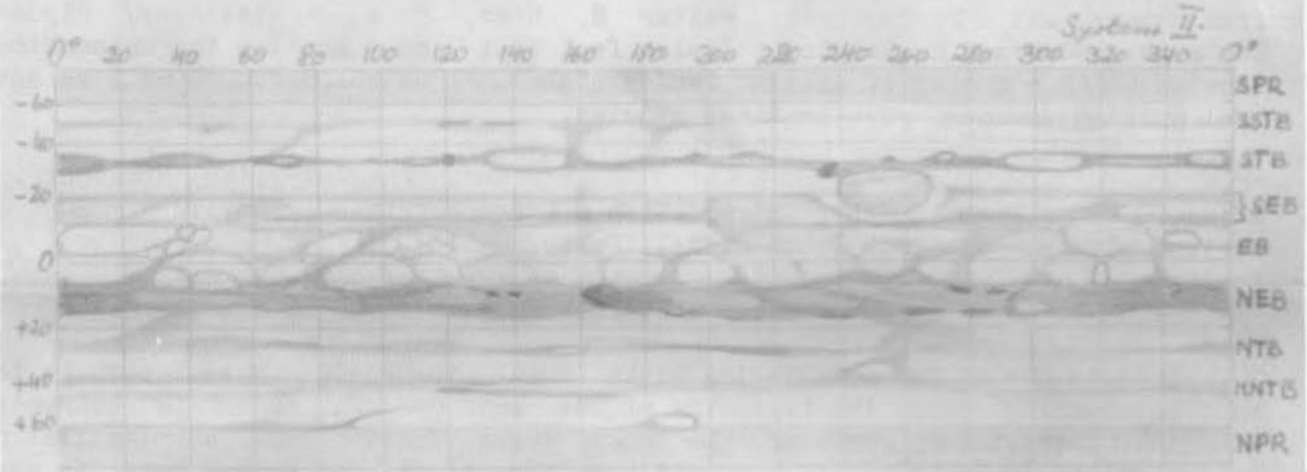
It has been pointed out (by our Secretary, Mr. D. P. Barcroft) that the reflex camera offers many advantages in this type of work in that it permits observation of the image until the time of exposure. Special microscope attachments have been constructed which permit observation of the image during exposure, at some loss of light.

In superimposing several images, it is essential that the images be secured in rapid succession. The maximum separation of the first and last exposures

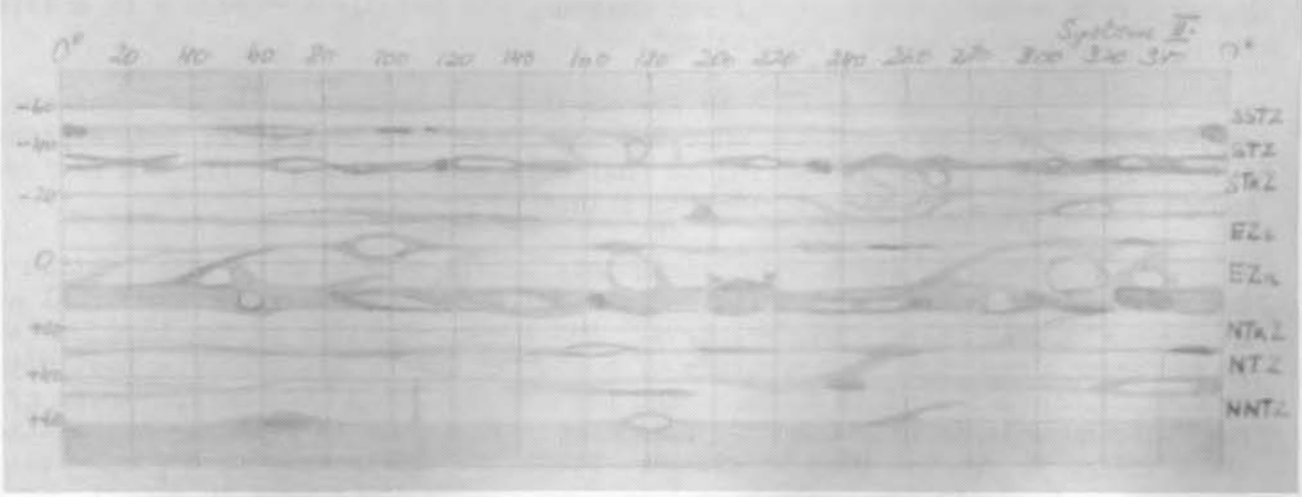
JUPITER in 1951-1952, after drawings by members of the A.L.P.O.



July-August-September 1951.



October-November-December 1951.



January-February-March 1952.

cannot exceed 60/a minutes in the case of Mars or 24/a minutes in the case of Jupiter or Saturn, where a is, as before, the aperture in inches.

Finally, here is a list of developers suited for this work classified according to film speed increase:

1-2 times	D-76, Edwal 12, Ansco 17
2-4 times	D-76, D-23 (development 30 minutes) Ansco 17, Promicrol
4-10 times	D-76f, Dektol and Ansco 125 (development 7-10 minutes, dilution 1:1) Promicrol, Hydram-treated developers.
10-20 times	D-76f (20 minutes) or Promicrol (15 minutes) plus Dektol or Ansco 125 (7-10 mins. dilution 1:1) Promicrol (30 minutes)
20-40 times	D-76f (40 minutes) or Promicrol (30 minutes) plus Dektol or Ansco 125 (10-15 mins. dilution 1:1)
40-80 times	(<u>Slow Films Only</u>) D-76f, D-76, or Promicrol up to 4 hours.

I wish to express my appreciation of the encouragement and advice received from Messrs. David P. Barcroft, Walter H. Haas, F. W. Schlesinger, Clyde W. Tombaugh, and Frank R. Vaughn. I also feel that I must mention the unconscious impetus which a number of amateur and professional astronomers, as well as several printed sources, gave to these studies.

<u>PHYSIQUE DE LA PLANÈTE MARS</u>, Introduction à L'Aréophysique by Gérard de Vaucouleurs. Editions Albin Michel, Paris. 1951

by Frederick Benario

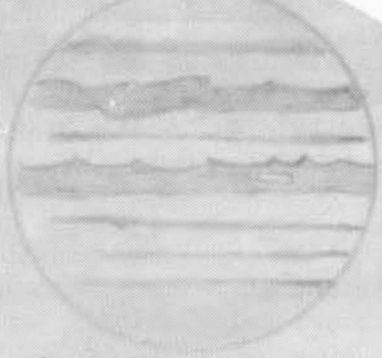
This is one of the outstanding books about the planet Mars, perhaps the most outstanding since the beginning of the century. The author is connected with the Observatoire Peridier, Le Houge (Gers, France) and the Institut d'Astrophysique in Paris. His enormous knowledge about the Planet Mars is contained in this monumental work, which is rather a compendium than just a monography. In its 420 pages is more science, pure and unadulterated, than the average astronomer, professional and amateur, can usually accumulate in a lifetime. This book contains "everything".

Its subtitle: Introduction to Areophysics - this is translated - demands an explanation. Ares is the Greek word for Mars, and this book gives many explanations about the physics prevailing on that most interesting planet. A reviewer can only mention a few things, just to illustrate.

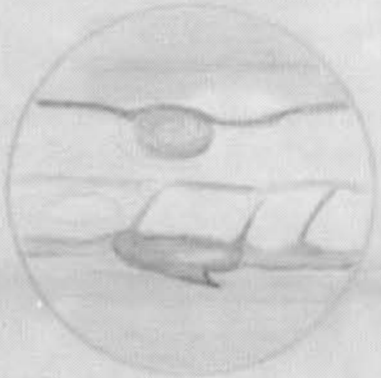
Like all studies about the planets this book begins with the description of the Martian atmosphere, which in thinness would correspond to our terrestrial atmosphere about 15 miles above sea level. But the composition of the Martian "air" is different from ours. It consists of more than 98% of nitrogen, in fact 98½", argon 1.2%, carbon dioxide 0.25%. The rest of the gases like water vapor, oxygen, etc. amounts to only 0.0005%. This composition puts to rest any speculation about living things on Mars of similar biological principle to the one valid on Earth. No earthling could breath on Mars. Its atmosphere in itself would be deadly.

It is impossible to go into details about the contents of this gigantic work so successfully compiled. A reviewer can only mention a few highlights, and even this is an injustice to author & work. This book might rather be considered

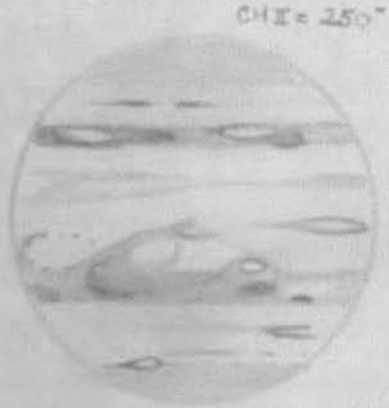
JUPITER 1951/52
ALPO



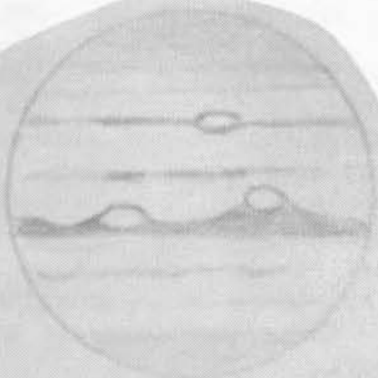
SEPT. 2/1951, P.J. NEMECEK
12.50" REFL. 276x
$10^h 30$ UT. CM I = 313°
CM II = 335°



JAN. 2/1952, R.H. CLUFF
6" REFL. 120x
$1^h 05^m$ UT CM I = 68°
CM II = 250°



FEB. 12/1952, E.E. BOTH
6" REFL. 240x
$5^h 15^m$ UT CM I = 206°
CM II = 73°



AUG. 20/1951, P.A. MOORE
8½" REFL. 350x
$1^h 10^m$ UT. CM I = 352°
CM II = 124°

JAN. 2/1952, T.H. CRAGG
12" REFL. 168x
$1^h 15^m$ UT CM I = 74°
CM II = 256°

MAR. 15/1952, O.C. RANCK
4" REFR. 120x
$23^h 25^m$ UT CM I = 155°
CM II = 133°

an encyclopedia, even when organized into chapters instead of subjects. Still, an excellent index and appendix makes the finding of any subject matter quite easy. And a most complete bibliography is listed in chronological order of the appearance of books and articles, beginning with the year 1905.

Again the atmosphere on Mars. What color is it? We do see the planet as red, perhaps a reflection of the very outermost layer of its gaseous envelope. But de Vaucouleurs speaks also of the "couche violette" a "violet bed" layer in the Martian atmosphere, which layer is generally opaque, and is situated on top of yellow clouds and underneath a layer of blue ones. What is this? Would an inhabitant of Mars see his sky also blue from his inside position, whereas we see the reflection of this same layer from the outside? Is this possible? If yes, how can there be on occasion clear condensations of the same violet "bed" or layer? These questions and many more like them are painstakingly scrutinized in this work.

This outstanding book is part of a French scientific collection now in the course of publication. The one drawback for English-speaking students is that it is written in French. Is there no one who might undertake the labor to translate and publish it in English? It would be a service to science and to Astronomy in particular.

Footnote by Editor. Mr. Benario's address is 151-10 State St. Flushing, New York. We thank him for this review of an outstanding book on Mars. It would be excellent indeed if Mr. de Vaucouleurs' important book could be translated into English.

FOURTH REPORT ON JUPITER IN 1951-52

by Ernst E. Both

This is our final report on Jupiter for the 1951-52 apparition. The evaluation of a total of 325 drawings is still under way. The greater part of it, however, is already finished; and the results are given in this report. A very detailed report will be ready after September 15, 1952 and will be sent to the more serious students of the planet upon request. There follows a list of all persons who participated in the observation of Jupiter during the 1951-52 apparition along with their addresses, instruments, and number of contributed drawings: H. G. Allen, 119 Woodland Ave., Coatesville, Penna., 2 drawings, 3.5-inch refl.; J. C. Bartlett, Jr., 7 drawings, 3.5-inch refl.; E. E. Both, 86 drawings, 6-inch refl. and 8-inch refr.; P. Cluff, 4101 E. Fourth St., Long Beach 14, Calif., 70 drawings, 6-inch refl.; K. B. Cockhill, 2362 Hingston Ave., Montreal 28, Quebec, Canada, 6-inch refr.; T. A. Cragg, 12 drawings, 12-inch refl.; C. M. Cyrus, 1216 Leeds Terrace, Baltimore 27, Maryland, 2 drawings, 10-inch refl.; E. Epstein, 1914 N. Curson Ave., Hollywood 46, Calif., 16 drawings, 6-inch refl.; R. N. Hartman, 2327 Glencoe Ave., Venice, Calif., 1 drawing, 12-inch refl.; T. E. Howe, Eckhart Library, University of Chicago, Chicago 37, Illinois, 9 drawings, 4-inch refl.; L. T. Johnson, Box 187, La Plata, Maryland, 8 drawings, 10-inch refl.; J. J. Merritt, 3542 Greenwood Ave., Venice, Calif., 2 drawings, 5-inch refr. and 12-inch refl.; P. A. Moore, Glencathara, Worsted Lane, East Grinstead, Sussex, England, 23 drawings, 8.5-inch refl., P. J. Nemecek, 3240 N. Walnut Grove, San Gabriel, Calif., 2 drawings, 12.5-inch refl.; T. Osawa, 844 Shinmen, Toyonaka, Osaka, Japan, 3 drawings, 6-inch refl.; O.C. Ranck, P. O. Box 161, Milton, Penna., 38 drawings, 4-inch refr.; E. J. Reese, 241 S. Mount Vernon Ave., Uniontown, Penna., 7 drawings, 6-inch refl.; G. D. Roth, Lengmoosstrasse 6, Munich 9, Germany, 2 drawings, 4.4-inch refl.; T. Saheki, No. 29 Shiei-Jutaku, Uriono-cho, II-24, Sumiyoshi-ku, Osaka, Japan, 23 drawings, 8-inch refl.; W. Sandner, 2 drawings, 8-inch refr.; R. Venor, 1 drawing, 6-inch refr.; J. A. Westphal, 1448½ So. Trenton, Tulsa, Oklahoma, 7 drawings, 12-inch refl.; C. E. Wierzbicki, 1600 E. Gold Ave., Albuquerque, N. M., 1 drawing, 3-inch refr.; H. P. Wilkins, 35 Fairlawn Ave., Bexleyheath, Kent, England, 1 drawing, 15-inch refl.

On pg. 113 are three composite maps of Jupiter, made chiefly from observations by J.C. Bartlett, E. E. Both, P. Cluff, L. T. Johnson, O. C. Ranck, and T. Saheki. Special drawings of the Great Red Spot by E. J. Reese were also used. These composite maps give a good picture of some of the changes and developments that took place on Jupiter during the past apparition. Six drawings of the planet by different observers are on pg. 115.

Since the Third Report on Jupiter was published, more material has been received on the Epstein-Both Disturbance in the South Temperate Belt(The Strolling Astronomer, Vol. 6, No. 5, pg. 66, 1952); and it is now certain that this Disturbance is identical with the Reese Disturbance (number 3 in the Third Report on Jupiter). The mean value of the longitude of this object in System II has been determined to be as follows: August 18, 44°; August 26, 38°; September 6, 30°; September 14, 23°; September 24, 15°; October 6, 6°; October 15, 359°; October 30, 346°; and November 25, 326°. This cloudlike white object was also observed by Dr. W. Sandner at Munich, Germany and by T. Saheki.

We now summarize our observations of Jupiter from July, 1951 to March, 1952.

South South Temperate Zone. The S. S. Temp. Z. was conspicuous during July, August, and September, 1951 and was recorded especially by Both, Johnson, and Saheki. During this time it showed some dark structures which were, however, rather unstable. Both was able to make special observations to determine the rotation-period of this zone and found it to be $9^h\ 55^m\ 8\overset{s}{.}7$. From October 20 through December the S.S. Temp. Z. appeared to decrease markedly in brightness, with a slight increase again in January.

South Temperate Zone. Festoons were frequently observed in this zone, mostly beginning on the south edge of the South Temperate Belt, crossing the S. Temp. Z., and reaching far into the shaded South Polar Region. These festoons were prevalent and very conspicuous in the earlier part of the 1951-52 apparition. During October and November, 1951, a large number of short-lived very bright structures were observed in the S. Temp. Z. P. Cluff recorded bright areas in this zone on October 29 at $5^h\ 30^m$, U.T. at longitudes (II) 15° and 20° and again on November 5 at $2^h\ 40^m$, U.T. at longitude (II) 237°. In December and January the S. Temp. Z. became less bright, and festoons and dark areas were again conspicuous. The rotation-period of this zone was found to be $9^h\ 55^m\ 14\overset{s}{.}4$.

South Tropical Zone. This zone was always very irregular, both in shape and structure. Dark disturbances were often the rule rather than the exception. A dark, very large disturbance was observed on December 13, 1951 at $1^h\ 10^m$, U.T. by P. Cluff and was confirmed by E. Both. The center of this disturbance was at 131° (II), and its longitudinal length was at least 30°. A very unusual festoon was observed by Cluff on January 11, 1952 at $1^h\ 20^m$; beginning in the South Equatorial Belt South at 175° (II), it crossed the S. Trop. Z. and terminated in the S.T.B. at 162° (II) in a small white spot. E. Both found for this zone a rotation-period of $9^h\ 55^m\ 32\overset{s}{.}4$.

through December, 1951 the Equatorial Zone consisted of very small whitish and yellow spots, as noted especially by Saheki and Both. Later on, these whitish spots gave way to larger, bright objects, chiefly during January.

North Tropical Zone, North Temperate Zone, and North North Temperate Zone. Few changes occurred in these zones, and the composite maps on pg. 113 give an excellent picture of what little change there was.

South Temperate Belt. The various Disturbances in this belt have already been dealt with in detail in the Third Report on Jupiter, The Strolling Astronomer, Vol. 6, pp. 65-66, 1952. A very large, white, cloud-like structure was observed by T. Cragg on October 22 and was at longitude (II) 3°. The changes which took place in the S.T.B. in the later stages of the apparition, especially after December 24, were very remarkable. The belt became much broader, and one had the impression that at the same time the many dark and bright disturbances so prevalent in the earlier stages of the apparition decreased very rapidly in numbers so that by the end of January the S.T.B. was very plain and void of any structure. This development stands in direct contrast to the changes which took place in the North Equatorial Belt, which became very complicated in structure, especially in the later stages of the apparition.

North Equatorial Belt. The structural changes which took place in the N.E.B. can be divided into three consecutive stages. Stage 1 comprises roughly the period from July through September, 1951 (see first composite map), at which time the N.E.B. was chiefly conspicuous because of the large number of very small and distinct dark spots, very unstable and short-lived. In addition, a great number of gaps and festoons originated on the south edge of the N.E.B. During this period the N.E.B. was perhaps the darkest belt on the planet, the S.T.B. being a possible exception. Stage 2 was roughly the period of October through December, 1951 (second composite map); and it was marked by a brightening of the N.E.B. caused by a number of whitish, cloud-like objects. At the same time the small dark spots which had been very distinct during stage 1 became diffuse and larger but at the same time brighter and not darker. Stage 3 designates a very marked and interesting change which took place during January through March, 1952 (third composite map). By January the white objects had decreased markedly in size and number; and the small spots from stage 1 had disappeared almost completely and had given way to very large and very dark objects, ranging from 5° to almost 45° in longitudinal length. The festoons and gaps by this time had also become diffuse and were more curved (?) than they were three and more months previously. Perhaps one of the largest objects of stage 3 was observed by P. Cluff on January 2, 1952 at $1^h\ 5^m$, U.T. The preceding end of this oval dark object was situated at 235° (II) on the north edge of the N.E.B.; its center lay at 250°, and its following end at 268°, on this belt-edge. Later this long dark oval divided into two objects, which drifted apart; Both observed these on January 15 and found the center of the preceding object at 240° (II) and the center of the following object at 260°. Each object was divided by a white bridge about 5° in width.

Here are more determinations of rotation-periods:

S.T.B.	$9^h\ 55^m\ 14\overset{s}{.}8$
N.E.B. [what part?]	9 55 23.2
North Polar Region	9 55 39.5
N. N. Temp. B.	9 55 37.8 (?)

The rotation of the shaded North Polar Region was determined with the aid of the white object on its south edge - see composite maps 2 and 3.

The Great Red Spot and the Red Spot Hollow. Throughout the entire apparition the Red Spot was seen without great difficulty. T. Cragg was able to observe the Red Spot Hollow in September. On October 8 and again on November 19 Cragg observed a bright cloud in the Zone normally occupied by the Hollow.

OBSERVATIONS AND COMMENTS

Figure 1 on pg. 107 is a drawing by Mr. Tsuneo Saheki of Miyamori's Valley, a lunar feature joining the east wall of the crater Lohrmann to the west wall of the walled plain Riccioli. This drawing may be compared with one Saheki made on February 20, 1951 (The Strolling Astronomer for August, 1951, drawing on pg. 1 and text on pg. 14). His more recent drawing is more detailed than his earlier one, a common experience for lunar observers who make a prolonged study of a given region. On May 8, 1952 Mr. Saheki again found this Valley very broad in its eastern part, much thinner and shallower in its western part. A transverse wall near the middle separated the two parts, as the drawing shows. Mr. Saheki further observed that the Valley had a shallow and rounded bottom. He quotes as follows from a letter to him in mid-April by Mr. P. A. Moore: "I have recently been on a visit to the Observatory of Meudon to do some lunar work with the great 33-inch refractor there. On one occasion the Miyamori Valley was well-placed. I do agree with you about the deepness of the eastern half and the shadow effect in the western, though I am inclined to think that even in the western end there is still a depression in the surface like a very shallow Valley. The bottom seems to me to be rounded, quite unlike a typical sharp-side cleft. Most unfortunately clouds came up before I was able to make a drawing of the area."

Mr. H. P. Wilkins has sent us a drawing by himself and Mr. P. A. Moore of the famous lunar elevated crater Wargentin, as they saw it in the Meudon 33-inch on April 7, 1952 at colongitude 65°.1. We shall not publish the drawing here because it will appear in The Journal of the British Astronomical Association, but we shall be glad to lend it to interested persons. The drawing shows some dozens of objects on the floor of Wargentin, almost all of them previously unrecorded; there were ridges, clefts, craterlets, hills, and bright spots. It will presumably take a large telescope to confirm these features or to add to their number. On May 23 Wilkins wrote in part as follows: "In the 5-inch finder all that could be seen was the most prominent ridge, a branch, and crater 1 [as numbered on sketch] as a white spot; but in the 33-inch the detail was amazing. This gives a pretty good indication as to whether a giant telescope is an advantage for lunar work. The answer is that for the highest class of work involving the finest details a large instrument is a necessity."

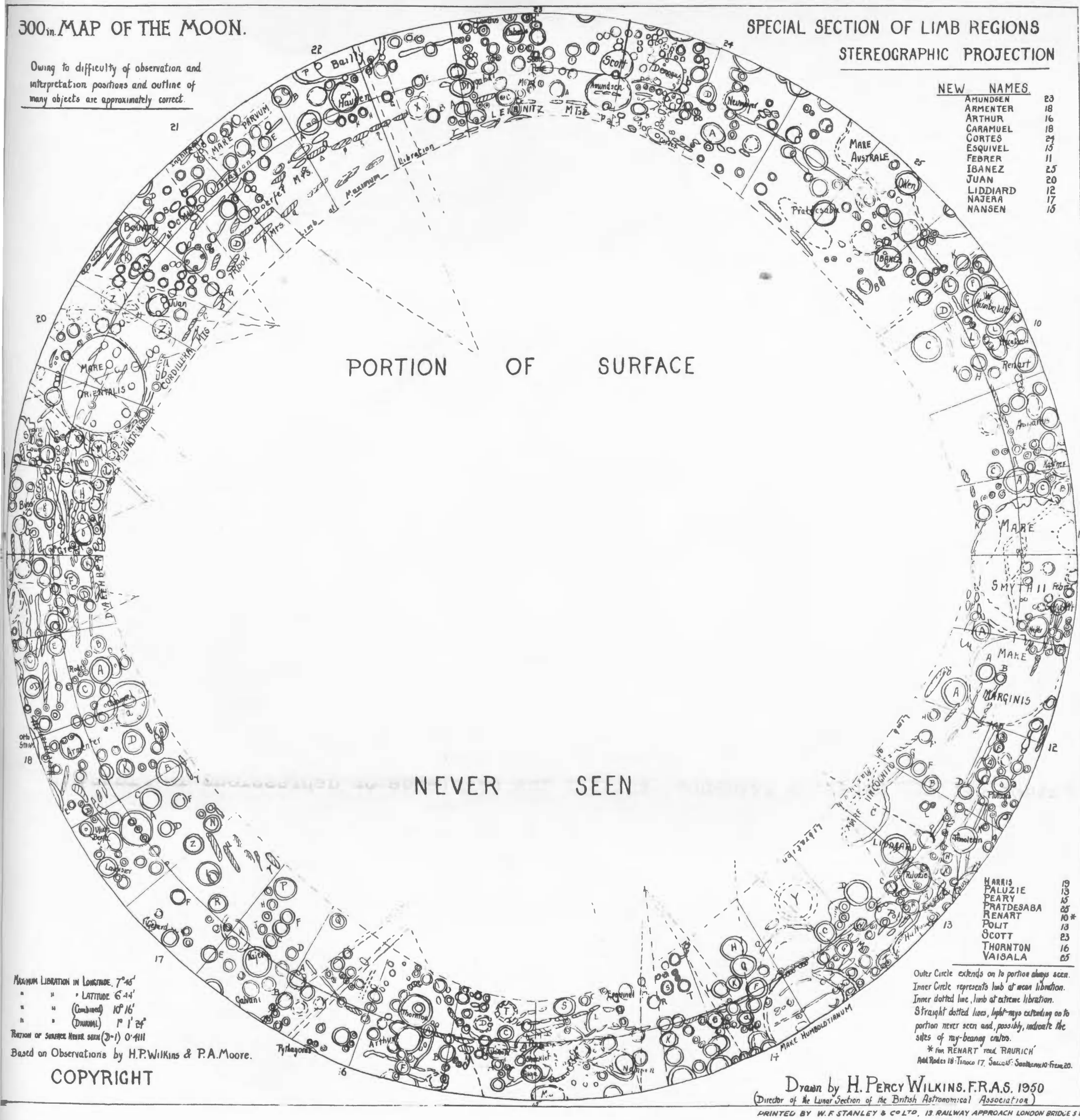
Figure 2 on pg. 107 is a drawing Wilkins made of the crater Marius with the large Meudon refractor. He calls attention to the landslip near the foot of the west inner wall and concentric with it, the central hill, the crater in the northwest part of the floor, the ruined ring faintly present at the south end of the floor, and the two peculiar, spindle-shaped objects at the foot of the northeast inner wall. The narrow valley in the center of each of these two objects was very distinct with a high power.

There has been much discussion from time to time in lunar and planetary literature about the relative performances of large and small apertures. We accordingly quote, and with complete approval, the following extract from a letter from Mr. H. P. Wilkins on May 22. We consider his remarks very instructive.

"A large proportion of the details shown on the drawings we brought back from France cannot possibly be seen as we saw them with small instruments because these do not have the necessary resolving power. Where we saw two pits close together a smaller instrument would present a single and indefinite spot, if it showed anything at all. A small instrument cannot possibly show the minute and delicate features seen with a large glass; it is impossible. The floor of Plato was seen in its true aspect at Meudon , and the four craters were seen as such; we could see the sloping outer slopes and the interiors with shadows. They were large and striking objects; but in the 5-inch finder of the 33-inch, <u>at the same time</u>, they looked like white spots and not like craters. The true view, however, was not what the 5-inch showed but what the 33-inch did. Hence details noted with small instruments are uncertain; a large aperture would probably resolve them in a quite different manner."

J. T. Carle, 2734 N. Sixth St., Fresno, Calif. and D. P. Barcroft have made several observations of the lunar walled plain Plato. Mr. Carle has been especially interested in the oval black area observed by him to the southeast of the near-central craterlet on February 5,1952 at colongitude 21°.9 (<u>The Strolling Astronomer</u>, Volume 6, drawing on pg. 61 and text on pg. 70). On June 2 Mr. Carle near colongitude 20° was unable to recover this black oval, but close study with an 8-inch reflector did appear to show a rolling depression extending from the center of the south rim toward the north for about two-thirds of the way across the floor of Plato. This depression appeared to be deepest at the position of the black oval of February 5; but if this oval was a shadow-filled depression, then its failure to reappear under similar lighting on June 2 is curious. Using Carle's 8-inch reflector, Carle and Barcroft on June 4 suspected a number of shallow depressions in the floor, the one noted by Carle on June 2 being the most readily visible. However, the colongitude was near 44° on June 4, rather high solar lighting for seeing depressions. The view was good enough that the twin craterlets in Plato were clearly divided. We do have, however, rather weighty nagative evidence against the existence of depressions in Plato; in his excellent view with the Meudon 33-inch refractor on April 3, 1952. H. P. Wilkins was impressed by the Smoothness of the floor and saw no sign of depressions or ridges.

On July 31, 1952 from $3^h 45^m$ to $5^h 30^m$, U.T., colongitude near 21°, Mr. Carle was amazed to find Plato almost blank of detail. Fine detail in other lunar regions, for example the chain of craterlets west of Copernicus, was seen quite as well as in past views which had shown much detail on the floor of Plato. On July 31, however, the most careful study revealed only one or two faint spots in the locations of known craterlets and a hint of the rolling depression of June 2 described above. Observing with Carle, Mr. J. Supinger with a 6-inch reflector also found a remarkable lack of detail in Plato. Actually, their experience is very far from unique; and many famous lunarians have reported an occasional remarkable lack of detail in Plato when observing-conditions and solar lighting were favorable to seeing markings. A recent example is T. A. Cragg's experience on April 4,1952, as reported on pp. 86-87 of the June, 1952 <u>Strolling Astronomer</u>. It is certainly tempting to invoke obscuring lunar mists to explain such well-supported observations in spite of the great theoretical difficulties which their existence poses.



SPECIAL SECTION OF THE H.P. WILKINS MAP OF THE MOON SHOWING THE LIMB-REGIONS ON A STEREOGRAPHIC PROJECTION

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