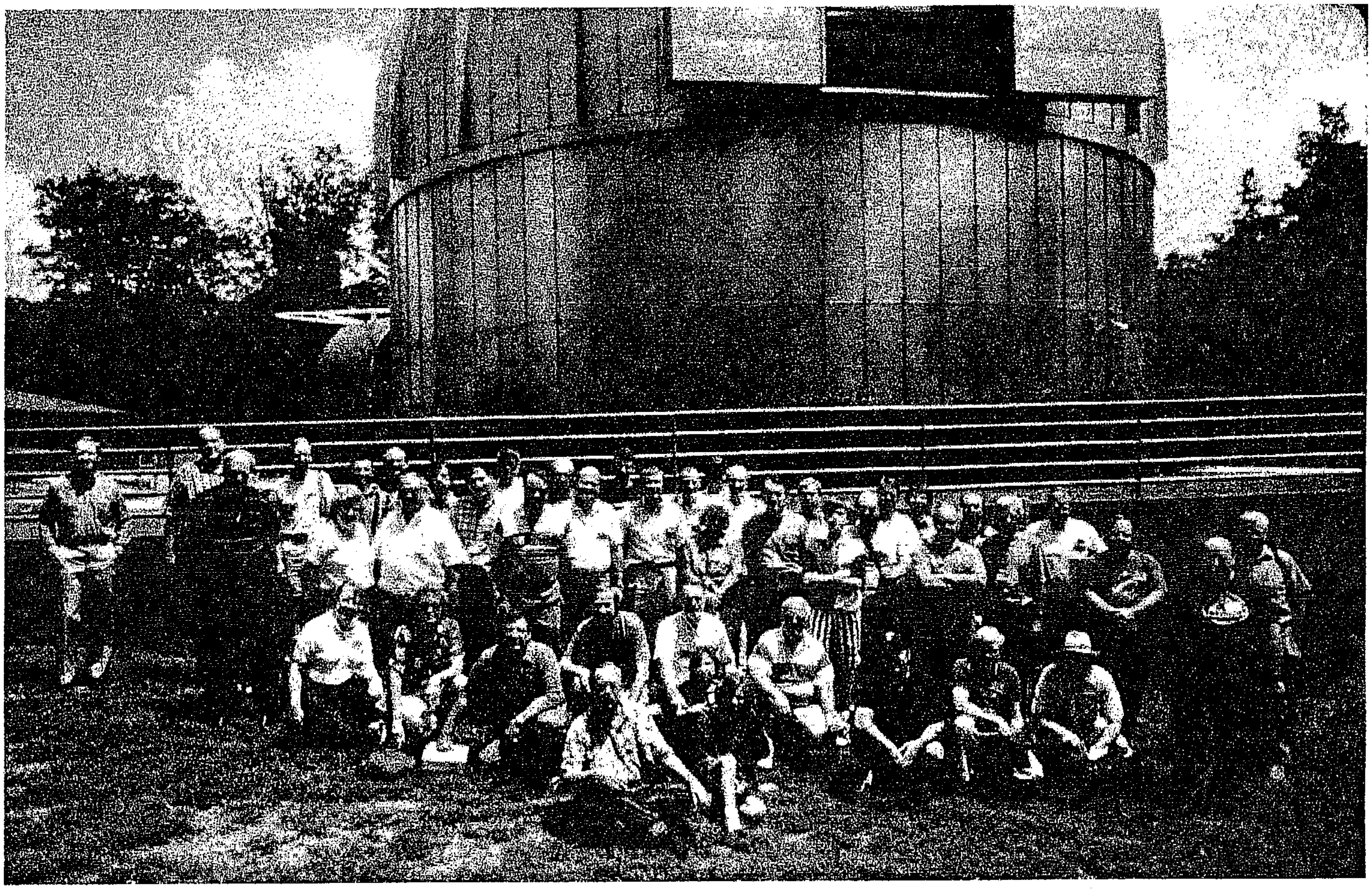
PROCEEDINGS OF THE 44TH CONVENTION OF THE ASSOCIATION OF LUNAR AND PLANETARY OBSERVERS

GREENVILLE, SOUTH CAROLINA, JUNE 15-18, 1994



Edited by: John E. Westfall

A.L.P.O. Monograph Number 2 . . . . July, 1995

Preface

The Association of Lunar and Planetary Observers held its 44th Convention at the Roper Mountain Science Center in Greenville, South Carolina, on June 15-18, 1994. We must thank Doug Gegen and the staff of the Science Center for hosting us and making our meeting a memorable experience. Among other privileges, the 23-inch Alvan Clark Refractor of the Science Center was made available to us for several nights of high-quality observing. This instrument is housed in the dome in the background of our group portrait on the cover. In addition, we were able to consult the Charles F. Capen collection in the Center's library.

We also thank the many A.L.P.O. members who gave papers or workshops or who brought exhibits to this meeting, and to Elizabeth Westfall for taking care of registration and numerous other tasks.

The following *Proceedings* include all the papers or abstracts that have been submitted to the Editor. "Editing" is a generous term here; for the most part consisting of placing the papers in order and assigning page numbers—except for unmounted illustrations, the papers that follow have been copied directly from the manuscripts supplied by their authors.

TABLE OF CONTENTS

A BRIEF HISTORY OF THE GREAT RED SPOT AND STB LONG-ENDURING WHITE OVALS

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

ABSTRACT

A brief history is outlined concerning the aspects, appearance, changes, and behavior of the Great Red Spot and the STB White Ovals for the last 42 years: 1952-1994. Included are statistics on their sizes, intensities,and interactions with other features. Also, in the case of the Red Spot a history of it`s color is reported. Earlier observations of these long-lived features are also discussed.

The Long-Enduring STB White Ovals

A. Introduction

Early observations by the B.A.A. (British Astronomical Association) indicate the STB Ovals were seen as early as 1939 and were prominent from 1941-1952. Elmer J. Reese (A.L.P.O.) as early as 1947 was tracking the STB Bright Ovals and identified the features preceding and following ends as F-A, B-C, and D-E. Later he named the "storms": FA-Fay, BC-Becky, and DE-Della! These identifications: FA, BC, and DE are still the "standard" nomenclature today.

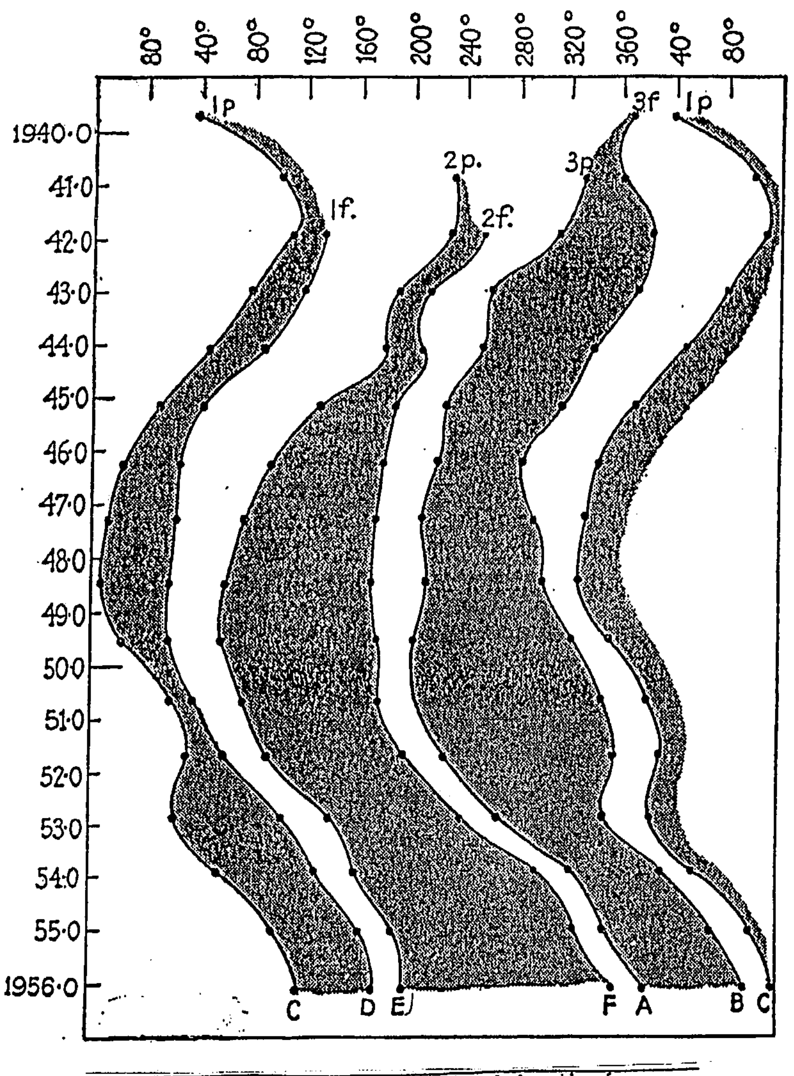
The ovals for many years were located on the south edge of the STB (South Temperate Belt) but in more recent years have moved in latitude to near the center of the STB. They have been continuesly observed for 55 years!

B. Length and Appearance

From an analysis of how BC, DE, and FA shrank over the last fourty years, Elmer J. Reese predicted several years ago that these spots could possibly shrink from existence by 1985. However, their shrinking rate has decreased as they have gotten smaller, and they continue to exist. In 1991 they appeared as "doughnuts" in the very faint STB and were very difficult to observe.

As a comparison of their shrinking behavior, in 1939 the white oval BC covered 30 degrees in area, DE covered 90 degrees in area, and FA spanned 70 degrees in area. However, by 1941 BC had covered 80 degrees in area. Dramatically- by 1951 all three ovals averaged 30 degrees in length! By 1991 BC was 6 degrees, DE was 6 degrees, and FA was 5 degrees. DE was the brightest. By 1993 all three ovals had increased slightly in length and had a mean length of 8 degrees! BC was the brightest and FA was the faintest in 1993. However, all three ovals had become more conspicous in the darkening STB.

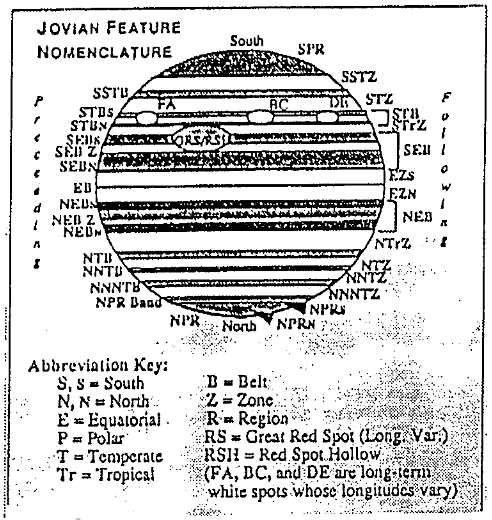
In 1994 the STB White Ovals have grown slightly in length. They all have a mean longitudenal length of 9 degrees. Their order of conspicousness is: BC, DE, and FA.

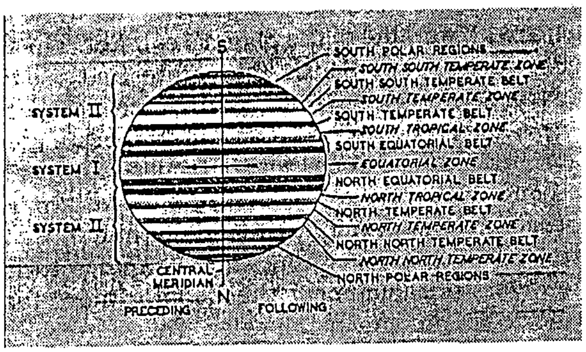


Graph showing decreasing longitudenal lengths for the STEZ-STB long-enduring white ovals: DE, FA, and BC for the period: 1939--1956

NOMENCLATURE OF JUPITER

DIAGRAMS OF NOMENCLATURE





Standard nomenclature for the belts and zones of Jupiter, shown in a typical simply inverted view. Also shown are the nominal ranges of the rotational Systems I and II.

The Great Red Spot

The Great Red Spot (GRS) is the most outstanding large-scale, long-lived feature on Jupiter. Having been observed for over 300 years. It was most likely first seen by Giovanni Cassini in 1665 and was definitely observed in 1831 by Heinrich Schwabe of Germany. The GRS is an immense anti-cyclone; a long-lived high pressure storm in Jupiter's South Tropical Zone. The Red Spot's cloud tops are usually reddish and are cool and complete one counter-clockwise rotation every six days. The GRS has not been real dark since it faded in 1976 after twelve consecutive apparitions. In 1960-61 when it appeared as a dark ellipse, it could easily be seen in small telescopes.

But even though the GRS has not been dark lately, the Red Spot region can still be seen because of the Red Spot Hollow which forms a bay into the southern edge of the SEB. The GRS is located within the large oval area called the RSH. The RSH is usually dull and difficult to see when the Red Spot is dark, but it becomes bright and white when the Red Spot fades.

The movement of the Great Red Spot and its hollow has generally been in a increasing longitude direction, but the motion is eratic. The GRS can move forward or backward and drift ahead or behind other Jovian features.

A. General Appearance of the Great Red Spot

1952-53: GRS is an ellipse, slightly flattened on south side Brighter border.
During December-January it had a dark border.

1953-54: Dark Border. Border touches north edge of STB and the south edge of the SEBn.

1956-57: Dark red border. Dark blood red color in April. Belt crossing GRS.

1959: GRS faded. Very faint during early part of the apparition. Later aspect was that of the RSH.

1960: RSH observed through February. By March GRS returned, GRS darkened by March 19. Interior was shaded and structured.

1961: GRS is darkest in a century of observation. Dark knots or spots were seen bordering the GRS.

1962-63: GRS is dark and has pointed ends. Toward the end of the apparition the GRS was fainter. After the eruption and full developement of the 1962-63 SEB Disturbance the GRS was expected to fade and to change to the "hollow" aspect as it had done after previous SEB Disturbances. However, this did not occur! The GRS was very red and its southern border was touching the STB. The contrast between the bright STrZ and the red GRS was striking!

1964-65: Still dark since 1960.

1965-66: The most startling bit of evidence during this apparition was the evidence of vorticity in the Red Spot. On November 24, 1965, a small dark spot was observed on the north edge of the South Temperate Belt: it was moving in the direction of the Red Spot. This spot was moving at 3.6 degrees per day in the direction of decreasing longitude in System II. By January 6, 1966 the spot had reached the following border of the Red Spot Hollow; by January 7 it was located at the following end of the Red Spot; by January 11 it was on the south-preceding edge of the Red Spot; and by January 17 it had returned to the following end of the Red Spot area. The spot was recorded by ALPO observers until January 25.

The dark spot described above was also recorded photographically by E.J. Reese and B.A. Smith of the New Mexico State University Observatory. They recorded it in mid-December 1965 and observed it until January 20, 1966. Their records indicate a movement of -3.4 degrees per day and a period of 9:53:21. ALPO observations give a movement of -3.6 degrees per day (-107.5) in 30 days and a period of 9:53:14. The dark spot circled around the Red Spot in a period of nine days.

1966-67: GRS color pink during early apparition, rosy at mid-apparition, and orange near the end of the period. It had a "Pink Fish" appearance during most of the period. GRS was long and narrow and had very prominent dark pointed ends. Streaks were observed in the GRS interior. By mid-January the interior was faded, GRS had a very dark border, and the southern portion of the Red Spot was darker. During mid-April to early May a dark streak was observed in the GRS region. RSH bordering GRS was bright in May.

1967-68: GRS had a dark border. GRS was oscillating in longitude.

1968-69: GRS continues to "oscillate" with a complete period in ninety days.

1969-70: GRS is dark.

1971: GRS is still dark.

1972: GRS is very prominent and a striking feature of Jupiter. Still dark after ten years.

1973: GRS still dark and there was no sign of fading; even after the 1971 SEB Disturbance.

1973-74: GRS is still prominent after eleven apparitions.

1974-75: Still dark. Not quite as dark as in 1972 or 1973.

1975-76: Dark and prominent in the early part of the apparition.

However, by December 5, 1975 the GRS had faded; and the northern portion was light and white. By January 15, 1976 the Red Spot Hollow (RSH) was developing and was becoming very prominent.

1976-77: GRS was faded.

1978: Prominent in southern portion. Dark Border.

1979: Dull. Dusky portion in southern part, faint border.

1981: Dark in southern part. No border.

1982: Dark in southern portion.

1983: Dusky GRS, fainter near end of apparition. Ellipse with no border.

1986: Dull ellipse with dark southern border.

1987: Dusky, dark southern border.

1988: Dusky ellipse, faint border.

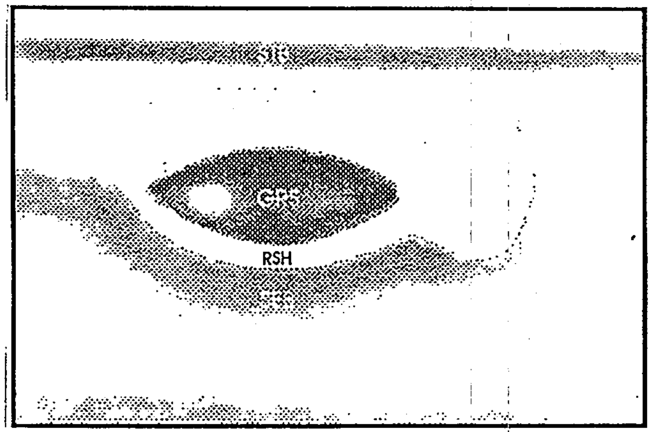
1989: Dusky ellipse, at times a "tail" belt on following end.

1990: Dusky GRS. Still has tail on f-end.

1991: Very dusky ellipse with f-tail. By May had rounder appearance with two belts in the interior.

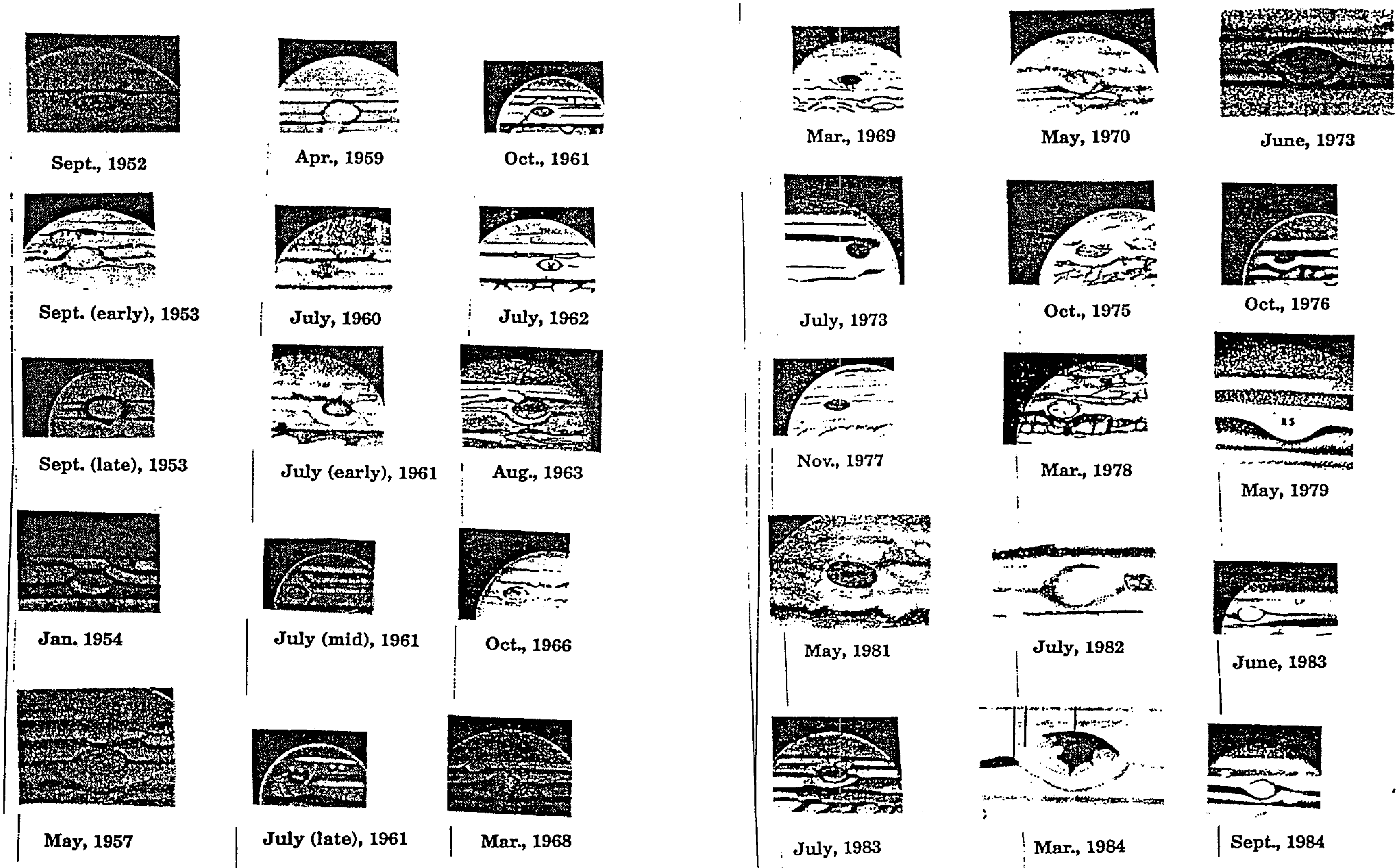
1992-93: Dark. Faint after SEB eruption.

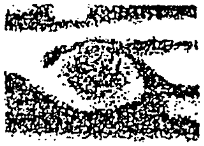
1993-94: Red Spot Hollow Aspect.



This is a sectional sketch, detailed drawing of a localized area or region, of the Great Red Spot and its surrounding region on October 28, 1989 (5:10-6:00 U.T.) by Carlos E. Hernandez using an 8-inch (20 cm) f/10 Schmidt-Cassegrain telescope at 200-286x.

ASPECTS OF THE RED SPOT

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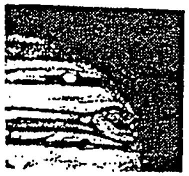
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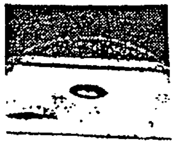
Nov., 1987


Aug. (early), 1988


Aug. (mid), 1988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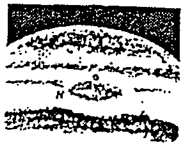
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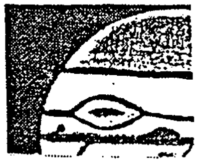
Jan., 1990


Feb., 1990


Sept., 1990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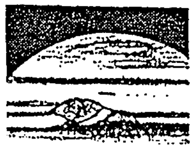
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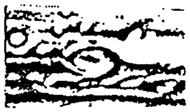
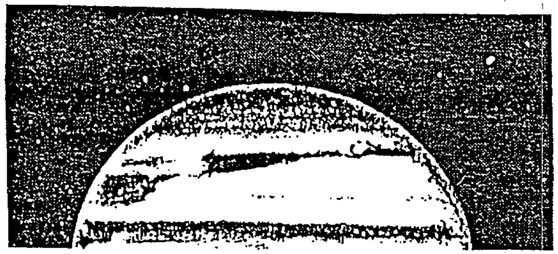

Jan., 1991


Mar., 1991


Nov., 1992


July, 1993


Dec., 1993

Intensities and Colors

The Great Red Spot

Apparition	Intensity	Color
1952-53	5.2	Yellowish-Ochre
1953-54	5.2	Yellowish-White
1954-55	4.3	Tan
1955-56	3.8	Reddish-Orange
1956-57	3.7	Red
1957-58	3.9	Orangish-Ochre
1959	5.5	Orange
1960	3.5	Orange
1961-62	2.9	Orange
1962-63	3.2	Orange
1963-64	3.5	Reddish-Orange
1964-65	3.5	Reddish-Orange
1965-66	3.7	Orange
1966-67	3.3	Reddish-Orange
1967-68	3.0	Red
1968-69	3.3	Reddish-Orange
1969-70	3.0	Red
1971	3.0	Red
1972	3.0	Red
1973-74	3.5	Reddish-Orange
1974-75	5.2	Reddish-Orange
1975-76	5.2	Orange
1976-77	5.0	Red
1977-78	4.3	Reddish-Orange
1978-79	3.8	Orange
1979-80	4.5	Reddish-Orange
1980-81	5.2	Orange
1981-82	5.2	Orange
1982-83	4.5	Orange
1983-85	4.2	Orange
1985-86	3.8	Orange
1986-87	3.5	Orange
1987-88	4.5	Orange-Pink
1988-89	4.3	Orange
1989-90	4.8	Orange
1991-92	5.2	Pink
1992-93	4.5	Orange
1993-94	5.2	Light Orange
1994	7.0	White-RSH

Table of Lengths

of the Great Red Spot

Apparition	Length
1952-53	26°
1953-54	20°
1954-55	22°
1955-56	28°
1956-57	26°
1957-58	27°
1959	29°
1960	23°
1961-62	25°
1962-63	24°
1963-64	25°
1964-65	26°
1965-66	22°
1966-67	24°
1967-68	20°
1968-69	23°
1969-70	20°
1971	20°
1972	22°
1973-74	22°
1974-75	21°
1975-76	24°
1976-77	20°
1977-78	18°
1978-79	16°
1979-80	22°
1980-81	17°
1981-82	20°
1982-83	21°
1983-85	19°
1985-86	19°
1986-87	25°
1987-88	25°
1988-89	23°
1989-90	20°
1990-91	20°
1991-92	18°
1992-93	20°
1993-94	20°

Interactions of the STB White Ovals with the Great Red Spot and the STB Fade

The STB Fade began in 1975 and was found between the long-enduring white ovals FA and BC. Since the STB Fade started the STB in the "fade" longitudes it has been either split, faint, or absent ever since. In 1975 as the STB Fade passed the RS (Red Spot) the STBn joined the SEBs to from the <u>first</u> STrDIS from FA to BC; its p (preceding end), like that of a STrD, interrupted the flow of the retrograding SEBs jet stream.

In 1978-79, the same STB Fade passed the RS again and induced the <u>second</u> STrDIS. The p-end did not interrupt the SEBs current. But, a STrB ran through it to the f-end where a classical STrD developed, with the SEBs current active. These events lasted until 1981.

In 1982 as oval FA again moved past the RS, the <u>third</u> STrDIS began exactly like the first two: the STBn faded and was formed into a belt between FA and the RS.

In 1983 the ovals FA and BC were 140° apart and BC was just passing the RS . The p-end of the STB Fade was 80° f oval FA and the STrB from there to BC/RS area was very faint.

In 1984 the STrDS had not developed an f-end. The STB Fade extended from BC to DE. By May the STB was split and oval BC was in the faded region with a dark STeZB south of it and a STrB north of the oval. Following DE a STrD was emerging from the p-edge of the RS. Oval DE was then 40° preceding the RS, so it is not known whether the passage of DE past the RS induced it. An f-end to the STrD emerged in 1984 (August). It was south of FA. In September the STrD faded away. The p-end of the STrDIS failed to stop retrograding SEBs spots, but eventually a STrD emerged from the pRS to provide the STrDIS with an f-end which did stop retrograding spots. Why did the f-end take so long to form in 1984? Possibly, because of the long length of the STB Fade. Another factor may have been the evolution of the three STB white ovals, which have progressively gotten smaller and more northerly (now in the latitude of the STB); since their formation in 1939-41.

In 1985 FA was past the RS; the region from FA to the RS again had a STrB formed and a <u>fourth</u> STrDIS had begun. The STrB reached to 150° (II) by early September. The RS was near 25° (II). By Sept. 12 a dark STrD had developed preceding the Red Spot.

In 1986 as FA was passing the RS it induced a STrB from a dark column preceding the RS which extended the STrB to oval DE and on to BC. The <u>fifth</u> STrDIS had begun.

In 1987 the oval BC was passing the RS on January 6. By the end of the 1987-88 apparition FA was approaching the RS. Again the STB Fade was present from FA to BC. The STrB was prominent from the RS to almost FA. This was the <u>sixth</u> STrDIS.

In 1988-89 oval DE on July 2, 1988 had just passed the RS. Oval FA was passing the RS on Mar. 13, 1989. During mid-August a STrB was forming from the preceding end of the RS. The <u>seventh</u> STrDIS had begun.

In 1989-90 there were no conjunctions of the STB ovals with the RS. But, the STB Fade was still prominent from FA to BC.

In 1990-91 oval DE passed the RS on Oct. 28, 1990 and FA was passing the RS on June 30, 1991. By January 2, 1991 the passing of oval DE with the RS had induced a STrDIS and in turn a STrD developed near the preceding end of the RS. These events resulted in the <u>eighth</u> TrDIS since 1975. A very prominent and lengthy STrB developed in early March, 1991 which extended from the preceding end of the RS to almost FA. BC and DE were surrounded by dark material ("doughnut look") which had concave preceding and following ends and took on the appearance of a STrD. The STrB had a length of 240°!

During early 1992 there have been to date (Mar., 1992) no conjunctions with the STB ovals. The STB Fade is still prominent. Ovals BC and DE are <u>very</u> difficult in the STB Fade. A very dark segment of the STB follows oval FA. Some are calling it a "false Red Spot". The STrZ is bright and quite void of detail except for a long-lived bright oval seen since 1975; located near 251° (II) and moving -0.20/day as of Mar. 13, 1992. Observers should be watching closely when BC and DE pass the Red Spot and for the possible ninth South Tropical Dislocation.

Summary

Observations and Voyager 2 films show strong interactions and circulations when the STB ovals pass the Red Spot . The resulting flow pattern is called a "chiasma". Voyager films showed recirculation of the various jet streams. The classical "Circulating Current" is an example of a "chiasma". The dynamics of the circulations of the chiasmas has only occurred since 1975 (in the STB Fade); and therefore the movement northerly into the center latitudes of the STB and shrinkage of the white ovals of the STB are probably the greatest factors in the causes for the events relating to the South Temperate Belt Fade, the South Tropical Dislocations, and the South Tropical Disturbances which have developed since 1975.

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3. Peek, B.M.; "The Planet Jupiter", London, 1980.
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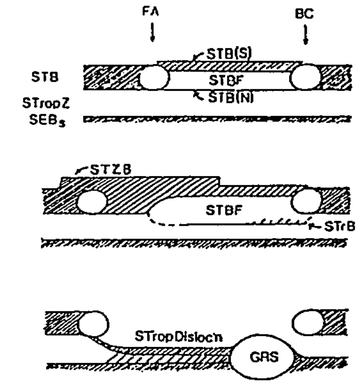
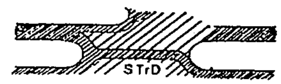
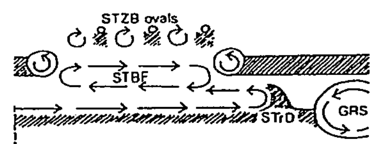


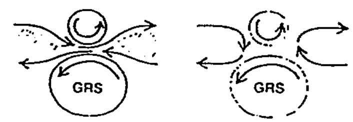
Aspects of the STB Fade (STBF).

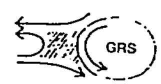


One aspect of STrD.



Major jetstreams and circulations as seen by Voyager 2 in 1979.





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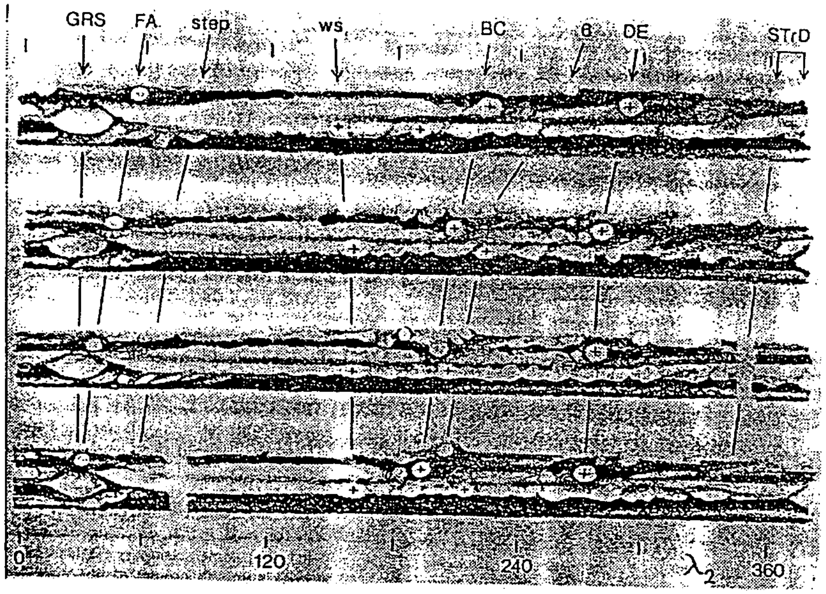
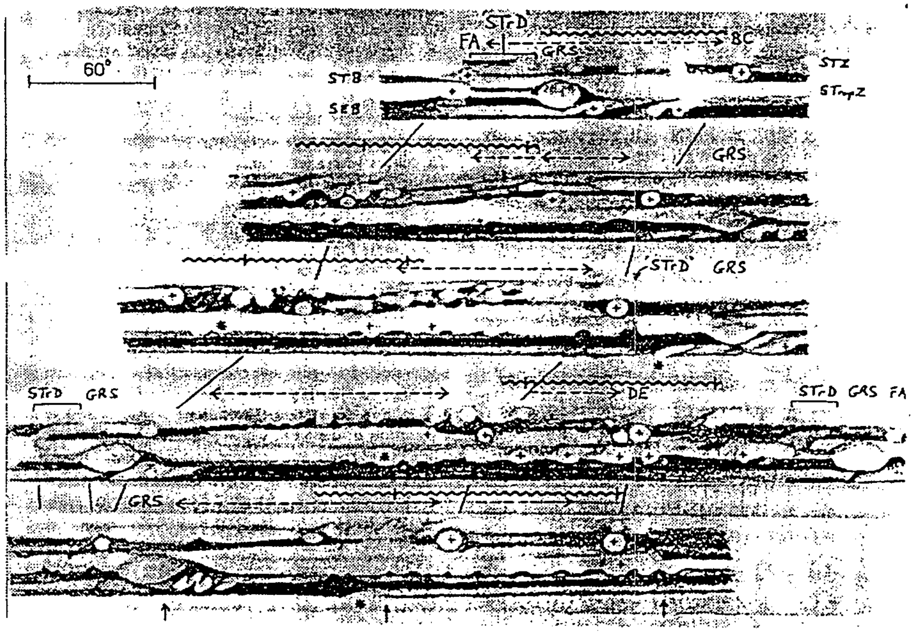
Chiasma formed as STB white oval passes the RS with reconnection of jetstreams.

Chiasma as incipient STrD emerges p RS.



South Tropical region in 1984 for period: Apr. 13-June 30. Based on photos by Dragesco and Parker.
STB Fade is from BC to DE.
WS = long-lived STrZ spot.



The Third STr Dislocation.
Dashed line extent of STB Fade.
* = long-lived bright spots in STrZ and EZs. Based on observations and photos by:
Rogers, McKim, Dragesco, Barbany, and Parker in 1982-84.

The STB White Ovals, the STB Fade, and the Ninth South Tropical Dislocation in 1992-93

During most of 1992 there were no conjunctions with the STB White Ovals and the Great Red Spot. However, early in the 1992-93 apparition BC and DE were approaching the Red Spot area. By November 10, 1992 BC`s preceding end had reached the Red Spot. During the period October 31, 1992 to February 8, 1993 ALPO observers (particularly Miyazaki, Benninghoven, and Whitby) observed the interactions of the STB Ovals BC and DE as they approached, reached conjunction, and passed the Great Red Spot. A South Tropical Zone Dislocation was induced and the STB Fade was observed. See the sketches which follow by Claus Benninghoven.

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OBSERVER CLAUS BENNINGHOVEN

ADDRESS BURLINGTON, IA.

SYSTEM I 8.5 II 306.8

NOTES

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OBSERVER CLAUS BENNINGHOVEN

ADDRESS BURLINGTON, IA.

SYSTEM I 57.3 II 355.2

NOTES

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OBSERVER SAMUEL R. WHITBY

ADDRESS Hopewell, Virginia

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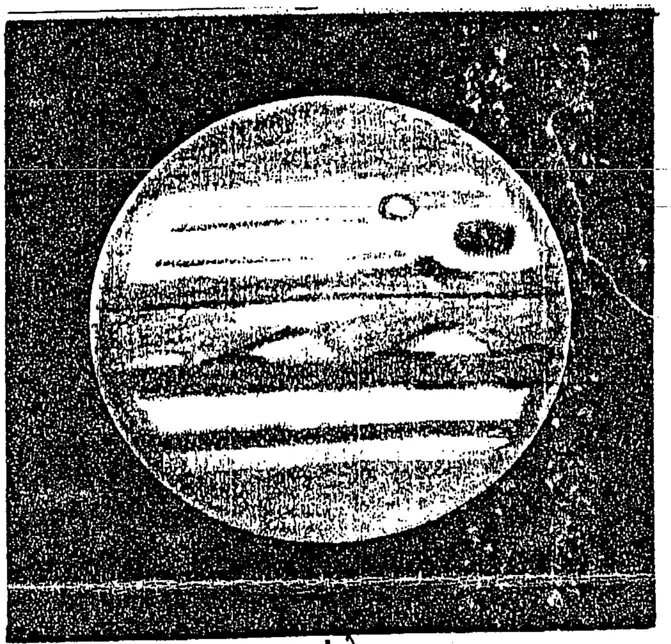

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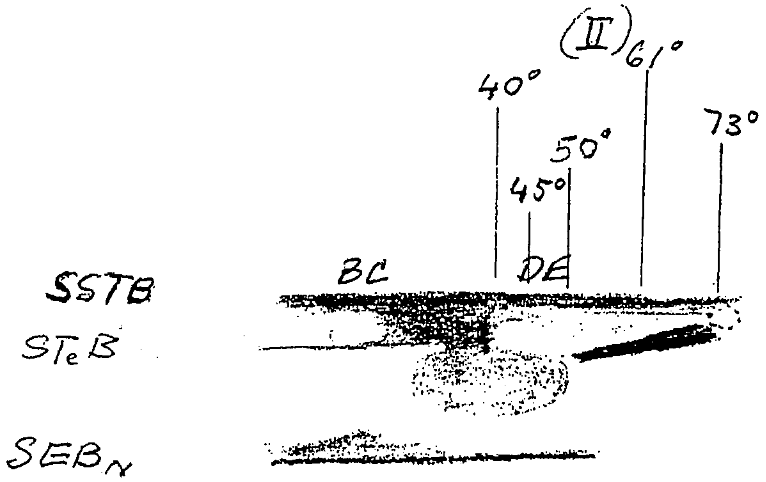
ADDRESS HOPEWELL, VA.

SYSTEM I 277° II 354°

NOTES



CLAUS BENNINGHOVEN

1-6-93 11:23 - 13:03 U.T.

8" IN. F/7 RL, 192X, 236X

S = 5-6, T = 5

JUPITER IN 1992-93: ROTATION PERIODS

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

Feature	Time Span	Long. Range	Drift Rate	Rot. Period
Oval BC	Nov. 29-Jul. 09	037°-298°	-13.4°	9:55:22
Oval DE	Nov. 29-Jun. 22	057°-340°	-11.3°	9:55:25
Oval FA	Dec. 16-Aug. 01	151°-050°	-13.3°	9:55:22
Dp No. 1	Jan. 17-Jun. 21	231°-157°	-14.2°	9:55:21
Dc No. 2	Jan. 17-Feb. 05	243°-236°	-11.7°	9:55:25
Df No. 3	Jan. 17-Jun. 02	254°-235°	- 4.2°	9:55:35
Dc No. 4	Jan. 28-Mar. 28	144°-116°	-14.0°	9:55:21
Df No. 5	Feb. 02-Mar. 28	147°-123°	-13.3°	9:55:22
Df No. 7	Feb. 28-Mar. 30	081°-071°	-10.0°	9:55:27
Dc No. 8	May 10-Jun. 15	019°-007°	-10.0°	9:55:27

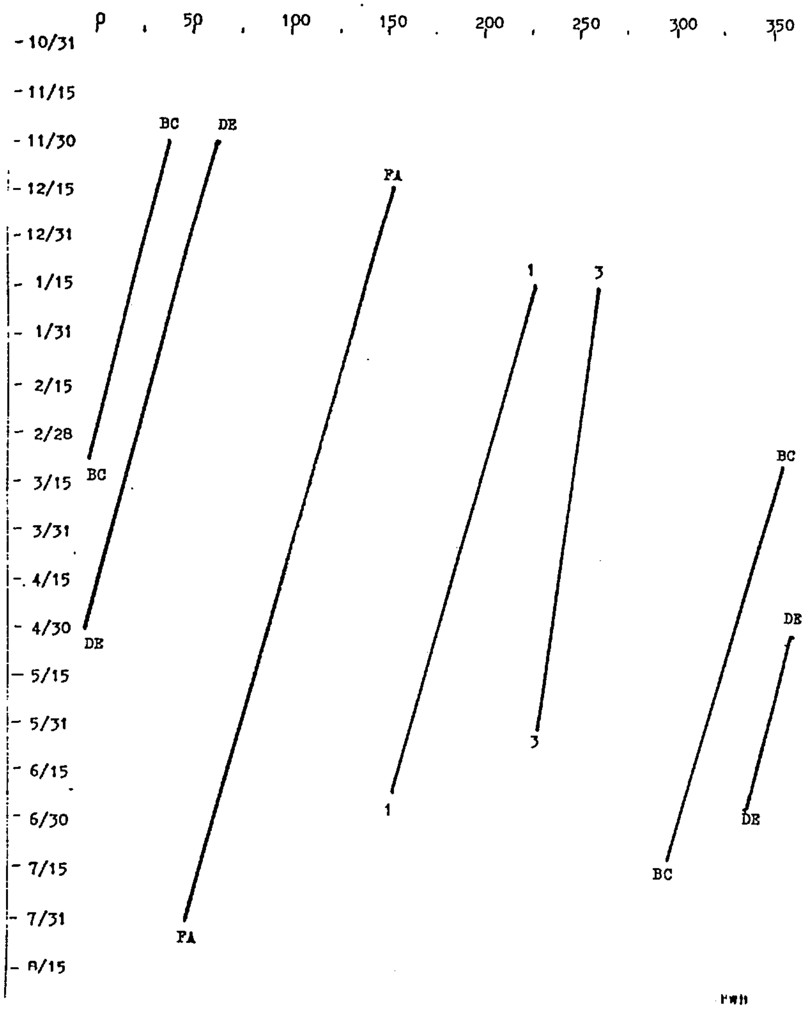
The three long-enduring white ovals of the STeZ-STB Current continued to be followed by ALPO Jupiter Section observers. They were located near the center of the location of the South Temperate Belt. The ovals were more conspicuous this apparition. These ovals in decreasing order of conspicuousness were: BC, DE, and FA. Their mean length was 8°. BC was in conjunction with the Red Spot (RS) on 1992, Nov. 29 at 037° (II). DE was in conjunction with the RS on 1993, Jan. 10 at 038° (II). FA was in conjunction with the RS on 1993, Aug. 01 near 50° (II).

Great Red Spot (STrZ), System II

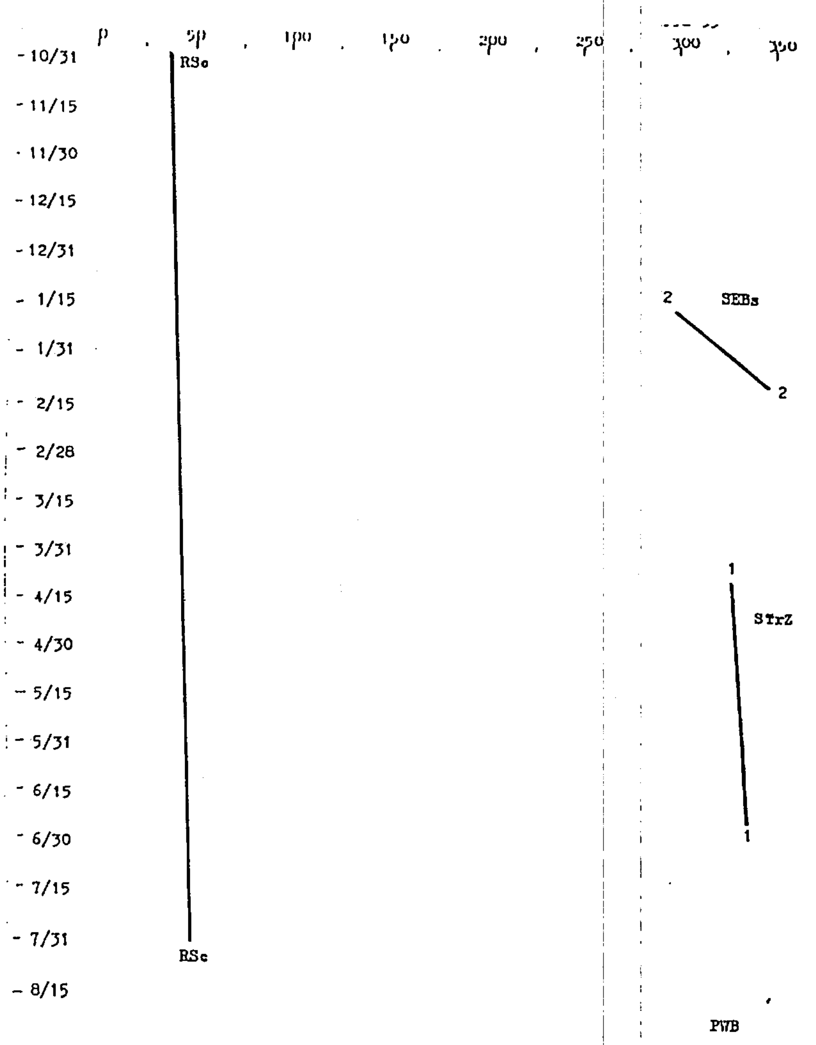
Feature	Time Span	Long. Range	Drift Rate	Rot. Period
RSp	Nov. 29-Jul. 19	027°-036°	+1.154°	9:55:42
RSc	Oct. 31-Aug. 01	037°-050°	+1.413	9:55:43
RSf	Nov. 29-Jul. 19	050°-056°	+0.769	9:55:42

The Great Red Spot had a mean longitudinal length of 20°. The RS was more prominent prior to the SEB outbreak of 1993, Apr. 07. After the outbreak the RS faded slightly; but was fairly prominent until very late in the apparition when the "hollow" aspect was becoming evident.

Important Features in System II STeZ—STB—S-STB 1992-93



Important Features in System II STrZ—SEBS 1992-93



Domes in the Hortensius - T. Mayer Cluster

By: Harry D. Jamieson,
A.L.P.O. Lunar Recorder

Abstract

The large-scale distribution of lunar domes across the lunar surface and their tendency to form chains and clusters is briefly discussed. Specific information about some of the members of the Hortensius-T. Mayer Cluster is given, and a general discussion of how to observe domes is provided.

Lunar domes are low swellings on the Moon's surface caused by upwellings of magma during the Moon's early history. Many are very similar to the shield volcanos found here on Earth, and some appear to have the same origins. Unlike such features on Earth, however, most lunar domes have an average slope angle of less than 5°, and are several kilometers in diameter; an astronaut standing on one would probably not be aware of it.

Fig. 1 shows the general distribution of all of the domes known to the A.L.P.O.. The first thing that becomes obvious when we examine this chart is that there are few domes in the Moon's southern highlands. The crust there was simply too thick to allow domes to form, and most of those that do exist there are within craters. Domes are creatures of the maria. The next thing that we notice is that domes tend to group together into chains and clusters. It has long been known that domes tend to be found around the edges of circular maria like Serenitatis, but in the middle of irregular maria like Nubium [1].

One of the richest of these groupings is the Hortensius - T. Mayer cluster. Centered at 30° West longitude and 11° North latitude, just west of Copernicus, the A.L.P.O. catalog [2] lists some 60 domes here. See the chart given here as Fig. 2. While some have been well observed and photographed, [3] many of these are unconfirmed or duplications (where the same dome may have been reported at different positions). Some examples of domes in this cluster are:

-.450 +.208 (27° 23'W, 12° 00'N) is near Wagner. In an observation made nearly 30 years ago, the Rev. Kenneth J. Delano described it as 7 miles (11 kms) in diameter and circular. LAC 58 shows this dome with a central pit, which Delano did not see because the Sun's altitude of 5° was too high. This could indicate that the pit is very shallow and does not retain shadow for long. I also observed this dome in 1987 under a solar altitude of 2.15°, and saw the pit, as well as the dome's flat summit. At that time, the dome was ¼ covered with black shadow, and under such circumstances the current solar altitude is assumed to be the dome's average slope angle. This allowed me to measure the dome's height. Using my diameter estimate of 15kms, the height would be just 280 meters.

-.452 +.121 (27° 05'W, 6° 57'N) is near Hortensius. In 1987, Craig MacDougal reported that this was a small ridge, and not a dome at all. The A.L.P.O. distinguishes between domes and ridges by how elongated the feature is. If the major-axis to minor-axis ratio exceeds 2:1, we assume it to be a ridge. An excellent photograph on page 202 of Antonin Rukl's ***Atlas of the Moon*** shows it to be very smooth and nearly twice as long as it is wide. If other observers or a photograph confirm Mr. MacDougal's observation, this feature will be removed from our catalog.

-.455 +.136 (27° 20'W, 7° 49'N) is also near Hortensius. The Rev. Delano observed this dome in 1964 as well, and describes it as elliptical with a diameter of 4X2 miles (6.4X3.2kms) and no central pit. This feature could also turn out to violate our 2:1 rule. On plate E4-b of the ***Orthographic Atlas of the Moon,*** this dome appears as a white spot elongated N-S. Several years ago, Marvin Huddleston noted that some domes appear as white spots under moderate to high illumination. This dome is also well shown on page 202 of Rukl's atlas, which also shows a small central pit.

The Hortensius-T. Mayer Cluster has been relatively well observed, [4,5] and yet our catalog entries for this region are replete with unconfirmed domes and duplications. The reason for the latter is that the original discoverer of a dome would report a position for it, and then someone else would observe it later and report a slightly different position. If the observers are equally reliable, which position do you keep? Our answer until now has been to await a third position and then average them together, but this has resulted in a cluttered catalog. What we really need are high quality large-scale photographs or CCD images of dome fields taken under low lighting conditions like the one by John Westfall shown here as Figs 3-6. These would allow us to positively position our domes and clear up the clutter. They would also allow us to obtain positive dome diameters. In the meantime, careful visual workers can still contribute by searching for new domes, classifying the domes we already know about, and - very importantly - measuring dome heights.

Though I have discussed how to make visual observations of domes in the past, [6] a few words on this subject would not be out of place here. As mentioned above, the height of a dome is equal to the dome's semi-diameter times the tangent of the Sun's altitude when the dome is ¼ covered with black shadow. Telling us when a dome is ¼ covered with black shadow is very valuable, whether you wish to actually calculate the height yourself or not. Observers interested in doing nothing more than watching for when domes are illuminated in this way would be doing a great service. Observers can also do valuable work by carefully estimating the diameter of a dome. Reports comparing the diameter of a dome to that of two nearby craters are very valuable. This would not only help us compute dome heights, but would also help us to understand how and why apparent dome diameters sometimes vary with telescope aperture. This phenomena was first reported many years ago by José Olivarez. And finally, visual observers can still help by contributing old-fashioned drawings. The eye can still see more than a photograph or often even a CCD image, and a carefully made drawing done under good conditions can be most valuable in helping us to classify a dome. Drawings do not need to be artistic; in fact, simple line drawings are sometimes best. Accuracy counts much more than style!

One of our problems in the past has been that observations were made and submitted haphazardly. It was difficult to carry out systematic observations of a particular dome or region because it was very laborious to predict when the lighting conditions would be just right. Also, observers did not always have a clear idea of what domes might be visible (i.e., within about 5° of the terminator) on a given night, and thus missed many opportunities to observe. To attempt to solve these and some other problems, I have written a computer program called the ***Lunar Observer's Tool Kit*** [7]. This program comes with the A.L.P.O. dome catalog, and can scan it to list out what domes are visible on any given night. Moreover, this program can predict when a dome (or any spot on the Moon's surface) will be illuminated by any given solar altitude, or when it will again be illuminated as it was on any date and time in the past. This allows observers to schedule their observations and always know when the illumination will be correct. In addition, the program can produce dome observing form text files with the co-longitude and other ephemeris information for your observations already computed and ready to print or add your notes to. This option can also produce spreadsheet-ready comma-delimited files of your observations. And finally, the program has other options to compute solar altitude, mountain heights, coordinate conversions, and ephemeris information. The cost of this program is just $20.00, and includes lifetime support.

The A.L.P.O. Lunar Dome Survey represents one of the few remaining opportunities for the amateur to contribute to our knowledge of the Moon. For the most part, Orbiter and even Clemintine images where made under moderate to high-sun conditions in order to maximize the ground covered. With today's technology, we can now produce a reliable catalog of lunar domes that can be of value to professional workers. Observers interested in contributing to this project should feel welcome to contact me for additional details.

References

1. Delano, Kenneth J. (1970). "The Distribution of Lunar Domes", J.A.L.P.O., 22, Nos. 1-2 (Jan.) 8-13.

2. Jamieson, Harry D. and Phillips, Jim (1992). "Lunar Dome Catalog", J.A.L.P.O., 36, No. 3 (Sep.), 123-129.

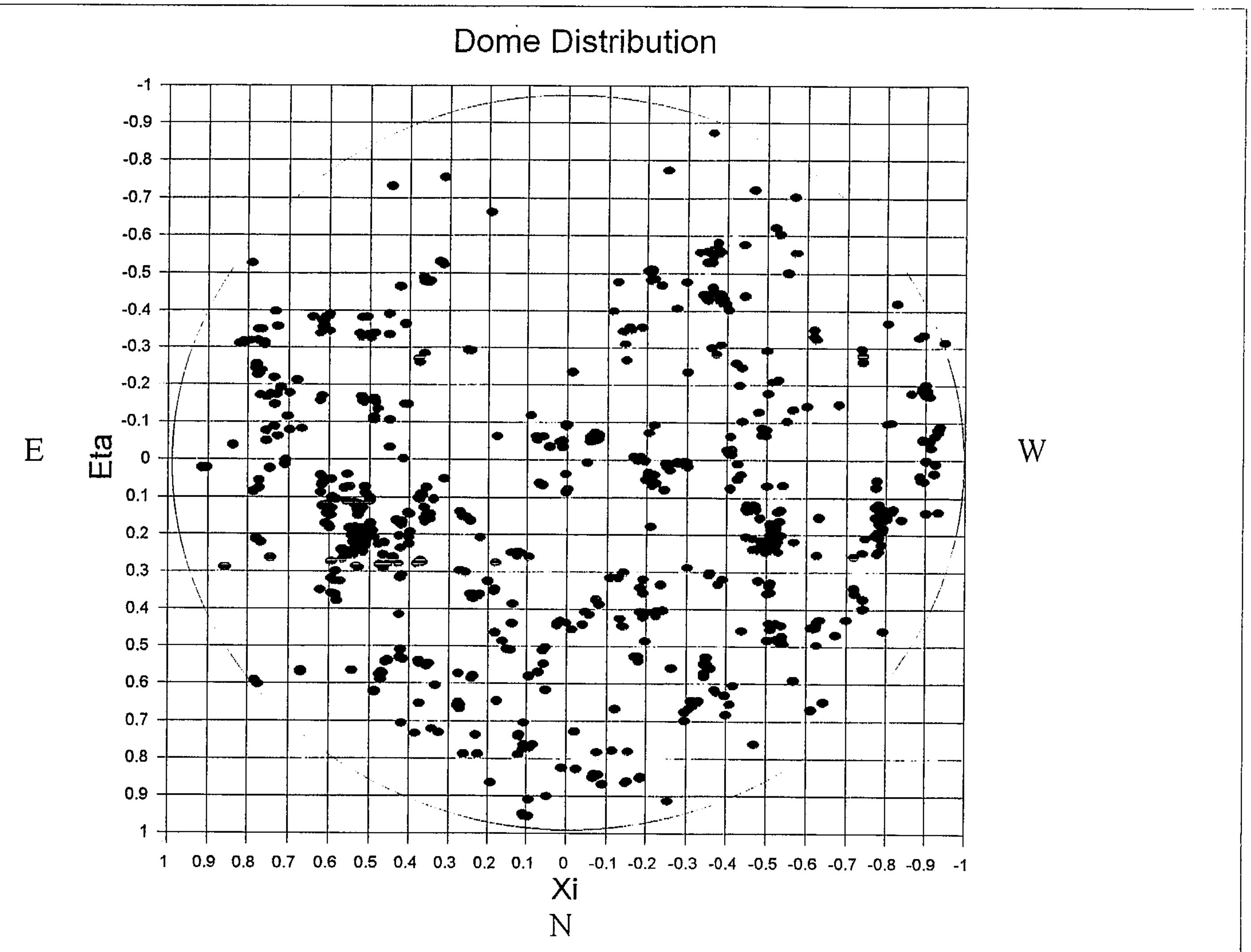
3. J.A.L.P.O., 33, Nos. 4-6, Front cover showing Yerkes photo Y163.

4. Phillips, Jim (1989). "The New Lunar Dome Survey: The Hortensius-T. Mayer Region.", J.A.L.P.O., 33, Nos. 4-6 (Apr.) 61-72.

5. ____________ (1989). "Observations of Lunar Domes North-Northwest of Milichius: An Interpretation.", J.A.L.P.O., 33, Nos. 4-6 (Apr.) 73-74.

6. Jamieson, Harry D. (1989). "Observing Lunar Domes", J.A.L.P.O., 33, Nos. 1-2 (Jan.) 23-24.

7. ________________ and Otis, Mike (1994). "The Amazing Lunar Tool Kit", Observatory Techniques, 9, 42-43.



Dome Distribution
Eta
Xi
E
W
N
-1
-0.9
-0.8
-0.7
-0.6
-0.5
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 0 -0.1 -0.2 -0.3 -0.4 -0.5 -0.6 -0.7 -0.8 -0.9 -1

Fig. 1

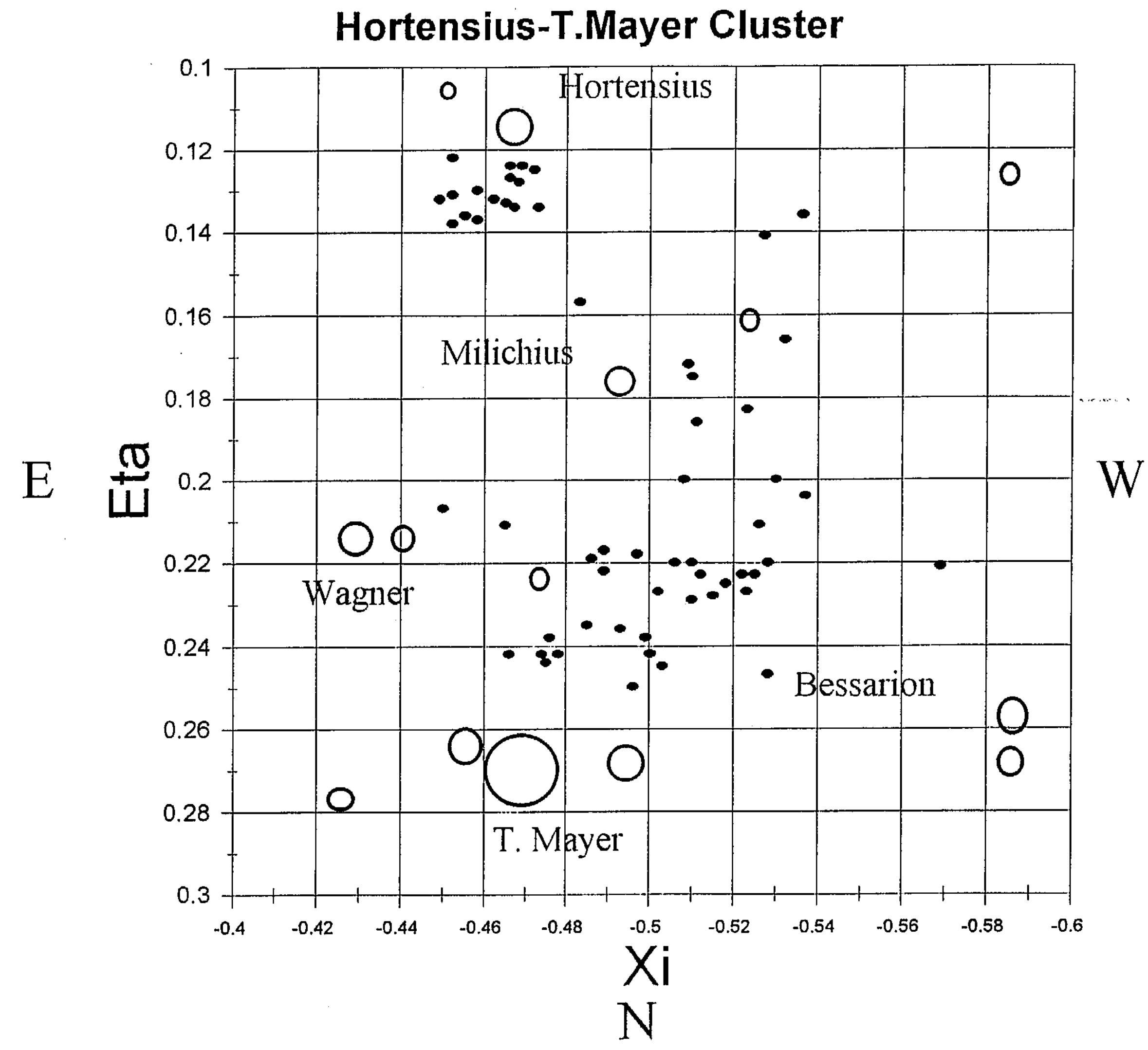

Hortensius-T.Mayer Cluster
Hortensius
Milichius
Wagner
Bessarion
T. Mayer
E
W
Eta
Xi
N
0.1
0.12
0.14
0.16
0.18
0.2
0.22
0.24
0.26
0.28
0.3
-0.4
-0.42
-0.44
-0.46
-0.48
-0.5
-0.52
-0.54
-0.56
-0.58
-0.6

Fig. 2

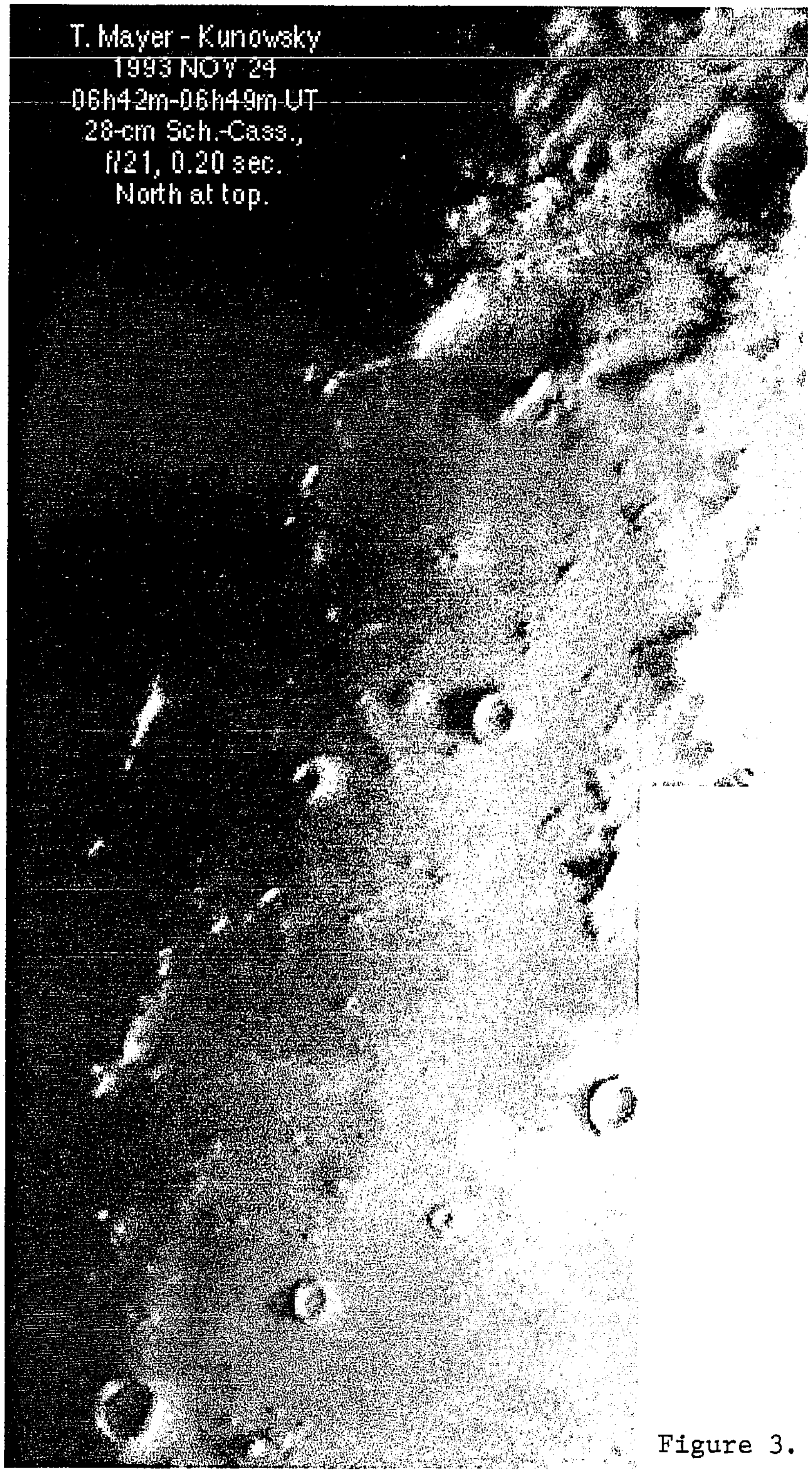

T. Mayer - Kunowsky
1993 NOV 24
06h42m-06h49m UT
28-cm Sch.-Cass.,
f/21, 0.20 sec.
North at top.

Figure 3.

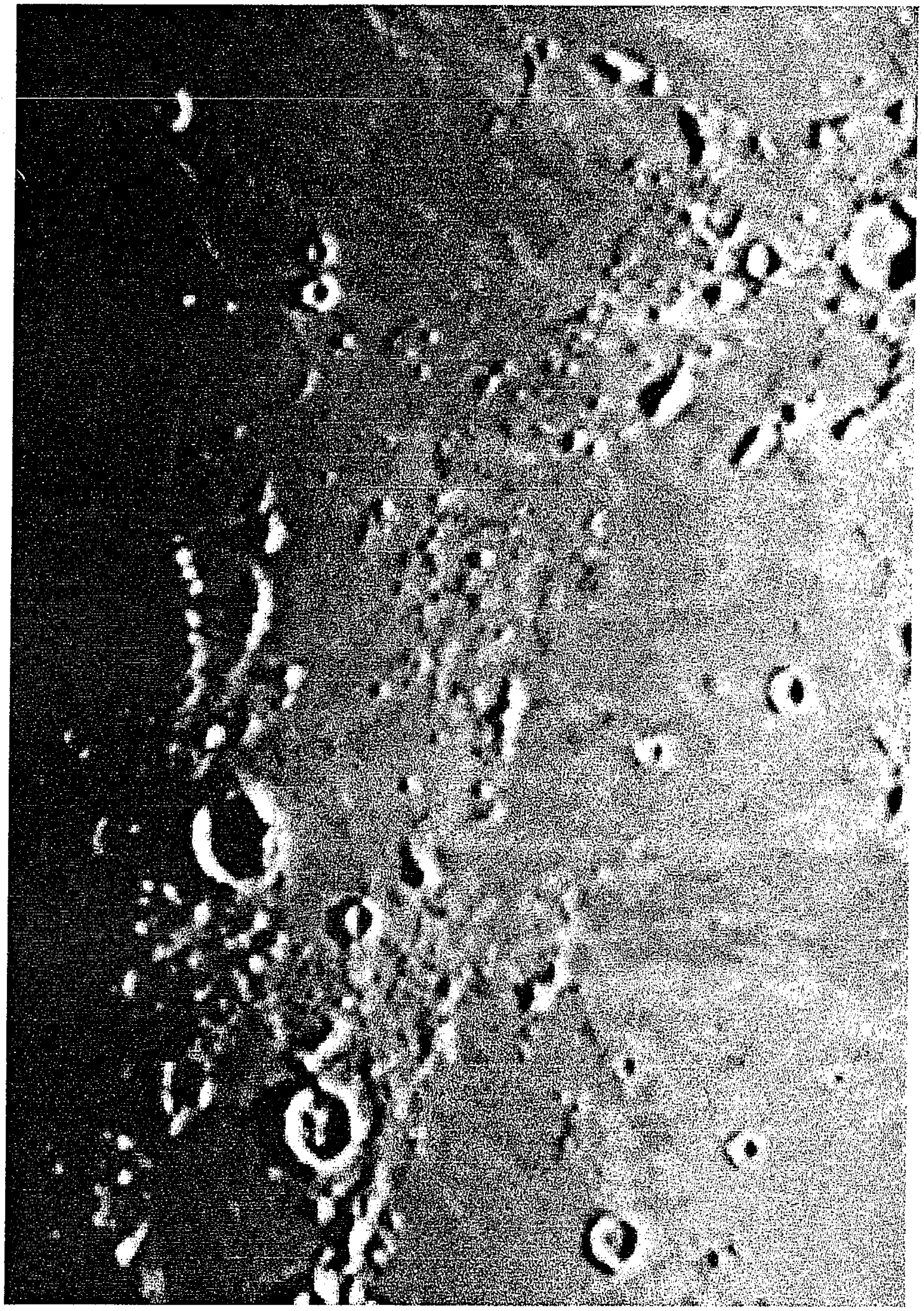


Figure 4. C. Mayer - Kepler - Kunowsky
1994 MAR 23, 04h03m-04h23m UT.
28-cm Sch.-Cass., f/10, 0.05 sec.
North at top.

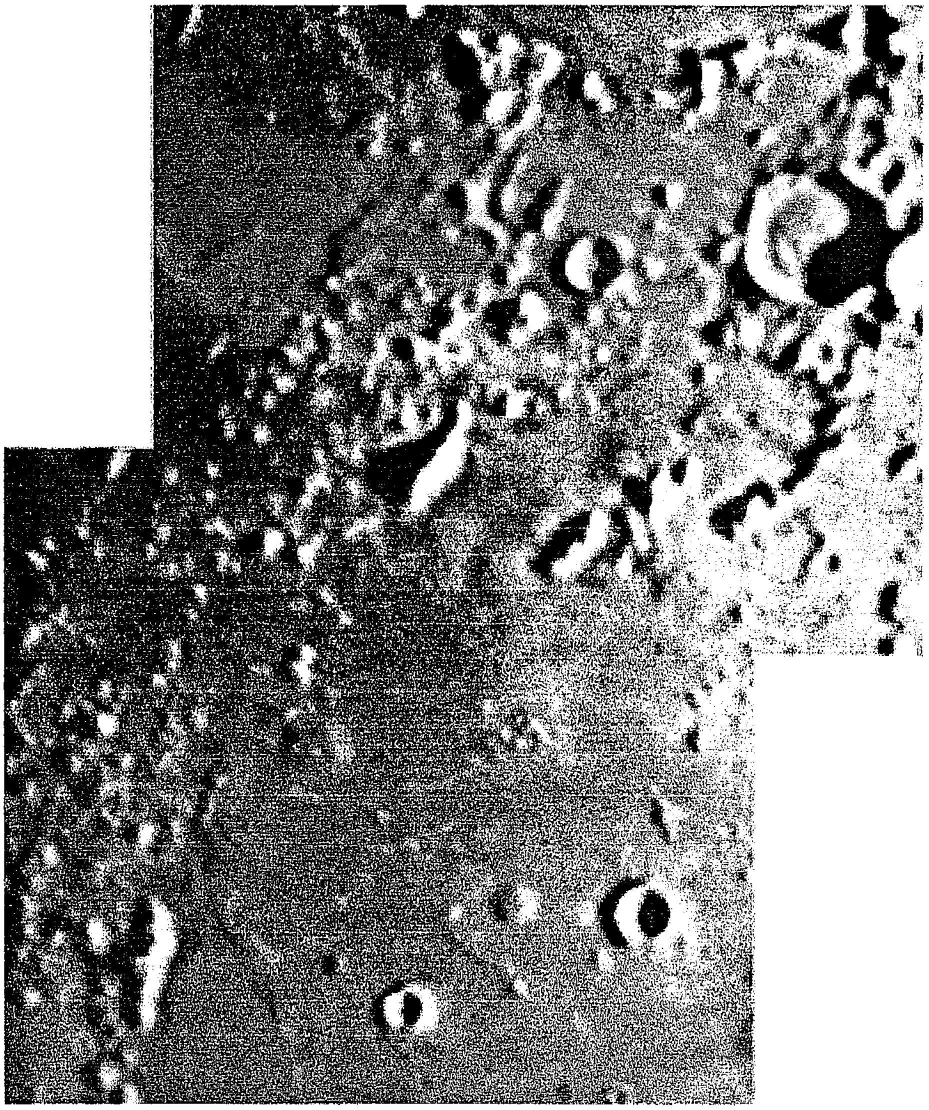


Figure 5.

Milichius-T.Mayer
1993 MAR 04, 02h56m-03h00m UT.
28-cm Sch.-Cass., f/21, 0.15 sec.
North at top.

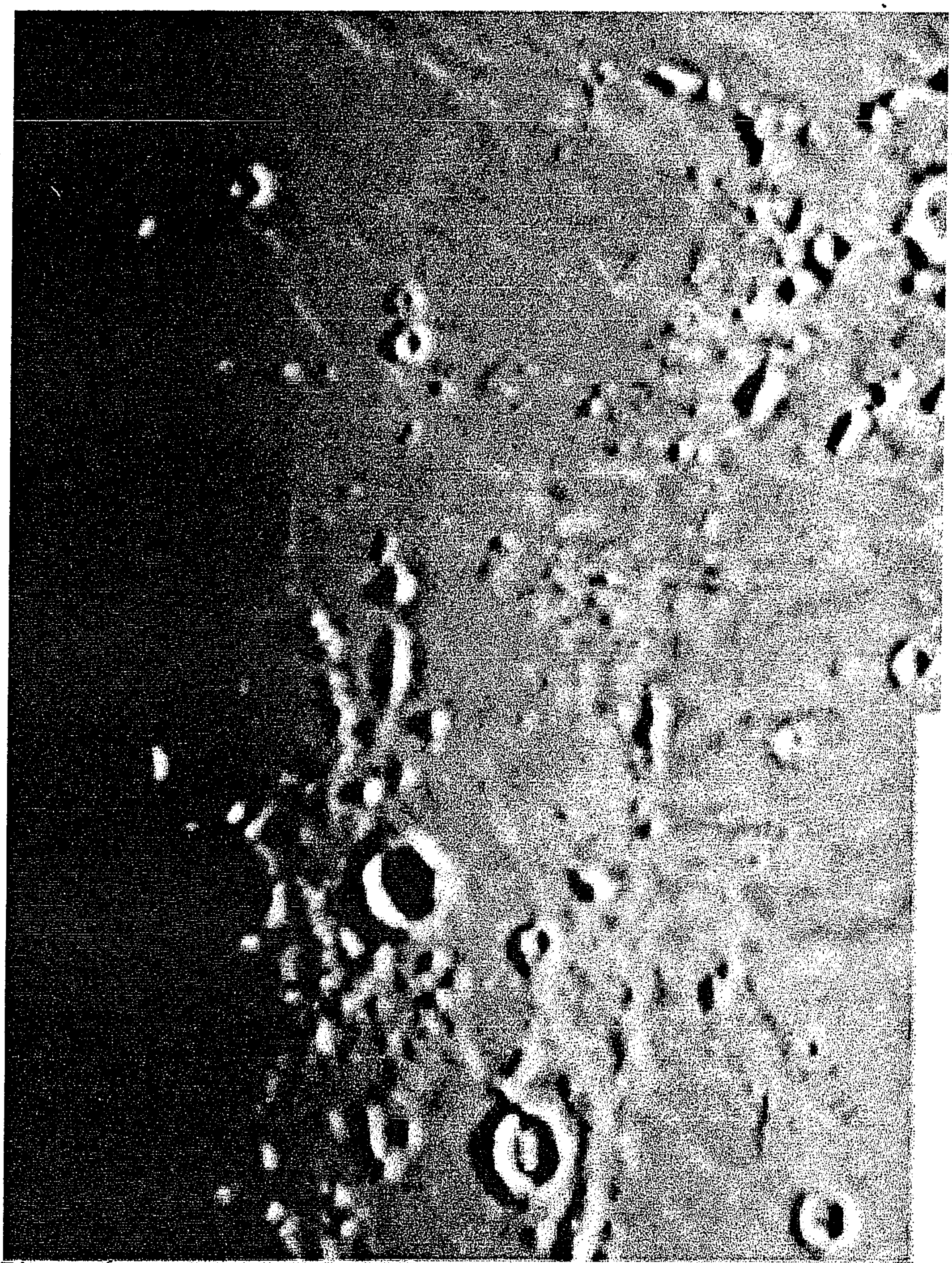


Figure 6.

C. Mayer - Kepler - Kunowsky

1994 MAY 21,
06h20m-06h39m UT.
28-cm Sch.-Cass., f/10,
0.05 sec. North at top.

ASTRONOMICAL BOOK COLLECTING:

THE LUNAR AND PLANETARY CLASSICS

By Jose Olivarez

ABSTRACT

The collecting of astronomy books is a hobby enjoyed by many amateur astronomers who also happen to be bibliophiles. Over the last two or three decades, the publishing of astronomy books has proliferated, but not every book published in the field has stood the test of time. Only a small percent of the astronomy books published attain "collectable" status and among these are books on lunar and planetary astronomy. Many are sought-after because they are authored by renowned observers such as Percival Lowell or E.M. Antoniadi. Other books attain collectable status because they are superb handbooks, are superbly written and rendered, or because they are lucid guides to the understanding and appreciation of the bodies of the solar system.

The attached "Selected List of Collectable Books on Lunar and Planetary Astronomy" itemizes 22 outstanding books that can still be obtained with some diligent searching. The list also includes eight books that may become tomorrow's sought-after collectables.

A SELECTED LIST OF COLLECTABLE BOOKS ON LUNAR AND PLANETARY ASTRONOMY

By Jose Olivarez

THE FOLLOWING ARE RARE BOOKS. With diligent searching, they can still be purchased from antiquarian booksellers or from private collectors.

1. THE MOON : Considered as a planet, a world, and a satellite. Nasmyth and Carpenter. 1874. 1st, 2nd, 3rd, and 4th editions.
2. THE MOON and the Condition and Configuration of its Surface. Edmund Neison . 1876.
3. THE MOON . By T. G. Elger. 1895 .
4. THE MOON in Modern Astronomy . By Phillip Fauth. Translated by J. E. Gore. 1909 .

THE FOLLOWING BOOKS ARE OUT-OF-PRINT. Used copies may be found at large used-book stores.

1. THE MOON . H. P. Wilkins and Patrick Moore. 1955.
2. MOON MAPS . H. P. Wilkins. The Macmillan Co, 1960.
3. THE FACE OF THE MOON . Ralph B. Baldwin. U. of Chicago Press. 1949 .
4. PHOTOGRAPHIC LUNAR ATLAS. Gerald P. Kuiper, ed. U. of Chicago Press. 1960.
5. THE TIMES ATLAS OF THE MOON. Edited by H.A.G. Lewis, 1969.
6. A NEW PHOTOGRAPHIC ATLAS OF THE MOON, Z. Kopal. 1971.
7. GEOLOGY OF THE MOON, A Stratigraphic View. Thomas A. Mutch. 1970.
8. LUNAR ORBITER PHOTOGRAPHIC ATLAS OF THE MOON. NASA SP-206 . 1971.
9. A HISTORY OF LUNAR STUDIES. Ernst E. Both. Booklet, 1961.
10. MOON MORPHOLOGY, Interpretations based on lunar orbiter photography. 1976. Peter H. Schultz. U. of Texas Press.
11. THE PLANET MARS. Gerard de Vaucouleurs. 1950.
12. THE PLANET MARS. E. M. Antoniadi. 1930. Translated by Patrick Moore.
13. THE PLANET VENUS . Patrick Moore. 1957. The Macmillian Co.
14. PLANETS AND SATELLITES .edited by Gerard P. Kuiper. 1961.
15. THE PHOTOGRAPHIC STORY OF MARS. E. C. Slipher. 1962.

16. ATLAS OF THE PLANETS. Vincent DeCallatay/ Audouin Dollfus. 1974.

17. THE PLANET SATURN A History of Observation, Theory, and Discovery. A. F. O'D Alexander . 1962.

18. THE PLANET SATURN (paperback edition). A. F/ O'D Alexander. 1980. Dover Publications.

19. THE PLANET JUPITER. B.M. Peek. 1958. Faber and Faber.

20. THE PLANET JUPITER. B. M. Peek . 1981 . Revised by Patrick Moore.

21. THE PLANET MERCURY. E. M. Antoniadi. 1934. Translated by Patrick Moore. 1974.

22. LOWELL AND MARS. William Graves Hoyt. 1976. U. of Arizona Press.

CURRENTLY AVAILABLE BOOKS that will be tomorrow's collectables.

23. The Geology of the Terrestrial Planets. NASA SP-469. Michael H. Carr, editor. 1984.

24. PLANETS AND PERCEPTIONS, Telescopic views and Interpretations 1609-1909. William Sheehan. 1988. U. of Arizona Press.

25. ATLAS OF THE MOON. Antonin Rukl. 1990.

26. COMETS, A Chronological History of Observation, Science, Myth , and Folklore. Donlad K. Yeomans. John Wiley & Sons. 1991.

27. TO A ROCKY MOON: A Geologists History of Lunar Exploration. By Don E. Wilhelms. U. of Arizona Press. 1993.

28. THE EXPLORERS OF MARS HILL. W. Putnam. 1994. Lowell Observatory.

29. A PORTFOLIO OF LUNAR DRAWINGS. Harold Hill. Cambridge U. Press. 1991.

30. CLYDE TOMBAUGH, Discoverer of Planet Pluto. David H. Levy. 1991 .

RECENT OBSERVATIONS OF JUPITER

By Jose Olivarez

Summary of Activity
February - May, 1994

The face of Jupiter is not much changed on June 15, 1994 from what it was on June 15, 1993 except that the South Equatorial Belt is now fully restored and a new bluish "South Tropical Zone Belt" has once again appeared on the planet. Otherwise, the dominant belts on Jupiter as of June 15, 1994 (in order of intensity) are the North Temperate Belt, the North Equatorial Belt, the South Equatorial Belt, the South Temperate Belt, and the North North Temperate Belt. The Equatorial Zone is now the brightest Zone on the planet with the North Temperate Zone and the South Tropical Zone appearing equally bright. The North North Temperate Zone is also visible.

EQUATORIAL ZONE

In two ways, the Equatorial Zone is one of the highlights of 1994. It has been bright and white and, secondly, its whiteness makes it easier to see and photograph the many bluish festoons that project from the south edge of the NEB. Indeed, Don Parker has captured a great number of these blue festoons in his CCD color images.

RED SPOT HOLLOW

The Great Red Spot has been in its "hollow" aspect since the current apparition of Jupiter began in November of 1993. Since then and through May, 1994, it has appeared like a great dark ellipse with a lighter orange-colored center. The southern arc of the ellipse has appeared particularly dark and appears bluish in CCD color photographs.

The longitude of the center of the Red Spot Hollow remained near 42 degrees (II) through May, 1994.

BLUISH SOUTH TROPICAL ZONE BELT

There has been a bluish "STrZ Belt" visible for most of the Jupiter apparition and the belt appears to have developed concurrently with the resurgence of the SEB in 1993. The new belt is vividly blue and appears in CCD color images taken by Don Parker as early as February 24, 1994. On that date, the belt appeared as a string of streaks and spots. Further imaging by Parker on March 10 UT and April 17 UT showed the belt was prominent and encompassing the southern border of the Red Spot Hollow.

WHITE OVAL SPOTS "BC", "DE", AND "FA"

The long-enduring South Temperate Belt ovals "BC", "DE" and "FA" continue to be well-defined due to their current location inside the broad STmB and have been seen by all observers using 6-inch apertures and larger. "BC" is the largest and brightest of the three, with "DE" next in size and "FA" the smallest of the three. On May 20 UT, Jose Olivarez determined by CM Transit Timing that the centers of "BC" and "DE" lay 14 degrees apart. On May 18 UT, the longitude of "FA" was 261 degrees (II) and on May 20 UT, the longitudes of "BC" and "DE" were 175 degrees (II) and 189 degrees (II) respectively. These three White Oval Spots (WOS) have now endured on Jupiter for 54 years!

SPECIAL FEATURES

Three small white oval spots on the SSTmB were photographed by Don Parker in March and April. They are all smaller than "FA" and are typical features of the SSTmB. Two of them were seen visually by Phil Budine and Samuel Whitby while using 6-inch apertures under excellent seeing conditions.

The appearance of a white oval spot on the north edge of the NEB and south edge of the NTrZ was first reported by Claus Benninghoven on February 13 UT and was photographed by Don Parker on March 10 UT. Jose Olivarez saw the white oval on March 16 UT at longitude 94 degrees (II). He subsequently timed its transit across Jupiter's CM again on May 17 UT and established its center at 92 degrees (II). Thus, this white oval has endured for a lifetime of about four months. (However, this is not untypical for a feature of this type.)

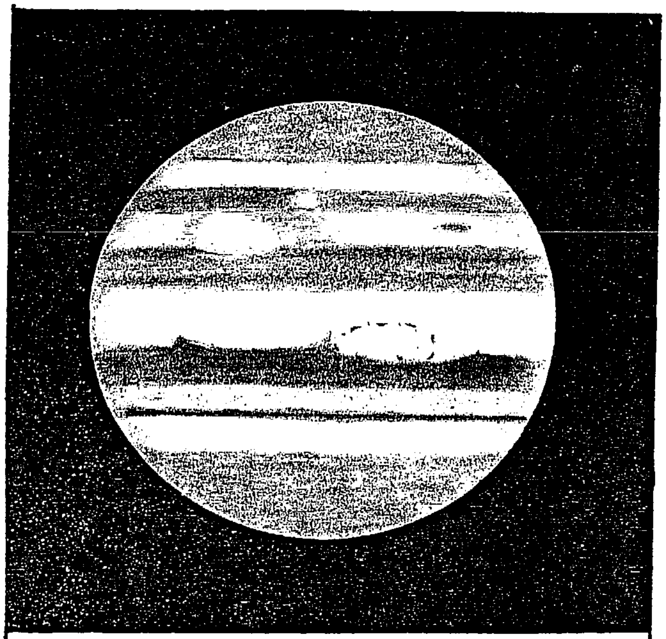
Another white oval spot similar to the one seen in the NEBn-NTrZ has also endured in the South Tropical Zone. It was last seen by Jose Olivarez on May 16 UT but it probably still exists. One May 16 UT, its location was near 300 degrees (II).

There was an unusual "notch" on the north edge of the SEB that was first recorded by Claus Benninghoven on March 5 UT and was subsequently seen by Samuel Whitby and Jose Olivarez. The longitude of the center of this "notch" lay at 79 degrees (I) on May 18 UT.

COLOR ON JUPITER

As in previous apparitions, Jupiter continues to be colorful. The EZ is white with bluish festoons that arc over its northern half, and the adjacent NEB has appeared predominantly brownish. The NTB appears dark brown this year, but in past years it has been bluish or orange! The SEB has displayed orange-brown tones as well as bluish streaks. Finally, the Red Spot Hollow has appeared as an intense ellipse with a bluish southern border and a light orange interior.

"A.L.P.O. JUPITER SECTION VISUAL OBSERVATION FORM" ✓☆



Filter —

DATE (UT) 12-31-1993

TIME (UT) 11:46

TELESCOPE 12" F/15 REFR

MAGNIFICATION 220X

SEEING 3-4 TRANS. 5

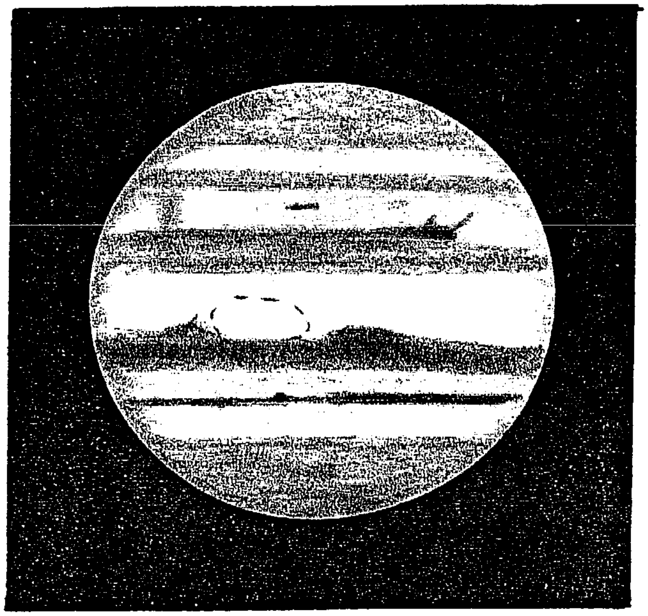
OBSERVER CLAUS BENNINGHOVEN

ADDRESS 421 S. MARSHALL
BURLINGTON IA 52601

SYSTEM I 191° II 332°

NOTES

EZ BRIGHTEST ZONE
NTRZ GRAY, A TINGE OF RED



Filter

DATE (UT) 12-31-1993

TIME (UT) 12:35

TELESCOPE 12" F/15 REFR

MAGNIFICATION 220X

SEEING 3-4 TRANS. 5

OBSERVER CLAUS BENNINGHOVEN

ADDRESS 421 S. MARSHALL
BURLINGTON IA 52601

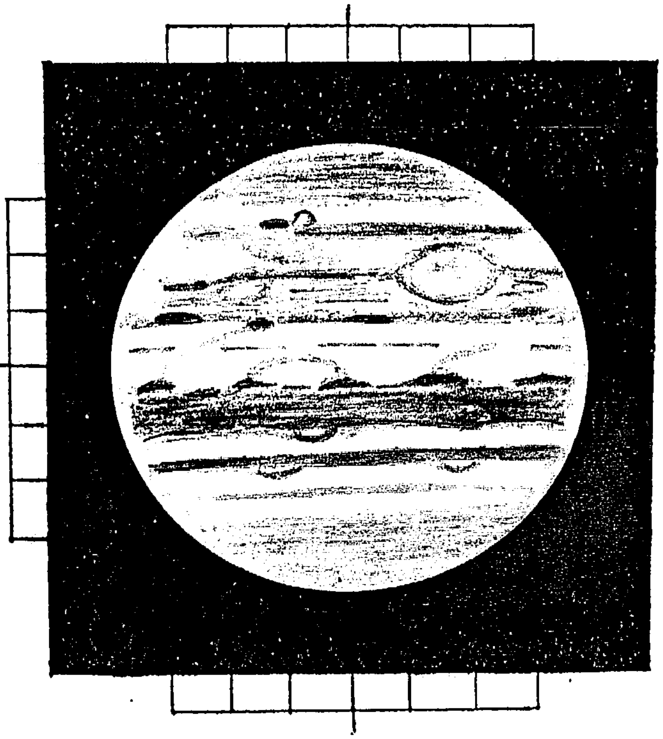
SYSTEM I 221° II 2°

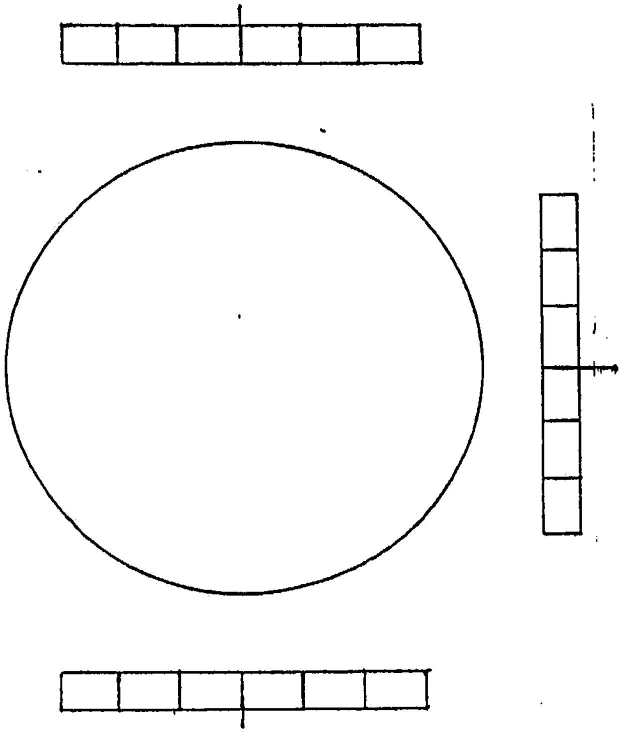
NOTES

CENTRAL MERIDIAN TRANSITS:

10.	TIME	SYS	LONG	DESCRIPTION
8	10:47	II	296°.8	✓DC COLUMN SEB_S-STRZ
9	10:48	I	155°.8	✓DC LOW PROJ. NEB_S-EZ_N
0	11:07	II	308°.9	✓WC BRIGHT OVAL STRZ, LARGE.
1	11:30	II	322°.8	✓DC GRAY VEIL STRZ.
2	11:47	I	191°.7	✓DC PROJ. NEB_S-EZ_N.
3	12:11	I	206°.4	✓WC LARGE BRIGHT PATCH EZ_N.
.	12:25	II	356°.0	✓DC BAR STRZ

JUPITER OBSERVING FORM No. 1





FILTER: ——

DATE(UT): 3/24/94

TIME(UT): 6:24 U.T.

TELESCOPE: 6-INCH APO REFR.

MAGNIFICATION: 152X, 183X

SEEING(1-10): 7-8

TRANS.(1-5): 4

INTENSITY ESTIMATES

OBSERVER: PHILLIP W. BUDINE

ADDRESS: R.D.3, BOX 145C
WALTON, N.Y. 13856

SYSTEM I: 143°

SYSTEM II: 23°

CENTRAL MERIDIAN TRANSITS:

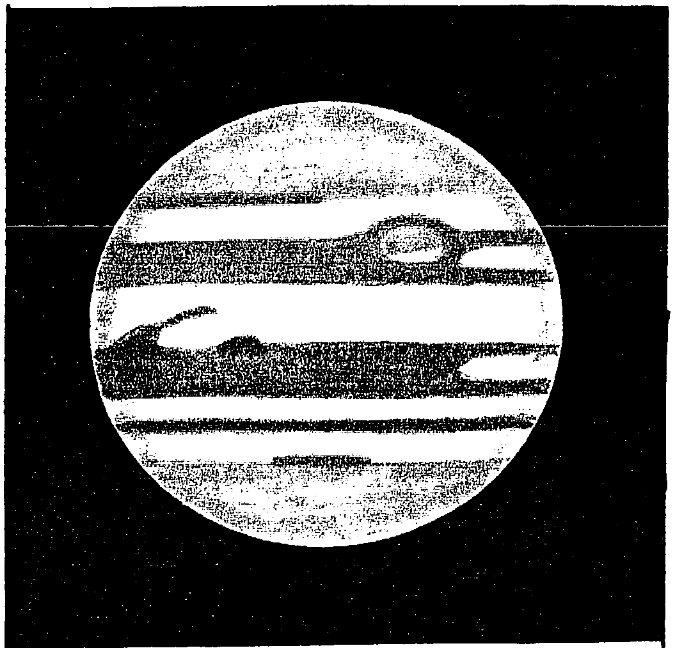
TIME(UT)	SYS.	LONG.	DESCRIPTION:
6:55	II	31°	RSp
7:13	II	42°	RSc
7:33	II	54°	RSf

NOTES:

RS – 23° IN LENGTH.

- RS IS LIGHT ORANGE
- EZ BRIGHTEST ZONE (BLUE TINT)
- NTB DARKEST BELT – NEB – SEB – STB.
- STrZ DUSKY PREC. RS; (*STrZDp) NEAR P LIMB. @ *356° (II).
- NOTE SMALL OVAL IN STeZ
[illegible]

"A.L.P.O. JUPITER SECTION VISUAL OBSERVATION FORM"



Filter________

DATE (UT) May 14, 1994

TIME (UT) 3:45

TELESCOPE 8-inch /7 reflector

MAGNIFICATION 195X

SEEING 6 TRANS. 4

OBSERVER Mr. Jose Olivarez

ADDRESS 1469 Valleyview Court
Wichita, Kansas 67212

SYSTEM I 185° II 27°

NOTES

The EZ looked "clear" and bright-white. It was the brightest zone on the planet.

Because of the clearness of the EZ, the NEBs-EZn blue features are showing up very well. The projection on the p. end of the planet was distinctly blue in color.

The SEB looked light orange in color.

Filter________

DATE (UT) May 16, 1994

TIME (UT) 3:43 U.T.

TELESCOPE 8-inch f/7 reflector

MAGNIFICATION 195X

SEEING 3 TRANS. 4

OBSERVER Mr. Jose Olivarez

ADDRESS 1469 Valleyview Court
Wichita, Kansas 67212

SYSTEM I 140° II 326°

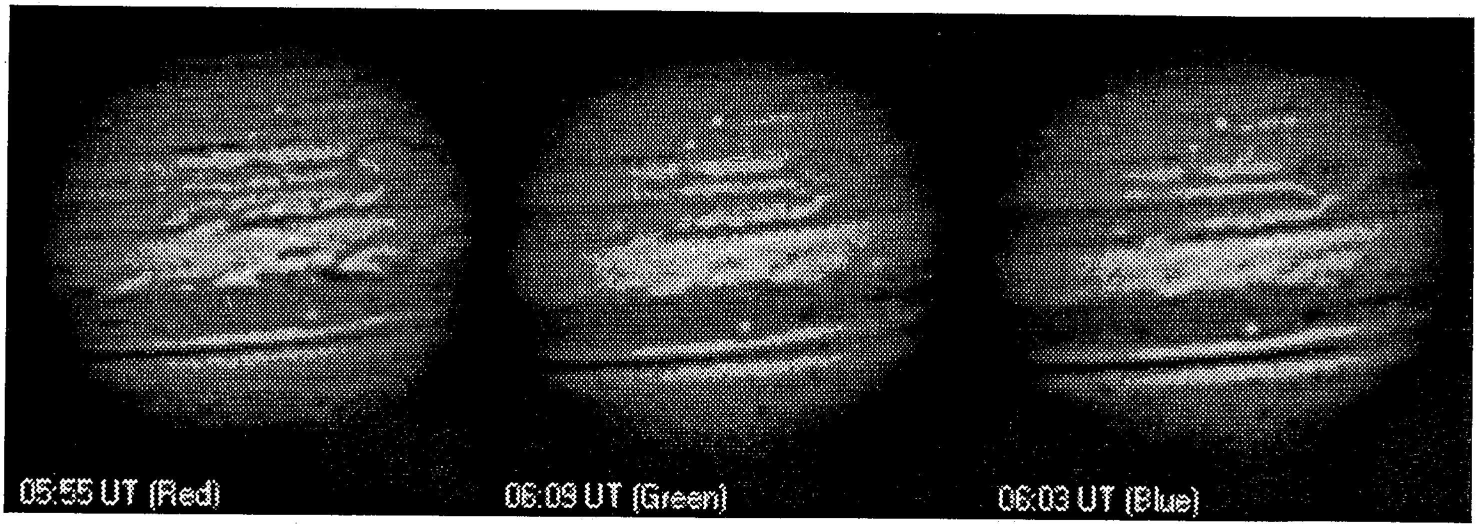
NOTES

The color of the NEB was brownish-orange. Note the bright oval in the STrZ. The brightest zone on the planet was the EZ. It was bright and clear.

The dark projection on the s. edge of the NEB was intensely blue as was the festoon projecting from it.

CENTRAL MERIDIAN TRANSITS:

TIME	SYS	LONG	DESCRIPTION
		42°	Center of Great Red Spot



A **B** **C**

← Preceding **South ↑**

U.T. DATE: **17 April, 1994**

Diameter: 44.3" Seeing: 7-8 Transparency: 4.5

IMAGE A	IMAGE B	IMAGE C
RED LIGHT	GREEN LIGHT	BLUE LIGHT
W-25 FILTER + IR REJECTION FILTER	**W-58 FILTER** + IR REJECTION FILTER	**W-38A FILTER** + IR REJECTION FILTER
U.T.: 05:55	**U.T.: 06:09**	**U.T.: 06:03**
C.M.-I: 317.9°	**C.M.-I: 326.5°**	**C.M.-I: 322.8°**
C.M.-II: 004.8°	**C.M.-II: 013.3°**	**C.M.-II: 009.7°**
Altitude: 50°	Altitude: 50°	Altitude: 50°
Exposure: 1.5 sec @ f/25	Exposure: 2.1 sec @ f/25	Exposure: 4.8 sec @ f/25

INSTRUMENT: 41-cm F/6 NEWTONIAN

IMAGING: SPECTRASOURCE LYNXX COD CCD CAMERA; FLATFIELD CORRECTED; RICHARD BERRY'S IMAGEPRO SOFTWARE USING BATCHPIX ®.

OBSERVER: **Donald C. Parker, M.D.**
12911 Lerida St.
Coral Gables, FL 33156 USA

REMARKS:

CCD IMAGING

If I can do it - anybody can.
James H. Phillips

Amateur astronomy has been a fascinating hobby of mine for almost three decades. My first telescope was a small two inch (Gilbert) Newtonian Reflector purchased by my mother for my fifteenth birthday (1965). Along the way I have owned all the major types of telescopes; Reflectors, Refractors, Maksutovs and Schmidt-Cassegrains. My interest has been primarily in visual observations of the moon and planets, particularly Jupiter. I'm sure my interest in the moon and Jupiter had something to do with the fact that so much detail is visible on the moon and to a great extent Jupiter even with a small telescope. My first "real" telescope was a six inch Criterion Dynascope Newtonian Reflector. I will never forget my first view through that telescope. It was of Jupiter and the detail was outstanding. That was over twenty-five years ago. Since then, for me a great night of observing consisted of sitting at my telescope making drawings of the lunar surface or Jupiter. Astrophotography has never worked for me so I did my best to represent the fine detail visible through an astronomical telescope by making drawings. Over the past couple of years I have been particularly interested in CCD images showing fine detail on the moon and planets.

I have gone from computer illiterate, gawking at CCD images in various astronomy magazines and journals, to taking images of my own. I have been astounded at the results I have been getting with my ST-6 CCD camera and nine inch F/15 folded

Astrophysics refractor. One year ago I had only read about CCD cameras. At that time I had no real computer skills. In fact, one of my biggest concerns when I decided to jump in was my lack of understanding of computers. Still, as I marvelled over superb images of deep sky objects taken from such areas of high light pollution as downtown Boston even London (!) combined with high resolution planetary images showing details comparable, (even better?) than visual observations I decided I had to go for it.

In September 1992 I ordered an ST-6 CCD camera from Santa Barbara Instrument Group. The camera took several months to manufacture so I had that time to try to learn how to use the computer. I knew the ST-6 required an IBM compatible computer and since the image would appear on the computer console screen the better the screen the better the image. When I went to my local computer outlet store I took a copy of the issue of Sky Telescope which had reviewed the ST-6. In that article there was information on the baseline requirements necessary for a computer to run the ST-6. At the store I explained that I knew nothing of computers but was an amateur astronomer interested in taking computer images through my telescope. I showed the salesman the article in Sky and Telescope and told him of my telescope. He took me over to a number of computers and consoles and began furiously typing and clicking some funny object attached by a cord to the computer. He was clearly proud of a thing called "Windows" and punched up dozens of different things using this funny object attached to the cord. I had no idea which computer to pick out so I choose one based on the salesmans advice which had a high resolution color monitor. I also bought a couple of games. I knew that there was a thing called software which came with the ST-6 camera which would tell me what to do to image through my telescope. Games I thought must work the same way so I figured that if I could get software of some game into the computer and working then I could do the same with the software for the ST-6. The computer store offered introductory courses for the computer illiterate. Unfortunately the next couple of classes were filled and it would be two months before I could get into a course. Things didn't look good.

Once I got the computer home I figured out how to plug everything in and turn it on. The computer game which I had picked out had clear instructions on how to insert the software. Apparently my computer had two drives an A and B and through trial and error I figured out which drive I had to put the software (disk) into. Unfortunately when I turned my computer on up popped some complicated menu (Windows) on which was a lighted dot which I could move around with the small clicker (mouse). The instructions for the game told me what to do starting at a thing called "C:\>" (C-prompt). What the hell is a C:\> and how do I get to it I thought. A quick call to the computer store and sure enough I was able to get to this thing which matched the hieroglyphics in the book, a C-prompt. Slowly it began to come together. I am far from understanding the intricacies of computer use but I have learned how to run the ST-6 software and by using the thick instruction manual (Micro Dos) I have learned a few commands. I am now able to copy files (that's how the image is saved) onto a floppy disk (one of two sizes which fits into the A or B drive) so I can send them off to friends, publications etc. By the time there was an opening in the computer class I had already figured out how to run the software (SBIG had sent a copy of the software prior to the arrival of the CCD camera). I ended up not taking the course although I'm not sure that was a wise move. Perhaps sometime in the future I will enroll.

After a couple of delays the ST-6 CCD camera arrived in March 1993. It required almost no assembly and hooked into the computer system without difficulty. Everything seemed straightforward. With the camera hooked up to the computer all I had to do was turn it on, get the computer to the ST-6 software program (ST-6 directory) and follow the instructions under the various menus. I inserted the 1 and 1/4 inch adapter on the CCD camera into my telescope focusser and aimed the scope at the Orion Nebula. Using the GRAB menu I typed in an exposure time of one second and set the various functions I had learned from reading the instruction manuals (auto contrast, focus mode etc.). I hit return and held my breath. The first image was ... out of focus! As you can imagine the first attempts to get a focused image were frustrating. As it turned out I needed an extension tube as my focusser would not rack out far enough to bring the object into focus. Luckily I had an extension tube. Once I reached focus using a nearby star I turned to the Orion Nebula set the exposure time at five seconds and hit return. When the image appeared on the screen I almost could not believe my eyes. While I have been interested in amateur astronomy for almost thirty years I have been a visual observer. I have had almost no experience with astrophotography. The detailed image of the central portion of the Orion Nebula which appeared on the computer screen was astounding. After that, using a 1.8 X Barlow and the extension tube I tried images of Jupiter. Again focusing was tedious but once achieved I was able to take images of Jupiter all night long. I found an exposure time of 0.15 to 0.20 seconds worked well. At first the images seemed soft and a little fuzzy and I was disappointed. Then I remembered that there was a portion of the ST-6 software that would allow some processing of the image. After taking an image of Jupiter I moved to the "Utility Menu" and hit "Sharpen". I then moved back to the Display portion of the menu and found myself amazed at the detail present on the image of Jupiter. I can say without question I never would have believed I would be capable of taking an image of Jupiter showing the kind of detail that I was able to capture using my telescope and the CCD camera. Over and over I found myself with incredibly detailed images of deep sky objects taken from a telescope in highly light polluted downtown Charleston and during the same evening turning and obtaining high resolution images of Jupiter and lately Saturn. The moon has been a problem because it is so bright. I have recently acquired a polarizing filter to help reduce the brightness and hopefully that will allow some high resolution images of the lunar surface.

Some of the major problems I have encountered have been locating the object and focusing of the image. Since I am using a 9 inch F-15 system the field of view is something like 6.5 x 8.5 arc minutes. It is even less than this with the extension tubes and Barlow. To locate the object I have relied on digital setting circles and the ability to center an object in an eyepiece, slowly remove the eyepiece and diagonal then slip in the CCD camera without moving the telescope. It is still a trial and error process but overall I have been fairly successful using these methods. To help solve the problem of focusing I have used a sharp object to etch a line on the focusser where it enters the telescope backing. Objects are very close to focus when everything is assembled and the focusser turned in so that one of the etched marks, lines up with the telescope backing. Small adjustments in focusing are necessary even after starting out this way but it has made focusing a whole lot easier and less time consuming. One thing I have found is that rather than have a couple of observing sessions of one and a half hours on separate nights with the CCD camera it is better for me to have one observing session that lasts for three or four hours. The initial set up, getting objects centered and focused, takes more time than centering or focussing any other object during the evening. Once an object is focused at say low power I do all the low power imaging I intend to do before I put in the 1.8 X Barlow and attempt high power imaging.

What has been the secret to my success? Well first of all learning the basics of computer operations is not as difficult as I tried to make it. Certainly if one would take an introductory course which appears to be available at a large number of computer outlet stores the basics could be easily mastered. Next, I must give a great deal of credit to the quality of equipment I am working with. Being able to slip out an eyepiece with diagonal after centering an object then replacing it with the CCD camera without having the object move requires a very steady mount. The mount for my telescope was made by John Styles of Optical Guidance Systems in Pennsylvania and it has been rock steady. Also the quality of the optics of the 9 inch F-15 Apochromatic Refractor by Roland Christen at Astrophysics plays no small role. Finally, the folks at Santa Barbara Instrument Group have put together a high quality CCD camera along with a software program that allows even the most inexperienced the ability to capture fine quality images.

At this point my biggest concern is trying to get a "hard copy" of the computer images I have been able to obtain. I have tried photographing the screen and have not been satisfied with the image I see on the screen versus the photographed imaged which I ended up with. Laser printing does not seem to be the answer. There are service bureaus out there apparently who can take a floppy disk and end up with a high quality "photograph". I tried one service bureau and while the detail on Jupiter was better than any photograph I had made of the computer screen the image was distorted so that Jupiter was oblong E-W about twice the norm. The future is bright however and I am sure I will figure this one out as I have so many of the other problems I have encountered along the way. Again, I cannot express how pleased I have been with the results I have obtained since receiving my ST-6 only six months ago. Deep sky imaging from a light polluted city location along with high resolution imaging is fantastic. And, if I can do it anybody can.

After the article above was written I began having better results with a local photography lab. The photographs I have been taking off the computer screen are now being custom printed and the detail is much better than anything I have obtained previously. In addition, the folks at Santa Barbara Instrument Group recently sent me a program which "rearranges the pixels" so that the image is not distorted east west as described above. As a direct result I have just gotten back some nice images processed by Image Technologies Ltd., a service bureau in Cambridge, Mass.

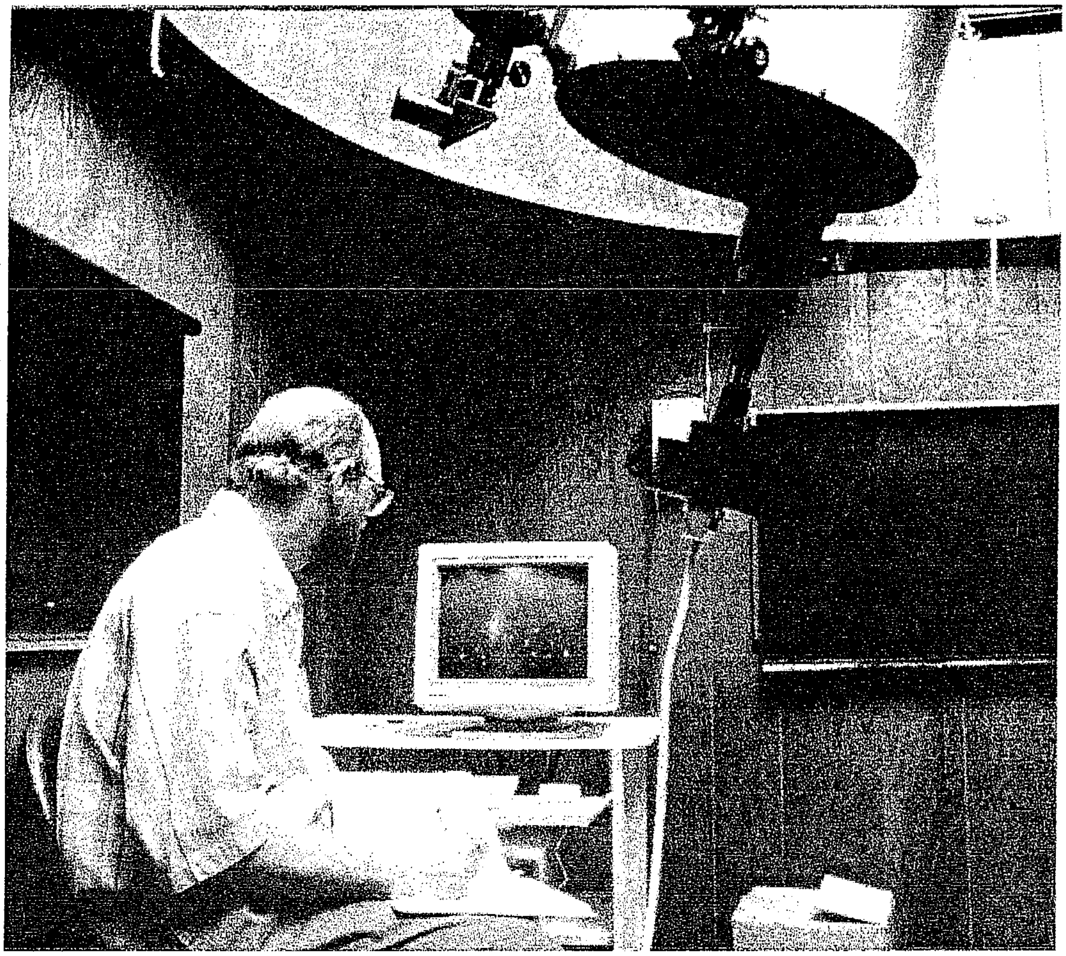


Figure 1. James Phillips using his ST-6 CCD camera, which is mounted in the eye-piece tube of his 9-inch f/15 folded refractor.

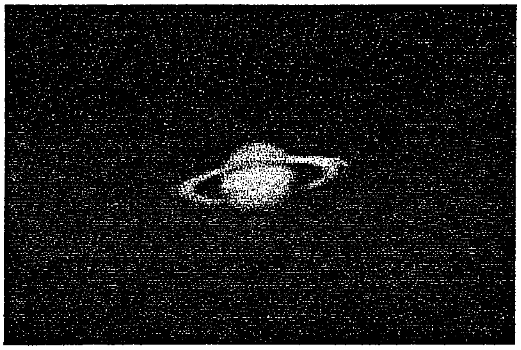


Figure 2. Saturn, 1993 SEP 12, 0.20-second exposure. South at top.

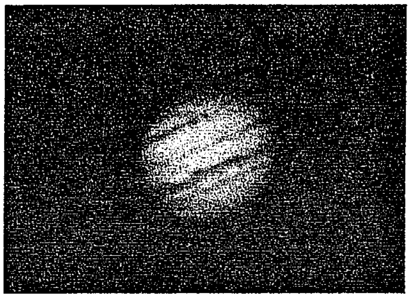


Figure 4. Jupiter, 1993 MAY 11, 0.15-second exposure. South up.

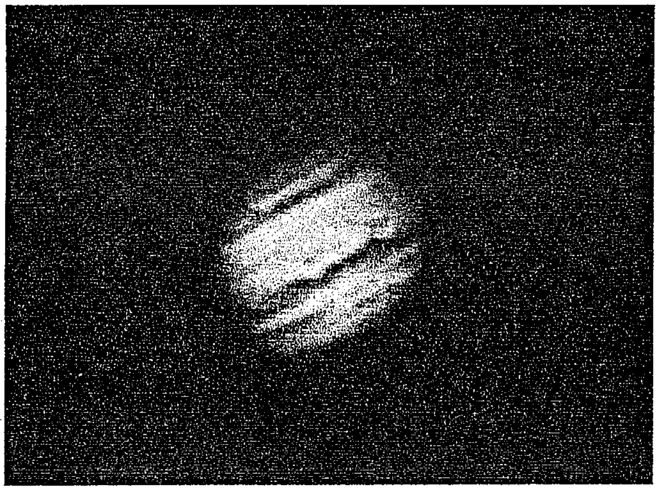


Figure 3. Jupiter, 1993 APR 19, 0.15-second exposure. South up.

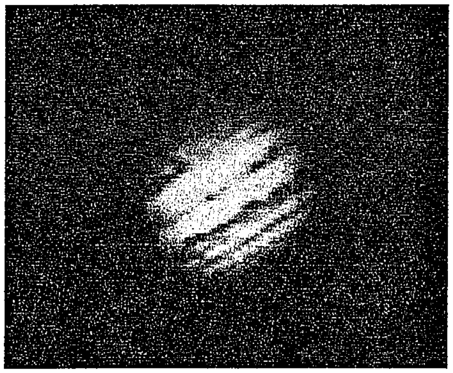


Figure 5. Jupiter, 1993 MAY 24, 01h18m UT. 0.15-second exposure. South up.

The New ALPO Lunar and Planetary Training Program: A Fresh Start

by

Tim Robertson and Matthew Will

A.L.P.O. Lunar and Planetary Training Program Coordinators

(provisional)

ABSTRACT

For the past year the ALPO Lunar and Planetary Training Program has been undergoing some restructuring to better accommodate both the student observer and the ALPO's observing programs for the various sections. The program will be administered at two distinct levels. The basic level will cover aspects concerning the proper recording of an observation, while the novice level will focus on mastering drawing techniques as well as other advanced observing procedures. A workbook has been developed and will be used to facilitate both levels of the Training Program. At the novice level, the student observer will be encouraged to refer to other literature that the ALPO provides in the way of handbooks. While the coordinators will administer the basic level of the program, tutors will be assigned to the student during the novice phase for guidance. The new Training Program will be activated later this year, pending peer review.

PHOTOMETRY OF URANUS AND NEPTUNE: 1989-1994

Richard W. Schmude, Jr.
Remote Planets Recorder

The SSP-3 solid-state photometer along with the B, V, R and I filters and the 36 cm telescope were used in making photometric measurements of Uranus and Neptune in April, 1994. The resulting 1994 normalized magnitudes for Uranus (with the number of measurements in parenthesis) are: B(1,0)=-6.55(4); V(1,0)=-7.16(4); R(1,0)=-7.00(4) and I(1,0)=-5.82(4). The corresponding values for Neptune are: B(1,0)=-6.48(3); V(1,0)=-6.93(3); R(1,0)=-6.60(4) and I(1,0)=-5.52(3). The 1994 R(1,0) magnitude of Uranus is 0.03 magnitudes lower than the 1993 opposition whereas all other magnitudes for Uranus and Neptune are the same as those in 1993. The same comparison star (50-Sgr) was used in both the 1993 and 1994 measurements. The A.L.P.O. remote planets section now has over 500 photometric measurements of Uranus and Neptune and these measurements including those made in 1994 will be presented in the talk. Year-to-year trends in brightness will be discussed.

MARIUS - REINER
1993 JUN 02, 04h31m-04h38m UT
28-cm. Sch.-Cass., f/21, 0.10 sec.
Colong. 56°.6, North at top.

Figure 1. Mosaic of CCD images of the Marius-Reiner area shortly after lunar sunrise.

Mapping From Lunar CCD Images: An Illustrated Tour

John E. Westfall

The seven illustrations on the following pages show the process of conversion of lunar CCD images to true-projection maps.

The first five illustrations show the mapping of the Marius-Reiner region, going step-by-step from a mosaic of CCD images to a final regional map at 1:1,500,000 scale with a latitude-longitude grid and feature names.

The final two illustrations show the crater Janssen, first as a CCD mosaic and then as a "rectified" view on the Conformal Conic Projection.

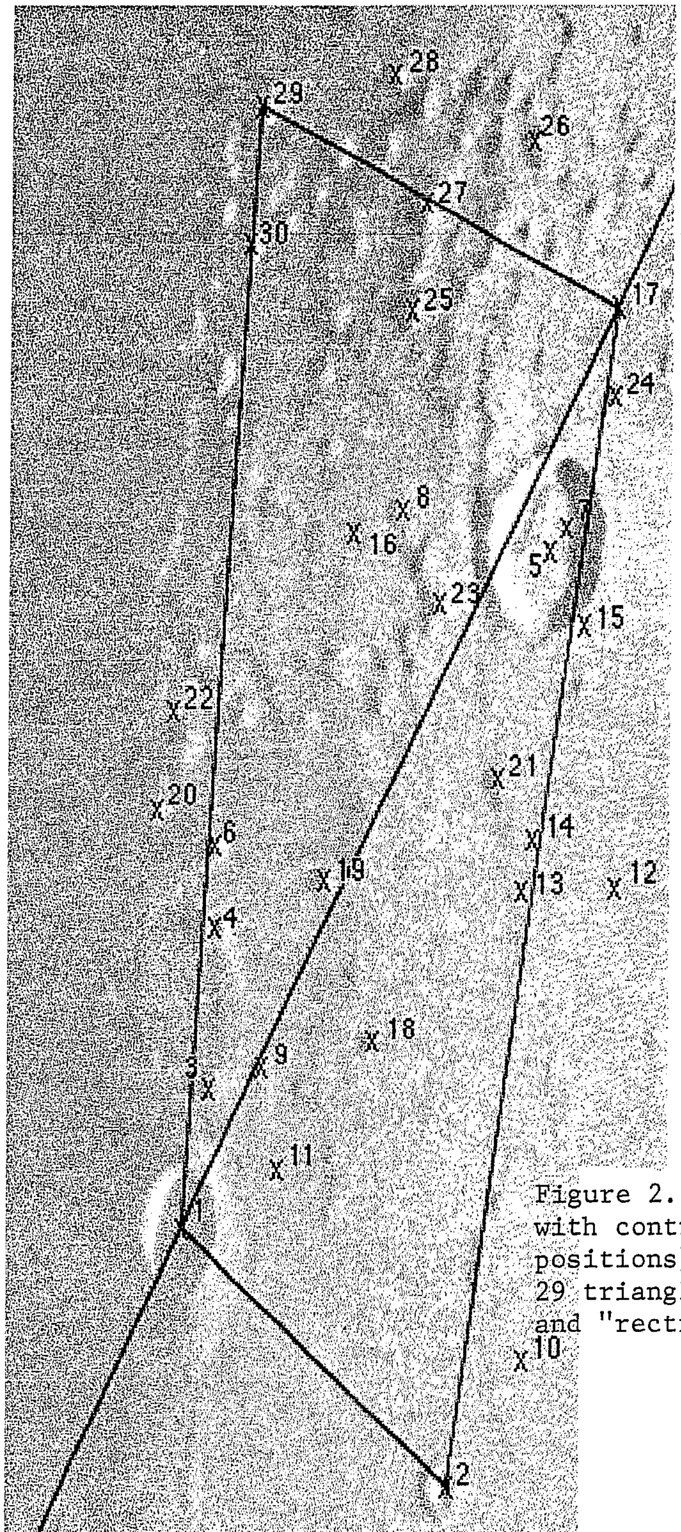


Figure 2. Previous CCD mosaic with control points (known positions) marked. The 1-17-29 triangle will be extracted and "rectified" in Figure 3.

STEPS IN RECTIFYING A CCD IMAGE

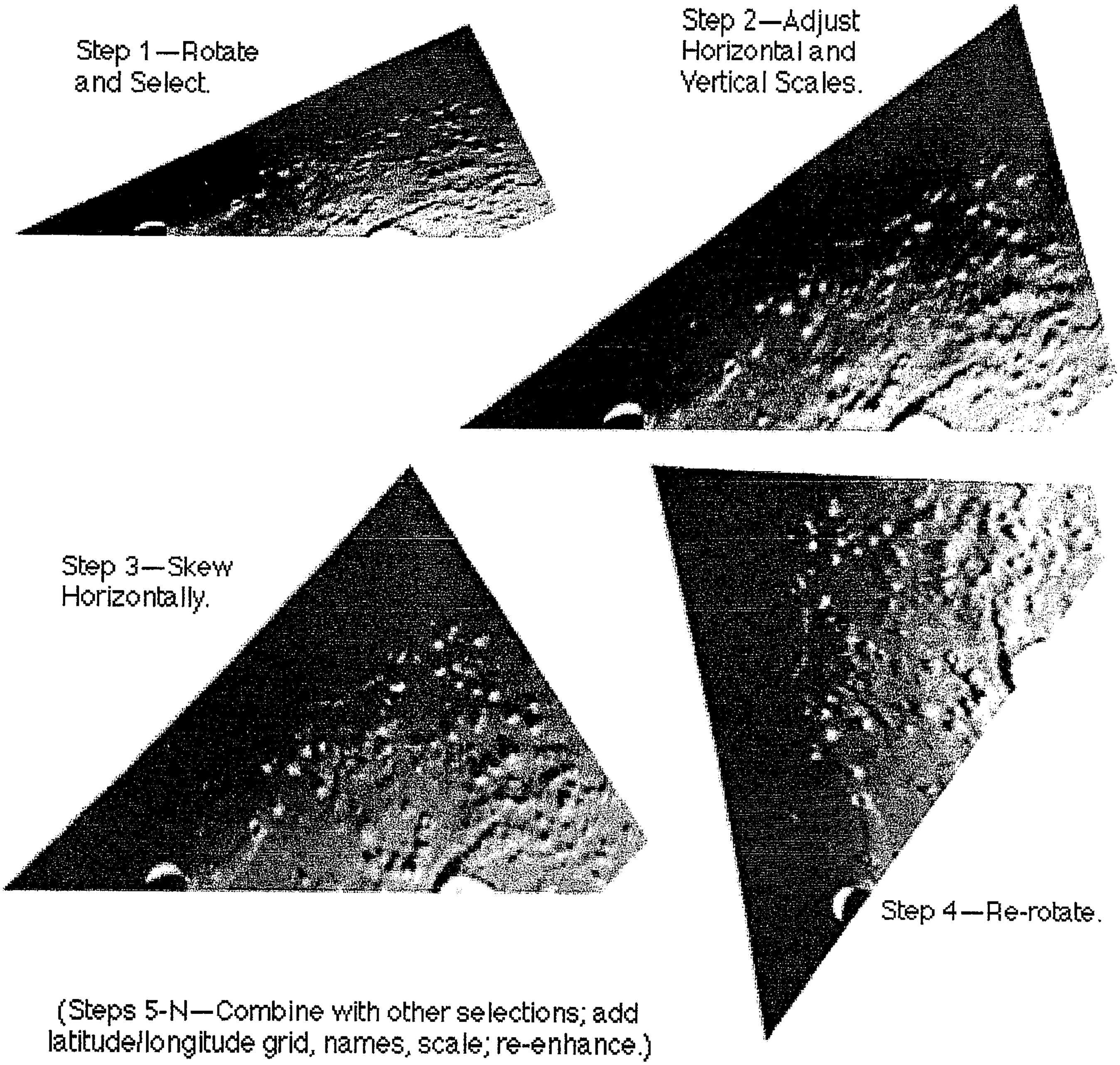
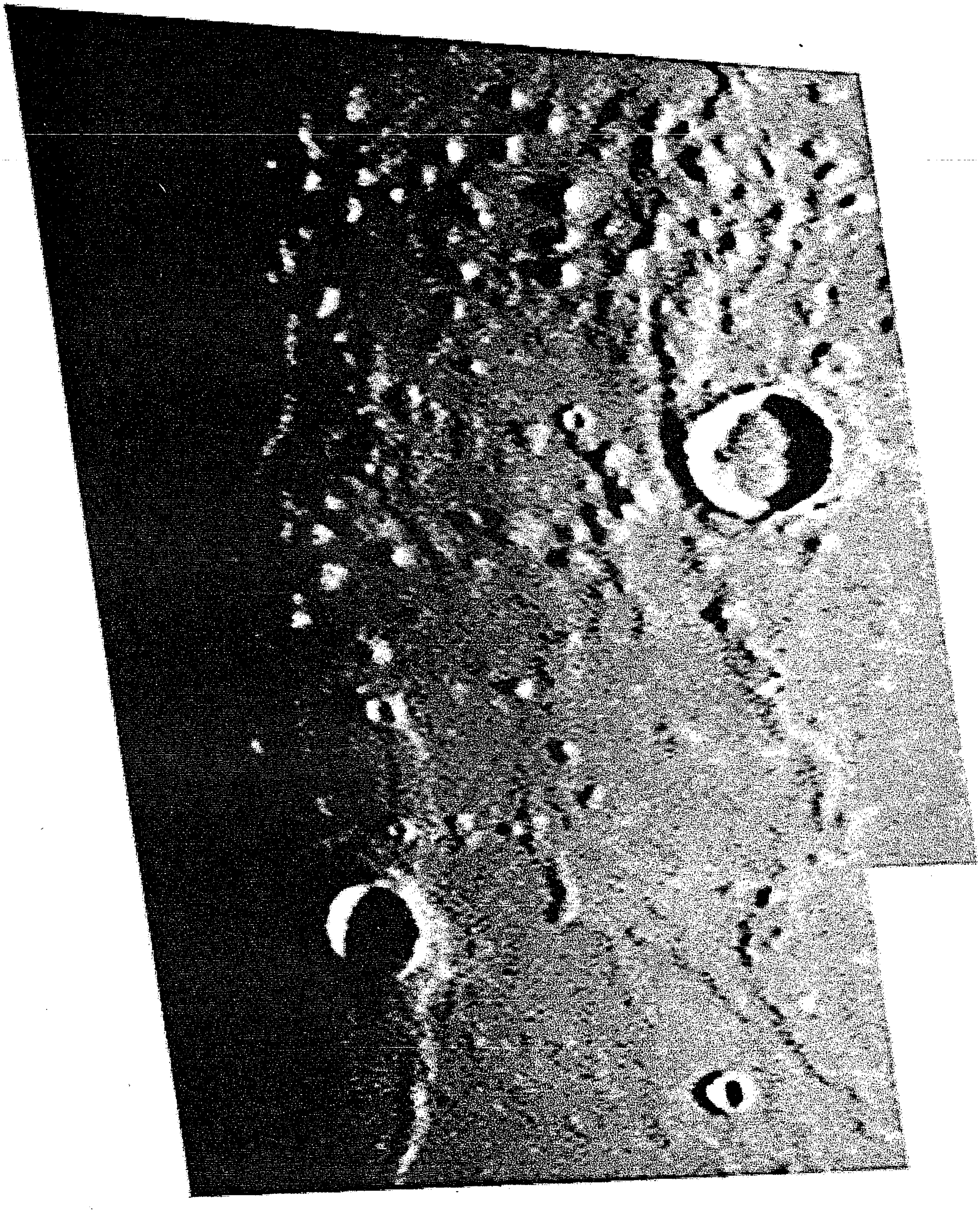
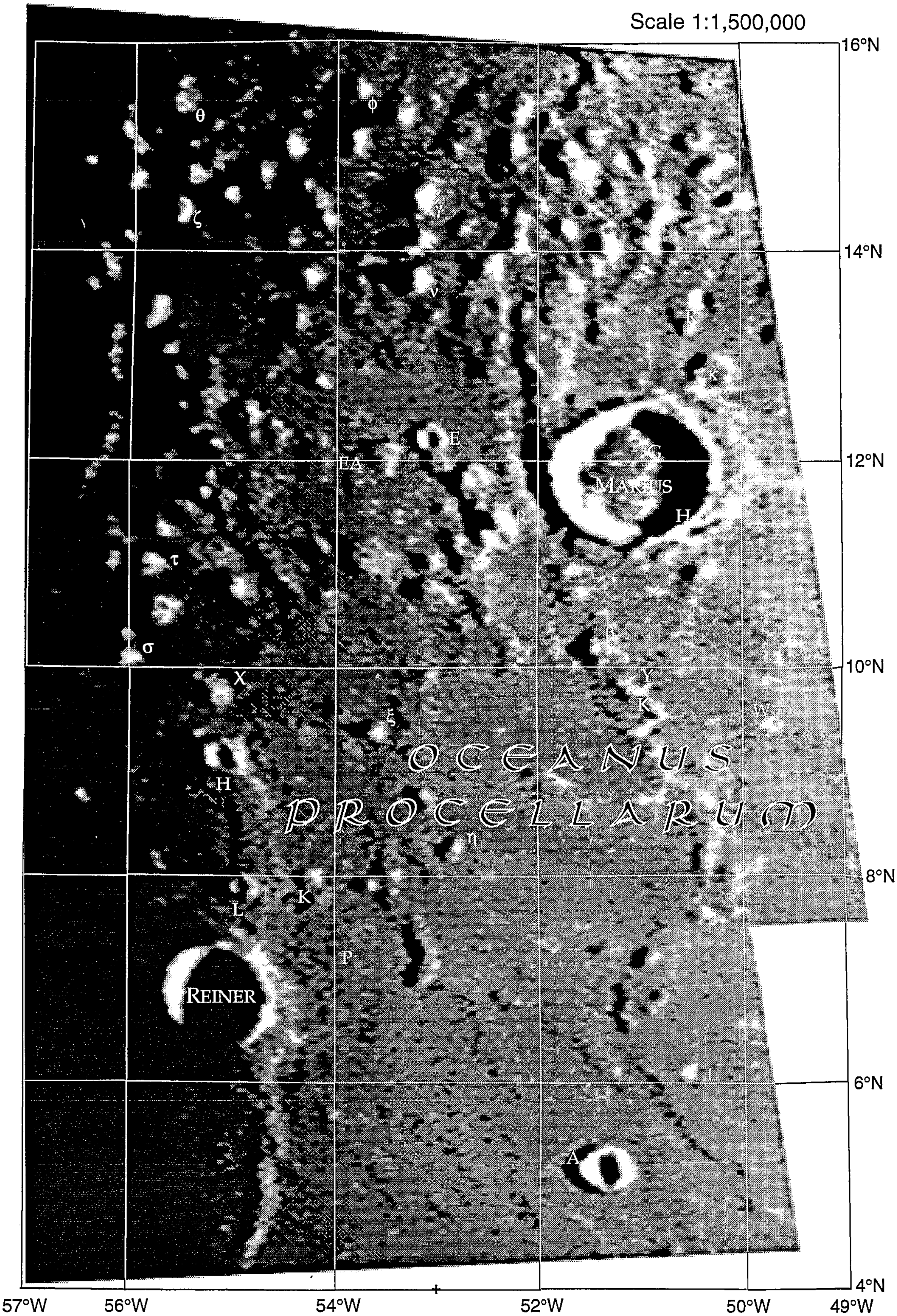


Figure 3.



Firgure 4. Both the 1-17-29 and 1-2-17 triangles have been rectified and have been reassembled.

Figure 5. The final map.



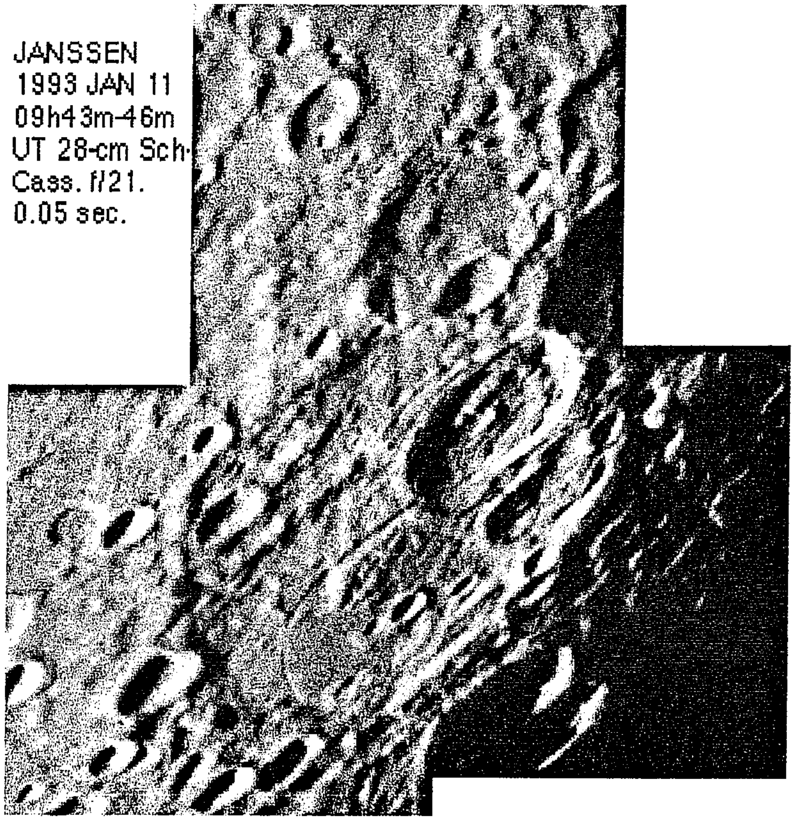


Figure 6. CCD mosaic of the crater Janssen.

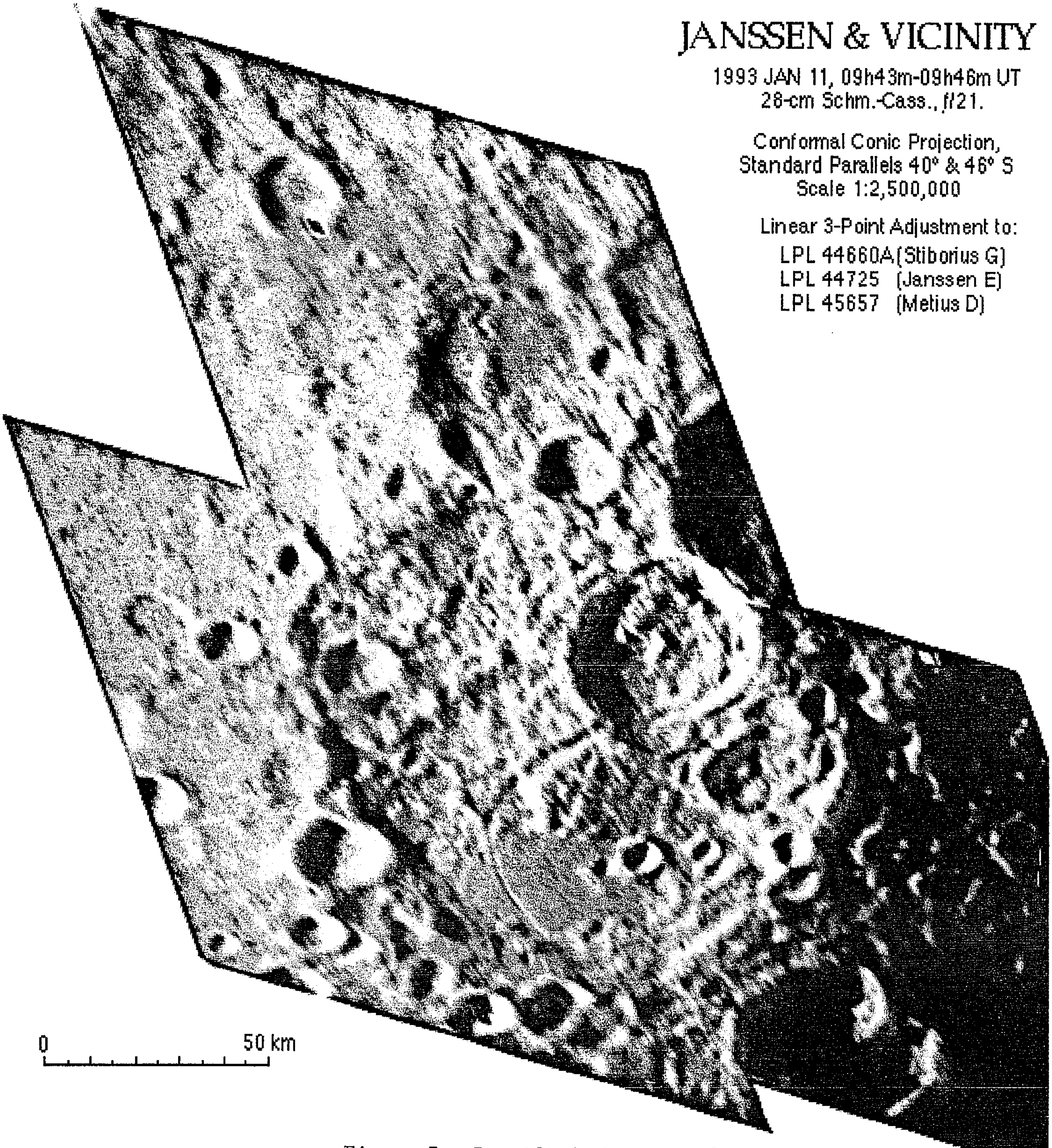


Figure 7. Rectified photomap of the crater Janssen.